

THE SCOTTISH GAS INDUSTRY UP TO 1914

by

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CHAPTER V

Organization(1) Gas Companies without Limited Liability

Almost all Scottish gas companies took advantage of peculiarities in Scottish law which enabled¹ them to operate lawfully as a 'company' or distinct 'persona' without the heavy expenditure of a Charter from Parliament. Instead, companies operated under regulations formulated by their own members, usually aided by a Writer who could ensure that they were compatible with the law of the land, and point out the main issues which had to be covered. As in other aspects of management, however, the "method of comparisons" played a leading role, and companies 'borrowed' guide-lines and rules both from the Acts of incorporated gas companies, and from their unincorporated predecessors. Despite this ad hoc development, contracts of co-partnery² throughout Scotland show a close similarity of construction,

1. Particularly after repeal of the Bubble Act in 1825, vide infra pp. 104, 946

2. S.R.O. The following Contracts of Co-partnery are used in this chapter:

<u>Company</u>	<u>Date</u>	<u>Source Ref</u>
Perth	1823	Perth Ref. Lib. Pamphlets Vol I
Dumfries	1824	BT2/22
Dundee	1824	Council/Sess. Vol. 265
Dunfermline	1828	BT2/2245; Dunfermline Ref.Lib.
Kirkcaldy	1829	BT2/1200
Cupar	1830	BT2/3117
Musselburgh	1831	BT2/1589
Barrhead	1833	BT2/1032
Peterhead	1833	BT2/144
Grangemouth	1834	BT2/2026
Falkirk	1834	Stirling Sheriff Vol. 19
Dalry	1834	BT2/3497
Kinross/Milnathort	1835	BT2/1481
Kirriemuir	1836	BT2/987
Selkirk	1836	GB1/72/1
Vale of Leven	1839	GB1/82/1

and the considerable number which are extant provide a minutely detailed picture of company organization, with far greater depth than the Acts of Chartered Companies.

Twenty-six companies are examined in this study, representing a nominal capital stock of over £99,650 (Table 5.1)

<u>Company</u>	<u>Date</u>	<u>Source Ref.</u>
Moffat	c.1839	BT2/1360
Dysart	1843	BT2/2003
Lochgilphead	1844	BT2/24
Banchory	1845	GB1/5/1
Falkirk Joint Stock	1845	BT2/6
Maxwelltown/Dum- fries	1845	BT2/112
Bridge of Weir	1846	BT2/3265
Innerleithen	1846	BT2/3998
Gourock	1848	BT2/878
Dunoon	1851	BT2/2585

Extant extracts and abbreviations of other contracts include:

Haddington	1834	<u>The Edinburgh Almanac</u> (1836) Nat. Lib. Scot.
Bo'ness	1844	S.R.O. (GB1/11/1) (7/4/1844)

NOTE: References in this chapter give the company name, and in brackets the Article of each contract, from sources listed here.

Dundee company also hoped to supply water (article 7)

Selkirk rules (on 4/2/1836) were drawn up at an Annual General Meeting attended only by eighteen shareholders, and were far more incoherent and less detailed than for other companies, with the exception of small companies like Moffat.

Several contracts, not used here, are extant for later periods. Vide, for example,

S.R.O. Sheriff Court of Perthshire (Deeds) - Alyth
gas company 5/7/1866
Auchterarder gas company 19/8/1857

TABLE 5.1 Companies in Organization Sample and
Length of Contract¹

<u>Company Name</u>	<u>Date Commenced</u>	<u>Contract Length</u> (Years)	<u>Nominal Value of Shares</u> (£)	<u>Nominal Capital Stock</u> (£)
Perth	7/12/1822	21	25	10,000
Dumfries	30/12/1824	21	20	8,000
Dundee	1/1/1824	21	20	20,000
Dunfermline	11/11/1828	21	10	5,000
Kirkcaldy	1/12/1829	21	10	4,000
Cupar	1/5/1830	21	10	2,500
Musselburgh	28/12/1830	31	5	2,500
Barrhead	23/9/1833	99	1	1,000
Grangemouth	1834	-	10	1,000
Falkirk Gaswork	18/6/1834	indefinite	10	2,000
Dalry	26/5/1834	21	5	950
Kirriemuir	31/12/1835	-	5	2,000
Kinross/Milnathort	24/6/1835	21	5	2,500
Moffat	c. 1839	-	5	1,000
Vale of Leven	9/5/1839		5	2,500
Dysart	1843	indefinite	5	1,200
Maxwelltown/Dumfries	17/6/1845	indefinite	5	5,000
Lochgilphead	12/6/1844	25	5	1,200
Banchory	14/11/1845		1	2,400
Falkirk Joint Stock	15/5/1845	21	2	4,000
Innerleithen	4/4/1846	31	2	800
Bridge of Weir	1846	-	2	-
Gourock	13/9/1848	indefinite	2	1,400
Haddington	Dec.1834		5	2,000
Dunoon	8/10/1851	indefinite	2	2,000
Bo'ness	1844		6	1,200

SOURCES: Vide supra p.895

Perth Contract (28/6/1823) is in Perth Reference Library
(Perth Pamphlets, Vol I, No. 4)

1. cf. Length of Contract in other Extant Examples

<u>Company</u>	<u>Date Commenced</u>	<u>Contract</u> (Years)	<u>Source (S.R.O.)</u>
Forres	(1837	21	BT2/1858
	(5/7/1858	30	
Airdrie	4/5/1830	indefinite	BT2/237
Coatbridge	1/1/1843	indefinite	BT2/191

Vide infra p.1817

At Dunfermline,¹ the general meeting of October 1828 which agreed to form a gas company also appointed a committee to draft a suitable contract of co-partnership. Another general meeting one month later authorized copies of the draft to be printed and distributed among supporters who made marginal notes where they wished the clauses to be altered, and then returned the drafts to the committee. A third general meeting approved revisions of the draft, and elected directors to make the alterations and then to employ Mr Cunningham, a solicitor, to complete the regulations. The final contract was then approved by a fourth general meeting. Later companies plagiarised freely.

Annan company in 1839 copied rules from Dumfries gas company, and the rules at Eyemouth in 1845 were based on those at Ayton.² Bo'ness company in 1844 copied five clauses from the Coatbridge company contract, and adopted a system of gas receipts and payments from the Crieff company.³ For further information on formulating the contract they wrote to the Falkirk company, and to that at Grangemouth, which had employed Messrs Russel and Aitken of Falkirk to design its contract.⁴ The Bo'ness contract was finally completed by Mr Cunningham, writer in Linlithgow.⁵

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1. S.R.O. Dunfermline Minute Book, op. cit., 21/10/1828, 19/11/1828, 2/12/1828, 4/12/1828, 12/2/29.
 2. S.R.O., Annan Minute Book, op. cit., 22/2/1839; Eyemouth Minute Book, op. cit., 19/10/1845
 3. S.R.O. Bo'ness Minute Book, op. cit., 5/5/1844, 9/8/1844
 4. Ibid., 29/7/1844. Russel was a coal lessee. Vide infra 'Coal' p.492
 5. Ibid., 9/8/1844. Local solicitors or 'Writers' composed the wording of contracts according to the wishes of Directors and the following solicitors resided in the same town as the company - Dundee - John Kerr; Musselburgh - T. Lees; Cupar - J. Dryburgh; Moffatt - T. Jardine; Dalry - J. McCosh; Falkirk J.S. - J. Smith; Peterhead (25) - W. Alexander; Gourrock - H.T. Patten; Maxwelltown (41) - W. Primrose and J. Gordon.

Each contract fulfilled eight distinct roles, the correct interdependent fulfilment of which was vital for the "rational and purposeful"¹ operation of gas or other companies. The contract defined the objectives² and justification³ for the company, how the capital would be invested,⁴ and how much capital was required. It stipulated the size of shares, the notice which would precede calls upon the shares, how calls would be enforced, and how new partners could be integrated into the company at a later date. The duties of all partners, the protection of partners and especially former partners, and any restrictions upon the number of shares per person, were explained. These were the priority considerations for any potential investor.

A hierarchical organization was then constructed with three 'holons' or self-governing sub-sections,⁵ interlinked by the Company Books which acted as a cognitive matrix and legal record of actions by all participants in the company's activities, providing consistency

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1. S. Pollard, Genesis of Modern Management (1968) op. cit. p. 302
 2. To prevent insidious transmutation into other commercial ventures
 3. Gaslight was usually stated to "be of great benefit and advantage to the town", making each company appear as a source of benevolence to the community. Vide infra p. 972
 4. The list of priorities in expenditure progressed from the cost of establishing the company, through surveys and plans, to purchasing the site and then erecting the works and laying pipes, e.g. Dunfermling (3), Kirkcaldy (3), Cupar (3), Dysart (3), Maxwelltown (4), Falkirk J.S. (3), Gourrock (3)
 5. 'Holons' are autonomous, self-governing wholes within the hierarchy, with participatory functions but also self-assertive tendencies. Problems of internal arrangement, and the derivation and enforcement of entrepreneurial decisions have received inadequate attention by historians according to Pollard, Genesis of Modern Management (1968) op. cit., pp. 18, 78
 - A. Koestler, The Ghost in the Machine (1970) p. 65
 - A. Koestler, The Act of Creation (1971) p. 288

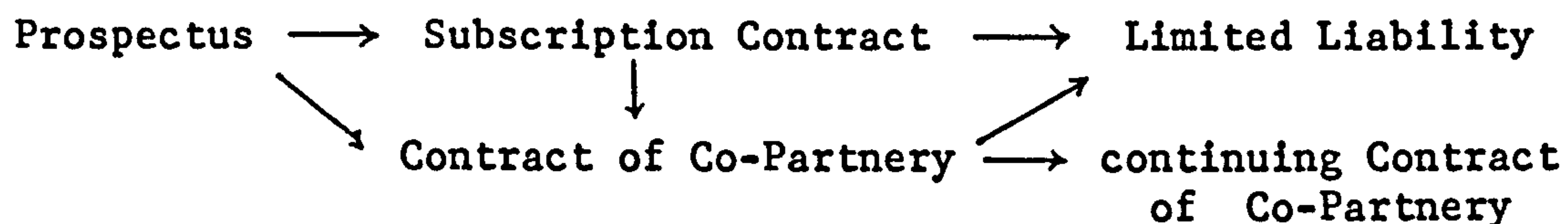
regardless of the absence, death or resignation of former participants. The shareholders in toto were the ultimate 'holon' governing company activities, and the contract stipulated a specific annual general meeting with agreed regulations on the method of making decisions, together with a mechanism for calling additional extraordinary general meetings when circumstances warranted a more rapid decision. To sustain its prerogative against lower holons, standing orders usually required extraordinary meetings to be held before the capital stock could be increased, the length of the company contract altered, or Parliament petitioned for an Act. Standing orders often also placed specific prohibitions on expenditure by the directors, and included Contingency Funds of various types.

The Directors' 'holon' was under the control of General Meetings, and therefore subjected in the contract to regulations governing the election of directors, their meetings, their liability for actions, and their powers to make by-laws. Directors were also partners, but received far greater powers than ordinary partners, and as a Board took control of the long-term planning and management of company affairs. The range of company staff varied with the size of the undertaking, but the 'Manager' or chief engineer and his helpers formed one 'holon' and the clerks, collectors and treasurers formed another. They obeyed regulations imposed both by the directors, as their immediate superiors, and by the General Meetings. The Manager was sometimes empowered also to formulate rules for his staff, but all the staff were covered by specific regulations in the original company contract.

Finally the contract provided legal rules, apportioning responsibility for signing Bills or other documents on behalf of the company,

and stipulating how disputes within the company over the contract, or between the company and outside parties were to be handled. The company promoters, or Interim Committee of Management, were responsible for the initial documents upon which the company commenced.

Possible Contracts and Legal Documents in Company Formation



The contract was often neglected until money had been subscribed and construction of the works begun, since the purpose of the company was normally advertized first in a Prospectus. Investors had a very carefree attitude towards the contract in many towns. The Prospectus was composed by the promoters, who alone were responsible for the size of shares and nominal capital stated, and the Edinburgh prospectus¹ of 1817 even listed the voting rules, the number and qualification of directors and the actual interim Directors. In later companies such details were gathered by an interim 'Committee' appointed by the subscribers and accepted only by popular acclaim.*

Fear of prosecution under the Bubble Act apparently led Edinburgh subscribers to sign acceptance of the prospectus, and pay calls on the shares, without a correct contract. At Dumfries the shareholders in 1824 signed a "Subscription Contract",² against the number of shares held. This was made to appear as an interim measure,

1. Vide supra p.154

2. S.R.O. (BT2/22). The Subscription Contract restricted investors to a maximum of ten shares. Formulated 13/12/1824, calling the members "a joint Company".

* Procedure at Perth, vide supra p.162

although it did bind them to pay subscriptions and claimed they would only be "liable to the amount respectively subscribed." It was apparently designed to prevent the company's rights being questioned, since although it stated that the subscribers would enter "a regular Contract of Co-partnership" if Parliament refused a charter, no application was made to Parliament. In January 1825 a general meeting agreed to more detailed regulations, and left responsibility for the application with the Directors who considered it unnecessary, and until 1857 only the Subscription Contract was signed.¹ The "Subscription Paper" was alone the basis for a full call-up on shares at Peterhead² in 1833, where the following year it became "part of" the Contract, and also at Dysart in 1843. At Falkirk and Grangemouth in 1834 all "preliminary arrangements" including contracts for materials, were made before a "regular Contract of Co-Partnery" had been agreed upon. The ease of starting a company enabled some to fail in providing a correct Contract of Co-Partnery at all. Bathgate³ company commenced in 1834, but in 1847 the company clerk was still trying to complete the Contract of Co-partnery, which was finally approved in 1850. Kinross and Milnathort⁴ company began with £2,500 stock in 1835, but did not even attempt to form a "regular Contract" embodying the agreed rules and regulations until much later,

1. S.R.O. (BT2/22) Letter to the Registrar of Companies 8/8/1857

2. S.R.O. (BT2/144)

3. S.R.O., Bathgate Minute Book, op. cit., 18/5/1847, 21/5/1850

4. S.R.O. (BT2/1481) Letter to the Registrar of Companies 2/9/1885.

The "Testing Clause" held the signatures of agreement of all proprietors.

when £3,004 had been subscribed and the works were fully operational. Even in 1885 the company had to admit that "the Testing Clause was never completed." Bo'ness¹ company began with subscriptions at a public meeting in September 1843 and had £4 called up on each £5 share by the following February, but when equipment contracts were placed that spring by interim directors, those directors were still inquiring into how to formulate a contract, and shareholders did not vote in favour of specific clauses until May and July. They finally signed it in September 1844.

Selkirk² gas company shareholders agreed to detailed regulations in 1836, which were engrossed in the Sederunt Book, but shareholders were warned in 1850 that "no regular or formal contract of Co-Partnery had been entered into", nor had Titles to hereditary property been completed. Selkirk first drew up correct rules and Articles of Association in 1851.

Carelessness over the contract occurred also at a later date. The thirty-one years contract of Dalkeith³ company expired in January 1858, and no one noticed the fact until July when a general meeting hurriedly backdated its renewal. Stranraer⁴ company was dissolved and reformed

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1. S.R.O., Bo'ness Minute Book, op. cit., 18/9/1843, 8/12/1843, 2/2/1844, 7/5/1844, 19/7/1844, 29/7/1844, 13/9/1844, 30/9/1844. Each shareholder was given a printed copy of the final Contract.
 2. S.R.O., Selkirk Minute Book, op. cit., pp. 40-51
 3. S.R.O., Dalkeith Minute Book, op. cit., 2/7/1858
 4. S.R.O., Stranraer Minute Book, op. cit., 19/1/1875.

The dissolution in 1862 was also due to carelessness over a clause in the original contract, which lost the company £500 to Stranraer Academy, vide infra p.1191

in 1862 to make major changes in the original contract, but the old company's property, vested in Trustees, was not transferred to the new company, due to carelessness, until 1875. Stornoway¹ company directors did not discover until 1870 that their 1847 "Deed of Constitution" had expired in 1868.

The first directors, or "Interim Committee"² were far more attentive in policing the payment of subscriptions by investors, and took immediate responsibility for using that capital to finance the construction of the works. To prevent indebtedness to contractors, or a law suit for recompense, effective measures to ensure payment from regretful partners was essential for the welfare of the corporate body. Only small deposits, or none at all, were demanded from shareholders when they first subscribed, though Dundee and Falkirk exacted ten per cent on the shares³ or forfeiture after three weeks. But, in signing, all became bound to pay whenever and whatever installments the directors found it necessary to call up on the shares.⁴

Standing rules sometimes modified this power. At Cupar, a

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1. S.R.O., Stornoway Minute Book, op. cit., 25/1/1870
Sir James Matheson owned fifty per cent of the stock, so the directors consulted him first over whether to renew the Deed, or sell the works to the Burgh Commissioners.
 2. Directors were responsible for employing engineers and getting the works built. Vide infra Chapter II I p.595; also p.755
 3. Dundee 1824(4), Falkirk 1834(2). Grangemouth in 1834 (2) took a fifty per cent deposit or immediate forfeiture. Musselburgh (2) took £1 on signing contract, and the directors could only make two further calls, each of £2.
 4. e.g. Dumfries 1824 (11), Dundee 1824 (4), Kirkcaldy (4), Peterhead (11), Falkirk (2), Gourrock (4), Lochgilphead (8), Dalry (4), Cupar (5), Dunfermline (4), Dunoon (5).
Calls were expected to be made of equal amount on all shares which had been subscribed, and not on particular investors only e.g. Dalry.

general meeting had first to approve of calls, at Maxwelltown each call could not exceed £1, and Falkirk Joint Stock directors had to allow one month to elapse between calls.¹ Bridge of Weir shareholders had to pay up ten per cent monthly, but at Innerleithen the full amount had to be paid within ten days.² Normally, however, the directors alone were responsible to making calls, and under the Contract the call had to be paid within a specified number of days. Those signing the contract bound "themselves, their heirs, executors and successors whomsoever" to fulfil the contract, and assigned their shares to the company as security for punctual performance.³ They also accepted specific non-fulfilment penalties which could be imposed by the directors (Table 5.2)

Shareholders often undertook a personal obligation to use their utmost "power and ability" to promote the advantages of the company⁴ and considerable loyalty was shown in companies which made no profit for many years.⁵ Provided that correct notification⁶ had been given

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1. Cupar (4), Maxwelltown (5), Falkirk J.S. (6). At Banchory (3) each call on £1 shares could not exceed 5s.
 2. Bridge of Weir (11), Innerleithen (2)
 3. Assingation - Banchory (19), Dunoon (19), Kirkcaldy (32), Cupar (28), Peterhead (22), Kinross (37), Dysart (27), Musselburgh (21) Maxwelltown (38), Innerleithen (22), Gourrock (23), Perth (32), Vale of Leven (3).
The "Testing Clause" which all original partners subscribed, personally or by proxy, was stated as being as binding as if it was in the body of the document. Dunfermline (4,36), Kirkcaldy (4,33), Cupar (4,29), Kinross (4,38), Dysart (4,27), Maxwelltown (5), Falkirk J.S. (6,39), Dundee (4), Innerleithen (27), Haddington (28)
 4. Dunfermline (1), Kirkcaldy (1), Cupar (1), Kinross (1), Dalry (2), Dysart (1), Innerleithen (1), Falkirk J.S. (2), Dundee (2)
 5. Vide infra 'Finance' pp.776, 787
 6. Notification was usually by circular letter, or a written notice from the Company Clerk delivered personally or by Post to the shareholder or his residence: e.g. Dumfries (11), Kirkcaldy (5), Falkirk J.S. (3), Dunfermline (4,11). At Grangemouth (2) and Falkirk (2) notification was either by letter or by advertisement in the Stirling Newspaper. Vale of Leven (3) directors could sue for repayment plus one-fifth more, as could Dundee (25).

TABLE 5.2 Stipulated Penalties against Shareholders
for Non-Fulfilment of Contract

<u>Company</u>	<u>Penalty</u>
Dundee	£10 per share
Musselburgh	£30 per person
Kirkcaldy, Cupar, Grangemouth, Falkirk	£10 per share
Dunfermline, Maxwelltown, Falkirk Joint Stock	£5 per share
Dalry, Haddington	£2 10s per share
Dysart	£2 per share
Kinross, Banchory	£1 per share
Gourock, Dunoon	10s per share
Peterhead	£5 per partner
Innerleithen	£10 per partner
Perth	£20 per share

SOURCES: Dundee (48), Musselburgh (16), Dunfermline (35), Kirkcaldy (32), Cupar (28), Grangemouth (6), Falkirk (28), Kinross (37), Dalry (28), Dysart (27), Maxwelltown (38), Falkirk J.S. (38), Gourock (39), Peterhead (22), Innerleithen (26), Perth (32), Haddington (30), Banchory (19), Dunoon (29)

of a call, as required by the contract, the directors were empowered to sue defaulters for the instalment plus damages and interest, or to declare their shares forfeited,¹ after a specified lapse of time. Small companies, with greater difficulty in obtaining support, often allowed a longer time than did others.

TABLE 5.3 Specified Interval between Call and Forfeiture

<u>Company</u>	<u>Interval</u>	<u>Interest Charged for Late Payment</u>
Perth	21 days	Legal Interest
Dunfermline	3 months	5%
Kirriemuir	21 days	Legal Interest
Dysart	14 days	5%
Maxwelltown & Dumfries	14 days	5%
Falkirk	14 days	5%
Vale of Leven	2 months	Legal Interest
Lochgilphead	14 days	5%
Kirkcaldy	30 days	Legal Interest
Falkirk Joint Stock	30 days	Legal Interest
Dunoon	28 days	5%
Cupar	30 days	Legal Interest
Banchory	6 weeks	Any losses due to company
Peterhead	1 month	5%
Dalry	2 months	5%
Barrhead	6 months	5%
Grangemouth	14 days	5%
Musselburgh	10 days	

SOURCES: Dunfermline (4,11), Kirriemuir (9), Dysart (4,5), Maxwelltown (7), Falkirk (2), Lochgilphead (8), Kirkcaldy (5), Falkirk Joint Stock (6), Cupar (4), Peterhead (11), Dalry (4), Barrhead (8), Grangemouth (2), Musselburgh (2), Vale of Leven (3), Perth (5), Banchory (3) Dunoon (3).

Forfeiture was the most usual method² of enforcing payment,

1. e.g. Cupar (5), Dysart (5), Maxwelltown (7), Falkirk Joint Stock (6), Lochgilphead (8), Dalry (6)
2. Legal action was more appropriate if the company was in financial difficulties and could find no market for any shares seized as forfeiture.

Vide supra p.755

since it eliminated the expense of legal action. The forfeit shares were then sold at public auction, and because the company remained "obliged to account to those having a right", the dispossessed shareholder was paid this money, less deductions for the expense of the sale and other penalties.¹ A simple formula was established to define the position of all shareholders regarding profits or losses, without specifically warning investors that their liability could be unlimited:

Every member of the Company shall be interested in the Stock, and Profits, and be liable for any loss that may be sustained by the Company according to the amount of Shares he or she may hold; and shall be bound to relieve each other of all debts and engagements of the Company, to the extent of their respective interests in the concern.²

Protection³ against company debts and other obligations was specifically granted to every partner who forfeited his shares, or who disposed of them to another partner who assumed his obligations. New partners took the "precise place"⁴ of their predecessors, with the

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1. The public sale sometimes had to be advertized in a specific way e.g. for three weeks in Dundee (5) and Perth (24) newspapers, or on a Dunfermline (25) or Gourock (5) church door. This probably served also as a social snub to the defaulters.
 2. Dunfermline (3) and Kirkcaldy (7). See also Peterhead (14), Falkirk (14), Kinross (3), Dysart (3), Maxwelltown (10), Falkirk J.S. (3), Innerleithen (3), Gourock (3), Cupar (3), Dalry (1), Barrhead (13), and Lochgilphead (13), Perth (3), Haddington (21), Vale of Leven (4), Selkirk (6), Musselburgh (3), Banchory (13) Dunoon (19)
Only a few companies, like Musselburgh (12) also stated that in the event of a loss, the directors could force partners to pay a proportional contribution to repay the money.
 3. Dundee (23), Dunfermline (10), Innerleithen (19), Kirkcaldy (15), Cupar (14), Kinross (11), Falkirk J.S. (12), Falkirk (22), Dalry (9), Haddington (22), Lochgilphead (15), Perth (11), Vale of Leven (16), Musselburgh (19), Banchory (13)
 4. Dunfermline (10), Perth (11)

"same privileges and benefits", but subject to all the regulations and losses "as if they had been originally partners".¹ Sometimes they had to sign a minute or deed of acceptance to this effect.²

Those purchasing shares in new stock issued at a later date were to be treated "equally and pro rata" with the original partners.³ Shares were deemed to be "personal and moveable, and not real or heritable estate",⁴ regardless of how the company used the capital, and whatever real rights it acquired.

Transference of shares and the integration of new partners without the invalidation of the contract each time, was vital for the coherence and stability of a co-partnership of this size.⁵ Company Directors were placed in firm supervision of this procedure by regulations in the contract which enabled them to inspect, and if necess-

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1. Dundee (6,22). See also Dumfries (17), Barrhead (10), Cupar (11), Kinross (11), Moffat (12), Maxwelltown (6,15), Gourrock (7), Falkirk (22), Innerleithen (19), Vale of Leven (4), Musselburgh (4)
 2. e.g. Lochgilphead (10), Dalry (8), Falkirk J.S. (11) Peterhead (16), Innerleithen (14), Perth (10), Banchory (3)
 3. e.g. Dundee (6,14) which required a full payment on such shares within twenty-one days, at their current market value, or they were forfeited. In paying that premium, they gained no extra privileges over original shareholders.
 4. Dundee (18), Dunfermline (6), Kirkcaldy (6), Peterhead (18), Banchory (17), Falkirk (13), Vale of Leven (12), Kinross (5), Dysart (6), Maxwelltown (9), Innerleithen (15), Gourrock (6), Musselburgh (5), Barrhead (9), Moffat (12), Dunoon (6), Lochgilphead (9), Haddington (19), Perth (6), Selkirk (14)
 5. On Scots law vide infra p. 104
Fixed capital growth depended upon institutional stability, vide W.H. Marwick, Economic Developments in Victorian Scotland (1936), op. cit., p. 121

Occasionally a specific statement was made that the contract was not invalidated regardless of any contrary "law or practice" e.g. Peterhead (21), Falkirk (26), Haddington (25), Banchory (15)

ary reject, hopeful investors. The company's books were made the only legal proof of the transfer of shares, and without a correct entry outsiders were denied any dividend or votes.¹ This was equally true of heirs and executors, who had to produce legal evidence of their right to shares.² Dumfries³ in 1827 expected both buyer and seller to countersign the book of transfers.

Although partners had a right to sell or transfer all or any of their shares, they were universally required to offer the shares first to the "Directors for behoof of the Company at a price not greater than they shall afterwards dispose of the same."⁴ In many companies like Perth,⁵ Kinross, Dysart, Kirkcaldy and Cupar, the purchaser had to be approved before a sale, by a quorum of directors. The directors usually had to decide within a set time limit,⁶ which varied from three days at Falkirk to fourteen at Gourock, Dalry and Dunfermline, and a month at Kinross and Dysart. Usually, "for regularity and the more perfect security of the Company",⁷ only their

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1. e.g. Kinross (7), Maxwelltown (13), Moffat (11), Dalry (8)
 2. e.g. Falkirk J.S. (10), Banchory (15), Dysart (12), Kinross (7), Vale of Leven (15)
 3. Dumfries (17). See also Moffat (12), Lochgilphead (10), Dalry (7), Selkirk (9)
 4. Dunfermline (7). See also Kirkcaldy (12), Cupar (11), Peterhead (16), Falkirk (20), Kinross (7), Dalry (7), Dysart (11), Innerleithen (16), Gourock (7), Musselburgh (16), Haddington (20), Dunoon (7)
 Bridge of Weir (10) stated that if any shareholder wished to sell out, "the other shareholders were to have the preference of purchasing."
 5. Perth (8), Vale of Leven (14)
 6. Kinross (7), Dunfermline (7), Falkirk (20), Dalry (7), Dysart (11), Gourock (7), Innerleithen (8), Perth (8), Vale of Leven (14)
 7. e.g. Dysart (11)

Clerk could record the conveyance of shares.¹

Restrictions placed upon the holding of shares were designed to ensure stability during the critical period of initial operations, to prevent confusion over ownership, and occasionally to prevent the concentration of ownership in a few individuals against the interests of community justice.² (Table 5.4) Selkirk³ only permitted shares to be transferred to persons resident, or holding property in the town. Normally shares could only be held "in the names of individuals and not of Co-partnerships",⁴ which had to use a trustee, and shares could not be sub-divided by sale or assignation.⁵ Where subdivision occurred between executors, they had to choose one legal representative for each share, or lost the right to vote.

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1. e.g. Kinross (7), Dunfermline (9), Perth (10), Musselburgh (18). Standing orders sometimes stipulated a separate Book showing shareholders e.g. Barrhead (10), Bridge of Weir (10), Banchory (15), Falkirk (20), Haddington (18).
A fee of up to 2s 6d was often charged to record transfers, and many companies assumed the right to retain Assignations drawn up by outsiders, e.g. Maxwelltown (13), Dunfermline (9), Falkirk J.S. (10), Innerleithen (10), Lochgilphead (10), Dunoon (7)
 2. Maximum limits upon shareholding by an individual also helped to spread the risks and, like the use of a Board of Directors, and annual general meetings, it was one of many aspects of gas company organization developed earlier by the late eighteenth century joint-stock Scottish Banks which competed with older public and small-partnership private banks. Perth Banking Company in 1787, for example, restricted partners to a maximum of six shares each. R.S. Rait, The History of the Union Bank of Scotland (1930, Glasgow) pp. 1, 23, 121, 152, 133
 3. Selkirk (9)
 4. e.g. Kirkcaldy (11), Cupar (10); Peterhead (17) also forbade its shareholders from ever joining or aiding a rival gas company in the town.
 5. Kirkcaldy (13), Cupar (12), Kinross (12), Innerleithen (16), Banchory (15).

Table 5.4 Restrictions upon Share Sales During Initial Operations

<u>Companies</u>	<u>Restriction</u>
Kirkcaldy	No transfer until 6 months after lighting commenced
Cupar, Bo'ness, Dunoon	No transfer for 12 months
Grangemouth, Falkirk	No transfer for 12 months after first installment
Dysart, Peterhead	No transfer for 12 months after lighting commenced
Falkirk Joint Stock	Residents within 5 miles radius could not sell one share, or more than half of any larger quantity, for 24 months
Selkirk	No transfer for 9 months
Banchory	No transfer for 2 years, except to residents within 5 miles of gasworks and approved by directors.

SOURCES: Kirkcaldy (12), Cupar (11), Grangemouth (2), Falkirk (2), Dysart (11), Peterhead (8), Falkirk J.S. (9), Selkirk (9), Bo'ness (2), Banchory (15), Dunoon (7).

Table 5.5 Maximum Shareholding Regulations

<u>Company</u>	<u>Maximum Shares per Person</u>	<u>Mitigating Circumstances</u>
Dumfries	10	Except by purchase from another shareholder
Kirkcaldy	20	Unless more by succession, legacy or donation
Cupar	10	Any surplus to be sold within 12 months
Peterhead	10	
Maxwelltown	100	
Kinross	50	Unless more by succession, legacy or marriage
Perth	20	Any surplus to be sold within 6 months
Musselburgh	20	Until seven months after company commenced, or by inheritance
Dunoon	125	Unless more by succession
Dunbar (1836)	20	
Brechin (1835)	20	

SOURCES: J. Miller, The History of Dunbar (1859, Dunbar).

Dumfries (3), Kirkcaldy (11), Cupar (10), Peterhead (3), Maxwelltown (8), Kinross (8), Perth (7), Musselburgh (3); Dunoon (4) also fixed a further 94 maximum per person in any later increase of stock.
Brechin, vide infra p.1328

To uphold the position of local investors, the directors¹ of several companies were also under instructions to allocate new stock preferentially to local residents, as at Falkirk, Kirkcaldy, Maxwelltown and Dumfries. Such persons were most likely to "promote the interests of the company".

The Annual General Meeting* of shareholders which was normally held on a particular day specified in the contract, in the months of May to July,² provided the regular opportunity for investors to examine company affairs, and to devise or alter the guide-lines³ within which the directors operated. Book-keeping and accountancy problems of

1. Kirkcaldy (4), Dumfries and Maxwelltown (6).

Falkirk J.S. (4) directors were to make allocation to "such consumers and persons of influence" as they saw fit.

Musselburgh (3) directors were to allocate new stock as widely as possible, but entirely to residents or property owners in Inveresk parish unless a majority of directors agreed to admit outsiders.

At Dunoon (4) existing shareholders had preferential options on new stock.

2. Presumably, as in the eighteenth century, because of greater ease of travel in summer. Musselburgh (4) and Moffat, however, met in January, Gourock in September, and Innerleithen in October.

Dumfries (6), Dundee (24), Dunfermline (11), Cupar (15) Barrhead (5), Peterhead (4), Falkirk (6), Kinross (13), Dalry (10), Moffat (5), Bo'ness (6), Maxwelltown (18,23), Falkirk J.S. (13), Innerleithen (4), Bridge of Weir (7), Dunoon (8), Gourock (8), Lochgilphead (5), Kirkcaldy (16), Perth (12), Vale of Leven (5).

The Directors could not remove the meeting to a distant town e.g. Dunfermline (11)

Falkirk J.S. (13), Kinross (13), Perth (12)

Some notification to remind shareholders to attend was often provided, from the town-crier in Kinross, to newspaper advertizements for Dysart, and postal notices at Falkirk and Lochgilphead.

3. e.g. Innerleithen (4), Kinross (13)

Decisions reached at the A.G.M. applied with equal force to partners who were absent from the meeting e.g. Barrhead (5), Lochgilphead (5).

Only a few imposed a minimum quorum for general meetings e.g. holders of 20 shares at Dalry (14) and £200 stock at Falkirk J.S. (17)

* Early general meetings were often held in ale houses, like the Bull Inn for Glasgow company in 1817 (vide infra p.1361), Burnett Arms for Banchory Co. 1845 (preface), and Argyll Inn for Dunoon Co. (8).

Schools were later used, like the Parochial School Room at Dunbarney for Bridge of Earn Co. in 1859 (4), and the Iron Company's Schoolroom for Muirkirk Co. Portobello Co. (1845) met at Ross's Inn; The Scotsman 25/6/1845
Directors meeting places, vide supra p.616

profit and loss had to meet this annual deadline, when dividends were due for payment and directors faced cross-questioning on all aspects of their management from shareholders who were usually directly affected also as consumers.

The prerogative of the Annual General Meeting was to elect directors¹ for the succeeding year, to declare dividends on any profits,² and to examine the general affairs of the company which usually had to be presented both in the regular books, and in an abstract³ composed by the directors for the meeting. The directors had considerable power to influence decisions of the General Meeting by the interpretation they presented, but upon any contentious issue the Meeting could over-rule them, or replace them, and was able to obtain independent information directly from the books and accounts. In some companies, like Dunfermline,⁴ the annual meeting had to review and approve or reject any "interim regulations" introduced by directors during the previous year.

Safeguards were often included in the Contract against major alterations being decided at a sparsely attended annual meeting, which was confined to "routine business".⁵ Only if shareholders were warned some time in advance could the annual meeting alter regulations in the Contract of Co-partnery. Grangemouth required twelve

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1. Dumfries (1), Dundee (24), Dunfermline (11), Kinross (13), Dalry (10), Maxwelltown (18), Banchory (4), Peterhead (4), Falkirk (6), Perth (12,18), Bo'ness (6)
 2. e.g. Falkirk (6), Kinross (13), Dysart (30), Dunoon (8)
 3. e.g. Dumfries (8), Dundee (24), Dunfermline (11), Peterhead (4), Perth (11), Dunoon (8)
 4. Dunfermline (13)
 5. Dunfermline (13), Perth (12)

months' advance notice, while at Dalry, Falkirk and Barrhead¹ the company Clerk had to be informed a month in advance, and shareholders were always informed of the precise proposals involved.

Voting regulations were quite elaborate, and a sliding-scale of votes in many companies provided a democratic structure in which large shareholders could be outvoted by relatively few, small shareholders. Many companies allowed only a fixed maximum number of votes to one shareholder regardless of the size of his investment, and in a company like Dysart seven persons each holding one share could outvote one person with thirty-one or more shares. Such regulations could prevent a small group of outsiders from gaining control and burdening the local community with very high gas prices.²

Each general meeting usually elected³ its own Chairman who had a deliberative vote, and also a casting vote if necessary. Only in a few cases did the Company Chairman,⁴ chosen by the directors themselves, preside over all meetings. Shareholders who had not paid the full amount called upon shares could not vote, and in several

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1. Grangemouth (4), Dalry (27), Barrhead (18), Falkirk (27). In these companies a simple majority of votes decided the issue. Moffat (13) Clerk required 3 weeks' notice, while at Dunfermline (13) the proposal had to be advertized for three weeks, and at Lochgilphead alterations had to be advertized a month before the meeting in the Glasgow Herald and North British Advertizer. Maxwelltown (33) and Peterhead (15) required a voting majority of two-thirds before alterations could be implemented. Haddington (29) required one month's notice and a Special General Meeting to alter the Contract.
 2. Vide infra Chapter II p.221; also p.1004
 3. Kirkcaldy (20) and Cupar (18). If there was an equal vote for two rival Chairmen, at Dundee (27), Perth (15) and Dunfermline (16) the choice was resolved by the most senior director or partner at the meeting, while at Dalry (14), Falkirk (6) and Falkirk J.S.(17) the rivals drew lots.
 4. e.g. Peterhead (6), Lochgilphead (5), Gourock (12), Maxwelltown (24), Dunoon(11)

companies neither could new partners for at least three months.¹ Voting by proxy through another shareholder was allowed, and was even compulsory for minors and women as at Kirkcaldy.² A written mandate, without holograph or testing,³ was generally accepted and in companies like Gourock⁴ it was a long-term arrangement and subsisted until recalled. Outside societies or partnerships which held company shares had to vote through one of their partners or office bearers⁵ and could not have several representatives.⁶ (Tables 5.6 and 5.7). Decentralization of voting power was also encouraged by placing a maximum restriction on the proxy votes exercised by individuals.

Bankruptcy of individual partners⁷ disqualified them from

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1. e.g. Dunfermline (14), Kinross (15), Falkirk (15), Vale of Leven (7). Perth (13) stated six months.
 2. Kirkcaldy (11), Cupar (10), Dysart (3)
At Vale of Leven (7) unmarried females could only vote by proxy; married females could only vote through their husband or his proxy.
 3. e.g. Dundee (25), Dumfries (3), Barrhead (4), Dalry (13), Moffat (3), Lochgilphead (4), Perth (13), Dunoon (10)
Kirkcaldy (18) was exceptional in requiring a holograph, or mandate taken before witnesses, which lasted only six months.
 4. Gourock (10), Dunfermline (14)
 5. Dundee (26), Dunfermline (15), Kinross (16), Dalry (13), Dunoon (10), Falkirk J.S. (16), Perth (14), Vale of Leven (6), Musselburgh (4)
 6. Barrhead (4), Innerleithen (4), Lochgilphead (4)
 7. "No Trustee or Commissioner, Judicial or voluntary" was allowed to vote, or to interfere in a company's affairs on behalf of a shareholder.

Dunfermline (15), Dundee (26), Kirkcaldy (19), Cupar (13), Dalry (13), Falkirk J.S. (16), Innerleithen (4), Kinross (26), Peterhead (20), Haddington (23), Perth (8,15), Musselburgh (4), Dunoon (10)

TABLE 5.6 Maximum Votes allowed to one Shareholder

<u>Companies</u>	<u>Maximum</u>
Dumfries	1
Dalry, Moffat, Innerleithen, Selkirk	3
Musselburgh	4
Gourock, Peterhead	5
Cupar, Kinross, Dysart	6
Dundee, Falkirk, Bridge of Weir, Lochgilphead, Perth, Vale of Leven	10
Bo'ness	20

SOURCES: Dumfries (3), Dalry (13), Moffat (3), Innerleithen (4), Cupar (17), Kinross (15), Dysart (3), Gourock (11), Peterhead (7), Dundee (26), Falkirk (8), Bridge of Weir (2), Lochgilphead (4)

TABLE 5.7 Maximum Number of Proxy Votes allowed per Shareholder

<u>Company</u>	<u>Maximum</u>
Dumfries	1
Cupar	6
Kinross and Milnathort	2
Falkirk Joint Stock	5
Maxwelltown and Dumfries	2
Falkirk	3

SOURCES: Dumfries (3), Cupar (17), Kinross (15), Falkirk J.S. (15), Maxwelltown (25), Falkirk (7)

Table 5.8 Voting Regulations at General Meetings

<u>Company</u>	<u>No. of Shares in Block</u>	<u>Votes Allowed</u>	<u>Additional Number of Shares in Blocks conferring</u>		<u>Maximum Total Votes per Person</u>
			<u>One</u>	<u>Extra Vote</u>	
Dumfries	1 to 3	0			1
	Above 4	1			
Dundee	1 to 10	1			-
	11 to 20	2		5	
Dunfermline	1	1	1	1	10
Kirkcaldy	1	1	(1 (up to 5)	(5 (after first 5)	-
Barrhead	1 to 4	1			-
	5 to 9	2			
	10	3		10	
Cupar	1	1			6
	2	2		2	
Peterhead	1 to 2	1			5
	3 to 4	2			
	5	3			
	Above 6	5			
Falkirk	1	1		1	10
Kinross / Milnathort	1	1			6
	2	2		2	
Dalry	1	1			3
	4	2			
	Above 7	3			
Moffat	4 to 6	2			3
	Above 7	3			

SOURCES: Dumfries (3), Dundee (26), Dunfermline (14), Kirkcaldy (19), Cupar (17), Barrhead (4), Peterhead (7), Falkirk (8), Kinross (15), Dalry (13), Moffat (3)

Voting Regulations at General Meetings

<u>Company</u>	<u>No. of Shares in Block</u>	<u>Votes Allowed</u>	<u>Additional Number of Shares in Blocks conferring</u>		<u>Maximum Total Votes per Person</u>
			<u>One</u>	<u>Extra Vote</u>	
Dysart	1 to 3	1			
	4 to 6	2			
	7 to 12	3			
	13 to 20	4			
	21 to 30	5			
	Above 31	6			6
Falkirk Joint Stock	1 to 2	1			
	3 to 4	2			
	5 to 7	3			
	8 to 10	4			
	11 to 14	5			
	15 to 19	6			
	20 to 24	7			
	25 to 29	8			
	30 to 34	9			
	35	10	£50 stock		-
	Innerleithen	1 to 9	1		
10 to 19		2			
Above 20		3			3
Gourock	1 to 4	1			
	5 to 9	2			
	10 to 14	3			
	15 to 20	4			
	Above 21	5			5
Bridge of Weir	1	1	1		10
Lochgilphead	1	1	1		10
Perth	1	1	1		10

SOURCES: Dysart (3), Falkirk J.S. (16), Gourock (11), Bridge of Weir (2), Lochgilphead (4), Perth (14)

Voting Regulations at General Meetings

<u>Company</u>	<u>No. of Shares in Block</u>	<u>Votes Allowed</u>	<u>Additional Number of Shares in Blocks conferring</u>		<u>Maximum Total Votes Per Person</u>
			<u>One</u>	<u>Extra Vote</u>	
Vale of Leven	0 to 1	0			
	2 to 4	1			
	5 to 9	2			
	10 to 14	3			
	15 to 19	4			
	20 to 29	5	10		10
Selkirk	1 to 3	1			
	4 to 6	2			
	7	3	-		3
Musselburgh	1 to 9	1			
	10 to 14	2			
	15 to 19	3			
	20	4			4
Bo'ness	1 to 2	1			
	3 to 4	2			
	5 to 7	3			
	8 to 10	4			
	11 to 14	5			
	15 to 19	6			
	20 to 24	7			
	25 to 29	8			
	30 to 34	9			
35	10		£50 stock		
Banchory	5	1	5		20
Dunoon	3 to 5	1			
	6 to 9	2			
	10 to 14	3			
	15 to 19	4			
	20	5		£20 stock	

SOURCES: Vale of Leven (6), Selkirk (1), Musselburgh (4),
Bo'ness (dated addendum 19/7/1844), Banchory (7),
Dunoon (10)

voting or acting in company affairs, and they had to sell their shares within a specified time¹ or the company assumed a right to dispose of the shares at public auction. This also applied to unclaimed shares of deceased partners,² and the revenue less expenses was later paid to anyone with a right to it. The arrestment of shares of living³ or deceased partners⁴ also had to be lifted within a specified time by their efforts or those of their representatives, or the company again assumed the right to sell the shares.

Extraordinary General Meetings with the same voting regulations as Annual Meetings provided the flexibility with which the shareholders as a whole could react to important and urgent business whenever this arose in the interval between annual meetings. The 'sleeping' partners were awakened either by the directors or by an anxious group of ordinary shareholders, according to regulations agreed in the Contract. A requisition stating the purpose of the meeting had

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1. Six months at Dunfermline (7), Perth (8), Musselburgh (12), Cupar (13), Dalry (13), Kinross (6), Maxwelltown (11) and Innerleithen (17); twelve months at Kirkcaldy (14).
Only three months were allowed at Falkirk J.S. (8); and Selkirk (10) directors sold such shares immediately.
 2. Dunfermline (8), Kirkcaldy (15), Cupar (14), Kinross (9), Dalry (6), Dysart (14)
 3. Within thirty days at Maxwelltown (12);
Two months at Dalry (6), Dunoon (25) and Lochgilphead (14);
Three months at Perth (9), Dunfermline (8), Kirkcaldy (15), Cupar (14), Kinross (9), Dysart (14) and Falkirk J.S. (8);
Six months at Musselburgh (17) and Innerleithen (17);
Twelve months at Haddington (24)
 4. i.e. "Attached by the diligence or Confirmation qua creditor"
Dunfermline (8), Kirkcaldy (15), Kinross (9), Dalry (6), Dysart (14), Maxwelltown (12), Falkirk J.S. (8)

to be delivered by these persons to an officer of the company,¹ who was responsible not to the directors but to the company as a whole to examine the authority of their request, and then to inform shareholders in advance of both the purpose and date of the meeting. The subsequent meeting was fully empowered to handle that particular business, but to prevent malpractice it was forbidden² to handle any additional matters. Selkirk (5) shareholders could call no Extraordinary General Meeting without the approval of the Directors, and other companies may have been muzzled in a similar way.

Capital stock was increased on the advice of the directors,³ but only after a special general meeting voted in favour of the change. At Dundee,⁴ where the stock was to be doubled by £20,000 if piped water was to be supplied, two special meetings were required, the first to agree in principle and the second a month later to ratify that decision. Elsewhere smaller amounts were involved, and although a few companies imposed a maximum limit on potential stock,⁵

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1. The officer varied from one company to another, e.g.
 Company Clerk at Dunfermline (12) and Gourock
 Manager or Company Servant at Kirkcaldy (17)
 Convener of Committee of Directors at Barrhead
 Clerk or Treasurer at Innerleithen
 Manager or Directors at Dundee (24)
 President or Vice President at Dumfries (20)
 2. e.g. Dunfermline (13), Kinross (14), Moffat (6), Dysart (16),
 Falkirk J.S. (14), Dunoon (9)
 3. Sometimes a specific clause forbade the directors to borrow money
 or extend the capital without permission from a special general
 meeting e.g. Kinross (33), Moffat (10)
 4. Dundee (9,10,11,12)
 5. Falkirk J.S.(5) allowed an increase only from £4,000 up to £7,000;
 Falkirk (3) allowed stock to be increased by only £4,000;
 Dalry(5) allowed an increase only from £950 up to £1,200;
 Gourock (3) allowed an increase from £1,400 to £1,800;
 Banchory (3) allowed an increase from £2,400 to a maximum £4,800

TABLE 5.9 Qualifications for Convening an Extraordinary General Meeting

<u>Company</u>	<u>Partners Holding</u> (fractions of Total Company Stock)	<u>Directors</u>	<u>Days</u>	<u>Advance Notice</u> <u>Given to Shareholders</u>
				<u>Communication</u>
Dunfermline	One-fifth stock	3	10	Circular letter
Kinross	One-fifth stock	3	10	Circular letter
Kirkcaldy	One-fifth stock	3	10	Circular letter
Cupar	One-fifth stock	5	10	Circular letter
Barrhead	(15 partners)			
Peterhead	50 shares	4		
		(or Chairman)	4	
Falkirk	50 shares	Directors	10	Printed notice (and newspapers)
Dalry	(10 partners)	Directors	2	Word of mouth
Moffat	(10 partners)	Clerk	14	
Dysart	One-fifth stock	4	10	Circular letter
Maxwelltown	(20 partners)	Quorum	14	Circular letter
Falkirk J.S.	150 shares	Directors	8	Circular letter
Innerleithen	One-tenth stock	Majority	5	Circular letter
Bridge of Weir	Majority	Majority		
Gourock	One-tenth stock	Quorum	10	Circular letter (or on church door)
Lochgilphead	(10 partners)			
Haddington	25% stock	Quorum		
Dundee	((3 partners with (100 shares or (20 partners)		21	Newspapers
Dumfries	(10 partners)	4	3	Circular letter
Perth	One-fifth stock	5	14	Circular letter
Vale of Leven	(3 voting partners)		3	
Musselburgh	One-tenth stock	Majority	5	Circular letter
Banchory	(10 shareholders (with above 200 (shares	(Chairman or (4 directors	8	Aberdeen newspapers
Dunoon	One-quarter stock	(Quorum or (Chairman or (Deputy Chair- (man	10	Circular letter

SOURCES: Dunfermline (12), Dundee (24), Dumfries (20), Kinross (14), Cupar (16), Barrhead (5), Peterhead (4), Falkirk (6), Dalry (11), Moffat (7), Haddington (7), Dysart (16), Maxwelltown (23), Falkirk J.S. (14), Innerleithen (5), Bridge of Weir (6), Gourock (9), Lochgilphead (5), Dunoon (9), Perth (12), Vale of Leven (9), Musselburgh (5), Banchory (4)

a single special meeting was normally all that was required to raise the stock to whatever amount was agreed by a simple majority¹ of votes. Frequently the existing shareholders were given preferential rights to purchase new stock.²

Contracts of Co-partnery usually lasted for twenty-one years,³ though some⁴ were thirty-one, and some were to last indefinitely.⁵ In the event of financial decline,⁶ or continued prosperity, a special general meeting could terminate or extend the contract. No transfer of shares was permitted between the calling of such a meeting and its conclusion.⁷ Dundee⁸ again required a second meeting to ratify the decision by a majority vote, and other companies also devised safeguards because of the importance of such a decision. Kirkcaldy

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1. e.g. Dundee (9), Dunfermline (3), Cupar (3), Kinross (3), Innerleithen (14), Dysart (14), Falkirk (3), Dalry (2)
Gourock (3) however required a majority of four-fifths, and Falkirk J.S. (5) imposed a quorum on the meeting of voters representing at least half the capital stock.
 2. e.g. Falkirk (5), Dalry (5)
 3. e.g. Perth (1), Dumfries (2), Dundee (3), Dunfermline (3), Kirkcaldy (3), Cupar (3), Dalry (3), Kinross (1), Falkirk J.S. (3); Forres (S.R.O. BT2/1858)
Vide infra Appendix XVII
 4. e.g. Musselburgh (1), Innerleithen (2)
 5. e.g. Falkirk (2), Dysart (3), Maxwelltown (3), Gourock (3), Dunoon(24); Airdrie (S.R.O. BT2/237); Coatbridge (S.R.O. BT2/191)
 6. Automatic dissolution was enforced in some contracts if ever the company made a "loss" equal to fifty per cent of the value of stock, e.g. at Gourock (22), Dunoon (14), and Maxwelltown (39) with contracts of indefinite length. Also at Banchory (16).
Only a majority of shareholders at a special meeting could forbid the automatic dissolution at Maxwelltown.
 7. e.g. Perth (30)
 8. Dundee (2,45) one month's advance notice of first meeting in Edinburgh Gazette and a Dundee newspaper. Most companies demanded public advertisement of the holding of such a meeting.

required a second meeting, while Dunfermline, Dunoon, Perth and Falkirk Joint Stock¹ companies required a two-thirds majority at the second meeting. Innerleithen² allowed a single meeting to extend the contract by a two-thirds majority, but to dissolve the contract a second meeting was required with ratification by holders of seventy-five per cent of the total stock, and the same large majority was required at Lochgilphead. Dissolution was made as difficult as seemed reasonably possible, even to the extent of fixing a qualification level³ for persons who could propose dissolution. At Dysart the decision had to be agreed by seventy-five per cent majority at both meetings, and at Dalry⁴ by two-thirds majority at both. Companies which allowed contract decisions to be taken by a single special general meeting normally required a majority of two-thirds on the vote, as at Kinross and Falkirk,⁵ and Cupar required four-fifths majority. A precise mechanism⁶ for winding up the company and distributing any surplus money was provided in the contract.

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1. Dunoon (24), Kirkcaldy (30), Perth (30) required two-thirds majority at both meetings.
 Dunfermline (33) - advance notice in an Edinburgh newspaper
 Falkirk Joint Stock (2,34) - public advertisement
 At Vale of Leven (18,19) a majority vote at an E.G.M. could alter the contract, but two-thirds majority was required to dissolve the company.
 2. Innerleithen (22), Lochgilphead (2,16)
 3. e.g. Dissolution could only be proposed by partners with 50 shares at Dalry (25) and Barrhead (2), or 100 shares at Lochgilphead
 4. Dysart (25), Dalry (25). At Musselburgh (22) dissolution had to be agreed by partners with two-thirds capital stock at the first meeting, and by 75 per cent of votes at the second meeting.
 5. Kinross (35) - printed advance notice to all partners
 Falkirk (25) - one month's notice in a Stirling or Edinburgh newspaper
 Cupar (26) - one month's notice in a Fife newspaper
 6. Dundee (46), Dunfermline (34), Falkirk J.S. (34), Dalry (26), Innerleithen (23), Lochgilphead (17), Cupar (27), Kirkcaldy (31), Barrhead (15)

A Parliamentary charter required the consent of a general meeting, because of the possibility that Parliament would impose regulations inimicable to the company's original contract. Dundee¹ feared "considerable departure" from the contract, but compelled members to accept the regulations of a Charter if it was approved by a general meeting, as did Dumfries.² Later companies entirely ignored the need for a Charter in their contract, with the exception of some competing companies like Falkirk Joint Stock³, which anticipated some possible opposition from their rival before Parliament.

Several aspects of Company finance were controlled firmly by General Meetings through standing orders which restricted the activities of the directors. Usually no dividend could be paid whereby the capital would be "reduced or impaired".⁴ To assure shareholders that their financial liability would be carefully 'limited'⁵ some companies prohibited their directors from contracting either loans or debts.⁶ At Dunfermline even a general meeting could not contract

1. Dundee (47)

2. Dumfries (5)

3. Falkirk Joint Stock (6) - directors could only apply for an Act with the consent of partners holding 1,000 shares. Banchory (22) was exceptional in giving full power to the directors to apply for a Royal Charter or Act if necessary. Before Dunoon (28) directors could seek an Act, they required the written consent of partners holding two-thirds of the total stock.

4. e.g. Dunfermline (23), Cupar (7), Kinross (34), Dalry (19) Maxwelltown (31), Falkirk J.S. (25), Perth (22)

5. This pseudo-Limited Liability was stressed in the contracts. In the Falkirk Joint Stock (31) contract it was "expressly understood that the said Partners shall be liable only for the amount of the share or shares" they owned.

6. Vale of Leven (9) directors were forbidden to contract loans; or take the company into debt above £50 without the permission of a special General Meeting.

Selkirk (11) directors could not "borrow money upon any pretence whatever unless sanctioned by a general meeting." Such rules were so insistent that the possibility of directors surreptitiously

obligations in excess of the capital stock, "without the consent of every individual partner."¹ At Falkirk and Maxwelltown, any debt beyond the capital stock was forbidden and directors who ignored the rule became personally and severally responsible since the companies accepted no liability.² Peterhead directors were restricted to a maximum £300 bank overdraft, or the same penalties were imposed.³ Gourock⁴ directors were also prohibited from contracting any debts "by Bond, Bill or otherwise," and even a two-third majority vote at a special general meeting could not permit more than £400 to be borrowed above the capital stock.

Contingency funds⁵ which were at first regarded as a safeguard against unforeseen problems, were in many cases controlled either partially or entirely by general meetings of the partners. Dundee⁶ instituted such a fund in 1824 as an insurance against accidents which could not be repaired by reploughing annual profit. It absorbed all of the first year's profits, but thereafter the directors controlled

taking loans was apparently a strong fear in gas companies. Banchory (5) directors could take no loans.

1. Dunfermline (30)
2. Falkirk (4), Maxwelltown (21) and Falkirk J.S. (31) directors were allowed "no pretence whatever" to ignore the rule. See also Banchory (5). Musselburgh (11) directors could place no contracts exceeding the total nominal capital of the company
3. Peterhead (5), Dunoon (21) directors could only borrow £200 unless a General Meeting allowed more.
4. Gourock (21). In some companies like Innerleithen (11,13) during the initial construction work directors could take loans, but only to the extent that loan capital plus paid-up capital did not exceed the nominal capital stock.
5. Vide infra 'Finance' p.834; also p.976
6. Dundee (13)

Table 5.10 Compulsory Contingency Funds

<u>Company</u>	<u>Date</u>	<u>Total Fund (£)</u>	<u>Minimum Annual Contribution from Profits</u>	<u>Total Contributions decided by</u>	<u>Directors could increase Fund to (£)</u>	<u>Maximum Dividend or Annual Cash to Fund after Accidents causing Depletion</u>
Kirkcaldy	1829	400	Over 10%	Directors	600	£5%
Cupar	1830	250	Over 10%	Directors	500	£4%
Grangemouth	1834	50	£10	Directors	Indef.	(£10 year)
Peterhead	1833	Indef.	-	A.G.M.	-	(£50 year)
Falkirk	1834	250	£50	Directors	-	5%
Dalry	1834	100	Below 10%	Directors	-	-
Moffat	c1839	Indef.	2%	-	-	-
Dysart	1843	150	Over 10%	Directors	-	4%
Maxwelltown	1845	500	-	Directors	-	-
Falkirk J.S.	1845	500	Below 10%	Directors	-	-
Gourock	1848	500	33%	-	-	-
Innerleithen	1846	Indef.	-	A.G.M.	-	-
Barrhead	1833	Indef.	-	A.G.M.	-	-
Haddington	1834	200	-	-	-	-
Dunfermline	1829	500	Below 10%	Directors	-	£5%
Coatbridge	1843	500	Below 10%	-	-	-
Perth	1823	1000	Over 10%	Directors	-	£5%
Selkirk	1836	100	10%	-	-	-
Bo'ness	1844	75	£15	-	-	-
Banchory	1845	100	-	Directors	-	-

SOURCES: Kirkcaldy (7), Dalry (9), Moffat (8), Dysart (7), Maxwelltown (29), Falkirk J.S. (25), Haddington (5), Dunfermline (23), Peterhead (13), Barrhead (17) Innerleithen (12), Gourock (16), Falkirk (5), Grangemouth (3), Cupar (7), Perth (22). Coatbridge S.R.O. (BT2/191). Selkirk (7) termed this a "fund to meet extraordinary expenses", in effect a reserve fund. Banchory (12) saw the fund both for contingencies and extending the works. Bo'ness (15) required £15 per year for the first five years.

the increments until £1,000 had accumulated. Although Dumfries had no rule for a contingency fund in 1825 or 1827, most companies from the late 1820s onwards, like Dunfermline, imposed some form of compulsory contingency fund.

The Board of Directors which met frequently throughout the year constituted the main entrepreneurial basis¹ of each gas company, with responsibility for "the whole Business, Affairs and Concerns",² though subject to regulations passed by general meetings.

TABLE 5.11 Boards of Directors - Total Size and Quorum

<u>Company</u>	<u>Number</u>	<u>Quorum</u>	<u>Company</u>	<u>Number</u>	<u>Quorum</u>
Dundee	12	3	Kinross	13	4
Dumfries	13	7	Dalry	9	5
Dunfermline	9	5	Moffat	5	3
Kirkcaldy	10	5	Dysart	7	5
Cupar	9	5	Maxwelltown	13	5
Barrhead	13	5	Falkirk J.S.	9	4
Grangemouth	9	5	Innerleithen	5	3
Peterhead	9	5	Bridge of Weir	10	5
Falkirk	7	3	Gourock	9	5
Perth	13	5	Haddington	5	3
Vale of Leven	8	3	Selkirk	5	3
Musselburgh	11	3	Bo'ness	9	4
Banchory	7	3	Dunoon	9	5

SOURCES: Dundee (28), Dumfries (6), Dunfermline (17), Kirkcaldy (21), Cupar (9), Barrhead (6), Grangemouth (4), Peterhead (5), Falkirk (9), Kinross (18), Dalry (15), Bridge of Weir (4), Gourock (13), Moffat (3), Dysart (18), Maxwelltown (16), Falkirk J.S. (19,22), Innerleithen (6), Haddington (9), Perth (16), Vale of Leven (5), Musselburgh (6), Bo'ness (9), Banchory (5), Dunoon (12)

1. Vide Infra 'Management and Labour' pp. 662 et seq .

By the late nineteenth century, possibly twenty years or so after most companies commenced, the directors' role in promoting new technology was dwarfed by the growing role of the Manager; but the directors sustained their second major task of financial control and decision taking.

2. Dunfermline (17) - this became the usual definition of their role. e.g. Kirkcaldy (21), Peterhead (5), Cupar (9), Grangemouth (4), Kinross (18), Dysart (18), Falkirk J.S. (19), Gourock (13)

The directors had a wide range of responsibility, from the construction of the works¹ and by-laws imposed upon employees and consumers, to supervision of the company books, control of share-transfers, and the signing of legal documents. Although shareholders at a general meeting could intervene with supplementary or over-riding regulations² in each of these fields, initiative very largely resided with the directors.

Although shopkeepers and artisans frequently became directors, they were joined by writers, bankers, gentry, merchants and industrialists, who ensured that all but the smallest companies had a calibre of leadership³ quite comparable with any other large business enterprise in Scotland.

All directors were partners in their companies, and many worked gratuitously, especially before 1860. They were not self-appointed, but were elected at annual general meetings by all shareholders present. Usually all shareholders⁴ were eligible to take office, though special restrictions were sometimes imposed. Residence qualifications were designed to exclude outside speculators gaining control of a company. Bankruptcy⁵ of a director, or his sale of shares below the qualifying limit,⁶ produced immediate disqualification.

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1. e.g. Peterhead (3,5), Falkirk (17), Moffat (4), Banchory (5)
 2. By-laws had to be consistent with regulations passed by General Meetings, and the company contract usually stated clearly the supremacy of General Meetings in all decisions, e.g. Dunfermline (24), Kirkcaldy (24), Cupar (21), Grangemouth (4), Kinross (22), Dysart (20), Innerleithen (7), Gourrock (17), Falkirk J.S. (35), Perth (23), Musselburgh (8)
 3. Vide infra Appendix III.3
 4. e.g. Innerleithen (6)
 5. e.g. Dundee (31), Kirkcaldy (22), Peterhead (24), Maxwelltown (20), Falkirk (11), Dalry (16), Haddington (11), Perth (19)
 6. e.g. Maxwelltown (20), Cupar (9), Falkirk (11), Perth (19)

TABLE 5.12 Boards of Directors Illustrating Occupations
of Directors

1830 Airdrie

A.Galloway, banker	W. Rankine, surgeon
W. Fleming, merchant	J.H. Mack, writer
W. Baillie, merchant	J. Graham of Broomfield
G. More-Nisbet of Cairnhill ⁺	

1831 Musselburgh

Sir John Hope of Pinkie House - Chairman *

Bailie Wilson, chief magistrate**

R. Brown of Gilston - Treasurer

J. Kemp, merchant	T. Moffat, merchant
G. Smart, merchant	T. Legat, merchant
J. Scott	W. Louden
J. Grieve, engineer ⁺⁺	W.Aitchison jn. of Drumore

1845 Banchory

J. Ogg, surgeon	A. Thom, surgeon
A. Paul, merchant	W. Sim, merchant
J. Grant, innkeeper	
I. Machray, coach proprietor of Aberdeen	
T. Blaikie, Lord Provost of Aberdeen *+	

1851 Dunoon

R. Eglinton of Dunoon Castle ⁱ	J. Leadbetter of Erich Bank
W. Wallace, portrait painter	D. McNicol, pier-master
D. McPhee, post-master	A. Oswald, grocer
D. Mains, grocer	G. Keith, draper
J. Stewart, feuar	

1869 Inverkip (shares £1)

Sir Michael Robert Shaw Stewart of Greenock and Blackhall (200) ⁱⁱ

M.J.Martin of Inverkip, Factor of Ardgowan Estate (20)

John Crawford Hunter, merchant of Greenock (200)

T. Forrest, builder (15) B.Ford, grocer (20)

James Bannatyne, clothier(10) J.French, hotel keeper (50)

NOTE :

- + George More-Nisbet also invested in Glasgow Co. vide infra p.209
- * J.Hope(1781-1853), coalmaster, built Pinkie Waggonway to Musselburgh harbour in 1814. Vide supra p.540; B.F.Duckham Scottish Coal Industry (1970) p.214
- ++ J.Grieve may have been a colliery engineer, vide B.F.Duckham ibid p.139; infra pp. 501, 1657
- i Lord Eglinton promoted Ardrossan gas co. in 1845; vide infra p.1054
- ii vide supra p.218
- ** To encourage municipal investment, Bailie Wilson, or in his absence Bailie Leitch, magistrate, or any other Bailie there became a Director at Musselburgh if either magistrate, or the Town, purchased shares; Musselburgh contract of copartnery (1831, article 7)

SOURCES : Airdrie - S.R.O. Lanark Sheriff Court Sasine 22/9/1830
(3948 P.R. 106.144);
Inverkip- S.R.O. (B.T.2/315)
Musselburgh (7), Banchory (preface; vide infra pp.117,767),
Dunoon (12)

TABLE 5.13 Qualification Restrictions upon Directors¹

<u>Company</u>	<u>Shares owned by Candidate</u>	<u>Other Restrictions</u>
Grangemouth	2	
Falkirk	5	
Maxwelltown	5	Resident within 5 miles of town
Falkirk J.S.	5	Resident in the town or parish
Peterhead	3	Resident within 3 miles of town
Kirkcaldy	1	Resident within 4 miles. Could not act on behalf of a rival gas com- pany, or join such a company
Cupar	1	Resident within the town or suburbs
Dumfries	3	
Perth	2	
Vale of Leven	2	
Bo'ness	4	
Banchory	100	Five of the Seven Directors to res- ide within 5 miles of the gas- works.

SOURCES: Grangemouth (4), Falkirk (9), Maxwelltown (16), Falkirk J.S. (19), Peterhead (5), Kirkcaldy (9), Dumfries (6), Perth (17), Vale of Leven (5), Bo'ness (9)

Continuity of direction was usually preserved by enforcing retirement upon only a fixed proportion of directors each year. A list² of directors was drawn up, either in alphabetical order as at Barrhead, or by ballot at Peterhead, or according to the number of votes first awarded to each director as at Dundee. Each subsequent year, a given number of senior directors at the head of the list had to retire or seek re-election, and new directors were placed at the

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1. Above a single threshold, all partners were usually eligible, but Gourock (13) employed segregation in which two directors held between five and ten shares, three held between ten and twenty shares, and four held above twenty shares. One director from each group retired annually.
 2. Barrhead (6), Peterhead (4), Dundee (29)

TABLE 5.14 Turnover of Company Directors

<u>Company</u>	<u>Total Board of Directors</u>	<u>Directors Retiring each Year</u>	<u>Time Lapse before Re-election</u>
Perth	13	4	One year
Dunfermline	3	9	-
Cupar	3	9	One year
Kirkcaldy	5	10	-
Barrhead	6	13	0
Grangemouth	3	9	One year
Peterhead	5	9	One year
Falkirk	3	7	One year
Kinross	6 or 7 (alternate)	13	0
Dalry	9	9	0
Moffat	6	6	-
Dysart	3	7	One year
Maxwelltown	4	13	0
Falkirk J.S.	9	9	0
Innerleithen	2	5	-
Bridge of Weir	5	10	-
Gourock	3	9	One year
Haddington	2	5	-
Dundee	12	4	0
Vale of Leven	7	7	0
Selkirk	5	5	0
Musselburgh	11	3	0
Banchory	7	7	0
Dunoon	9	3	-

SOURCES: Perth (18), Dunfermline (17), Kirkcaldy (9,22), Cupar (9), Barrhead (6), Grangemouth (5), Peterhead (5), Falkirk (10), Kinross (18), Dalry (15), Moffat (3), Dysart (18), Maxwelltown (16), Falkirk J.S. (19), Innerleithen (6), Bridge of Weir (4), Gourock (13), Haddington (10), Musselburgh (6), Banchory (Preface, 4), Dunoon (12)

bottom of the list. Small companies experienced greater problems in finding reliable directors, and at Dalry¹ any partner who was elected and refused to serve was fined 2s 6d, if he had not held office the previous year.

1. Dalry (15)

Vacancies in the directorate, caused by death, disqualification or resignation, could usually be filled by an interim director chosen by the other directors,¹ but he was to retire at the next general meeting. Some companies, however, insisted upon a special general meeting to elect substitute directors². To safeguard against financial mismanagement for private gain, company contracts, as at Dundee from the outset, stipulated that a director could not "deliberate or vote in any matter in which he is interested as an individual".³ "No person holding an office of profit under the Company", or employed in work, or contracting for work from the company could be a director⁴ in most gas companies.

The directors met regularly to consider company affairs,⁵ and decisions were reached by voting through "a majority of voices",⁶ the principle of one vote for each director present quite regardless of his shareholding wealth in the company. Although a general meet-

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1. e.g. Vale of Leven (9), Banchory (20), Dunoon (12)
Dundee (31), Dunfermline (19), Cupar (9), Peterhead (24), Falkirk (11), Maxwelltown (20), Falkirk J.S. (21), Kinross (20), Dysart (9), Haddington (11), Dalry (16), Gourock (13), Perth (19) Kirkcaldy (9,22) directors could not do so unless their total number fell from ten to below five
 2. e.g. Dumfries (8), Innerleithen (7), Grangemouth (5) Musselburgh (7)
 3. e.g. Dundee (32), Dunfermline (20), Gourock (14), Bo'ness (addendum 19/7/1844)
Haddington (13), unlike most companies, used standing orders to make the directors take several tenders for all items costing above £5. Vide infra 'Finance' p. 862; c.f. pp. 145, 149
 4. Dunfermline (18), Cupar (9), Kinross (27), Dysart (9), Maxwelltown (16), Falkirk J.S. (20), Dumfries (12), Barrhead (6) Dunoon (26)
 5. At Bridge of Weir (4) each quarterly meeting was specifically required to inspect the books of the Treasurer and Secretary.
 6. e.g. Dunfermline (20), Grangemouth (4), Kirkcaldy (23), Kinross (19), Bridge of Weir (5), Dalry (17), Dysart (18), Dundee (32), Perth (20), Vale of Leven (8), Musselburgh (8), Bo'ness (addendum, 19/7/1844)

ing of shareholders sometimes elected a leader for the directors¹, as at Moffat, in most cases the choice of a "President or Convener"² or a "Chairman of the Company"³ was made among the directors themselves*, who in some cases also appointed a Vice President⁴ or Deputy Chairman.⁵ Quarterly meetings of the full Board of Directors were frequently required under the contract.

TABLE 5.15 Periodicity of Directors' Meetings

<u>Companies</u>	<u>Meetings</u>
Dumfries, Musselburgh	Monthly
Dunfermline, Kirkcaldy, Barrhead, Kinross, Dalry, Falkirk J.S., Gourock, Bridge of Weir, Perth	Quarterly

SOURCES: Dumfries (19,22) - advance written notice of the agenda sent to each director.

Falkirk J.S. (22), Gourock (14), Musselburgh (8).

August, November, February and May were the usual meeting months, as at Dunfermline (20), Kirkcaldy (23),

Barrhead (7), Kinross (23) and Dalry (17), Perth (20)

Dalry imposed a fine of 6d upon truant directors,⁶ but several companies like Dundee⁷ allowed their directors to hold meetings whenever they chose to do so.

1. e.g., Moffat (3) - the company President
Barrhead (6) - director with most votes became President
Vale of Leven (5) - President and Vice President

2. e.g., Dunfermline (20), Dalry (15), Perth (20)

3. e.g., Innerleithen (6), Gourock (13), Peterhead (5), Falkirk (9), Banchory (6), Kinross (11), Falkirk J.S. (22), Kirkcaldy (23), Grangemouth (4)

4. e.g., Bridge of Weir (5)

5. e.g., Maxwelltown (21), Dysart (18). Dunoon (12) directors had to chose a chairman with over twenty-five shares, and a deputy chairman with over fifteen shares, so that in some cases wealth did gain special advantages within the Board of Directors.

6. Dalry (17) 3d fine if absent when meeting commenced.

7. Dundee (32), Innerleithen (8)

* Chairmen often had outside business experience e.g. S. Cameron, chairman of Elgin gas co. in 1863 held the same position in Elgin Joint Stock Water Co. John Barr, gas chairman at Ardrossan for many years, was a railway and harbour contract-engineer, who became a shipbuilder in 1842, and was later Provost, and chairman of the School Board.
Black's Morayshire Directory (1863, Elgin) p.102
Ardrossan Burgh Centenary 1846 - 1946 (1946)

Additional meetings of the directors were called whenever necessary, as commanded in the contract, to handle unusual or urgent business.

TABLE 5.16 Qualifications for Convening Extraordinary Meetings of Directors

<u>Companies</u>	<u>Persons Qualified to call a Meeting</u>
Dunfermline, Gourock	Company Clerk; any directors
Barrhead, Dalry	President; 3 directors
Kinross	Chairman; Clerk; 3 directors
Falkirk Joint Stock	Secretary; 2 directors
Bo'ness	Clerk; 2 directors

SOURCES: Dunfermline (20), Gourock (14), Barrhead (7), Dalry (17), Kinross (18), Falkirk J.S. (22), Bo'ness (addendum 19/7/1844)

Legal protection of the directors by the company was essential before entrepreneurs would voluntarily undertake the duties of directorship, especially the personal obligations in which they signed for contracts and loans.¹ Under the gas company's contract directors were therefore relieved of liability for the sufficiency of securities or property upon which they lent out or invested the company's monies, or for "the actions or intromissions of the manager" or

1. e.g., Perth (27), Selkirk (12). Vide infra 'Finance' p.768 Promissory Notes, Bills, and the indorsation of receipts, were usually signed by directors, e.g., Dundee (42). Sometimes the Directors at the "bottom of the list", those who would retire last, had to sign. All shareholders accepted responsibility for such deeds, as if they had signed these themselves. Usually three directors together signed a minute covering such deeds, e.g. Dunfermline (28), Falkirk J.S. (29), Kinross (31), Dalry (21), Barrhead (11), Falkirk (12), Lochgilphead (11), Haddington (14); four at Dunoon (27).

At Perth (27) all promissory notes were given and taken in the name of the Clerk/Treasurer, and all securities owned by the company in his name and that of two junior directors.

other official of the company. They were not responsible for the intromissions or solvency of tradesmen contracted by the company, nor unforeseen contingencies. Directors were not "liable in solidum nor for the intromissions of each other, but each for his own actions and intromissions allenary".¹ Dundee² shareholders were pledged to relieve directors or other officers of all obligations taken in accordance with the contract, and many companies reiterated this at a special general meeting before large loans were secured.

The directors fixed the sale price of gas,³ and negotiated bulk sales or contracts at special rates. They could refuse to supply deceitful consumers, or prosecute for non-payment. From the earliest gas companies, like Dundee and Dumfries, by-laws by the directors were made binding on the company⁴ and its employees,⁵ but Perth, Dunfermline and later companies obliged the directors to enter all rules as a Minute which had to be brought to the attention of the next general meeting⁶ for review. Directors also had some control over the

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1. Dundee (40), Dunfermline (27), Kirkcaldy (27), Cupar (23), Falkirk (12), Kinross (30), Dalry (20), Dysart (22), Maxwelltown (22), Dunoon (20), Falkirk J.S. (28), Lochgilphead (12), Moffat (11), Barrhead (12), Innerleithen (20), Gourock (19), Perth (26), Musselburgh (20), Banchory (21).
 2. Dundee (43); vide Selkirk (18) and Vale of Leven (11) where directors were "entitled to all the usual privileges and exemptions conferred on persons acting gratuitously in such offices".
 3. e.g., Musselburgh (10), Haddington (13), Banchory (5), Moffat (4), Innerleithen (1,10), Gourock (2), Maxwelltown (21)
 4. Dumfries (10,15), Dundee (37,38), Perth (23), Vale of Leven (9)
 5. Moffat (4) directors, probably like other small companies, took "the advice of the Contractor" who built the works, in framing such regulations.
 6. Dunfermline (24), Kirkcaldy (24), Cupar (21), Kinross (22), Dysart (20), Gourock (17), Perth (23), Dunoon (18)

membership of the company often being empowered to decide who could purchase reserve stock,¹ and able to use contingency or reserve funds to purchase shares² instead of allowing transfers to take place.

Forward planning, and control of working capital, were the directors' responsibility. Heritable property was usually vested in the directors as permanent trustees³ for the company, until a subsequent committee of directors divested them of that responsibility. In some cases, however, trustees were appointed and controlled directly by general meetings,⁴ but they were apparently always partners in the company. The appointment of an engineer or "Manager" and other staff, was usually another responsibility of the directors, and of critical importance in the technical advancement of the gasworks.

1. e.g. Dundee (6), Banchory (3)

2. e.g., Kirkcaldy (26), Cupar (22), Dysart (21), Falkirk J.S. (27), Innerleithen (16), Dundee (17), Gourrock (18)

The directors were sometimes specifically forbidden from exercising the voting right of shares held in the company's name, or in the directors' names as Trustees, e.g. Dunfermline (26), Kinross (29), Perth (25).

3. e.g. Dunfermline (29), Falkirk (12), Falkirk J.S. (30), Gourrock (20), Dalry (22), Lochgilphead (9), Innerleithen (11), Banchory (18), Dunoon (22)

Alternatively, the directors were authorised to appoint trustees, e.g. Dysart (6).

Under the contract, company property could not be subjected to the private debts of individual Trustees e.g. Barrhead (9), Dalry (22), Innerleithen (11), Lochgilphead (9)

4. e.g., Kirkcaldy (26), Lochgilphead (preface). Inveraray company on 2/3/1841 appointed Trustees at a general meeting viz: L. Campbell, Chamberlain to Duke of Argyll, J. Wright, provost, W. Ingram, writer, S. Mactaggart, writer, J. Walker, innkeeper, W. Minto, road surveyor, and R. Campbell, forrester. All were local residents.

S.R.O. Argyll Sheriff Court Book (SC.51/50/1606) Folio 27 (rrbiiij) Feu Contract between Duke of Argyll and Inveraray Gas Company.

Dundee¹ was exceptional in appointing the Manager at general meetings. In several companies, directors delegated to the manager the task of recruiting whatever additional manual workers he or they deemed necessary. General meetings, as at Maxwelltown,² retained the right to dismiss any official chosen by the directors.

The appointment of Treasurers, Clerks or Secretaries, and other officials who kept the company books, and had a direct and separate responsibility to the general meetings, was often retained as a prerogative of general meetings³ to provide an independent record of the directors' actions and guard against maladministration. Elsewhere these appointments were also made by the Directors,⁴ possibly out of their own number.⁵ Sometimes the Clerk and Treasurer had to be two separate people,⁶ but small works often combined their tasks,

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1. Dundee (33,34) in 1824 advertised the post in London and Edinburgh newspapers, and then balloted shareholders to choose their manager, who had to provide a caution of £1,000 against intrusions, but the directors decided upon the manager's salary, and thus controlled the quality of engineers who would apply.
At Haddington (12) general meetings appointed the Manager and Collector.
 2. Maxwelltown (19)
 3. e.g., Maxwelltown (19), Bridge of Weir (5), Barrhead (7), Kinross (21), Dysart (18). Kinross appointed J. Kidd, accountant at the British Linen Bank, as first Treasurer. Dysart appointed the town clerk, T. Dow, as first Company Clerk. Perth (21) appointed G. Gray, writer, as Clerk and Treasurer.
 4. e.g. Kirkcaldy (24), Lochgilphead (7), Dalry (18), Cupar (20), Dunoon (13), Falkirk J.S. (24), Innerleithen (9), Dundee (35) Vale of Leven (5)
 5. e.g., Gourock (15). The Vale of Leven (5) directors had, unusually, to choose a Treasurer and Secretary from among the partners, and these became "ex officiis Directors of the Company". At Selkirk (3) the Clerk/Treasurer had to be a director.
 6. e.g., Dunfermline (22)

and Peterhead appointed "one person only to be Clerk, Cashier, Manager and sole Director [sic] of Works".¹ Independent auditors² appointed by a general meeting to check the books were rare.

Security against intrusions³ was usually demanded from employees, but most companies⁴ relied upon the directors to arrange an appropriate amount, though some stated a minimum in the contract of co-partnery.

TABLE 5.17 Minimum Security from Employees
Against their Intrusions

<u>Company</u>	<u>Date</u>	<u>Employees</u>	<u>Amount</u>
Perth	1822	Treasurer / Clerk	£ 500
Dundee	1824	Gas Manager	£1,000
Dunfermline	1828	Trusted Officials	£ 250
Kirkcaldy	1829	Gas Manager	£ 200
Falkirk	1834	Treasurer, Collector &c.	£20 each

SOURCES: Falkirk (16), Dunfermline (22),
Kirkcaldy (24), Dundee (34)
Perth (21)

A Bank account, usually in the company's name, was an essential safeguard in company organization. Company officers were obliged to quickly deposit all monies received, before these accumulated to

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1. Peterhead (5)
 2. e.g. Dysart (18) appointed P. Greig, Manufacturer, and W. Walker, ironmonger, as auditors to re-examine the books annually.
Maxwelltown (27) A.G.M. could appoint auditors to re-check the directors' books.
Cupar in 1830 also appointed separate auditors - W. Walker, grocer, J. Shaw, writer, and J. Mackenzie, accountant in the Commercial Bank.
 3. Vide infra 'Labour' p.625
Later termed 'Fidelity Guarantee'
 4. e.g., Lochgilphead (7), Dysart (19), Kinross (24), Dalry (18), Falkirk J.S. (24), Vale of Leven (9), Dunoon (13)

unmanageable proportions. This ensured that the sources of revenue were written down at the time received, prior to banking.

TABLE 5.18 Maximum Small Change to be held by Employees before Banking

<u>Company</u>	<u>Cash</u> (£)	<u>Employees</u>	<u>Maximum Time before depositing in Bank</u>	<u>Penalty</u>
Dunfermline) Vale of Leven)	20	Treasurer	One day	
Falkirk J.S.	20	Treasurer	One day	
Kirkcaldy	10	All	Three days	Double the excess
Banchory	10	Manager, Treasurer &c	One week	
Haddington	10	Treasurer	-	
Peterhead	10	Manager	One week	
Gourock) Kinross) Dunoon)	10	Treasurer	One day	

SOURCES: Dunfermline (22), Kirkcaldy (24), Falkirk J.S. (24), Kinross (25), Gourock (15), Peterhead (12), Vale of Leven (9), Haddington (12), Banchory (11) Dunoon (13)

Withdrawals from the bank were closely supervised both by the directors, and by the general meetings. The directors' permission was usually required for each individual withdrawal, which was normally made by the Treasurer personally.¹ Usually a minute in the books had to be recorded each time and signed both by the Treasurer and a specified number of Directors,² to satisfy the contract regulations.

1. Vide Selkirk (8), Banchory (11), Dunoon (17). At Musselburgh (9) all sums above £10 had to be paid by cheque signed by two directors.

2. Dunfermline (22), Kirkcaldy (10), Falkirk J.S. (24), Gourock (15), Cupar (19), Falkirk (19), Moffat (19), Dysart (18), Maxwelltown (37), Haddington (16), Peterhead (12) Vale of Leven (9) At Bridge of Weir (11) withdrawals had to be signed by the Secretary and Treasurer.

Company books which recorded the inflow of money, labour, and raw materials and the outflow of manufactured goods and expenditure, were largely under the supervision of the directors, but through standing orders they also recorded the activities of the directors. The company clerk or treasurer maintained his books, on his own authority derived from standing orders, but "at the sight of the Directors".¹ The books were legal documents in which general meetings recorded alterations of company regulations,² instead of placing those on a separate deed. Directors were obliged to enter all their contracts and agreements into the books,³ allowing these to be reviewed or criticized by any partners when the books were presented to annual general meetings.

Balancing the books usually had to commence upon a certain date⁴ under the standing orders and share transfers were normally suspended from two weeks before the balance until after the general meeting.⁵ The directors alone,⁶ without the specified aid of external accountants, were responsible for supervising the Treasurer's balance, and

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1. e.g. Dunfermline (21), Falkirk J.S. (23), Kinross (24), Bridge of Weir (5), Vale of Leven (9), Dunoon (14)
 2. Barrhead (18), Banchory (14)
 3. e.g. Dumfries (26), Falkirk (19)
 4. e.g. Dundee (41), Dunfermline (22), Kirkcaldy (8), Cupar (8), Falkirk (18), Kinross (26), Dysart (8), Innerleithen (12), Gourrock (15), Banchory (12), Dunoon (15), Maxwelltown (27), Perth (21), Vale of Leven (9), Musselburgh (12)
 5. e.g. Dunfermline (22), Falkirk (20), Kinross (26), Gourrock (20), Dunoon (15), Dundee (41);
Banchory (12) allowed one month.
 6. e.g. Dunfermline (22), Falkirk (18), Kinross (26), Innerleithen (12), Banchory (12), Peterhead (13), Perth (21), Vale of Leven (13), Musselburgh (12)

for examining, docqueting and signing the balance. In some cases the company President¹ took this responsibility. For most of the year, only the directors or a general meeting had access to the books.²

TABLE 5.19 Access to Company Books allowed to Ordinary Shareholders

<u>Company</u>	<u>Time when Access allowed</u>
Kirkcaldy	4 weeks before, and 4 weeks after A.G.M.
Dundee; Cupar; Kinross	2 weeks before and 2 weeks after A.G.M.
Innerleithen	10 days after A.G.M.
Maxwelltown	4 weeks after A.G.M.
Dunoon	4 weeks before A.G.M.

SOURCES: Cupar (8), Kirkcaldy (8), Kinross (26), Dundee (41), Innerleithen (12), Maxwelltown (27)

The directors' final responsibility was to prepare an abstract of the accounts and of events affecting the company, which was "exhibited and read over" at the annual general meeting³ to keep the shareholders informed on the company's activities and prosperity.

Two forms of legal action were brought within the scope of the contract for the security of the company - internal disputes over

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1. e.g. Dalry (18), Barrhead (17), Lochgilphead (19)
 2. Dysart (8) and Gourock (15) were exceptional in allowing all partners to have access to the books at all times; so was Banchory (12) in forbidding all shareholders except Directors from examining the books.
 3. e.g. Kinross (26), Dunfermline (22), Dundee (41), Perth (21), Vale of Leven (13), Selkirk (4), Banchory (12), Dunoon (13,15)

the contract itself; and external disputes between the company and outside parties, consumers or suppliers. By signing the contract or purchasing shares from an existing partner, all new partners agreed to accept the judgment of an arbitrator, usually the local Sheriff or his Depute, in all disputes which they could later raise over interpretations of the contract of co-partnery made by the directors, and in all disputes between the directors' holon and the company, or general meeting holon.¹ This greatly reduced the possibility of ruinous litigation within the company itself.

For external disputes in which the company was the "Complainer", its trustees² were empowered to pursue in their own names all actions relating to trust property, and its Manager, Treasurer or other officials³ to pursue for behoof of the company all other actions. When the company was the defendant, actions or diligence could be lawfully executed against it, in terms of the contract, by serving them

1. e.g. Dundee (43), Dunfermline (31), Kirkcaldy (28), Cupar (24), Peterhead (9), Falkirk (23), Dalry (23), Dysart (23), Maxwelltown (34), Lochgilphead (21), Haddington (26), Perth (28), Vale of Leven (17), Banchory (9)

At Barrhead (19) the arbiters were to be three local Justices of the Peace; and at Musselburgh (25), Falkirk J.S. (32) and Innerleithen (25), the Dean of the Faculty of Advocates.

2. e.g., Dunfermline (32), Kirkcaldy (29), Cupar (25), Dysart (24), Perth (29)

3. e.g., Manager at Dundee (44), Kirkcaldy (29), Peterhead (10), Maxwelltown (35).

Treasurer at Falkirk (24), Falkirk J.S. (33), Dalry (24), Perth (29), Dunoon (23).

Clerk at Cupar (25), Dysart (24), Moffat (11), Haddington (15)

(in the above cases, the directors could also appoint alternative officials to handle the action)

Directors at Barrhead (10), Innerleithen (7), Lochgilphead (18).
Manager or Cashier at Banchory (10).

against the directors jointly, and one company official individually,¹ instead of against each member of the company individually. This was of paramount importance in a co-partnery of such size, which could not have functioned in the legal morasse which would otherwise have occurred. The formula was acceptable to the Lords of Council and Session who in 1860 tried the case of T. Turnbull, builder, against the unincorporated Callander Gas Light Company.² The company was found guilty of non-payment by a jury verdict of nine to three.

Company organization as delineated in the contract of co-partnery, or engrossed in the company books, produced a coherent, integrated system used on a national scale which was adopted by companies without limited liability and remained largely unaltered from the early 1820s into the 1850s, and even later for companies which ignored the Limited Liability Acts. Efficient and practical large-scale joint stock organization was therefore a well-established principle in Scotland before the 1820s and was used by the gas industry without necessitating great modifications related to the nature of the industry, apart from encouraging resident consumer-investors to retain local control.³

1. This official was the Manager at Dundee (44), Kirkcaldy (29), Peterhead (10) and Maxwelltown (35); the Treasurer at Dunfermline (32), Falkirk (24), Perth (29), Dunoon (23), Falkirk J.S. (33) and Dalry (24); and the Clerk at Cupar (25) and Dysart (24); and the Manager or Cashier at Banchory (10).

Selkirk (13) hoped to sue, and be sued, in the name of the Treasurer alone, but was misinformed. Musselburgh (8) was to sue and be sued in the name of the first directors and their survivors, and then in the name of specially appointed Trustees.

2. The action was brought against the company, and each director, and the company Secretary individually. Unextracted Process - Callander Gas Light Co. (1860) S.R.O. (Currie Dat.T. 8/29)

3. Vide infra 'Consumer Companies' p.1119

(2) Chartered Gas Companies

An Act of Incorporation¹ for a gas company fulfilled two functions. To the company it gave specific legal privileges and sanctioned detailed regulations for the control and management of company affairs. For Parliament it provided an opportunity to prevent malpractices, to introduce national standards of commercial practice into individual companies, and to protect both shareholders and consumers from hazards as diverse as rash financial speculation which could adversely influence the entire national economy,² and the pollution of local water supplies. For this reason Parliament granted incorporation to a vast number of small gas companies, while denying its advantages to many larger companies³ outside the 'service industry' sector.

By private Act, the existing and future members of the company were declared "to be one Body Politic and Corporate", and in the name of the company they had "perpetual Succession and a Common Seal, and by that Name shall and may sue and be sued."⁴ Until the repeal of the 'Bubble Act' (1720) - 1825) a private Act was the only legal

1. Hereafter, Private Acts for gasworks are distinguished by date, town, and the Article (a.) or clause which is relevant. A full list of Acts, with financial details, is given later.

Vide infra Appendix XVIII.3

2. e.g. 1824-5 financial crisis Vide supra p.431 , 109, 163

3. e.g. Shotts Iron Company

4. Tolcross gas company (1836 a. ci) was unusual in suing in the name of the Clerk, Treasurer, or a Shareholder. Several private Acts specifically allowed partnerships to sue in the name of their Manager (for the time being), e.g., Standard Life Assurance Company Act of 1832.

basis for joint-stock ownership of a company. The advantage of taking court cases in the name of the company or its principal officers, instead of the names of each individual member, was more apparent in England, however, because unincorporated companies had the same privilege under Scots Common Law.¹

It remains uncertain² how rigorously the Bubble Act was applied in Scotland, but many early nineteenth century firms applied for incorporation in the belief that it was applicable. The first two Scottish gas companies, at Glasgow³ and Edinburgh, therefore took Acts as protection against their new and apparently hazardous projects, which required very heavy capital outlay because of the size of the markets. Nevertheless, both companies were fully committed to the extent of purchasing apparatus before the Acts were obtained, and could not have recouped their expenditure without continuing regardless. Both had previously obtained the support of the Town Council,⁴ which was necessary to prevent opposition to the Act, and the majority of subsequent Scottish gas companies relied entirely upon municipal approval and the concensus of local inhabitants.

The format of private Acts served to illustrate central Government policy on gas supply, and became the framework for "Rules and Regulations" adopted by unincorporated companies⁵ for their own

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1. This privilege was not always accepted, however, and both Shotts company and Leith glass company had problems with debtors who did not accept that the company existed separately from its members.
Vide supra p.104
 2. R.H. Campbell, "The Law and the Joint Stock Company in Scotland" in P.L. Payne, Ed., Studies in Scottish Business History (1967), p. 138.
 3. F. Clifford, A History of Private Bill Legislation (1887) Vol. 2, pp. 447-8. Clifford provides a valuable guide to legislation on early gas, water and transport companies.
 4. Vide infra 'Municipal Control' p. 1007
 5. Vide supra p.895

organization, and copied by them as rules for their legal conduct towards third parties. Companies formed in the 1820s frequently agreed to promote a Bill if it was necessary,¹ but few like Paisley in 1823 actually did so. Three principal causes underlay later applications for incorporation. The company could promote a Bill out of fear of a new rival company, as in the case of Dundee Old company in 1830, Hamilton Old company in 1846, and Ayr company in 1845. Alternatively, a new company required a Bill to oppose the old company, as in the case of Glasgow City and Suburban² in 1843, Hamilton New company 1846, and Dundee New company in 1846. Finally, a Bill could invigorate the status of a company being threatened with municipal takeover as at Stirling in 1898.

Parliamentary³ supervision increased considerably during the 1840s, but all general regulations, except those governing the accuracy of gas meters,⁴ were confined entirely to Chartered companies.⁵ In 1847 the Gasworks Clauses Act⁶ produced national gas regulations from rules which had previously been inserted piecemeal into private Acts, and could thereafter be quoted in private

1. Vide infra Dundee pp. 902, 926

2. Vide infra 'Consumers Movement' p. 1132

3. F. Clifford, Private Bill Legislation (1885) Vol. I, op. cit., p. 222

4. Vide infra p.1155

5. Laissez faire was not applied to company organization. Companies which registered under the 1870 Gas and Water Facilities Act became subjected to similar regulations as those of Chartered companies. (Vide infra Appendix XVIII. 2 - 4) Gasworks which registered for Limited Liability did not have to conform to the Gasworks Clauses Acts

6. 10-Victoria Cap. XV (23/4/1847) An Act for Consolidating in One Act certain Provisions usually contained in Acts authorizing the making of Gasworks, (hereafter abbreviated G.C.A. 1847)

Superseded by 34-5 Victoria Cap. 41 The Gasworks Clauses Act, 1871 (G.C.A. 1871)

Acts to avoid tedium. Special surveyors¹ appointed in England to examine all private gas Acts, greatly extended the expert knowledge available to Parliamentary Committees.

Many gas companies seeking Incorporation in the late nineteenth century were allowed to acknowledge that surplus profits had been re-invested in extensions of the gasworks. Some, like Coatbridge and Busby,² were already limited companies. Stirling was not, but had a stock of £12,400 by 1845 as "a joint adventure", and in 1878 had equipment valued at £30,000, without having borrowed money or mortgages. In 1845 'Civis' advised Stirling town council to purchase the gas company,³ and in 1874 the council again threatened action⁴ when the price of gas was raised for public lighting. In 1896 the council again proposed to purchase the works, so the company retaliated by promoting a Bill for incorporation, and popular agitation against the price of £62,697 agreed through the arbitration of Sheriff Lees⁵ led to a plebiscite which defeated the Council proposals.

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1. These surveyors had the Powers of Commissioners of Her Majesty's Woods &c., and their duties were extensive, virtually a civil service department on the gas industry. B.P.P. Local Acts - Preliminary Inquiries 1847 (xxxiii) 87 pages 106(95) to 12(98); powers as stated in 9-10 Vict. Cap. 106.
 2. Busby supplied Cathcart and Mearns parishes
 3. To prevent amalgamation with the consumers gas company. Stirling Journal 21/11/1845; vide infra 'Consumer Relations' p.1146
 4. In 1874 the £2 shares had a market value of £4. Mr Laidlaw of Glasgow evaluated the works at £24,850 and advised nine per cent annuities on the capital stock of £14,886. Provost Christie, who favoured the takeover, was outvoted in Council. Stirling Journal 25/9/1874; 30/10/1874
 5. Stirling company commenced in 1825 with £6,200 capital stock, but by 1875 had reploughed £15,000 surplus profits and paid ten per cent dividends. In 1874 the paid-up nominal share capital of £14,886 was raised in the books to £29,772, and no extra shares sold up to 1898 when the company's Bill declared the value of the works to be £40,000 and undertook to accept maximum dividend

Ardrossan sought a Bill when heavy expenditure was required to extend the gas and water works and mains, but accepted an offer of purchase by the Police Commissioners during the progress of the Bill, and the final Act had provisions for the takeover.¹ Ardrossan shareholders raised the nominal value of their stock from £9,750 to £13,930. Coatbridge in 1877² claimed to have invested £10,120 surplus profits on capital extensions, but only £5,060 was allocated to the old shareholders by providing five fully paid £10 shares for each old £30 share. During the transition to incorporation, old Articles of Association became void,³ and new share certificates were issued,⁴ but all other liabilities and rights were unaltered.⁵

regulations of ten per cent on £30,000 and five per cent on £10,000. Gas output had risen from 4.5 million cu ft in 1846, to 67.5 million in 1897. An accountant acting for the Town Council, A. Lass, stated that only £22,978 was spent on capital equipment up to 1878, and a further £6,000 up to 1896, or at most £29,576 by 1898. For the company, J.A. Robertson, accountant of Edinburgh, showed £39,607 spent on capital equipment, and argued that raising the nominal value of shares was not "watering the stock" but was a legitimate procedure. Company profits were £461 in 1846, £1,190 in 1856, £1,190 in 1866, £1,860 in 1876, £2,607 in 1886, and £2,607 in 1896.

Gas World, "Battle of Stirling", 2/4/1898 pp. 519-21; 29/5/1897 pp. 907-10; 2/7/1898 pp. 24-6

Industries of Stirling and District (1909, Stirling) pp. 106, 111-2 R. Rennie, Ed., Third Statistical Account - Stirling/Clackmannan (1966) op. cit. c.f. infra p.828

1. 1886 Ardrossan, a. 94 et seq., Preface
2. 1877 Coatbridge a. 20
3. 1886 Ardrossan a. 7; 1898 Stirling a. 5
4. 1886 Ardrossan a. 21, 1877 Coatbridge a. 22
5. 1886 Ardrossan a. 8 to 18; 1898 Stirling a. 9 to 11

TABLE 5.20 Companies Recognised by Parliament in the Late Nineteenth Century

(1) Chartered Companies

Date of Act	Company	Capital before Incorporation		Capital after Incorporation				Nominal Value of Shares
		Paid-up Capital	Nominal Value of Shares	Nominal Capital	Allocated to Old Shareholders	New Capital Issued	Nominal Value of Shares	
1855	Kilmarnock	15,000 (i)	25	30,000	15,000	15,000	25	
1877	Coatbridge	7,590	30	44,650	12,650	32,000	10	
1886	Ardrossan	9,750	10	36,000	13,930	22,070	10	
1898	Coatbridge	-	-	65,650	-	20,000 (ii)	10	
1898	Stirling (iii)	12,400	-	50,006	40,006	10,000 (ii)	10	
1902	Coatbridge (iv)	-	-	84,650	-	25,000	10	
1904	Stirling	-	-	75,000	-	45,000	10	

NOTES: (i) Kilmarnock also had £2,000 debt

(ii) Only £5,000 to be issued in first twelve months

(iii) Coatbridge avoided a new Act by applying through the Secretary for Scotland under the Private Legislation Procedure (Scotland) Act 1899

(iv) Stirling avoided a new Act by permission of the Board of Trade, using the Gas and Water Facilities Act (1870)

(2) Companies Registered under the 1870 Gas and Water Works Facilities Act¹

Date of Act	Company	Capital before Incorporation		Capital after Incorporation			Nominal Value of Shares
		Paid-up Capital	Nominal Value of Shares	Nominal Capital	Allocated to Old Shareholders	New Capital Issued	
		£	£	£	£	£	£
1887	Musselfburgh (1)	15,000	-	20,000	15,000	5,000	-
1896	Fort William	3,000	-	10,000	3,000	7,000	-
1902	Bridge of Earn	1,000	-	5,000	1,000	4,000	-
1902	Bothwell / Uddingston	23,000	-	40,000	23,000	17,000	-
1911	Busby	10,000	-	10,000	10,000	-	-

NOTE: (1) Fort William works were owned by Hugh Mayberry, of Hope Street, Glasgow

SOURCES: Acts and Orders of Parliament. Vide infra Appendix XVIII.3

1. 33-4 Vict. Cap 70 An Act to Facilitate in Certain Cases the Obtaining of Powers for the Construction of Gas and Water Works 9/8/1870;

36-7 Vict. Cap 89 An Act to Extend and Amend the Provisions of the Gas and Water Works Facilities Act, 1870 5/8/1873

From 1870, with the consent of a local authority, any Company or Person could apply to the Board of Trade for a Provisional Order (later ratified by an Act) to raise extra money for operating gas or water works. A Provisional Order subjected applicants to all the provisions of the Gasworks Clauses Acts of 1847 and the Lands Clauses Acts, thus placing similar restraints upon them as Chartered Companies with special Private Acts. The legislation of 1873, prompted by the 1872-3 coal crisis, empowered the Board of Trade to grant Provisional Orders to Chartered and Municipal Gasworks in order to waive maximum price and gas quality regulations in their Acts, for a maximum period of two years, whilst restricting their dividends to ten per cent per year or the average dividend of the past two years (if lower).

Dundee was the first Scottish gas company to seek Parliamentary protection from a competitor upon the argument that it provided a social service. When Dundee company commenced¹ in 1823 "it was very difficult to get the shares off" and only a third had been subscribed when the gas supply commenced in 1825.² Up to May 1826 only 749 shares had been sold at £20 each, and 251 remained. That year 194 shares were sold at £27 to existing shareholders because of the company's success, and over the next two years sixty-seven were sold in 'lots' at public auction for about £36 each. The premiums were used as a contingency fund. 'Dundee New Gas Light Company'³ was promoted in 1828 and purchased land before applying to the Town Council for permission to break open the streets for pipes. This was refused and the new company promoted a Bill which the Council opposed.

Before the 1832 Reform Bill "the Council elected themselves", and Christopher Kerr the town clerk in 1829 was also clerk to the Old gas company.⁴ The Provost, together with many councillors, magistrates and bailies, were also members of the Old company.⁵ In March 1829 following normal practice, the Bill was examined by a committee of

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1. Vide supra 'Companies without Limited Liability' p.926
 2. Evidence of Mr Cross, technical adviser to Old company. H. Lords 1846(Vol. 10) 20/5/1846 p. 76
 3. H. Commons 1846 (Vol. 98) 23/3/1846, p. 124;
Vide infra 'Consumer Companies' p.1119
 4. H. Commons 23/3/1846 pp. 137, 139
 5. Evidence of J. Brown, Provost. About seven members had shares, and although they were excluded from the Council Committee which reviewed the New Company, they probably influenced it. The Old company which paid £20 annually to the 'common good' of the Burgh, gave "private conditions" to the Council in return for support.
H. Commons 23/3/1846, pp. 100, 121, 159

local MPs representing the Burgh and County of Dundee, Montrose, Arbroath and Fife.¹ They decided² that in a small town like Dundee, with narrow streets, a monopoly under "proper restraints" would best serve the public interest. The New company was quashed, on condition that the Old company raised its capital by the public sale of new £20 shares, in order to extend an adequate supply through the town and suburbs. No new subscriber could have more than twenty shares, unless some remained unsold. The company had to provide gas as cheaply as the average of seven other towns,³ and auditors were to be appointed, ^{one} by the magistrates and two by the Police, to examine the accounts for the public benefit. The Old company also had to promote a Bill for incorporation, in 1830, under which the original share capital of 1,000 shares of £20 was increased by 250 shares which sold at a premium of £13, raising the total capital by £8,039. Already the company had spent £29,702 on the capital account, equivalent to £23 15s per share by reploughing surplus profits, and after 1830 more extensive additions were made to the works.

In Paisley, a new company formed in 1843, with a nominal capital⁴ of £40,000, was opposed by collusion between the Old company and the Town Council which was persuaded to municipalize the old gasworks.⁵ The New company promoted a Bill to erect separate gasworks⁶ at

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1. Evidence of C. Kerr. H. Commons 23/3/1846, p. 124
 2. H. Lords 20/5/1846
 3. Vide infra pp.969, 993
 4. H. Lords 1844 Vol. 8, op. cit., 31/7/1844, p. 317
 5. Vide infra p.1020
 6. Evidence of J. Stranant. H. Lords 30/7/1844, p. 13

Paisley, Barrhead and Johnstone, the latter being without¹ gas supply. Paisley old company had also failed to supply Elderslie² village which had requested gas since 1836, as well as Quanelton and Thornhill.³ The New company claimed that less than a quarter of the inhabitants had gas in the 13,000 dwelling houses rented at under £5 and occupied by the poor. Meters⁴ cost two guineas, and not until August 1843, under threat of competition, had they been hired out at 2s 6d a year. Landlords did not provide gas fittings and could seize them for unpaid rent, and because many cheap houses were let by the month,⁵ the poor who moved houses frequently could not afford to purchase fittings.⁶ The Old company provided service pipes only to the base of houses, and tenants had to finance all pipes to the upper storeys.⁷

On the advice of Walter Neilson,⁸ the New company proposed to supply pipes, fittings, and meters to the poorer classes, as the Glasgow City and Suburban company was doing, at a rent of only about 1s a year, which would raise consumption "prodigiously".⁹ They would also have abolished 'time-contracts', which the Old company charged

1. A small private company provided gas at Barrhead and Grahamston at the very high cost of 10s per 1,000 cu ft. Johnstone had a small gasworks, owned and run by the millowners who only supplied part of the town with gas at 8s 6d.

H. Lords 30/7/1844 pp. 118-9, 133-4

2. H. Lords 30/7/1844, pp. 19, 130

3. H. Lords 30/7/1844, p. 29

4. H. Lords 30/7/1844, p. 151

5. H. Lords 31/7/1844, p. 141

6. Evidence of J. Stranant; H. Lords 30/7/1844, pp. 14-17

7. H. Lords 31/7/1844, pp. 138-9

8. Probably Walter Montgomery Neilson, vide infra p.599

9. H. Lords 30/7/1844, p. 31, 31/7/1844 p. 21

at 12s per 1,000 cu ft., and persuaded the weavers in a shop to share a single meter.¹ Excessive discounts² were being granted to large consumers by the Old company, which supplied poor gas contaminated with sulphuretted hydrogen.³

The Old company was accused of giving inadequate supply to factories and mills, which it resented supplying at all because they required high mains-pressure causing a wastage of gas by time-consumers, thereby reducing the company revenue.⁴ Many factories commenced at 6 a.m. and closed at 8 p.m., but in winter the gas supply was often turned off on the mains at 8 a.m. though the workers could not see by daylight until 9 a.m. The supply was not resumed until 4 or 4.30 p.m., which was too late, and factories were obliged to hold a dinner break from 3 to 4 p.m. Shops lit early, and most inhabitants used gas by 5 p.m., causing the pressure to fall until lights were inadequate to work by. Between 6 and 7 p.m. jet flames were reduced in height by one inch, and factory weavers often used auxilliary candles. Weavers who contracted for four-inch flames,⁵ often

1. The Old company time-contracts:

Weavers 4" jet to 11 p.m. all week, 18s 4d per burner or 8s 11½d per 1,000 cu ft.

Kitchen lights 11s 11½d to 8s 6d per 1,000 cu ft.

H. Lords 31/7/1844, pp. 333, 338-9

2. H. Lords 30/7/1844, p. 25

3. Evidence of J.T. Cooper, consulting chemist of London, who tested Paisley gas on behalf of Glasgow Old company, and found it inferior to Edinburgh, Dundee, Perth and Greenock.

H. Lords 31/7/1844, p. 293.

4. Evidence of W. McNicol, manager of R. McArthur & Co., a factory employing 250 weavers. H. Lords 30/7/1844, p. 23, 31/7/1844 p. 7

5. Evidence of G. White, hardloom weaver. In 1825 weavers' time-contracts were sunset to sunrise, but a majority of the town's weavers preferred 7 a.m. to sunrise and sunset to 10 p.m., and petitioned the company for lower rents and those hours. The company enforced the hours, but did not reduce the rates, and shortened the winter season by 3 weeks, instead of increasing it 3 weeks as required: H. Lords 31/7/1844 pp. 57, 69, 70-1

received only 2½ inches.

The Old company perpetrated an iniquitous pre-payment system. Weavers had to pay for half a year in advance,¹ reduced to quarter of a year when the New company threatened opposition. This caused great hardship during the trade depression of the early 1840s, because gas could be used only during working hours and there was no rebate when work ceased, though some weaving shops with five or six weavers had paid for gas and then been idle for two months at a time.²

W. Neilson³ estimated that all three gasworks would cost £29,825 including pipes and meters. That in Paisley would be technologically superior to the old works, and cost only £20,000, but would produce 17 million cu ft. of gas for sale at 5s 9d per 1,000 cu ft. above half the town's total consumption for several years. It was therefore scandalous for the Town Council to purchase the old gasworks for £64,000 when they were only worth half that amount.⁴ Trade had increased rapidly since 1843, especially when the railways reduced the price of common coal for factories from 5s or 8s to 3s 9d, and there was adequate scope for two competing gas companies.⁵

1. H. Lords 31/7/1844, p. 77

2. Almost all independent weavers worked together in a "warehouse" not at home, each supplying a different manufacturer, and paying individually for his loom stand and gas light. In the "Great Distress", the gas company refused to extend contract hours for gas to allow a single loom to run all day on two shifts.

H. Lords 30/7/1844, pp. 25, 26, 153; 31/7/1844 p. 82

3. H. Lords 31/7/1844 p. 319; 30/7/1844, p. 33.

Detailed engineering plans Vide infra Appendix XVI.1

4. H. Lords 30/7/1844, pp. 17, 22

5. The New company's Bill contained a clause prohibiting future amalgamation with the Old company; by 1844 it had spent over £4,000 in Parliamentary costs alone. H. Lords 31/7/1844 pp. 117, 153.

In the Paisley shawl depression of 1841-3, 67 out of 112 firms failed; vide W.H.Marwick Economic Developments in Victorian Scotland(1936) p.124

Archibald Cook,¹ engineer and manager of the Old Paisley company, replied with details of the experiments he had made to ensure the most economical use of coals at Paisley, while the gas was so pure that it was used in local factories making silver and gold thread which would otherwise discolour rapidly.² For £1,500 the productive capacity of the present work could be doubled, but in fact consumption had declined in the early 1840s because of "the bad trade in the Town, and the emigration of a great many people going to America".³

TABLE 5.21 Effect of 1841-3 Trade Depression upon Paisley Chartered Gas Company

Date	1840-1	1841-2	1842-3	1843-4
Millions cu ft Gas consumed	47.5	40	36.5	40

SOURCE: House of Lords 2/8/1844, p. 210

The price of gas could only be reduced by increasing the amount consumed, but a second company would reverse that process. Already pipes supplied every street in town, and public lights were supplied up to 100 yards from the mains. Mains were not laid to villages like Elderslie because the profit would only be about one per cent, forcing Paisley consumers to heavily subsidise such villagers.

Abuse of 'contract-lighting' had caused the company considerable

1. Cook was a highly skilled engineer, who designed the original Paisley gasworks, and from 1823 to 1844 while manager there, constructed fifty new gasworks in England and Scotland.

H. Lords 1844 2/8/1844, pp. 1, 80

2. H. Lords 2/8/1844, p. 22

3. Total gas consumption in Scottish industrial towns always closely reflected the trade cycle, and in some cases was used locally as a guide to economic prosperity.

losses, and weavers working in a 'warehouse' who could not afford individual meters at 1s 6d rent a year, refused to share a meter between them because they varied their working hours considerably according to their temperaments and their "hurry to get into the work-house". Consequently the new Glasgow City and Suburban company¹ supplied very few weavers, and neither could a new Paisley company. The existing Paisley gasworks were in good condition, because any deterioration was soon replaced, and although Cook agreed that an entirely new works could be built for £27,000 compared to the £37,000 expended on the old works, it could not have any technical improvements.

J. Headley,² consulting gas engineer of London, verified the high quality of Paisley gas, and estimated the average output per ton of coal since the works commenced to have been 10,000 cu ft, a very efficient output. The Town Council had been misinformed by the New company that the old works were ill-designed, worn out, and that good works should give 18,000 cu ft per ton. That output was possible, but would give a low quality like London gas.³ About fifty per cent of Paisley gas was lost between output and consumption, but Headley claimed most was due not to leakage but to "over-burning" by time-contractors, who thereby reduced their price from 10s per 1,000 cu ft to 3s. Competition between gas companies was an impossible fallacy,⁴

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1. Evidence of G. Miller, Superintendent of Glasgow City & Suburban. Landlords refused to supply gas fittings to the poor weavers. H. Lords 2/8/1844 pp. 207, 208, 210, 211
 2. H. Lords 2/8/1844, p. 88. With list of 11 English and Irish, and 3 French gasworks Headley built, and 4 English gas companies he promoted.
 3. H. Lords 2/8/1844, p. 117
 4. Vide infra p.1120

and Headley stated that gas could be supplied better and cheaper under municipal control, as at Manchester where the price had been reduced from 6s to 5s, the illuminating power of 1,536 cu ft was equivalent to 3,092 cu ft of London gas, and annual profits of £3,000 were spent for the good of the town.¹ The promoters of Paisley New gas company conceded defeat, and agreed to exclude the town of Paisley from their Bill,² and the Old company was able to form a public Trust with the Town Council.³

Hamilton old gas company commenced in 1831, chiefly on the initiative of W. Henderson,⁴ writer and town clerk, with a nominal capital of £3,000 in £10 shares, of which only £8 was called up to finance the works. People were reluctant to finance the 'risk' of a gasworks, but Henderson persuaded his personal friends to take shares, and also sold twenty-five to the Town Magistrates, and twenty-five to the Duke of Hamilton. By 1846 the company had also reploughed about £200 of excess profits. Henderson frequently attempted to persuade the Town Council⁵ to run the works, but they refused on the grounds

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1. For the remainder of the century gas profits at Manchester remained a glittering wealth which tempted other municipal authorities in Britain to experiment.

Gross Profits of Manchester Corporation

Date	1838	1839	1840	1841	1842	1843 (gas reduced 1s)
£ Profit	19,377	24,547	24,738	29,694	31,232	27,927

H. Lords 2/8/1844, p. 225

2. H. Lords 5/8/1844. The New company rapidly dissolved
3. Vide infra 'Municipal gasworks' p.1020
4. H. Commons 1846 Vol. 102 11/5/1846, pp. 46-9
5. H. Commons 11/5/46, p. 69

of high expenditure and risk.

Nevertheless, the company successfully served all sectors of the community, as illustrated by the gas rents:¹

TABLE 5.22 Gas Sales at Hamilton to various Classes of Consumers (1846)

Number of Consumers	606	253	61	12	6	12
Gas per Year	Under £1	£1-2	£2-3	£3-4	£4-5	Over £5

SOURCE: H. Commons Vol. 102 11/5/1846, p. 218

Unfortunately, two factors upset the local population - the supposedly high price of gas,² and the arrogance of the company manager, Andrew Brande who was formerly Henderson's house factor and weavers' agent. Brande enforced ruthless efficiency to keep the small works profitable in a handloom-weaving centre which was becoming depopulated by the flight to the coalfields.³ Brande was "not an engineer", and from 1831 relied exclusively on Lesmahagow coal from the Duke of Hamilton's pit at Auchinheath twelve miles away, ignoring the alternative pit of Mr Ferguson, or the possibility of different coals. Coal prices rose to an exorbitant 16s 6d a ton in 1845, but Brande maintained that gas in Hamilton was as cheap as in any equivalent town.⁴

Early in 1843, D.E. Gwinn,⁵ M.D., a local magistrate, promoted a New Gas company, and the public readily agreed that the supply was

1. H. Commons 11/5/1846 p. 218

2. Nearby Larkhall gasworks, also using Lesmahagow coals, sold gas at only 5s 6d and still made good profits. H. Commons 7/5/1846, p. 1

3. Evidence of Rev. W. Patrick, H. Commons 11/5/1846, pp. 91-2

4. H. Commons 13/5/1846 p. 28. Vide infra Appendix XV p.1753

5. H. Commons 11/5/1846, p. 191

TABLE 5.23 Gas Prices charged by Hamilton Old Company
compared to other Towns

Date	Hamilton	Paisley	Lanark	Coatbridge	Glasgow
1843	6s 6d	8s 6d	9s	8s 6d	8s
1846	6s 6d	6s	8s	8s 6d	6s 8d

SOURCE: H. Commons Vol. 102 13/5/1846, p. 28

inadequate, the quality poor, and prices exorbitant. Gwinn never believed that two companies could compete in a town so small, but succeeded in his object of getting the price reduced, from 8s to 6s 6d, while new gas mains were laid to improve the supply. The New company was dissolved, but a year later in 1844 agitation was renewed by other consumers and encouraged by the Town Council which desired cheaper gas for public lamps. Consequently, the old company reduced the charge on those lamps from 10s to 8s 5d each per year, but the agitation continued.

A prospectus for the New company, with a capital stock of £3,500 and powers to borrow up to £5,000 was formulated in January 1845 and published in July. Walter Black,¹ the Provost and Chief Magistrate, became Chairman of the New company, and in council elections the issue eclipsed Free Trade² when voters ejected supporters of the Old company. W. Aikman,³ the burgh Treasurer and agent of the Western Bank, became Treasurer of the New company. The Duke of Hamilton gave support - and ground at a nominal rent.⁴ By 1846 the Scrip

1. H. Commons 7/5/1846, pp. 94, 110

2. Evidence of R. Chalmers. H. Commons 7/5/1846, p. 11

3. H. Commons 7/5/1846, p. 174

4. H. Commons 13/5/1846, pp. 13, 31.

was issued and "very nearly" all paid up, mostly by Hamilton householders,¹ with only twenty-five shares held by Glasgow residents.

Although the Town Council owned only about five streets in Hamilton, they threatened to refuse access² for the pipes of the Old company, so that company promoted a Bill for its protection. Consequently, the New company,³ which had hoped to compete on equal terms, reluctantly petitioned for a Bill to protect themselves also. Before a Commons Committee, the New company stated that they had already commenced construction,⁴ thereby forcing the Old company to provide cheaper gas, although the quality had greatly declined and the meters had been mysteriously adjusted⁵ since 1843. Moreover, to force time-contract consumers to install meters instead, the company in 1843 fitted them all with much smaller burners,⁶ which gave inadequate light for working and led about 500 people to purchase expensive meters. The gas manager was widely disliked, had fined persons using gas for only five minutes longer than the stipulated times though most gas companies allowed a half-hour leeway, and in 1834 created a furore by alarming a woman in child-bed when lights were used over the time allowed.⁷

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1. H. Commons, 7/5/1846, pp. 126, 131
 2. Evidence of T. Anderson, Chairman of Hamilton Old company. H. Commons 13/5/1846, p. 92
 3. H. Commons 7/5/1846, p. 121
 4. H. Commons 7/5/1846, p. 70
 5. H. Commons, 7/5/1846, p. 181
 6. Evidence of R. Chalmers, shoemaker: H. Commons 7/5/1846, p. 18
 7. Evidence of Rev. W. Patrick: H. Commons 7/5/1846, pp. 58, 90, 98

The Old company gave poor service. In March 1846 R. Chalmers, a local shoemaker,¹ surveyed the households and out of 1,829 in Hamilton only 823 used gas. Bothwell village, 1½ miles distant and containing 177 families, desired a gas supply as did Motherwell village, with 218 households who were willing to pay half the cost of pipes from Hamilton Bridge. The New company aimed to supply them. The Old company also provided deficient gas pressure, with lights sometimes extinguished for hours, and at 7 to 9 p.m. in mid-winter gas lights were too weak to work by.²

Walter Neilson³ had planned the New works with modern technology, to cost £1,927 and to supply 3,169 jets with gas at 5s per 1,000 cu ft. They could produce 4.7 million cu ft a year, from Lesmahagow mixed with other coals, compared to the existing consumption of 3.8 million. Neilson stated that the New concern was "what is called a Consumers' Company" to make cheap gas, while the Old was a "profit-making Company ... interested in getting the most they can for the gas".⁴

George Miller⁵ presented the main arguments for the Old company. He testified that their equipment was in good condition, the gas of

1. H. Commons, 7/5/1846, p. 63

2. H. Commons, 7/5/1846, pp. 33, 52

3. Glasgow engineer since 1837. Trained by his father, J.B. Neilson of Glasgow gasworks.

H. Commons, 7/5/1846, p. 202. Vide infra 'Labour' p.599

4. H. Commons, 11/5/1846, p. 27

5. Chemical manufacturer of Glasgow. Member of the Committee of Works which superintended the erection of Paisley gasworks. For ten years manager of Blantyre cotton and dye works, and manager of gas production there. Blantyre supplied 2,400 lights in the works, and part of the village, and had a larger gasworks than Hamilton town.

H. Commons, 11/5/1846, pp. 103, 162

better quality than in Glasgow since it lasted 91 instead of 80 minutes on a jet photometer, and coal could not be obtained in Hamilton as cheaply as Neilson anticipated. He illustrated the failure of competing gas companies in various English towns, the wastage of capital, and the worthless nature of cheap gas of low quality.¹

Miller recommended municipal ownership of Hamilton gasworks, as at Paisley, Greenock, Manchester and Salford, and hoped that a local Sheriff would be empowered to have the gas quality tested.² Thomas Hawksley³ verified these remarks, claimed that villages like Bothwell could be supplied better from gasworks of their own, and recommended that monopoly gas companies should continue, but under the supervision of a Parliamentary "Board" or Commission. Unwilling to promote such radical changes, the Commons Committee refused to allow two companies to operate in Hamilton, and upheld the Bill⁴ of the New company.

Even so Hamilton New company⁵ was not wealthy, and paid only eight per cent dividends for the first five years. Almost the entire nominal stock was sold after the Act, and for extensions to the equipment in 1851 the entire Depreciation Account was reploughed, and a loan taken from the Western Bank of which £150 was outstanding in 1852. Nevertheless, outside speculators afflicted the company and

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1. In the 1840s Parliament did not stipulate gas quality or candle-power for Chartered companies.
 2. H. Commons, 11/5/1846, pp. 138, 177, 182
 3. H. Commons, 13/4/1846, pp. 35, 42. Vide infra 'Consumers' Movement' p.1120
 4. H. Commons, 13/5/1846, pp. 99; 14/5/1846
 5. S.R.O. Court of Session (C.S. 275/121) W. Black v. Hamilton New Gas Light Company.

in 1852 W. Black and other original shareholders obtained an Interdict* and Note of Suspension against the decision of a general meeting to raise the dividend to ten per cent upon the motion of P.W. Dixon, a Glasgow accountant and new partner, and J. Main a non-voting partner who had not paid-up fully his shares. The directors had recommended eight per cent, and £130 into the Depreciation Fund to raise it to £286, but Black showed that the Accounts, made up to 14 August 1852, had omitted £150 expenditure since 14 June. Consequently even eight per cent dividend would have required a bank loan of £220, which was in effect a dividend out of capital, and hence illegal.

TABLE 5.24 Hamilton Accounts as Stated in 1852

(1) Revenue		(2) Disbursed	
Company Credit in Bank	£ 662	Debts due by Company	£217
Unpaid Arrears on Shares	£ 178	Annual Expenditure	£150
Gas arrears due	£228		£67
Irrecoverable	£ 50	Dividends unpaid	£88
	£ 177	Loan from Depreciation	
		Account	£156
Total	£1,017	8% Dividend on £7,184	£576
		Balance unexpended	£130
			£1,017

N.B. 'Annual Expenditure' pre-deducted as Working Costs

SOURCE: S.R.O. (CS 275/121)

Only £662 of profits was on hand, and not the £1,017 upon which shareholders wished to declare dividends.

The dissatisfaction of Dundee consumers brought further Parliamentary action. A prospectus for Dundee New Gas company¹ appeared in November 1843, and the company applied to the Town Council for

1. Evidence of W. Moyes, Magistrate: H. Commons 1846 Vol. 98 23/3/1846.

* Equivalent to an injunction : a judgement or order to do or refrain from doing a particular thing - either perpetual (a judgement), or interim (pending a Court hearing). J.Burke Ed. Stroud's Judicial Dictionary of Words and Phrases (1952) 3rd Edn. Vol.2 p.1454

permission to lay pipes in March 1844. A committee on the Town's Property approved, though it imposed strict rules for pipe-laying and an annual charge of £50 for the Common Good of the Burgh. Although petitions by the Old company delayed a decision, the Council finally voted in favour by fourteen votes to two. The opposers in Council were members of the Old company. The Harbour Trust and Police Board also gave permission for pipe-laying.¹

Between May and October 1844, the Old company² made no complaints to the Town Council over their decision, but then took an Interdict against the Council to prohibit them from permitting pipes to be laid. Lord Ivory upheld the Interdict in the Inner House, and it was still in force when the New company appealed to Parliament for a Bill, although in 1824 Dundee Council had specifically not granted exclusive rights to the Old company.

The new gasworks were designed in May 1844 by James Leslie³ a civil engineer based at Edinburgh who had also designed Dundee harbour. Contracts were placed that summer, and excavations began in November, so that the works would have been completed by the winter of 1844-5 until the Interdict hindered progress. John Zuil Kay⁴ was appointed manager in August 1844, after training as a draughtsman and engineer for three years with Glasgow Old gas company. Kay testified to a Commons Committee that the ground was purchased before

1. H. Commons, 23/3/1846, pp. 31-2

2. Evidence of J. Barrie; H. Commons, 23/3/1846, p. 122

3. H. Commons, 23/3/1846, p. 142; vide infra 'Labour' p.598

4. H. Commons, 27/3/1846, p. 1. A very talented and later famous gas engineer.

August, the pipes and excavations contracted in September and the foundations in October 1844, so that by the time the inquiry was held before Parliament £23,700 had been expended on the new works.

Dundee New company argued that the growth of population and manufacturing in Dundee gave room for two companies to operate, and a petition signed by 8,000 inhabitants supported them.¹ The Old company gave inadequate supplies, and failed to provide for all public lights so that the Police² had to use some oil lamps in 1836-7. They had refused to light the suburb of Lochee until 1844 after indicting the new Company.³ Before competition was threatened they failed to provide service pipes to the upper storeys of houses.⁴ The Old company made large extensions of pipes and the supply district after March 1843, and followed the example of Greenock in laying pipes to upper storeys in October 1843, followed by free installation to upper flats early in 1844.⁵

They refused all requests for a day-time supply of gas until 1845, despite the common use of meters in Dundee unlike London.⁶ The New company promised a day-time supply. The Old company gave

1. H. Commons, 23/3/1846, p.21; H. Lords, 20/5/1846, p. 88

2. H. Commons, 23/3/1846, p. 23

3. Lochee was a centre of flaxspinning, weaving mills and hand-loom weaving. The Old company argued that after a Depression in 1837, Dundee and Lochee had recovered in 1843-4 but previously Lochee was too distressed to use gas; they obtained cheap pipes in 1844 because of temporary low iron prices preceding expected railway extensions, and therefore extended mains to Lochee.

H. Commons, 23/3/1846, pp. 22, 87, 48; H. Lords 20/5/1846, pp. 52-4, 85

4. H. Commons, 23/3/1846, p. 36

5. H. Lords, 20/5/1846, p. 140; H. Commons, 24/3/1846, pp. 181-3

6. Evidence of J. Leslie. H. Commons, 23/3/1846, pp. 150-3

excessive dividends, which led to excessive premiums and speculation in shares, against the interests of consumers. In 1839-42 the dividend was fifteen per cent, or £3 on each £20 share, and those shares¹ had a market value of £50 to £55. Discounts to large consumers, though common among gas companies, were a tax upon poor consumers² and would be abolished by the New company. Earlier when discounts were reduced from twenty per cent to 12½ per cent, the Old company had been able to reduce all gas prices.³

Finally, excessive gas prices and meter rents were charged until competition was threatened. James Russell, manager of the Old company had not fulfilled the provisions of that company's Act in monitoring gas prices in the towns to which Dundee prices had to conform, and relied upon infrequent newspaper accounts instead of personal letters.⁴ The gas price⁵ was 8s 3d in 1843, but in November fell to 7s 9d because of the New company, and by 1844 was 6s 8d. Meter rent was 4s until 1843, before being reduced to 3s, and by 1846 2s. The Old company felt obliged to reduce the rate for public lamps also, by 3d in 1843, to 6s per 1,000 hours, and in 1844 to 5s, thereby saving the Police Commissioners £80 a year.

The Commons Committee⁶ declared that the New company had proved

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1. H. Commons, 23/3/1846, p. 21; Evidence of Mr Forsyth H. Lords 20/5/1846, p. 38
 2. H. Commons, 23/3/1846, p. 50
 3. The Old company maintained that discounts were justified because there was less chance of bad debts, and installation costs were relatively smaller with large consumers; H. Commons, 24/3/1846, pp. 89, 143-5
 4. H. Lords, 20/5/1846, pp. 133-7; H. Commons, 25/3/1846, pp. 74-80
 5. H. Commons, 23/3/1846, pp. 26-9, 38
 6. H. Commons, 25/3/1846, p. 175

its case, provided that their Bill had clauses to prohibit amalgamation with the Old company, and to allow the sale of the works, if desired, to the Town Council.

The Old company, which had presented its own Bill to convert the existing £20,000 loans into stock and to enlarge its works, withdrew that Bill and its opposition in the Commons,¹ but renewed its attack before a Committee of the Lords. In November 1843 the Old company published in Dundee details of the 1830 arrangements, and argued that a new company could not reduce gas prices or produce better gas,² that re-opening the narrow streets would greatly inconvenience the inhabitants, and that the New company had "little possibility of any profit". The Old company already had £29,000 stock expended, plus £20,000 loans, mainly at three per cent interest.

Before Parliament they claimed that no part of the town had inadequate supply, and because of the high quality of gas it was "very much used" in private houses.³ Competition would not improve candle-power or quality, but the duplication of capital and management would raise gas prices.⁴ Prices had continually been reduced, to avoid a second company being formed; the company had never been sued for cheaper gas under their 1830 Act, and by giving dividends lower than the maximum in that Act⁵ had saved the public £28,379. Thomas

1. H. Commons, 24/3/1846, pp. 128-30; 26/3/1846

2. Evidence of C. Kerr; H. Lords 20/5/1846

3. Evidence of J. Brown, chief magistrate; H. Lords 20/5/1846, p. 118; H. Commons, 23/3/1846, p. 136, 24/3/1846, p. 180

4. H. Commons 23/3/1846, p. 21; Evidence of A. Sasson, H. Lords 20/5/1846, pp. 100-3

5. H. Lords 20/5/1846, pp. 46, 43-4.
Statistics of the 'savings' - vide H. Commons 24/3/1847, p. 135

Hawksley¹ in 1842 found the Dundee gas to be very pure and of high candlepower, 254 candles from 100 cu ft compared to an average 234 candles at fourteen other Scottish works, and competition could only raise gas prices. The Old company maintained that the New had laid only £300 foundations, and contracted £9,000 masonry at the time of the Interdict,² but their Lordships declared that the New company had proved its case for improving the gas supply of that town.³

Initially the problem for Parliament was to control a large quasi-monopoly, serving a large number of small consumers, and to ensure equitable treatment. In practice the law became heavily biased against the consumer, and provided the company with a right of access to private property. Parliament imposed regulations for solvency, borrowing and contingency funds, but made little effort to guide depreciation accounts, the price of gas, or to define who had a right to purchase new shares. For several early companies the Act was inoperative until the entire nominal capital was subscribed, as at Leith in 1822, whilst for Glasgow in 1817 the threshold was £20,000, or half the total, and at Edinburgh in 1818 £70,000 while the entire £100,000 had to be taken within five years of the Act.⁴

1. Gas and water engineer of Nottingham.

1842 survey made for Glasgow Old company, for which Hawksley visited fourteen Scottish gasworks.

H. Lords, 20/5/1846, p. 153 Vide infra p. 1120

2. H. Lords, 20/5/1846, p. 69

3. H. Lords, 20/5/1846, p. 183

4. Tolcross (1836 A.iii) had £3,367 subscribed before applying for an Act.

The Act contained a preface explaining why it was required, and defined its own geographical boundaries.¹ Early companies emphasized the size of the town to be supplied, and the "great Benefit to the Citizens" to have public roads and squares, houses, shops and manufactories better lit. Public lighting had to be emphasized as an excuse for placing the supply of gaslight in one centralised company when Parliament favoured individual enterprise. The community would also benefit from the availability of coke as fuel, and "Tar, Pitch Asphaltum, Ammoniacal Liquor and Essential Oil" for local industries.² The persons named in the act were thus public benefactors "at their own Costs and Charges". Later applications for more capital, or by competing companies, stressed the growth of the town during the interregnum, especially when the "Suburbs are in a State of Constant Increase".³ In large cities, all the Parishes to be supplied were listed individually.⁴ Chartered companies were not granted a mono-

1. Definition of geographical boundaries in gas Bills became compulsory under Parliamentary Standing Orders in 1854. However, by the early twentieth century many companies obtained permission to supply gas in bulk outside the limits of the Act, e.g. Bridge of Earn (1902 a.30), Bothwell/Uddingston (1902 a.23), and Busby (1911 a.19). Bothwell in 1902 was empowered to supply part of the area (north of the R. Clyde) which fell inside the Hamilton Corporation zone but had no supplies. The Bridge of Earn (1902 a.21) company took power to purchase gas in bulk from Perth Gas Commissioners if required.

O.C. Williams, The Historical Development of Private Bill Procedure and Standing Orders in the House of Commons (1948, H.M.S.O.) Vol. I, p. 168.

2. Edinburgh 1818 preface, Glasgow 1817 preface, Leith 1822 preface
3. Edinburgh 1829 preface, Glasgow 1826 preface, Paisley 1832, Inverness 1847, Dundee New 1846, Dundee Old 1867.
4. Edinburgh 1840; Edinburgh and Leith 1840 a.ii, Dundee New 1846 a. xx; 1877 Coatbridge a.iv, 1898 Stirling a.iv, 1843 Glasgow C & S a. 3.

Several companies hoped to supply water as well as gas, as did

poly over gas supply and the exclusive privileges given by Edinburgh Town Council for the Edinburgh company to open city streets, were declared null and void.¹

Most Chartered companies could empower their directors to borrow money up to limits stated in the Act, usually subject to prior ratification by a General Meeting.² A variety of methods was permitted for raising loans. Glasgow company in 1817 could borrow up to £10,000 on whatever "Bonds, Obligations or other Deeds" were required, "binding the said Committee of Management, and their successors in Office and the Trade, Stock and Estate of the said Company, for Payment" plus interest.³ Loans often became preferable debts against the estate, effects and profits of the company, with preference over "all other creditors" and the proprietors.⁴ Those who made the loans could normally transfer them without recall. Edinburgh and Leith company in 1840 could borrow up to a third of the subscribed capital value, or take £25,000 cash credit from a Scottish bank "upon the security of the Property and Effects" of the company.⁵ More

Dundee Old company in 1823. Tolcross company (1836 a.xl, cvi) planned to supply pure water from coalmines, using the machinery of Colin Dunlop at Muir Pit, Carmyle, but specifically not from the River Clyde. At Inverness (1826 a. xlviii, lxxxviii; 1840 xxxiv, 1847 xl, xliii, xxxiii) the waterworks, for a supply from the River Ness and reservoirs, were expected to cost £7,200 and were an important reason for seeking the Acts which gave compulsory purchase powers in 1840.

1. 1818 Edinburgh a. xiii
2. Edinburgh Oil 1824, Leith 1822, Edinburgh & Leith 1840. The Act often illustrated the "Form" to be used, and required special Books recording debts e.g. Inverness 1826, Edinburgh 1840, Dundee 1830
3. 1817 Glasgow a. iv
4. e.g. Edinburgh Oil 1824, Paisley 1832, Hamilton 1846
5. Edinburgh & Leith 1840 a. x; similarly 1836 Tolcross a. x

explicit rules governed the loans¹ of later chartered companies. Loans could be replaced by shares only if the company² imposed a maximum dividend of five per cent on all stock. In several cases Debenture stock was also permitted.³

When borrowing power was increased by a new Act, priority was given to existing loans.⁴ To safeguard mortgagees and lenders, they were allowed to appoint a Judicial Factor, or official receiver, under certain conditions when the gas company defaulted on payments.⁵ A sinking fund specifically to repay loans was only imposed on Inverness company, in 1826, at the annual rate of £15 per cent of all loans, placed in a Chartered bank, and "applied in Payment of the Principal of such Loans, and no otherwise."

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1. Usually loans could be repaid and later re-borrowed, provided the repayment had not been made from the statutory Sinking Fund: e.g., 1843 Glasgow C&S a. 36
 2. 1886 Ardrossan a. 29; 1877 Coatbridge a. 32; 1898 Stirling a. 37.
 3. Subject to provisions of 1863 Companies Clauses Act mortgages and debentures were given preference over all other debts.
1886 Ardrossan a. 29, 31, 32; 1877 Coatbridge a. 32, 33, 35; 1898 Stirling a. 37, 39, 40.
 4. e.g. 1847 Inverness; 1867 Dundee New
 5. i.e. A 'Threshold Level' of arrears, over one month, after which mortgagees could apply for a Judicial Factor - 1887 Dundee Old, £2,000; 1855 Kilmarnock £1,000; Coatbridge (1877 a. 34) £1,000; Ardrossan (1886 a. 30) £1,000; Stirling (1898 a. 38) £2,000
It was later made more difficult to appoint a Judicial Factor.

At Coatbridge in 1902 (a. 21) this could only be done by mortgagees with over one-eighth of the company's total debts, and at Stirling 1904 (a. 19) with over one-tenth of total debts. Both of these companies, at those dates, were permitted to issue Debenture Stock under the terms of Part III of Companies Clauses Act, 1863, but debentures and mortgages could not be converted into Stock.

TABLE 5.25 Mortgage Restrictions placed upon Chartered Companies

<u>Company</u>	<u>Date</u>	<u>Mortgages Secured against Original Stock</u>	<u>Mortgages Secured against New (Fully Subscribed) Stock</u>
Coatbridge	1877	£2,000	£8,000 ⁽ⁱ⁾
Ardrossan	1886	One Third Total Stock	One Third Total ⁽ⁱ⁾
Musselburgh	1887	One Quarter Total ⁽ⁱⁱ⁾	-
Fort William	1896	£2,500 ⁽ⁱⁱ⁾	
Coatbridge	1898	-	One Quarter Total ⁽ⁱⁱⁱ⁾
Stirling	1898	One Quarter Total (£10,000)	One Quarter Total (£2,500)
Bridge of Earn	1902	One Quarter Total ⁽ⁱⁱ⁾	-
Bothwell/ Uddingston	1902	One Quarter Total ⁽ⁱⁱ⁾	-
Coatbridge	1902	-	One Quarter Total ⁽ⁱⁱ⁾
Stirling	1904	-	One Third Total ⁽ⁱⁱ⁾
Busby	1911	One Third Total ⁽ⁱⁱ⁾	-

- NOTES: (i) Half of the capital had to be paid-up, and so proved to the Sheriff.
(ii) All the capital had to be paid-up, and interest on loans could not exceed five per cent (or four per cent at Coatbridge in 1902, and Stirling in 1906)
(iii) All capital had to be paid up.

SOURCES: Acts and Orders of Parliament, vide infra Appendix XVIII.3
1877 Coatbridge a. 30,31; 1886 Ardrossan a. 27-29, 1898 a. 7; 1898 Stirling a. 35, 36; 1887 Musselburgh a. 16; 1898 Fort William a. 9; 1902 Bothwell/Uddingston a. 15; 1911 Busby a. 9; 1902 Bridge of Earn a.15

Contingency Funds, however, were virtually a prerequisite because of the supposed dangers in manufacturing gas. Glasgow Old company¹ could pay no dividends until £2,000 to £3,000 was accumulated in such a fund, out of annual profits. Most companies had to place at least ten per cent of annual free profits in the fund up to a stipulated amount, but the rule was not universal. Thus Edinburgh company in 1840 artfully omitted a maximum size for the Fund, and gained permission to replough profits by using the entire £5 - 10,000 Fund accumulated since the Act of 1818 to extend the works. Dundee New company in 1846 also modified the rule, to allow ten per cent dividends before placing surplus profits in the Fund until £8,000 accumulated. When that fund exceeded £3,000, interest was deemed profit, whilst if dividend fell below ten per cent it could be boosted by money from the Fund. Moreover Dundee New company could use the fund "for the Improvement or Extension of their Works".² In most cases, however, the Fund had to accumulate by cumulative interest which was only divisible as profit when the Fund was complete,³ and penalties were imposed for depleting the Fund.⁴

Less emphasis was placed on Contingency Funds in the late nineteenth century. Then, if clear profits exceeded the amount necessary for dividends, up to one per cent more could be invested in

1. 1817 Glasgow a. ii.

2. Dundee New company had to deposit an annual Abstract of Accounts, showing Contingency Funds, with the Sheriff of Forfar, to give some measure of public accountability.

3. e.g. 1824 Edinburgh Oil; 1826 Inverness

4. Vide infra Appendix VIII.3

Government or other securities until "an insurance fund" against exceptional demands accumulated up to five per cent of the nominal Capital Stock.¹ Any further excess profits could be carried forward, or placed in a special Reserve Fund² to meet any deficit in divisible profits in future years.

Only Paisley, in 1832, stipulated a Deterioration Fund because of the rapid deterioration of machinery "and in particular the Iron Work". One per cent of the total expenditure on the works since they commenced was to be used annually for "Repairs, Additions and Improvements", above those chargeable to annual revenue. In effect, it appears to be designed to finance extensions without the need to

1. 1898 Coatbridge a. 18-20; 1898 Stirling a. 32-4; 1887 Musselburgh a. 17; 1896 Fort William Schedule B. a. iii - v; 1902 Bothwell/Uddingston a. 16; 1911 Busby a. 27 (maximum of only ten per cent total stock).

Special provision for the Reserve Fund to repay any deficit dividends was made at Bothwell/Uddingston (1902 a. 18). At Busby (1911 a.10) a Reserve Fund was in prior existence, and £100 was released from it to a special reploughing account for works and pipes. Coatbridge after 1898 erred in the sums placed in reserve and insurance funds, and in 1909 (a. 11) was forced to present detailed accounts to the Town Council, and reimburse the money through cheaper gas.

2. The 1847 Gasworks Clauses Act permitted Chartered companies to grant dividends up to a maximum ten per cent (unless more was required to make up for a lower dividend in earlier years), and further profits could be placed in a reserve fund until that accumulated to ten per cent of the nominal capital stock. Thereafter, if two gas consumers complained to the Sheriff, the books could be examined and surplus profits had to be used in reducing gas prices. However, the reserve fund could be depleted for "any general purposes of the undertaking", and in practice the Act could not be used to enforce reduction in gas prices. This Act did not supersede profit and dividend regulations in earlier Private Acts, but imposed such regulations where none previously existed. Like other 'Clauses Consolidation Acts' on Land, Companies and Railways in 1845-7, it could be incorporated in subsequent Private Bills, enabling them to be greatly abbreviated in volume but not quality; such Consolidation Acts were inspired by the urgency for more rapid Parliamentary procedure following the railway boom of 1844-6.

10-11 Victoria ch. XV An Act for Consolidating in One Act Certain

increase capital stock.¹

The shareholder in a Chartered company was provided by Parliament with a detailed and legally binding statement of his rights as well as his responsibilities. Limited liability was the foremost gain in all cases. Thus for the 1818 Edinburgh company² no shareholder, or corporate body holding shares, was liable for "any Debt or Demand whatever, due or to become due from the said company, beyond the Extent of his, or her, or their Capital Stock" or shares, regardless of "any Law, Custom or Useage to the contrary".³ The Act stipulated when annual general meetings were to be held, and how they were to be advertized, as well as rules for voting on motions proposed by directors or other shareholders.⁴ The procedure for making calls upon shares, dividing profits, and transferring shares was clearly defined.

All shares in the "Joint Stock or Fund" of the company were deemed personal estate, and not real or heritable property.⁵ Apart

Provisions Usually Contained in Acts Authorizing the Making of Gasworks 23/4/1847 (a. 30-38)

O.C. Williams, The Historical Development of Private Bill Procedure (1948) Vol. I op. cit., p. 107

1. Similarly Stirling (1898 a. 42) was permitted to spend £5,000 out of current revenue, instead of capital on repairs and renewals.
2. 1818 Edinburgh a. xxii; see also 1843 Glasgow C & S. a. xxxii
3. e.g. 1824 Edinburgh Oil a. xxxv, 1817 Glasgow a. xxii, 1822 Leith a. xxxvii, 1823 Paisley a. xxix, 1826 Inverness a. iii, 1836 Tolcross a. xxx, 1830 Dundee a. xxvii.
4. Vide infra Appendix VIII
No particular standard of voting rights in relation to shareholding was imposed nationally.
5. 1823 Paisley a. xxx, 1818 Edinburgh a. xxiii, 1817 Glasgow a. xxiii, 1824 Edinburgh Oil a. xxxvi, 1822 Leith a. xxxviii, 1826 Inverness a. iv, 1836 Tolcross a. xxxvi
Vide supra p. 909

from funds stipulated by the Act, shareholders were entitled to "the entire and net Distribution of an equal proportional Part ... of the Profits and Advantages"¹ from revenue. Flexibly interpreted, this allowed the reploughing of some profits which increased the "advantage" of all shareholders. Few restrictions were placed upon shareholders, though Edinburgh in 1818 and Leith in 1840 forbade them to vote on matters in which they had "a separate Personal Interest". Only Dundee in 1830 limited the number of shares which any individual could hold, to a maximum of twenty.

A maximum limit to dividends was rarely imposed in the early nineteenth century, but became common at a later period. Glasgow² company in 1825 was restricted to ten per cent a year until a second company³ was formed in the city. If the average revenue over three years exceeded that level of profits, the price of gas had to be reduced. The same maximum dividend was imposed upon the Edinburgh company⁴ in 1829. Later companies were faced with a ceiling of £7 per

1. e.g. 1817 Glasgow a. ii

Dividend was normally withheld if calls made on shares had not been met, e.g., 1818 Edinburgh a. xxxii, 1840 Leith a. xli, 1826 Inverness a. ii, 1836 Tolcross a. xxxviii

2. 1817 Glasgow a. vi, vii. To enforce this the cash accounts were open to inspection by the Lord Provost, Dean of Guild, or Deacon of the Trades House, and failure to comply allowed anyone to petition the Court of Session to prevent the company levying gas rates under the Act.

3. 1843 (a.110) Glasgow City and Suburban company was restricted to profits of ten per cent a year, above the Contingency Fund and running costs. Any excess had to be used to reduce gas rates, and an Abstract of Accounts sent to the Sheriff Clerk of Lanarkshire annually, to enforce this public accountability.

4. 1829 Edinburgh a. xiii, xiv. Each June the company's books were to be examined by the Master of the Merchant Company of Edinburgh, and the City accountant, but in practice this was never enforced.

cent on new ordinary shares and £6 per cent on new preference stock.¹ Both Glasgow Old and City and Suburban companies² in 1857 were restricted to a maximum £7 10s per cent dividend on all new shares issued.

The sale of new stock authorised by an Act was normally left to the discretion of the company. Like unincorporated companies, many offered it proportionally and preferentially at par to existing shareholders, and only those shares which remained were sold to the public at upset prices.³ Parliament first opposed this procedure with the Glasgow company⁴ in 1826, restricting the sale of new

1. e.g. 1867 Dundee Old a. x, 1886 Ardrossan a. 23, 23; 1874 Inverness ; 1898 Coatbridge a. 14; 1867 Dundee New a. v.

New shares issued at Kilmarnock after 1855 (a. xxi) had a maximum dividend of £7 10s per cent.

Coatbridge (1877 a. 23) could pay ten per cent dividend on old capital, but only 7 per cent on that raised after the Act; Stirling (1898 a. 25) was restricted to ten per cent on £24,000 original capital, five per cent on £16,000 2s 6d original capital, and five per cent on all new capital after the Act. If profits were inadequate for a full dividend, "a proportionate reduction shall be made in the dividend of each class" including preference shares (e.g. 1886 Ardrossan a. 23,24; 1898 Stirling a. 26; 1902 Bridge of Earn a. 14)

Fort William (1896 a. 8) and Musselburgh (1887 a. 14) were restricted to ten per cent dividend on original capital, and six per cent on new capital after the Act. Later maximums included -

Bridge of Earn 1902 (a.13) ten per cent on original capital, seven per cent on additional capital.

Busby and District 1911 (a. 8) 5 per cent on all stock

Bothwell & Uddingston 1902 (a.13) ten per cent on original capital seven per cent on additional capital; 5 per cent on new preference capital.

Stirling 1904 (a.14) five per cent on new shares.

Coatbridge 1902 (a.14) seven per cent on new ordinary shares; six per cent on new preference shares.

2. Glasgow 1857; 1857 Glasgow C & S. a. xxiii.
a. 23
3. Paisley (1832 a. iii) stipulated this procedure; also Inverness (1847 a. xvii); Kilmarnock 1855. Edinburgh, vide supra p.773
4. 1826 Glasgow a. ii.

shares to public auctions, well advertized in advance in the newspapers, and only unsold shares could subsequently be offered for private sale, at or above that price, and only within six months after the public sale. This move to widen the ownership and public control of the company, also forbade the division of share premiums as 'profit' and stipulated their use in extending the works for the public benefit.¹ This rule was also applied to Coatbridge² in 1877, and Stirling in 1898. Moreover Coatbridge³ was later, like Stirling, restricted to offering maximum 'lots' of shares of £100, giving twenty-eight days advance notice of sales to the local authority and the Secretary of Glasgow Stock Exchange, advance notice of the

1. Glasgow City and Suburban in 1846 (a.liv) could only sell new shares by public auction, to the highest bidder, after advertizing the sale in local newspapers. The premium (a.lvii) on these had to be spent as capital and not divided as profits. In the event of bankruptcy (a. xxxiv) the premiums were repaid as preferential burdens on the undertaking, a clause not used by other Gas Companies. Vide supra p.808 ; also p. 1057.
2. Coatbridge (1877 a.36); Stirling (1898 a. 27-30). Public auction of new stock permitted by Parliament, became mandatory under Standing Orders (S.O.201) in 1877, and these also allowed a sliding scale of dividends related to gas prices. Vide O.C. Williams, The Historical Development of Private Bill Procedure (1948) Vol.I, op. cit., p. 170.
3. Coatbridge (1898 a.11); Musselburgh (1887 a.8-11) similarly had to send advance notice to the Secretary of Edinburgh Stock Exchange. Auction sales with maximum 'lots' of £100, no preference to existing shareholders, advance notice of upset prices sent to the Board of Trade, and payment of full price plus premium, were also stipulated at:
1902 Bridge of Earn a. 8,9; 1902 Coatbridge a. 8-10; 1902 Bothwell/Uddingston a. 8, 9; 1904 Stirling a. 9-10.
Premiums could not be divided as 'profit', but was to be used extending the works. Private sales of shares, but not at lower prices, were permitted after the public auctions. Twenty-eight days' advance notice of auctions had to be given by Bothwell to Glasgow Stock Exchange, by Bridge of Earn to London Stock Exchange and the local municipal authority, by Stirling (1904) to the Edinburgh Exchange, and by Coatbridge (1902) to Glasgow Exchange.

upset prices to the Board of Trade, and demanding full payment of the shares within three months of the sale.

Both Parliament and the company promoters were anxious to ensure that all calls made on shares would be met. No national system for calls was devised, but limits were set within which the directors could make calls. If shareholders failed to pay up, the directors could sue for debt¹ plus interest at five per cent per year. Alternatively after a lapse of six months at Glasgow, but elsewhere reduced to between fourteen days and three months, the directors could declare the shares forfeit, thereby absolving the former shareholder from further obligations to the company. These shares were then sold at public auction, and any profit above the calls due, interest and expenses, was repaid to the former owner.

Although the vast majority of shareholders were 'sleeping' partners, provision was made for extraordinary general meetings which could be called by ordinary shareholders to draw attention to matters neglected or mishandled by the directors, or called by the directors to request guidance on especially difficult or important problems. Those special meetings could only discuss the particular business for which they were called, and about which the shareholders were forewarned.²

A careful record of share ownership was vital, and the transfer

1. e.g. 1817 Glasgow a. xxxviii; Edinburgh a. xxxviii; 1826 Inverness a. xiii; 1840 Edinburgh & Leith a. xii; 1836 Tolcross a. xxix. Vide supra p. 907

2. Regulations vide infra Appendix VIII. Vide supra p.914

of shares which was permitted¹ became the subject of a distinct ritual. At Edinburgh in 1818 each transfer had to be endorsed by three directors, and entered into a Book of Transfers at a fee of up to 5s. At Paisley each such entry had to be "signed by the Governor, or Deputy Governor, and Clerk". Share certificates were only issued if demanded, but to reduce errors by a lazy clerk, Glasgow and Paisley imposed a penalty of £5 on the clerk if transfers were not booked within two days and three days respectively. The Inverness clerk in 1826 had only one day, subject to a penalty of £2. The directors were rarely involved in transfers, which in most cases became the responsibility only of the Treasurer or Clerk, and most companies reduced transfer-fees² to 2s 6d.

The transfer of shares was normally prohibited during the period between a call being made and being paid up,³ and because all persons standing in the company's books as Proprietors were legally deemed to be so, no votes or dividends were allowed to new shareholders until they correctly registered ownership. Unlike the unchartered gas companies, regulations did not require shareholders, before transferring, to offer their shares to the directors for behoof of the company,⁴ or allow the directors to judge who could purchase such shares. All new shareholders took precisely the same rights and responsibilities as their predecessors.

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1. 1817 Glasgow a. xlii. Often the 'Form' for transfers was illustrated in the Act. This is an echo from earlier and much smaller companies, where directors personally checked the probity of new shareholders.
 2. e.g. 1817 Glasgow; 1822 Leith; 1843 Glasgow C. & S.
 3. Glasgow (1817 a. xli) omitted this, but made the former owner liable to all calls made during the period of ownership
 4. Vide supra p. 910

The directors or Committee of Management were not professional managers, but merely shareholders above a minimal level of investment,¹ who were voted into office by the other shareholders in order to pursue the best commercial interests of all the partners. Directors could be members of other corporate bodies holding shares,² especially public bodies. Improvement and Street Commissioners could be directors in Hamilton New company, but could not vote on questions regarding these commissions. Later in the century it became established practice that contracts for gas with local authorities did not disqualify their members from being directors, but they could not vote on issues regarding these Authorities.³

At Edinburgh and Paisley, the anachronistic Governor and Deputy Governor⁴ were elected by shareholders, but elsewhere the directors elected their own chairman and his deputy for the succeeding year. To reduce corruption, directors were disqualified if they held "any Place of Profit" under the company, or supplied any article or had personal interest in any contract made by the company.⁵ Directors each had a single vote at their meetings, and the Chairman

1. Regulations on the election of directors, vide infra Appendix VIII

Dundee directors in 1830 had to reside within two miles of the town. Edinburgh Oil (1824 a. xlv) directors could not hold shares in any other gas company within ten miles of Edinburgh. Several companies imposed novel conditions on the directors to protect their interests. Vide supra p.932

2. e.g. 1823 Paisley

3. e.g., 1877 Coatbridge a. 46; 1886 Ardrossan a. 41; 1898 Stirling a. 52. c.f. infra p.890

4. A reminder of the 'Courts' of mediaeval trading monopolies.

5. e.g. 1822 Leith a. xlvi, 1826 Inverness a. viii, 1824 Edinburgh Oil a. xlv, Edinburgh and Leith 1840 a. xv, 1830 Dundee a. xxxii, 1836 Tolcross a. xix.

had a casting vote if they were equally divided.¹ Their actual meetings were also sometimes stipulated. From 1817 Glasgow directors² had to meet in the first week of July, October, January and April. At Glasgow, as with later companies, directors could form "a Sub Committee for particular Purposes, for the better attending to and transacting the Business", which met more frequently.

The Board of Directors played the most crucial role in the prosperity of a company. It decided on matters as diverse as the purchase of equipment, the allocation of financial resources, the appointment of engineers and other staff, the method of book-keeping and auditing to be used, and it also drew up by-laws to regulate both staff and consumers. The greatest burden inevitably fell upon the very first directors who, with "custody of the Common Seal",³ were to purchase or feu lands, tenements and materials, pay compensation or damages, contract tradesmen, organize the entire gas supply, fix the price of gas, and take contracts to supply street lights, factories, and dwelling houses.⁴

To avoid embezzlement, the Clerk normally had to be a different person from the Treasurer, and without private commercial ties, under a penalty of £50 to £100 which at Paisley could be paid to any person complaining of the collusion.⁵ Edinburgh and Leith in 1840 forbade

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1. 1818 Edinburgh a. xxx, 1826 Inverness a. ix, 1830 Dundee a. xxxiii
 2. 1817 Glasgow a. xxx. 3. 1840 Edinburgh & Leith a. xxviii.
 4. 1818 Edinburgh a. xxxiv, 1822 Leith a. lv, 1824 Edinburgh Oil a. lii, 1823 Paisley a. xliii, 1826 Inverness a. xxxiv, 1830 Dundee Old a. xxxix, 1836 Tolcross a. xxii.
 5. Glasgow (1817 a. xxxiii) £50; Edinburgh Oil (1824 a. xlix) £100; Paisley (1823 a. xxxix) £50; Dundee (1830 a. xxxv) £100; Inverness (1826 a. xi) £100; Edinburgh & Leith (1840 a. xxxiii) £100; Glasgow C. & S. (1843 a. xcix) £100.
Vide supra p.672

the Treasurer to hold any other office under the company, but this was unusual. At Edinburgh in 1818 the Treasurer could also act as Collector of gas rents, and Edinburgh Oil gas company allowed the manager to double as Collector. Normally all officials were appointed by the directors who had to take "sufficient Security" against their intromissions¹ if they handled money. In a few cases a general meeting alone could appoint some officials, for example the Treasurer and Clerk at Tolcross in 1836, and the Treasurer at Leith in 1840. Glasgow directors² had to declare the appointments they made at a general meeting which would review them. Dundee in 1830 was quite exceptional in requiring a Special general meeting to "appoint, by Ballot, a Manager or Treasurer and also a Clerk", the former having to give a security of £1,000.

Directors were notheld personally liable for the performance of company contracts they signed,³ and their remuneration was normally fixed by a general meeting,⁴ though Paisley in 1832 set an upper annual limit of £120. They were to formulate by-laws which were "not repugnant to the Law of Scotland",⁵ and which had to be obeyed by the

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1. 1817 Glasgow a. xxxii (specifically £50 cash); 1824 Edinburgh Oil a. xlviii; 1822 Leith a. xlix, 1826 Inverness a. x; 1823 Paisley a. xxxix; 1843 Glasgow C. & S. a. c. Vide supra p. 937
 2. 1817 Glasgow a. xxxii. At Glasgow C & S (1843 a. xcvi) the A.G.M. had to appoint the Secretary and Treasurer, and also two Auditors (each owning twenty-five shares, a. lxxxviii) to re-check the accounts (and hold no other company office). Kilmarnock company (1855 a. xlii) had an unusual provision for a general meeting to appoint two independent auditors every two years.
 3. e.g. 1840 Edinburgh & Leith a. xxx.
 4. 1847 Inverness a. xxxi; 1832 Paisley a. xi.
 5. 1822 Leith a. lviii; 1824 Edinburgh Oil a. lv, 1826 Inverness a. xxxiii.

company staff¹ under a penalty of £5, and by consumers. Those fined had the right of appeal, normally before the local Sheriff or his Depute,² or at Leith before the Admiral and Magistrates, and at Paisley before the Provost and bailies.

Responsibility for the upkeep of books, which were required to show all financial transactions, contracts and liabilities, and also the orders and minutes³ of all meetings held by the shareholders and directors, rested with the Board of Directors.⁴ The Treasurer was normally unable to make any payments without the specific sanction of directors.⁵ The directors were also charged with having the books balanced and accounts made usually in May around Whitsunday each year, and they had to be "examined, docqueted and signed" by a quorum of directors.⁶ The books had to be presented for inspection at the Annual General Meeting, and usually for a month beforehand the shareholders had a right to examine them in detail.⁷ Glasgow directors⁸

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1. 1818 Edinburgh a. xxxvi, 1824 Edinburgh Oil a. lv, 1822 Leith a. lviii, 1823 Paisley a. xlv, 1826 Inverness a. xxxiii, 1836 Tolcross a. xxii; Dundee (1830 a. 1) had a fine of only £2.
 2. 1818 Edinburgh a. xxxvii, 1824 Edinburgh Oil a. lvi, 1822 Leith a. lix, 1823 Paisley a. xlv, 1826 Inverness a. xxxiii, 1830 Dundee a. li.
 3. Such books were specifically required e.g. 1822 Leith a. lvi, 1826 Inverness a. xxxi, 1824 Edinburgh Oil a. liii.
 4. 1818 Edinburgh a. xxxv; 1824 Paisley a. xliii, Tolcross a. xxvii
 5. 1826 Inverness a. xxxiii, 1823 Paisley a. xliii, 1830 Dundee a. xlix, 1817 Glasgow a. xxxvii. Edinburgh & Leith (1840 a. xxxiv) required a written order signed by two directors or chairman.
 6. 1817 Glasgow a. xxxii; 1818 Edinburgh a. xxi; 1822 Leith a. xlix; 1824 Edinburgh Oil a. xlvi; 1843 Glasgow C. & S. a. cv docqueted by three directors.
 7. 1818 Edinburgh a. xxi; 1824 Paisley a. xxxix; 1826 Inverness a. xxviii; Dundee (1830 a. xxxvi) only allowed seven days; Glasgow (1817 a. xxxvii) allowed access throughout the year.
 8. 1817 Glasgow a. xxxii.

from 1817 had to organize the preparation of annual Abstracts of the company's business in addition to the Balance Sheet, and send printed copies to shareholders before their meeting. Inverness directors¹ in 1826 were to have "a concise Report of the Proceedings and Management for the preceding year", plus a balance sheet, recorded in the Minute Book. Dundee in 1830 also required an annual abstract, and this became regular practice with all gas companies.²

Acts of Incorporation in no way reduced the rights and powers of the local town council and magistrates.³ They subjected the company to a number of earlier general Acts,⁴ and also specific local regulations.⁵ Legal suits under the Acts were normally held in the Sheriff courts, but in some cases could be held before local magistrates⁶ provided the case did not personally involve them. Edinburgh Oil gas company was forbidden to make gas from coal.⁷ The Edinburgh⁸ company from 1829 was forbidden to manufacture coal gas at Tanfield, or to amalgamate with any other gas company. The latter rule also applied to Edinburgh and Leith company in 1840, and to the Dundee

1. 1826 Inverness a. lxxxv

2. 1830 Dundee a. xxxvi. At Glasgow (1817 a. xxxv) a general meeting could appoint three or more shareholders as a "Committee of Accounts" to recheck the directors' audit.

3. 1817 Glasgow a. xlvi, 1818 Edinburgh a. lxix, 1840 Edinburgh & Leith a. lxxx, 1823 Paisley a. lviii, 1830 Dundee a. lxi, 1846 Dundee New a. lix, 1887 Musselburgh a. 25.

4. Vide infra Appendix XVIII.2,4.

5. e.g. Glasgow C. & S. (1843 a. 198) was forbidden to amalgamate with Glasgow Gaslight Company, or to share authorities or properties with it.

6. e.g. 1822 Leith, 1823 Paisley, 1824 Edinburgh Oil, 1830 Dundee; Hamilton (1846) could sue before two Justices of the Peace.

7. 1824 Edinburgh Oil a. lxxxii

8. 1829 Edinburgh a. xv, xvi.

New company in 1846 which was also obliged to sell its works to Dundee Town Council or Police Commissioners if so requested.¹ In other matters the Acts provided comprehensive legal protection for company transactions.

Any person maliciously hindering or interrupting the company's workmen was subjected to a fine up to £5 or £10.² Malicious damage to outdoor gas equipment carried a similar penalty, although at Tolcross³ the wilful damage of works, pipes, lamps, posts, or water apparatus, or the wilful wastage of gas or water, carried a penalty up to £20 plus three times the cost of damages. Similarly at Hamilton⁴ in 1846, damage, wastage, or the wilful extinguishing of public lights carried a penalty of £5 plus three times the cost of damage. Consumers were also coerced with heavy potential fines. Damage or alteration of meters⁵ normally carried a penalty of up to £5 and the disconnection of supply. All gas consumers in the early nineteenth century were strictly prohibited from supplying "any other Person whatsoever with any Part of such Gas", under a penalty of £5 to £10

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1. 1840 Edinburgh & Leith a. lxxxiv, 1846 Dundee New a. lvii.
 2. £10 at Edinburgh (1818 a. xx), Edinburgh Oil (1824 a. xxxiii, Leith (1822 a. xxxv), Inverness (1826 a. lxxv); £5 at Glasgow (1817 a. xx), Paisley (1823 a. xxvii), Dundee (1830 a. xxiv). At Tolcross (1836, a. lxxxvii) £5 plus three times the damage or loss sustained.
 3. 1836 Tolcross a. lxxxviii
 4. 1846 Hamilton a. xlv.
 5. e.g. 1829 Edinburgh a. vi, 1822 Leith a. xxxiv, 1846 Dundee New a. xlv, 1836 Tolcross a. lxiv, 1886 Ardrossan a. 85; Paisley (1832 a. xv) imposed £10; Hamilton (1846 a. xlv) only £2 plus the cost of repairs; 1843 Glasgow C. & S. a. 160

and the disconnection of supplies.¹ Tolcross fixed 20s for each day such gas was used.

Those who illegally attached a service-pipe to the gas mains were fined for each day that it was used.² As consumers began to experiment for themselves, the scope of illegality was broadened to include the attachment of "any Wire or other Substance above or across the Orifice of any Burner",³ incorrect burners, or excessive number of burners,⁴ enlarging the burners supplied, wasting gas, or using gas for longer hours than contracted.⁵ The invasion of private property was sanctioned for the benefit of Chartered companies. Officers of Edinburgh Oil⁶ gas company could enter any building lit by gas, at one hour's notice, to check the number of lights in use and the integrity of the meter, and faults on either account carried a penalty of £5 to £10. The Leith company imposed a fine of £5, whilst the Edinburgh and Leith company⁷ of 1840 had to give three hours notice of an inspection but raised the fine to £10. Dundee

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1. 1817 Glasgow a. xix, 1818 Edinburgh a. xix, 1840 Edinburgh a. xxx, 1822 Leith a. xxiv, 1824 Edinburgh Oil a. xxxii, 1840 Edinburgh & Leith a. lxxv, 1823 Paisley a. xxvi, 1830 Dundee a. xxi; 1836 Tolcross a. lxv.
 2. Glasgow (1817 a. xviii) £1 a day; Edinburgh (1818 a. xviii) 10s; Paisley (1823 a. xxiii) 20s; Hamilton (1846 a. xliii) 40s a day plus £5; Leith (1822 a. xxvi) 10s; Edinburgh & Leith (1840 a. lxvii) £2; Dundee (1830 a. xx) £2.
 3. 1832 Paisley a. xvi, 1836 Tolcross a. lxv.
 4. Edinburgh Oil (1824 a. xxxiii) fine to £10; Paisley (1823 a. xxxiv) fine to £5.
 5. Paisley (1832) and Tolcross (1836) fined up to £1 per day.
 6. Edinburgh Oil (1824 a. xxxii)
 7. 1822 Leith a. xxxiv, 1840 Edinburgh & Leith a. lxxv; Paisley in 1823 (a. xxvi) also fined £10.

officers in 1830 had to give six hours notice, but the Dundee New company and Hamilton New company could demand admittance at any "reasonable Times".¹

Failure to pay the gas rent could result in the supply being disconnected.² Because individual gas debts were often small, and expensive to recover in normal Debt Courts, chartered companies were often granted special arrangements.³ Leith Company,⁴ fourteen days after giving a final demand, could apply to local magistrates, or the Sheriff Depute of Edinburgh, for a warrant to enter the debtor's premises and seize goods and effects. Three days later, if the debt remained unpaid, they were sold "by public Roup, in Front of the Court House of Leith", and any surplus after paying the debt and expenses, was repaid to the owner. This procedure was also used at Paisley⁵ on a warrant from the Provost and bailies. At Inverness, Dundee Old company, Tolcross and Kilmarnock, application was made to the sheriff⁶ or depute under whose warrant fines were recovered in a summary way by distress and sale of goods. Inverness debtors lacking property could be imprisoned up to three months.

1. Dundee (1830 a. xxi) £5; Dundee New (1846 a. xli) £5 a day; Hamilton New (1846 a. xl) £10 a day fine.

2. 1818 Edinburgh a. xviii, 1823 Paisley a. xxiii, 1846 Dundee a. xxxvii, 1836 Tolcross a. xcvi, 1898 Stirling a. 73. Tolcross could require contract consumers to pay in advance.

3. Glasgow (1817 a. xviii) was entitled to recover debts by distress and sale of goods.

4. 1822 Leith a. xxx

5. 1823 Paisley a. liii.

6. 1826 Inverness a. lxxxvi; 1830 Dundee Old a. xxvi, 1836 Tolcross a. xcvi, 1855 Kilmarnock a. li. Kilmarnock retained the option of suing for amounts under £12 in the Small Debt Court.

There was however no uniform system of small debt recovery. Edinburgh¹ company in 1840 could only take "Action of Debt before the Judge Ordinary of the Bounds". Paisley² had only to apply to one Justice of the Peace, who could examine company officials and witnesses under oath, and sanction recovery by distress and sale for several persons on a single warrant. Dundee New company in 1846 could recover all sums under £5 that way by applying to two Justices, but Hamilton³ could only recover sums under £8 6s 8d in the Small Debt Court.

Gas consumers received very little protection regarding the price or quality of gas, except in the case of public lighting⁴ or where two rival companies competed in the same town. Edinburgh Oil gas company, and Leith⁵ company which commenced with oil gas, had to ensure that their gas gave a cheaper and better light in public lamps than did liquid oil. Paisley, Inverness and Dundee companies⁶ which supplied coal gas also had to fulfil this standard which became a normal qualification for public lighting. Dundee company⁷ from 1830 had to provide gas "of as good Quality as that furnished by any other Gas Light Company in Scotland, and ... at a Rate or

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1. 1840 Edinburgh a. xxix
 2. 1832 Paisley a. viii to x
 3. 1846 Dundee New a. xxxvii; 1846 Hamilton a. xli
 4. Contracts with the local magistrates, town council or Road Trustees were specifically permitted e.g. 1818 Edinburgh a. xviii, 1823 Paisley a. xxiii, 1847 Dundee New a. xxxvi.
 5. 1824 Edinburgh Oil a. xxxix, 1822 Leith a. xxxii
 6. 1823 Paisley a. xxiv, 1826 Inverness a. lix, 1830 Dundee a. xxii.
 7. 1830 Dundee a. xxiii, xxiv; vide infra pp. 954, 969
The same price regulation was imposed on Dundee New company in 1867 a. xviii

Charges as low as shall be the average Price ... in the several towns of Edinburgh, Glasgow, Paisley, Perth, Arbroath, Montrose and Aberdeen, during the same Time." From 1867 it had to supply a candlepower also above the average of these towns.¹ Dundee magistrates were expected to annually nominate one person, and the Police Commissioners² two people, from 1830 to audit the company's accounts and review the charges, but in practice this was never done.

Competing companies were subjected to extra controls. At Hamilton the New company could not give a dividend above five per cent unless gas was provided at less than 5s per 1,000 cu ft. in Hamilton and 6s 8d in Motherwell and Bothwell. The gasworks could also be sold by mutual agreement to the magistrates or town council without requiring a separate Act.³ Dundee New⁴ company in 1846 could not charge above ten per cent of the original cost when hiring out meters and fittings. That company⁵ was forbidden to make profits above ten per cent on capital, and any ten inhabitants could petition the Sheriff to have their books audited, with power to enforce a lower price of gas if profits were excessive.

Quality controls were not widely introduced until the late 1860s. They were first tried in Scotland with the Glasgow companies in 1857. The Old company⁶ had to provide gas at a price below

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1. 1867 Dundee Old a. xxv, xxix. 2. 1830 Dundee Old a. lxiv.
 3. 1846 Hamilton a. lxxiv, lxxiii At Fort William (1896 a. 25) the Police Commissioners could also purchase the gasworks within five years of the Order. Hamilton municipal action, vide infra pp.1015, 1037
 4. 1846 Dundee New a. xl. 5. 1846 Dundee New a. xviii.
 6. Candlepower test by Argand burner, as later at Dundee. 1857 Glasgow a. xiv, xviii. Standard 'Candlepower', vide supra p.711

5s 6d per 1,000 cu ft, and a quality above twelve candlepower. The gas could be tested at the works by the Lord Provost, magistrates and Council, and a fine of £20 imposed if it was substandard. Glasgow City and Suburban¹ had to provide gas at 5s 6d and a minimum of ten candlepower. These illumination standards were less than half what was actually being supplied and were a mere gesture of sympathy for the consumers. Dundee Old and New companies were the next to be affected,² in 1867. At the gasworks they had to instal an Argand burner with fifteen holes and a seven inch chimney, with a special meter to supply five cu ft gas per hour. Gas burned in that apparatus had to equal the intensity of light from eighteen sperm candles, of six in one pound, burning at 120 grains per hour. Dundee Council or Police Commissioners could appoint a person to test the gas on that apparatus and inadequate candlepower carried a fine up to £20. Specific candlepower was stipulated for all companies in the late nineteenth century, and they all had to instal a test apparatus at the gasworks, normally with a Union Jet Burner³ consuming five cu ft per hour at five-tenths inch pressure. Minimum gas pressure was also stipulated at the junction of service pipes with the mains. This⁴ had to be six-tenths inches from midnight to sun-

1. 1857 Glasgow C. & S. a. xl

2. Vide supra pp. 970, 992
Dundee Old a. xxv to xxvii; Dundee New a. xiv, xv

3. Later the Board of Trade replaced this by a Sugg's No. 1 Argand, with 6" x 1½" chimney; e.g. Bothwell and Uddingston (1902 a. 29); Busby (1911 a. 23); Bridge of Earn (1902 a. 25)

4. 1877 Coatbridge a. 52; 1886 Ardrossan a.45; 1887 Musselburgh a. 29; 1896 Fort William a. 20; 1898 Stirling a. 68; 1902 Bothwell a. 28; 1902 Bridge of Earn a. 24.

Busby (1911 a. 24) had to provide eight-tenths inch at all times.

set and eight-tenths inch from sunset to midnight. A variety of gas price controls were also introduced, at first by setting a maximum price for all gas supplied by meter.

TABLE 5.26 Minimum Candlepower of Gas supplied by
Chartered Companies¹

Date	Company	Candle- power	Date	Company	Candle- power
1877	Coatbridge	20	1902	Bothwell/Uddingston	15
1886	Ardrossan	20	1902	Bridge of Earn	14
1887	Musselburgh	22	1906	Stirling	20
1896	Fort William	15	1909	Coatbridge	15
1898	Stirling	25	1911	Busby	14

SOURCES: Private Acts and Orders of Parliament.
Vide Appendix XVIII.3

TABLE 5.27 Maximum Gas Prices Permitted to
Chartered Companies

Date	Company	Price s. d.	Date	Company	Price s. d.
1855	Kilmarnock	6 0	1896	Fort William	7 0
1877	Coatbridge	5 0	1902	Bridge of Earn	6 3
1886	Ardrossan	5 3	1909	Coatbridge	2 6

SOURCES: Private Acts and Orders of Parliament.
Vide infra Appendix XVIII.3

A more stimulating arrangement was the development of a sliding scale of charges and dividends revolving around a set price. At Coatbridge² in 1898 the set price was 2s 6d per 1,000 cu ft, and when-

1. These low candlepower figures were well below the quality previously supplied and their stipulation was a hollow gesture.

2. 1898 Coatbridge a. 26.

ever gas was a fraction or one whole penny more expensive, dividend was reduced by 0.25 per cent below the standard ten per cent, or a reduction of 5s below ten per cent dividend on £100, and 3s 6d below seven per cent dividend on £100. If gas was sold below the set price, dividends could be raised proportionally above ten per cent. The sliding scale was also applied¹ to Stirling, with a set price of 3s 4d, Fort William with 7s, Musselburgh with 3s 9d, Busby² with 5s gas, and Bothwell and Uddingston³ with 3s 1d gas. Chartered companies retained the right to give concessions to large consumers. Ardrossan⁴, for example, could supply cheap gas in bulk "for trading or manufacturing purposes", and Stirling⁵ could grant ten per cent discounts for large consumers, and as an incentive for prompt payment of gas rents.

Chartered companies were empowered to hire out meters and other fittings, in the secure knowledge that these could⁶ "not be subject to Arrestment, Poinding, or other legal Diligence, or to be hypothecated or attached for Rent due to Landlords" by gas consumers. In the late nineteenth century, consumers had to keep the meter maintained and

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1. 1898 Stirling a. 64; 1896 Fort William Schedule B. a. ii; 1887 Musselburgh a. 28; 1911 Busby (a.26)
In 1904 the Stirling (a.15) price was reduced to 3s 2d. In 1909 the Coatbridge price was reduced to 2s 6d and a sliding scale introduced.
 2. At Busby, if gas price rose 1d., or a fraction of 1d., above the standard, then five per cent dividend on £100 was reduced by 2s 6d
 3. In similar circumstances to Busby, the Bothwell ten per cent dividend on £100 fell 5s, and seven per cent dividend fell by 3s 6d.
 4. 1886 Ardrossan a. 72. 5. 1898 Stirling a. 65
 6. An important factor when large sums were invested in service pipes and interior fittings.
1832 Paisley a. xiii, 1840 Edinburgh a. xxviii, 1836 Tolcross a. xiii, 1846 Hamilton New a. xxxix.

accurate at their own expense, and the company was empowered to remove meters for checking the accuracy. The expense of the test fell upon the consumer if faults were found.¹ Security was sometimes required by the company to insure the payment of gas and meter rents, but Parliament demanded the payment of interest on such money.²

The large number of tenement flats in Scotland raised questions over access through common stairways and passages. Thus although the Glasgow³ company in 1817 could not damage buildings without the owner's consent, it had the right without consent to place external pipes on buildings, for public lighting, and external pipes to supply tenements on upper floors. Tolcross required the consent of proprietors to supply upper floors, but Edinburgh, Edinburgh and Leith, Glasgow City and Suburban, and Hamilton companies⁴ in the

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1. e.g. 1886 Ardrossan a. 83, 85. Penalty to £5 for damaging meters. Twenty-four hours written notice was required before connecting or disconnecting meters, on penalty of 40s (1886 Ardrossan a. 82). Consumers using gas engines could be forced to install effective anti-fluctuators for steady mains pressure, e.g. 1904 Stirling a. 27; 1911 Busby a. 35.
 2. Usually paid twice a year, at £5 per cent per year on every 10s e.g. 1886 Ardrossan a. 75, 1877 Coatbridge a. 56, 1896 Fort William a. 23, 1887 Musselburgh a. 32; Bothwell and Uddingston 1902 a. 31. 1902 Bridge of Earn a. 27.
Stirling (1898 a. 63) paid only £3 per cent interest on every sum of £2 deposited, and Busby (1911 a. 31) 4 per cent, so the procedure was again not standardized.
Parliament very rarely regulated the rent of meters, but at Busby (1911 a.17) the gas through prepayment meters had to be the same price as normal meters, plus up to 10d per 1,000 cu ft to cover the hire charge of meter and fittings, or 1s if these included a cooker.
 3. 1817 Glasgow a. xvii
 4. 1840 Edinburgh a. xii, 1840 Edinburgh & Leith a. lxx, 1843 Glasgow C. & S. a. 155, 1846 Hamilton a. xxxvii

1840s were empowered to lay pipes up common stairs or access without the consent of other occupiers or owners. Later companies like Ardrossan and Coatbridge¹ required the consent of owners and occupiers before laying pipes through or against buildings.

In two final aspects, Parliament intervened to protect local inhabitants from abuse by chartered companies. Pipe-laying and trenching, and operations likely to pollute water supplies, were closely regulated. The authority to open public "side Pavements, Streets, Squares, Ways, Lanes, Passages and Places"² was vital for laying and repairing pipes, water traps and valves, but advance notice had to be given to the Police Superintendent, Town Council or convener of Road Trustees. This varied from twenty-four hours at Paisley and Inverness, to thirty-six at Tolcross and forty-eight at Glasgow, Edinburgh, Leith, Hamilton and Dundee.³ Those controlling the road could appoint an inspector to check the excavations, and even plan where the pipes had to be placed.⁴ Failure to give

1. 1886 Ardrossan a. 43; 1877 Coatbridge a. 49

2. e.g. 1818 Edinburgh preface.

3. 1823 Paisley a. xvi, 1826 Inverness a. liv, 1836 Tolcross a. xci, 1818 Edinburgh a. xiv, 1824 Edinburgh Oil a. xx, 1822 Leith a. xvii, 1817 Glasgow a. xii, 1846 Dundee New a. xxviii, 1846 Hamilton a. xxvi, 1826 Inverness a. xlvii

Glasgow had to give the same notice to "Proprietors or Possessors of Shops or lower Floors or vacant Ground fronting the Pavements to be lifted", on penalty of £5. Unusually, Glasgow could allow consumers to lay service pipes under pavements, but the main pipes had to be under the causeway of the road.

Edinburgh (1818 a. xv) had excessive powers in 1818 to open private roads for the gas mains in the town.

4. 1818 Edinburgh a. xvi, 1840 Leith a. lii, 1846 Dundee New a. xxviii, 1846 Hamilton a. xxviii

notice often carried penalties, 5s per square yard at Tolcross, 40s a day at Hamilton, and £5 a day at Dundee. All damage caused by trenching operations had to be paid for, or referred to the Sheriff's arbitration, and the company had to remove surplus earth or rubbish, and relay the streets and pavements in a workmanlike manner.¹ At Hamilton the road had to be kept in repair for the following twelve months.² Pipes could be laid across private property only with the written consent of the owner.³

Consumers' rights to a supply of gas were largely neglected by Parliament. However, as a sop to the 'Consumers' movement', in 1840 both Edinburgh and Edinburgh and Leith companies undertook to supply gas to any person requiring it within one hundred yards of the main pipes, at normal prices, provided they paid the expenses of a service pipe and gave security for one year's supply of gas.⁴

Serious pollution of the urban environment could occur in two ways: by the disposal of refuse from the gasworks, or by a leakage of gas into piped or underground water supplies, and the penalties imposed to prevent both were severe. No substance which "soiled, fouled or corrupted" the water, or was "noisome or offensive", was allowed "into any River, Brook or running Stream, Reservoir, Canal, Aqueduct, Feeder, Pond or Springhead or Well or into any Drain,

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1. 1830 Dundee a. xi, 1823 Paisley a. xvii, 1824 Edinburgh Oil a. xxii, 1836 Tolcross a. xcii, 1846 Dundee New a. xxvi, 1846 Hamilton a. xxix
 2. Regulations for trenches were strict. Vide infra Appendix VII.4.v
 3. 1823 Paisley a. xvi, 1824 Edinburgh Oil a. xvii, 1840 Leith a. lv, 1826 Inverness a. xlvi, 1846 Dundee New a. xliii, 1846 Hamilton New a. xlii
 4. 1840 Edinburgh a. xxvi; 1840 Edinburgh & Leith a. lxxxvi

Sewer or Ditch communicating therewith" upon a penalty of £200 recovered through the Court of Session, for every offence. The company also had to cease such pollution within twenty-four hours of a written complaint, or pay a penalty of £2 per day.¹ As an incentive for complainers to act in the public interest, the money was paid to those whose water had been spoiled.

Glasgow company, to which this rule was not applied until 1822, from 1817 was specifically² forbidden to erect any gasometer within one hundred yards of any river or ten yards of any stream, 400 yards of the River Clyde, or fifty yards of the Molendinar or Blind Burns. No waste liquids, or even water out of gasholder tanks, could be disposed in those waters, or any substance which harmed "the Fisheries, the Vegetation on the Banks of the River, or the Life or Health of Animals", or which smelled offensive to nearby residents. In Edinburgh, from 1818 until 1840 when the practice was specifically forbidden, the mouth of Restalrig stream was used to dispose gasworks refuse,³ but elsewhere Chartered companies did not

1. 1822 Glasgow a. vi, 1823 Paisley a. xxii, 1824 Edinburgh Oil a. xxviii, 1826 Inverness a. lxxix, 1830 Dundee a. xvii, 1846 Dundee New a. xlvi, 1836 Tolcross a. lxx, 1829 Edinburgh a. xii, 1840 Edinburgh & Leith a. xviii. This also applied to Greenock (1840 a. lxxiii) municipal gasworks.

Glasgow C. & S. (1843 a. 165) had a daily penalty of £20.

2. 1817 Glasgow a. xvi. Contemporaries found other sources of pollution, especially town sewage, a greater problem.

Vide R. Reid (Senex) Glasgow Past and Present (1884, Glasgow) Vol. I, p. 131

Dr. J. Glaister, "The Pollution of Scottish Rivers", Proceedings of the Philosophical Society of Glasgow 1896-7 Vol. XXVIII, p. 50

J. Skelton, The Handbook of Public Health for Scotland (1890, Edinburgh) p. 34.

Gasworks smoke pollution in Canongate, Edinburgh vide J.G.L. 29/5/1883.

3. 1840 Edinburgh & Leith a. lxi. Edinburgh Old company had an initial penalty of only £20 for pollution, but thereafter it was £10 per day.

cause pollution. Several gas companies were permitted, subject to the control of magistrates, to make "Sewers or Cuts"¹ beneath the streets to carry waste liquids before disposal, but they were forbidden to run into the town sewers, or to pollute private wells.

Any gas leaks from pipes had to be repaired by the company within twenty-four hours of a written complaint,² upon a penalty of £5 a day. If gas contaminated "the Water of any Body Politic or Corporate, or Person, or any Water in any Well or Pond",³ the plaintiff could usually charge the company £20, and if pollution did not cease within twenty-four hours, a further £10 per day. In Edinburgh from 1829, half of the fine was to be paid to the informer, and half to the owner of water rights. If the gas company refused to accept responsibility for gas pollution, the plaintiff was empowered to

1. 1817 Glasgow a. xv, 1824 Edinburgh Oil a. xvii, 1822 Leith a. xxiii, 1840 Edinburgh & Leith a. lx, 1823 Paisley a. xxi, 1830 Dundee a. xvi.

2. Inverness and Edinburgh Oil companies were allowed forty-eight hours grace. 1822 Glasgow a. viii, 1822 Leith a. xxi, 1823 Paisley a. xix, 1840 Edinburgh & Leith a. lix, 1830 Dundee a. xv, 1826 Inverness a. lxxx, 1846 Dundee New a. xlix, 1829 Edinburgh xi, 1824 Edinburgh Oil a. xxvi, 1843 Glasgow C. & S. a. 168.

The payment of 'way-leave' for opening the streets was very unusual, but Dundee New company (1846 a. lvi) paid £50 a year to the Common Good of the burgh.

3. 1825 Glasgow a. iv, 1840 Edinburgh & Leith a. lxii, 1824 Edinburgh Oil a. lxix, 1826 Inverness a. lxxxii, 1829 Edinburgh a. ix, 1830 Dundee a. xviii, 1836 Tolcross a. lxviii, 1846 Dundee New a. 1, 1832 Paisley a. xvii, 1843 Glasgow C. & S. a. 170.

Hamilton (1846, a. xlvii) reduced the penalty to £5 a day.

Most gas-pollution rules appeared in the mid 1820s, being absent in the 1822 Glasgow Act but present in 1825. They included special distances from waterpipes, 90° crossings, and no jointing of pipes outside the trenches.

excavate gas pipes, and if leakage was proved the gas company had to pay all expenses¹ in addition to the fine.

Correct pipe-laying was considered very important by Parliament. Gas pipes had to be laid "the greatest practicable Distance" from water pipes or the gas pipes of another Company, and wherever the width of the carriageway was adequate a minimum separation² was legislated. Where gas pipes unavoidably crossed water pipes, they had to be the greatest practicable distance above or below the latter, and cross at right angles to keep the joints away from the water pipe. The crossing pipe had to be of a stipulated length, and all joints a minimum distance from the waterpipe.

Pipes could not be joined before placing them in the trenches, to avoid leakage from poor joints,³ which had to be proved gas-tight⁴ before refilling the trench, on penalty of £10. These comprehensive regulations severely restricted Chartered companies from causing any offensive pollution.

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1. 1825 Glasgow a. v, 1824 Edinburgh Oil a. lxx, 1840 Edinburgh & Leith a. lxiii, 1826 Inverness a. lxxxiii, 1830 Dundee a. xix, 1846 Dundee New a. lii, 1836 Tolcross a. lxix, 1846 Hamilton a. xlix, 1829 Edinburgh a. x, 1832 Paisley a. xviii.
 2. Vide infra Appendix VII
In Edinburgh and Leith (Edinburgh 1840 a. xli, Edinburgh & Leith 1840 a. lxiv) the water authorities had to be given advance notice, so they could check that the Act was obeyed, and no damage caused.
 3. No two pipes could be joined beforehand at Glasgow (1825), Edinburgh (1829, 1840), Hamilton (1846), Tolcross (1836), Inverness (1826), Edinburgh Oil company (1824), though Paisley (1823 a. lx) could join up to four pipes outside the trench; Glasgow C. & S. (1843 a. 177).
 4. 1824 Edinburgh Oil a. lxviii, 1826 Inverness a. lxxxix, 1825 Glasgow a. iii, 1830 Dundee a. xiv, 1840 Edinburgh a. xx.
Dundee in 1830 had a penalty of £50, and Hamilton (1846 a. liv) only £5.

Parliamentary control over Chartered companies provided the guidelines for regulations adopted by companies without limited liability, and also produced a fund of experience which was later applied to regulating the financial management of municipal authorities which sought to extend their ownership over the supply of gas.

(3) Municipal Control

Most municipal authorities actively encouraged¹ the first gas companies within their communities, as a source of cheap lighting for streets, homes and industry. Few invested large sums of public money in such enterprises, principally because gas works were considered high risk ventures, and were capital intensive. The more adventurous town councils, like Greenock (1830) and Rothesay² (1843), were concerned less with supplying gas at the lowest feasible prices, and more with creating profits which could be used for the "common good" of the Burgh, in effect transferring part of the rates burden from householders on to gas consumers.³

Early gas companies allowed "socialism from above"⁴ by enabling a wide variety of local inhabitants as shareholders to uphold the social responsibility of the company in regard to consumers. Municipal intervention was delayed until avarice brought the system into disrepute. Straight-forward competition⁵ was the traditional cure for a company which failed to respond to market demands, and in cases

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1. e.g. the Glasgow company has been viewed as a joint venture between the Town Council and citizens, and Airdrie gas company of 1830 was "mainly on the initiative of the Town Council".
J. Cunnison, Ed., Third Statistical Account - Glasgow (1958, Glasgow) p. 565.
J. Knox, Airdrie - A Historical Sketch (1921, Airdrie) p. 65
 2. Vide supra Chapter I p.85
 3. cf. Greenock municipal enterprise has been seen as a reflection of the greater social responsiveness of Councils around the time of the 1832 Reform Act with its preceding agitation.
T. Johnston, A History of the Working Class in Scotland (1946, Glasgow) Vide infra pp. 1016, 1020, 1040
 4. R. Buckmaster-Fuller, Utopia or Oblivion (1972) p. 280.
 5. Disadvantages vide infra p. 1120

like Hamilton¹ it successfully cauterised the complaints. Elsewhere, as at Aberdeen,² it produced insincere appeals to the municipal authorities for protection in return for concessions. Only at Paisley did the Old company press their case successfully, and a New company³ was defeated in return for partial municipal control. This proved so ineffectual that the Paisley experiment deterred Scottish municipal authorities from a similar attempt for two decades.

The heavy capital investment required for gas manufacture considerably hampered the working of market forces so that competition was rarely present to serve the public interest; and the limited successes achieved by the 'Consumers Movement'⁴ were highlighted by Flintoff's campaigns in the early 1860s which intensified the concern of consumers but failed to implement many viable Consumers' gas companies. The public turned increasingly in favour of municipal control of essential services like gas lighting, which in most towns remained a monopoly industry. Their aim, as in the Consumers' companies, was to sell gas as cheaply as possible.⁵ Unlike Greenock and Paisley, these new municipal enterprises were forbidden by Parliament to make profits to be expended on other municipal projects. The gas

1. Vide infra p.960

2. In 1836 a Consumers company in Aberdeen was defeated while bogus attempts were made to sell the old gasworks to the Police (Aberdeen Journal 11/5/1836), and a similar venture in 1843 only succeeded after great controversy since Provost Blaikie and two other Councillors, who were shareholders in the Old company, recommenced agitation for municipal control over the Old gasworks, supposedly to obviate the cost of duplicating capital and labour in the city. (Aberdeen Journal 6/12/1843).

Vide infra 'Consumer Relations' p.1124

3. Vide infra p.1020

4. Vide infra p.1177

5. Nevertheless, high 'depreciation' allowances were used in much the same way as reinvested 'profits' were in gas companies, for extension of capital equipment. Vide infra p. 1075

prices were to be so low as to allow revenue to only equal expenditure¹ on the gasworks.

By the 1860s most efficient gas companies, provided they were not exceptionally badly located in relation to raw materials, gave annual dividends of about seven to ten per cent, or even fifteen per cent. The element of risk had largely disappeared, and municipal authorities could be reasonably confident of success. Gasworks were either purchased outright, by taking a loan secured against the prospective gas revenue, or more normally by annuities which could later be redeemed. Many companies already made use of loans, by spending large sums on the works in excess of the share capital. The interest on loans, at between three and five per cent per year, was cheaper than paying dividend from an equal amount of capital stock. Provided no difficulty was experienced in obtaining loans, and that interest never exceeded potential dividend, this was the great advantage which municipal gasworks possessed. Loans could similarly be used periodically to redeem annuities.

In the early Scottish gas companies, a mixture of belief in "socialism from above" by individuals purchasing shares in the apparently high risk enterprise, and public benevolence by these figures, produced a close alliance between municipal councils² and gas

1. "Expenditure" is defined elsewhere. Vide infra p. 1095
Regulations on contingency and other funds, and financial statistics are given in Appendix VIII

2. Several authors have noted the prominence of civic dignitaries in early nineteenth century commercial ventures, like railways, which could benefit local residents. Directors of the 1838 Southern Bank of Scotland, which aimed to retain banking profits in the Dumfries area instead of allowing their 'export', included the Provost of Dumfries, the son of a former Provost, and a former Bailie.

J.M. Reid, The History of the Clydesdale Bank 1838-1938 (1938) p. 93. Vide infra pp. 108, 164, 165, 168, 676, 823, 931, 935, 953, 960, 962, 1128, 1130, 1133, 1164, 1243. Activities of T.Blaikie, Provost of Aberdeen, vide infra pp.767, 1005; see also p.117

companies. Many Councillors were also private shareholders. In October 1816, leading Glasgow citizens, including a former Lord Provost, proposed to form a gas company,¹ but first communicated with the magistrates, Council and Police Commissioners to suggest that one of those bodies constructed and operated the gasworks.² The Council declined, but approved "the measure as a public improvement". In November the company again urged the Council to purchase shares,³ in view of the potential improvement in street lighting. Two Councillors, K. Finlay and H. Monteith (1764-1848)⁴ urged the Council to purchase £500 stock, but in order to justify this purchase, which was made in December,⁵ the Council appointed a committee supposedly to make a critical examination of the proposal. Both Finlay and Monteith sat on the four-member committee,⁶ yet they were also members of the company's Committee of Management. Another

1. The period 1816-17 was one of trade recovery in Glasgow after the American War of 1812-15.

Promotion of Glasgow gas company is examined elsewhere, vide supra p.155; see also p.208

G. Neilson, "Glasgow Burghal Records 1718-1833", Scottish Historical Review 1917 Vol. 14, p. 347

2. Glasgow City Archives - Extracts from the Records of the Burgh of Glasgow Vol X 1809-22, p. 347, 9/10/1816

3. Extracts from Glasgow Burgh Records, op. cit., Vol. X 19/11/1816 pp. 353-4

4. Henry Monteith of Carstairs, wealthy cotton manufacturer and owner of Dalmarnock Turkey-red Dye works, was Provost of Glasgow in 1815-16 and 1819-20.

G. Stewart, Curiosities of Glasgow Citizenship (1881, Glasgow) p. 114.

New Statistical Account - Glasgow (1958, Glasgow), p. 259

5. Extracts from Glasgow Burgh Records, op. cit., Vol. X, 27/12/1816, p. 354

6. The other Committee members were D. Mackenzie and Andrew Templeton, a banker who also supported the company.

Glasgow City Archives "Glasgow Burgh Minute" (M.S.S.) 27/12/1816.

A. Templeton vide infra 'Labour' p. 672

manager, James Hamilton,¹ was a Commissioner of Police, and as the first shopkeeper to use gas lighting from the company, gave considerable publicity to the venture. Ferguson, a former magistrate, in conjunction with J. Thomson a city banker, became the first "Managers" or comptrollers of the gasworks.

Investment in the Glasgow gas company crystallized around the shareholding of the Council, and that of £500 by James Dennistoun,² founder of the Glasgow Bank.³ The Town Council collaborated in forming the company's Bill, especially regulations on the opening of streets,⁴ before it was presented to Parliament. Their involvement reduced the intensity of opposition to the company, for example by the Master Court of Masons⁵ who objected to the encroachment on property and privileges. Moreover they continued to support the company

1. Gas World 11/6/1887, p. 751

2. P. MacKie, Reminiscences of Glasgow (1890, Glasgow) Vol. II, p. 163

3. Glasgow gas company was also supported by William McGavin, merchant, author, preacher, editor of The Protestant, and from 1823 manager of the Glasgow branch of the British Linen Bank. Another banker, John Thomson of Gogarburn, acted as collector of instalments on shares and enjoined his considerable reputation to the enterprise. Thomson was the Bank of Scotland agent in Aberdeen until 1817, and then Royal Bank of Scotland agent in Glasgow where he supervised "probably the most important single branch in the Scottish banking system of the time." In 1828 he took management of the Royal Bank as Cashier, but resigned in 1845, and in 1850-8 was the Edinburgh manager of the Edinburgh and Glasgow Bank.

J.M. Reid, The History of the Clydesdale Bank 1838-1938 (1938) p. 102;

N. Munro, The History of the Royal Bank of Scotland 1727-1927 (1928, Edinburgh) p. 172; Glasgow Chronicle 12/4/1817

C.A. Malcolm, The History of the British Linen Bank (1950, Edinburgh) p. 186

Vide supra Chapter II p.156

4. Extracts from Glasgow Burgh Records, op. cit., 28/2/1817, p. 367

5. Glasgow Chronicle, 17/5/1817

despite the mistakes, inefficiency and high gas prices of the first decade. A Consumers' company¹ projected in 1819 castigated the Police Board for using gas lights on the streets when whale-oil lamps were actually cheaper.² The Council refused³ to invest in this New company, yet purchased twenty shares more in the Old company in 1822, and a further twenty Quarter shares in 1825.⁴ Shortly afterwards they sold about half of their original £25 shares at an upset price of £50 10s., but in 1830 still held twenty shares⁵ worth £1,100. Thereafter the Town Council was notably lax in influencing or controlling the company's operations, a factor which enhanced the agitation of the Consumers' Movement.

Edinburgh gas company obtained municipal support of a different type. When first projected, in May 1816, the twelve promoters met in the Council Chamber under the chairmanship of the chief magistrate, Kincaird Mackenzie, indicating close interest by the Council.⁶ A

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1. Vide infra 'Consumer Relations' p.1115
 2. Especially since the Police Board included shareholders in the gas company. Glasgow Chronicle 4/5/1819
 3. Extracts from Glasgow Burgh Records, op. cit., Vol. X 7/9/1819 p. 511
 4. The Quarter shares were of £6 5s nominal value. Extracts from Glasgow Burgh Records, op. cit., Vol. XI 2/1/1823 p. 9; 20/6/1825 p. 164
 5. In perspective, the Burgh owned £43,082 moveable property in 1829, of which £9,450 was invested in the Water company, Forth and Clyde Navigation, Gas company, and London Street Joint Company. In 1833, twenty-five gas shares were still held giving an annual revenue of £62 10s.
J.D. Marwick, "Glasgow 1781 and 1833" The Regality Club (1912, Glasgow) 4th series, pp. 135, 136
Extracts from Glasgow Burgh Records, op. cit., Vol. XI 23/3/1830, pp. 55, 372.
 6. Gas World, 10/7/1886, p. 42 "The History of Gas Lighting in Edinburgh"

committee was sent to London, where the earliest gas companies in Britain were operating, and they employed a prominent London engineer, John Grafton, to plan a gasworks for Edinburgh. In October 1816, before publishing a Prospectus, they petitioned the Council for permission to open the streets to lay gas pipes, and claimed that because the capital requirements were so great, they would not operate unless given "that exclusive privilege for a period of at least Twenty-one years."¹ In January 1817 the Council granted a fourteen years monopoly, conditional upon a rapid supply of gas for public lighting, and the company commenced in 1817 with a capital stock² of only £20,000. Although the Prospectus allowed application to be made to Parliament for an Act, the promoters at first hoped to operate entirely under the protection of the Town Council. In May 1817 a General Meeting voted to promote an Act in order to obtain limited liability,³ but the capital was paid up and gas supplied well before the Act was granted. Parliament forced them to increase the capital stock to £100,000, as extra security to the public against damages, and also prohibited the monopoly granted by the Town Council.

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1. Edinburgh City Archives Council Record 1816-17, p. 160 29/1/1817. Public lights had to have gas by October 1817, but this was not achieved.
 2. Scots Magazine, 1817, Vol. 79, p. 314
Prospectus issued 1/3/1817. Vide S.R.O. - Unextracted Process S. Reid/Governors of Gas Light Company 1822 (McNeil R.16/2).
Whole capital was subscribed by 17/3/1817; subscription closed 14/4/1817.
 3. Unrestricted Process S. Reid/Gas Light Co. (1822) op. cit.
"Case Presented by Gas Light Company" p. 3. Meeting on 7/5/1817.
Calls made on shares - 9/6/1817 twenty per cent; 15/9/1817 two calls of fifteen per cent; 12/3/1818 twenty per cent; i.e. seventy per cent original capital paid up before Act granted on 23/5/1818.

The proprietors¹ then included both public figures like Lord Gray, and prominent municipal dignitaries like A. Henderson, Lord Dean of Guild, and William Arbuthnot the former Lord Provost.

As in Glasgow, the Police Commissioners patronised the company for public lighting despite very high charges for gas and public complaints.² In practice the Council continued to enforce the Edinburgh company's monopoly. It petitioned Parliament for exclusion from the General Gas Bill of 1824, and in the same year refused permission to the British Gas Lighting Company to lay pipes in Edinburgh.³ The Council permitted the short-lived Oil Gas Company of 1824 to lay mains because of the very influential local promoters of this company, and even allowed the Leith oil gas company⁴ to lay pipes to the city because this was an entirely different type of gas which did not seriously compete with coal gas.⁵ In 1825 the Leith company changed to coal gas, and Edinburgh Council promptly forbade any extension of their mains in the city, thus protecting the old Edinburgh company.⁶ Both Edinburgh and Leith companies had shareholders on Edinburgh Council, and despite several debates the Leith supporters could not get the ban lifted until 1829.

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1. Promoters of the Edinburgh company are reviewed elsewhere: vide supra Chapter II p.153
 2. The Scotsman, 6/10/1821 - strong criticism of Police Commissioners
 3. Edinburgh City Archives - Council Record Vol. 90, 13/11/1824, p. 292; Vol. 189 19/5/1824, p. 282
 4. Edinburgh Council Record, op. cit., Vol. 186, 28/1/1824
 5. Oil gas was very expensive, and largely used only by consumers who demanded very pure gas, without combustion products, and would normally use no coal gas at all.
 6. Edinburgh Council Record, op. cit., Vol. 196, 16/11/1825; Vol. 193 12/10/1825.
Vide infra 'Consumer Relations' pp.1118, 1128; also pp. 973, 1054

At Inverness the town council was also active in promoting the first company in 1824, and J. Robertson, the Provost chaired a public meeting in the Town Hall where the company was first agreed upon.¹ The meeting even hoped to have "the transference of the powers" vested in the magistrates, for supplying water and lighting the streets, vested wholly in the company by mutual agreement. Robertson himself led the Interim Committee of Management, and the Town Council soon purchased fifty shares in the stock.^{*} Despite the public standing of company shareholders and Council investment, within a few years the company was accused of speculation against the public interest, unjustifiably high premiums on shares,³ and excessive secrecy.⁴ Elsewhere the pattern was repeated. In 1822 Provost Stewart acted as chairman of a public meeting in the Guild Hall which sponsored the first Perth gas company.⁵ The promoters of the first gas company in Paisley in 1821 invited the Council to purchase shares. The Council regretfully declined because of insufficient funds,⁶ and the project was delayed until 1823.

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1. Prospectus in Inverness Journal and Northern Advertiser, 17/12/1824; Inverness Town Clerk's Office Town Council Records 1824-34 7/1/1825
 2. Inverness Town Council Records, op. cit., 29/12/1824, 14/2/1825
 3. "A Burgess's" letter to Inverness Journal 5/1/1827 p. 3
 4. Inverness Journal 19/1/1827 p. 3. Mismanagement and capital manipulation by speculators had already occurred over one public project, the New Bridge, vide Inverness Journal 3/2/1826
 5. The company did not seek an Act, but while a Bill was being considered the magistrates authorized the Provost officially to persuade local Borough and County Members of the importance of the company.
Perthshire Courier 24/1/1823 p. 3; 13/12/1822; 20/12/1822.
 6. R. Brown, The History of Paisley from the Roman Period down to 1884 (1886, Paisley) Vol. II p. 288
- * Inverness Town Council Records op.cit. 29/12/1824, 14/2/1825

In Stirling, the magistrates¹ were the chief promoters of the gas company in 1824, especially because of the benefits of public lighting. A Town Council committee² obtained all necessary information on the subject, which was then presented to a public meeting and the public invited to form a gas company because the magistrates believed that private local ownership was the best basis for such an undertaking. Provost Gillies and Provost Thomson led the committee for obtaining subscriptions, and subscriptions were received at the Town Clerk's office where the draft company Articles were displayed.³

Potential shareholders were left in no doubt about the support they would receive from the Town Council, which provided them with a site for the works at very low cost.⁴ Though the land had to be sold by public auction, other potential buyers were excluded by a clause which permitted only the construction of gasworks upon it. A nineteen-year contract for public lighting was signed by the Council even before the first gas was produced.⁵

In Hawick⁶ the second public meeting to form the gas company was convened at the Town Hall by magistrates in March 1830 under the chair-

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1. Stirling Journal 30/12/1824, p. 4
 2. Stirling Journal 13/1/25; 24/3/1825; Stirling Town Clerk's office Records of the Minutes of Committees appointed by the Town Council
 3. Stirling Journal 16/6/1825
W. Drysdale, Old Faces, Old Places and Old Stories of Stirling II Series (1899, Stirling) p. 236
W.B. Cook, Local Notes and Queries Reprinted from Stirling Observer Vol. II (1886, Stirling) p. 78
 4. Minutes of Council Meetings, op. cit., 25/6/1825
 5. Ibid., 8/8/1825
 6. R.E. Scott, "The Story of the Hawick Gas Company", Transactions of the Hawick Archaeological Society, 1969

manship of the Chief Magistrate. Engineering data had already been acquired, and when the meeting agreed to form a company, the subscription committee included the Town Clerk and Magistrates. Similarly the Selkirk¹ gas company was formed after Mr Clarkson, the chief magistrate, met Mr Blaikie, the manager at Shotts Foundry, while on a visit to Melrose where Blaikie had designed the gasworks. Blaikie was persuaded to visit Selkirk, and a public meeting in the Town Hall in March 1835 resolved to form a gas company. Provost Nelson² chaired the public meeting in Annan which initiated a gas company in 1836, and at Stranraer the Town Council provided land for the gasworks.³ The travels and consequently wider experience of magistrates^{*} was an important catalyst in public support for early gas lighting in Scotland, while a continuing belief in "socialism from above", as expressed by the municipal authorities in the early nineteenth century, postponed any general desire for the municipal ownership of gasworks in Scotland until the 1870s.

Hamilton town council,⁴ together with the Duke of Hamilton, was the chief promoter of the gas company there in 1830. The Council at first held twenty-five of the £10 shares and was later described as "the most extensive shareholders". Nevertheless they supported the new consumers' company of 1846, but without purchasing any shares.

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1. S.R.O., Selkirk Minute Book, op. cit.
Vide supra Chapter II pp. 138, 148
 2. S.R.O., Annan Minute Book, op. cit.
 3. S.R.O. Stranraer Minute Book, op. cit.
cf. Haddington municipal authorities in 1834 provided land for the local gasworks. J. Miller, The Lamp of Lothian (1844, Haddington) op. cit.
 4. A Century of Gas Supply 1831-1931 (1931, Hamilton Advertiser);
A.G.M. Municipal Hamilton (N.D. Hamilton Library 21164/155 L.352)
p. 168.

* e.g. Mr Lawson jr., chief magistrate at Elgin, who promoted the gas company there on the platform of improved street lighting.
New Statistical Account Vol 13 Part II p. 18

In 1868, as a protest against the resumption of high charges, the Council combined with private citizens to form the Hamilton Corporation and Gas Consumer's Company.¹ This was opposed in the Court of Session by the 1846 Hamilton company, but the latter finally agreed to sell their entire works at arbitration to the Council in 1868. The Consumers' company then disbanded.

The earliest direct municipal control of a Scottish gasworks was undertaken at Greenock.² In 1824 Greenock Town Council unsuccessfully promoted a Bill to enable them to build a municipal gasworks.³

1. In 1867, when the Council refused to pay higher charges, the Court of Session examined the company books and ordered a reduction in price.

Hamilton Council held fifty per cent stock in the Consumers' company, which had a nominal £7,000 in £1 shares (Board of Trade BT2/280). The Council paid £12,148 for the 1846 company's works, though the company first demanded £19,148. Gas profits thereafter went to the common good of the burgh. Glasgow Herald 6/12/1868 p. 6.

Vide infra, 'Consumer Relations' p. 1200

2. From 1819, nine trustees elected annually by feuars and burghesses, acted in Greenock as "Commissioners on the Funds for paving, lighting, cleaning and watching" and supplying water. Parliament allowed them to raise £20,000 in loans. They took another Act in 1817 for a further £10,000 loan, and powers "to use Coal Gas for lighting the Town ... and procure all such Apparatus, Pipes, Furnaces and other Things" necessary, as desired. These powers were taken in the same year as the first gas companies commenced in Scotland, and indicate the interest taken by Greenock in the new light.

50 Geo. 3 c.167 Act for Enlarging Powers for the Improvement of Greenock (9/6/1810)

57 Geo. 3 c.32 Act for further Improvement of the Town of Greenock (1817).

3. From 1817, trustees of the Water Fund were responsible for lighting Greenock. The general improvement Bill of 1824 proposed a levy of 6d in £1 on the rates, and hence was opposed by Sir Michael Shaw Stewart.

Provost D. Campbell, Historical Sketches of Greenock (1881, Greenock) p. 68.

Greenock Advertiser 29/3/1824; 1/4/1824.

R.M. Smith, The History of Greenock (1921, Greenock) pp. 46-8.

On legal aspects of early nineteenth century Burgh finance vide J.D. Marwick, "The Municipal Institutions of Scotland", Scottish Historical Review 1904 Vol. I, pp. 287-9.

Again in 1826, a public meeting in the Town Hall chaired by the Chief Magistrate indicated that the Council was the main promoter of gas. The meeting "was not numerously attended",¹ but could not decide whether the gasworks they approved should be run "by a Joint Stock company, by the Trustees of the Water Fund, or by both in connection". A committee was appointed to gather information, and employed Mr Cook of Paisley gas company to survey the town. Cook planned a works costing £10,000 to meet double the initial demand for light, and when the committee reported to a second public meeting in January 1827 public opinion had been considerably aroused by the press² over the merits or demerits of public ownership.

The opposition stated³ that it was "unprecedented in any town in Great Britain"⁴ for the Council, which would only use one-seventh of the gas, to have total control over it. Gas would probably be used by only 800 people, unlike the universal water supply, and it was unjust to tax those few consumers for the public benefits provided to 25,000 inhabitants. Moreover any monopoly was bad in principle and practice. Council supporters, however, maintained that gas was not a speculative enterprise; no coal-gas works had ever been unprofitable and most gave dividends of ten per cent or twenty

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1. "As at most of our public meetings, the business was discussed rather in brief conversational dialogue across the council table, than in regular debate". Greenock Advertiser, 7/11/1826
 2. Greenock Advertiser, 16/1/1827
 3. Greenock Advertiser 16/1/1827, letter from "An Observer".
 4. In fact, earlier municipal gasworks began in England, where Manchester Police Commissioners built a works in 1817 for lighting the streets. They obtained a special Act in 1834, and transferred the works to the Corporation in 1838.
F.R.J. Jervis, The Evolution of Modern Industry (1960) pp. 189-94.

per cent which would be an important addition to burgh revenue. Technology had "attained a great degree of perfection"¹ and the mistakes by early companies would be avoided. Shopkeepers who used gas could not be trusted with holding shares in a company to provide gas, because they frequently moved premises and would sell their shares to speculators, while under the Council they would be taxed through gas to benefit the permanent inhabitants and feuars.

A. Clark contended -

... for the right and policy of admitting the consumers of Gas to an interest in the manufacture, and the profits anticipated to flow from it, by having a moiety of the undertaking, divided into small shares, distributed amongst them... 2

possibly 1,000 shares of £10 each, of which the Council could own 500 shares. The management would be divided between Council and shareholders. Clark believed that joint stock companies could give democratic representation of consumers' interests, and this argument again appeared in the Consumers' companies of the 1860s. Nevertheless, the committee was in favour of total ownership being vested in the Water Trustees, and the meeting voted in support of this. Many were relieved that some gas supply would be achieved, as it was claimed that since the original Council proposal in 1820 the town had spent £200 a year more than necessary on lighting,³ or equivalent to the entire cost of a works. The supposed nuisance of gas manufac-

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1. Greenock Advertiser, letter from "A.B.C.", 16/1/1827
 2. This public meeting was more numerously attended than any other for many years. Greenock Advertiser 9/1/1827
 3. Greenock Advertiser, 6/2/1827.

ture caused further delays in obtaining a site for the works,¹ but once completed they were very profitable.²

Eventually, subscribers to a Gasworks Fund³ on 27 December 1827 agreed by a 'deed of contract' to advance up to £9,400 to the Trustees of the Water Fund, and in fact £9,100 was raised. The gasworks were initially vested in 'Trustees of the Subscribers' and the Water Fund Trustees were empowered to purchase them by June 1832, including five per cent interest on the capital, or the Subscribers would have formed a Joint Stock company. The Water Trustees, however, exhausted their own Parliamentary borrowing powers, and with the approval of the Subscribers' Trustees,⁴ in April 1830 they transferred their option to the Town Council which paid off the capital and interest. The profit or loss on the undertaking, after charging interest on the capital of £9,100 plus the costs of management, repairs and extensions, was thereafter divided equally between the Water Trustees and the Town Funds. Both public bodies appointed half of the Committee of Management. This arrangement was reaffirmed in the 1840 Greenock Improvement Act.⁵ A later Act in 1865 empowered a Board comprising

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1. Sir Michael Shaw Stewart tried to get the works built well out of the town, on the shore near Inch Green and the Blubber Works. Others tried to promote portable gas instead of coal gas, as at Edinburgh and Manchester. Greenock Advertiser, 13/4/1827
R.M. Smith, History of Greenock (1921, Greenock)
 2. Campbell claimed the subscribers to the original loan took fifteen to twenty per cent dividends before the Water Trust took control. D. Campbell, Historical Sketches (1881) op. cit. pp. 81-3.
 3. Greenock Gas Act (1871) Preface. Some loans, however, were made to the Water Trustees in February 1827, and pipe-laying began in June. Vide Greenock Advertiser 6/2/1827, 29/6/1827.
 4. Agreement on 22/2/1831; recorded in Books of Council and Session 7/3/1831. Vide infra p. 1857
 5. In 1840 borrowing powers were raised from £30,000 to £50,000. The nine Trustees were Hector McPhail, James Kerr, David Melville, John Paul, Mathew Orr, William Scott, David McLeod, John McIlvain

the Provost, Magistrates and Town Council, to entirely supersede the Water Trustees' function, and by July 1870 over £34,003 had been invested in the works.¹

Several other towns in Western Scotland emulated Greenock. In 1830 a "Society of gentlemen"² subscribed £3,000 to £4,000 for the construction of Port Glasgow gasworks and, like those at Greenock, "agreed to relinquish the benefit in favour of the Corporation, on being paid common interest on the money advanced." This transfer was completed before 1835, and J. Dykes the Town Clerk acted as secretary to the gasworks. Renfrew³ gasworks passed early into municipal control, and at Rothesay⁴ the gasworks built by a company in 1840 were acquired by the town council in 1843.

and John McLoskey. Three were to retire annually, but could be re-elected.

3 Vict c. XXVII Greenock Improvement Act (a. v, xlv, lxvii, lxxi), 14/4/1840.

1. In 1865 the Board was given powers to borrow a total of £120,000, either on a cash account from Banks, or on Mortgage on the security of the Police Assessment.

The Board was not empowered to supply any gas to Port Glasgow.
28-9 Vict. c. CCC Greenock Consolidation Act (a. 53, 55)
5/7/1865.

2. Fowler's Directory of the Lower Ward of Renfrewshire (1836, Paisley) p. 180

No further details are given in D. Weir, The History of Port Glasgow (1930, Glasgow) p. 181

3. No details have been located though C.W. Hastings' Gas and Water Companies Directory (1891) states 1855.

A list of twenty towns with municipal gasworks, compiled in 1851 by the Journal of Gas Lighting, is incomplete and shows only Greenock and Paisley in Scotland.

J.G.L. 10/1/1851, p. 19

4. H.A. Moisley, Ed., Third Statistical Account - Renfrew and Bute (1962, Glasgow) p. 446.

In Paisley, the old gas company¹ of 1823 attempted to persuade the Town Council to acquire the works in 1844, but were opposed both by a proposed New gas company and by a large public meeting² of tradesmen and weavers who appointed a committee to lobby the Council. The Council agreed to call a public meeting before making any final arrangements, but did not do so. Only later, in March 1844, did the Provost and Council attend such a meeting of 1,300 inhabitants, and when they failed to defend the arrangement, that meeting resolved to petition Parliament in favour of the New company instead. They opposed gas monopoly, even by the Council, in the fervour of opposing Corn Law monopoly.³ They also distrusted the commercial practices of the Council which had founded two Savings Banks in 1836 and obtained £19,000 in deposits, but after speculating in improvements to navigation on the River Cart and borrowing about £10,000 on the security of the Town's property, had become bankrupt in 1841 and all these monies were lost.⁴ Since the Council owned no public property, they could only guarantee the proposed six and two-fifths per cent dividend to company shareholders by a strict monopoly of gas rates, to the disadvantage of the community and municipal control gave absolutely no guarantee of cheaper gas.⁵

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1. Paisley public lighting commenced in 1768, and was vested in the Police by the Paisley Police Bill of 1806, but despite their commercial interests Paisley Council on 12/10/1821 refused to invest in the newly formed gas company which promised thirteen per cent dividends. R. Brown, A History of Paisley (1886, Paisley) Vol. II, pp. 33, 289. Glasgow Herald, 18/4/1820, p. 3.
 2. H. Lords 1844 Vol 8 'The Paisley Gas Bill' 30/7/1844 pp. 36, 40, 157-9.
 3. H. Lords, op. cit., 30/7/1844 p. 81
 4. H. Lords, op. cit., 30/7/1844, pp. 99, 100, 50-61.
 5. Evidence of W. Galloway, shawl manufacturer. H. Lords, op. cit., 30/7/1844 pp. 172-4.

Parliament, however, sanctioned the arrangement between the Council and company, and vested the gasworks in a "Board of Gas Light Commissioners", in whose name it could sue and be sued, and acquire lands, buildings and heritages.¹ While the stock unpurchased by the Council exceeded £30,000, the Magistrates and Council could appoint four members to the Board of twelve. When the amount still owned privately was £20,000 to £30,000 the Council could appoint five members, and the Council had to purchase all but £10,000 to £20,000 before it could appoint half of the Board. The Council remained at a considerable disadvantage thereafter because it had to redeem the entire stock before the company ceased to appoint six members. Moreover, the Board in great part controlled how rapidly the stock could be redeemed.

The Board met monthly, and with one vote to each member it directed the business of the company.² With a quorum of seven, the Board elected its own chairman at each meeting. Each Commissioner elected by the Council had to be a gas consumer, and on the electoral roll of Paisley or Renfrewshire. The Commissioners were all elected annually, in June, and could hold no office or place or trust under the Board, or be concerned personally in contracts granted.³ Their

1. The Board was subjected to all the same regulations as chartered gas companies in the 1840s.

Paisley Council and Old company paid £3,600 in compensation to the New company for withdrawing its Bill; and £4,800 for their own Act.

R. Brown, A History of Paisley (1886, Paisley) op. cit., p.289. The Paisley Gas Question (Paisley Public Library Ref. P.C. 608)

2. 1844 Paisley Act, a. xxii

3. Penalty £20 for non-compliance. 1844 Paisley Act, a. v to xiii.

remuneration¹ was to be fixed by the proprietors to a maximum £120 a year. Commissioners were not individually responsible for the actions² of the Board, which was empowered to raise money on mortgages or bond.³ These loans included up to £10,000 for extending the works, which was convenient for the company, and further sums for redeeming company stock by the Council. Yet the constitution of the Board mitigated against redemption⁴ which could only be made in units larger⁵ than £10,000.

If individual £8 shares were purchased⁶ by the Commissioners, dividends still had to be paid to their former owners until the entire £10,000 block was redeemed. Annually in July the Board was obliged to pay a dividend⁷ of £6 8s⁰/₁₀ on each share of the company's paid-up capital of £40,000, and only surplus profits could be allocated by the Board for extensions of the works, or for the redemption or purchase of stock. Little effort was made to keep the public informed of the Board's activities. Although two independent auditors⁸ had to be appointed annually by the Sheriff of Renfrew, their annual abstract of accounts could only be seen by the public for a fee of 1s at the offices of the Town Clerk or Sheriff Clerk. No special fund was demanded by Parliament to ensure the rapid redemption of company stock for the public benefit, and although a Contingency Fund⁹ of £5,000 was allowed, the Board had full control over the

1. 1844 Paisley Act a. xxiii

3. 1844 Paisley Act a. xxxi

5. 1844 Paisley Act a. lxviii

7. 1844 Paisley Act a. lxvi

9. 1844 Paisley Act a. lxiii, to a maximum ten per cent annual profits.

2. 1844 Paisley Act a. 1

4. 1844 Paisley Act a. xxxiii

6. 1844 Paisley Act a. lxix

8. 1844 Paisley Act a. lii

rate at which it accumulated.

At Dundee in 1843 the Old gas company, threatened by competition¹, also sought protection from the Town Council. Proposals were originally made in 1823 to run the Dundee company as a public trust,² but the Council could not acquire capital to build a gas-works:

Gentlemen had not such a confidence as they have now /1846/ in rates arising from Gas and therefore they could not borrow money on them and the impression was that there must be an assessment on the people...

which was opposed. In 1843 the Council again rejected an offer of the gasworks on the grounds that it was insolvent, and was unwilling to guarantee to shareholders ten percent dividends, despite their existing fifteen per cent dividends. In April 1844, Mr Kerr³ the clerk of the company, acting informally but on behalf of the shareholders, again proposed the sale. When the Council refused, he declared the shareholders were willing instead to accept annuities, though at the astronomical rate of twenty per cent, and surplus revenue could "be applied to Public purposes". The Council refused, because it was a blatant attempt to muzzle the New company, and the New company would fight any Act proposing council takeover. Nevertheless, the Old company attempted a Bill which allowed the Council to purchase⁴ their

1. The mid-1840s saw a proliferation of the Consumers' Movement. Vide infra p.1133

2. H. Commons MSS. 1846 Vol. 98 23/3/1844, pp. 151-4

3. H. Commons 23/3/1846, p. 110; 24/3/1846, p. 143.
Kerr's offer may have been, as at Aberdeen, merely designed to persuade the New company to disband. The works could not have been sold without an agreement by three-fifths of the shareholders. (H. Commons 24/3/1846 p. 146).

4. H. Commons 24/3/1846, p. 147.

works, and Provost J. Brown¹ testified to a Commons Committee that municipal control was desirable, to sell gas "at prime cost", even though Parliament in 1846 strongly disapproved such Trusts. The New company won its case for competition.

Greenock gasworks were run for profit, unlike the municipal gasworks of the 1860s and later. Thus they provoked the ire of the Consumers' Movement in the 1840s, and in 1845 the Greenock and Sub-urban New Gas Light Association² was promoted with a capital of £40,000 in £5 shares, to compete in the supply of gas. The Association claimed that only 2,000 of the 8,000 householders used gas, which cost 9s 2d per 1,000 cu ft, or forty to one hundred per cent more than in other large towns. Whereas most gas companies only obtained ten per cent dividends, Greenock Corporation took twenty-one per cent, or £3,800 profit on £17,550 capital investment. The Association proposed to also extend gas supply to Gourock,³ which with a population of 2,000 had no gas, and possibly to Port Glasgow; and accused Greenock town council of breaking its pledge on supplying cheap gas. They aimed to sell gas twenty to thirty per cent cheaper, and pay a dividend of nine to ten per cent to local consumers who would invest in the company, which hoped to obtain an Act of Parliament for limited liability.

The price of gas in Greenock was promptly reduced to 8s 4d, and

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1. H. Commons 27/3/1846, p. 109
 2. Prospectus in Greenock Advertiser 22/4/1845. Preference given to persons who agreed to use company's gas. Vide infra 'Consumer Relations' p. 1143
 3. When the Association collapsed, Gourock formed its own gas and water company; vide Prospectus in Greenock Advertiser 2/5/1845

the Provost threatened a further thirty per cent reduction before the Association could begin to compete.¹ He argued that the Association was a speculative venture prompted from Glasgow,² which could not even obtain twelve local directors, while special conditions affected gas prices in Greenock. The 4s annual meter rent had been abolished, free service pipes were fitted even up common stairs, while coal was twenty-five per cent more expensive than in Glasgow. Glasgow consumed twenty times more gas, and Paisley three times more gas than Greenock, giving them economies of large scale production, yet Greenock gas was richer and therefore better value.³ The Provost warned proprietors that because gas profits relieved them of 9d. in £1 on rental value, reduced profits would lead to higher rates.⁴ He was contemptuous of small gas consumers and expressed no desire to improve the lighting facilities of the poor. Three thousand householders used gas, including "the whole of the high-rented houses", and 700 meters had recently been fitted to houses under £10 rental value to enable tradesmen to use gas. Those without gas included 2,000 with a rent under £3, and 3,000 with a rent of £3 to £5, but they were not worth bothering about since "small consumers were not profitable consumers - the difficulty of collection, and the interest of meters, running away with the whole profit on the small

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1. Council debate in Greenock Advertiser 25/4/1845
 2. This was normal defence by companies opposed by the consumers.
 3. The Provost quoted Dr. Thomson's lecture to Glasgow Philosophical Society in proof of this.
 4. A Council survey of consumers with property of £2,580 rental value showed a gas consumption of £146. If rents rose by 9d, or £97 a year, the competing company would have to sell gas at an unprecedentedly low 5s per 1,000 cu ft for the consumers to make an overall gain from the change.

quantity used".

If the Association cultivated this market, and the suburbs, he forecast a maximum increase in consumption of four million cu ft a year, raising the town's total to twenty million, of which a large proportion was used directly for public lighting. If the company and the Town sold only ten millions each, production costs would rise by 2s to 2s 6d per 1,000 cu ft. Moreover the new gasworks would cost £30,000, or £1,200 profit a year for four per cent dividends, and on ten million cu. ft the dividend alone involved a burden of 2s 4d per 1,000 cu ft. In comparison, the Town Council had been slowly reducing gas prices.

TABLE 5.28 Greenock Gas Prices (to Consumers of £2 to £ 10 after allowing discounts).

1838	10s 9d
1840	9s 9d
1842	9s 6d
1843	9s 0d
1844	8s 3d
1845	7s 6d

SOURCE: Greenock Advertiser 25/4/1845

The Association was defeated, but within two years consumers led by Mr Clark were again campaigning against the Council, with a public meeting in 1847 in the Sheriff Court Hall.¹ Gas was then sixty per cent cheaper in Glasgow, and forty per cent cheaper in Paisley, while the Council committee on gas was so lax that the old gas-manager² had undertaken the entire management and called seven special meetings of the Committee in as many years to show defects which the

1. Greenock Advertiser 16/4/1847, p. 2; 2/4/1847

2. Mr Dunn, who retired in 1839.

directors of a company would have eliminated much earlier. Clark demonstrated that the fears about Corporation control expressed in 1827 had become reality, and that gas was used to subsidise burgh revenue in the reverse way to taxes like that on windows, because the poor paid most and the rich received discounts. The profit¹ on gas used by the poor was 3s per 1,000 cu ft, and that on gas to the rich only 2d to 4d. Shopkeepers were also being taxed twice over, and Clark maintained that the maximum rate assessment allowed by Greenock Police Bill was far less than the indirect tax being paid on gas. The Council was proposing to disconnect all consumers with only one jet burner, yet upon the Provost's motion² they declined to receive Mr Clark's petition of complaint.

The Council did, however, publish statistics which demonstrated a great improvement in management after 1839, when Alexander Ritchie became manager.³ Cheaper gas of better quality by 1846 saved the Town £1,200 a year, leakage had been reduced by £3,600, coke and ammoniacal liquor was sold for the first time giving £300, and bad debts were reduced by £170, a total saving of £5,270 a year. The original gasworks⁴ were designed to produce only seven to eight million cu ft a year, yet by 1846 supplied almost sixty-six million cu ft. Up to 1839 very inefficient, piecemeal additions had been made, and it was only during the early 1840s that extensive capital investment was made to modernise the works.

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1. Greenock Advertiser 2/4/1847. Account of meeting in Sheriff Court Hall.
 2. Greenock Advertiser 16/4/1847
 3. Greenock Advertiser 16/4/1847; "Report by the Manager of Greenock Gas Works". Vide infra Appendix XIII p.1561
 4. Greenock Advertiser 9/4/1847, letter to Editor.

Discounts were normal commercial practice, by gas and other companies, because the collection of rent from large consumers was cheaper and more reliable than from a host of small consumers. No suggestion was ever considered for making large consumers subsidise the cost of supplying gas to small consumers. By 1846 the Town funds had gained £23,000 from gas profits, and under this argument the consumer agitation again collapsed.¹ The gasworks were for the benefit of the Town, not the consumers, and the extent of improvements made by the manager, Mr Ritchie, from 1839-50 at a cost of £22,250 indicate that the Town managed the gasworks most incompetently before that date.

During the 1850s, however, the works were again starved of capital and profits took precedence over efficiency. In 1860, when output had reached fifty-six million cu ft., the Committee of Management² sent a deputation to visit other gasworks and compare them with Greenock. They reported that leakage at Greenock was very small³ but the works were outdated,⁴ had no exhaustor or photometer, and storage for only 46.66 per cent of maximum daily output⁵ when most engineers recommended seventy-five per cent. The Council Committee

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1. In 1851 Councillors W. Allison and H. McIlwraith renewed the attack on gas management, but were defeated by similar arguments. The Town Council released detailed statistical statements which became a cause célèbre in the Journal of Gas Lighting: J.G.L. 10/5/1851.
 2. "Report of the Committee of Management of the Greenock Gas Works" 16/10/1860: bound in The Paisley Gas Question (Paisley Public Library Ref. PC.608).
 3. Approx. 4.4 per cent in 1859, 0.8 per cent in 1857.
 4. Vide infra, 'Technology' pp.336, 328
 5. 1846 had four small holders with 60,000 cu ft capacity; 1847 built 80,000 cu ft holder for £1,845, when output was twenty-four million cu ft a year.

began to exercise effective technical control over the gasworks management, instead of leaving this entirely to their engineer, and brought in a consulting engineer, Hunter Jones. Excess retort pressure and slow re-charging was causing rapid retort deterioration. Gas-pressure on the mains was still controlled manually by valve, instead of a governor or even an old-fashioned pen-gauge to record the pressure level. The Committee proposed to purchase the missing equipment, including 192,000 cu ft telescopic holder,¹ and a completely new retort-house with long through-retorts instead of the existing low-temperature 7½ foot retorts. Moreover they suggested moving the entire works out to the suburbs of the town at Bottlework, Cartsydyke. The 1860s therefore saw the final emergence of professional and capable management of the gasworks directly by the Town Council, which in 1871 led to the construction of a new and very efficient gasworks at Inch Green.²

At Paisley the Town Council originally aimed to save £640 per year for the redemption of stock, by reducing the company's dividend of eight per cent or £3,200, to £6 8s per cent or £2,560. This proved to be impractical. By 1859 the Gas Board had redeemed only £3,974, of half the amount anticipated, and Provost Brown³ attacked the Board for circumventing the Act by using surplus profit not only for extending main pipes and redeeming stock, but extravagant pro-

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1. Ritchie, the manager, opposed this holder as unsightly; and the photometer and exhauster on grounds of cost. The exhauster and steam engine he estimated at £300 plus £50 a year, but Jones showed it would only be £215, and £69 a year to run. Estimated cost of telescopic holder £1,200.
 2. Vide infra p.405
 3. Glasgow Herald, 6/10/1859

jects like a recent railway branch-line. All coal to Paisley was obtained from the East up to 1856, when the Board resolved upon a railway link.

TABLE 5.29 Raw Material Supplies to Paisley Gasworks
(1856 - 9)

(I) From the West:

<u>Date</u>	<u>Tons Coal</u>	<u>Tons Limestone</u>	<u>Total Tons</u>
1856	67	205	272
1857	1,315	450	1,765
1858	575	653	1,228
1859	1,678	560	2,238

(II) From the East:

1859	3,056	303	3,359
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Many Western coals had been tried, but only that from Mr Ferguson of Lesmahagow had proved worthwhile. The Glasgow and South Western Railway only charged 6d cartage from their old station or new Underwood Street Coal Depot, to the gasworks, and even if they had charged 8d the railway branch could have saved the gasworks only £74 12s a year or six and a half per cent. This was further reduced by the expense of moving railway waggons, and maintaining signal lamps.

The Paisley Saturday Post was incorrect, according to the Provost who wanted £900 spent on redeeming stock, in claiming that the Gas Board had saved the town £36,000 over the past eight years. In reality they had made Paisley gas more expensive than in Glasgow and Greenock, and in the face of rising coal prices had only been able to sell cheaper gas through the economies of enlarged output.

TABLE 5.30 Paisley Gas Price compared to Twelve Scottish Towns (1844 and 1859)

Company	Rate per 1,000 cu ft		1844 Lowest Price after Discounts		Rate per 1,000 cu ft		1859 Lowest Price after Discounts	
Paisley	7s	0d	5s	9½d	5s	0d	4s	6d
Glasgow	8	0	5	7½	5	0	4	3
Edinburgh	7	6	7	6	5	5	4	11½
Perth	11	0	11	0	7	6	6	8½
Dundee	7	9	5	9½	5	6	4	5
Stirling	10	0	9	0	6	0	6	0
Aberdeen	9	0	6	9	6	6	5	0
Kilmarnock	8	6	8	1	5	10	4	11½
Ayr	10	0	9	0	6	8	6	8
Greenock	10	0	7	6	5	0	4	0
Port Glasgow	11	3	11	3	8	4	6	5
Dumbarton	10	0	10	0	6	8	6	0

SOURCE: Glasgow Herald 17/10/1859

TABLE 5.31 Paisley Gas Output (1845 - 59)

Year to 31 May	Cu. ft Produced	Price per 1,000 cu. ft	Year to 31 May	Cu. ft Produced	Price per 1,000 cu. ft
1845	40,417,770	6s 6d	1853	60,274,200	5s 0d
1846	43,830,510	6 0	1854	65,071,400	5 0
1847	41,769,120	6 0	1855	61,994,900	5 5
1848	41,022,610	6 0	1856	57,994,800	5 5
1849	41,748,060	6 0	1857	59,284,400	5 0
1850	39,913,030	6 0	1858	53,890,200	5 0
1851	45,029,500	6 0	1859	59,931,000	5 0
1852	52,226,300	5 0			

SOURCE: Glasgow Herald 17/10/1859

Although high gas-price and the failure to extend municipal control were genuine grievances, the Board¹ could show that it was not entirely at fault. The technical improvements enabled sixty

1. Glasgow Herald 17/10/1859; Paisley Herald 8/10/1859

million cu ft to be made with the same labour as forty million in 1845, and extensions to meet growing demand had prevented the Commissioners from redeeming shares. Out of a capital stock of £40,000 in 1859, £37,857 had been spent on the works, and £2,311 on meters, including capitalized profits of £168. Those surplus profits which were placed into the Contingency Fund, of almost £5,000, were vital since that Fund was used as working capital, to purchase coal and other materials.

The railway branch, according to J. Kerr, gave far greater savings than Provost Brown had claimed, reducing the delivered price of lime, for example, from 7s to 5s 6d per ton.

TABLE 5.32 Paisley Gas Board: Cost Benefit Analysis
of (1859) Railway Sidings

Expenditure

Cost of Railway Branch	£1,100
Cost of by-product liquor pump	<u>30</u>
	£1,130

Savings Made

Less carting from West 2,238 tons at 8d	£74	12	0
from East 3,056 tons at 1d	12	14	8
Lower coal price from Mr Fergusson, 2,000 tons at 6d	50	0	0
Rent from Lessee for By-Products	10	0	0
Reduced Labour - 1 man pumping tar and)			
1½ men moving coal and lime)	97	10	0
	<u>£257</u>	6	8
Total Saving made on Cartage and Theft			

SOURCE: Glasgow Herald 17/10/1859

Extensions to mains pipes were only made if the gas manager¹ forecast a profit of fifteen per cent on the operation. The principal extension had been pipes costing £406 6s to Blackland Mill, Glen-

1. Glasgow Herald, 17/10/1859

field, Nethercraigs and Hawkhead Mill, which gave an annual profit of £72 14s. If the sum of £1,536 spent on pipes and railway line had instead been invested at four and a half per cent interest the annual revenue from it would have been £69 2s 8d, compared to the profit of £330 which was made by employing it for extensions.

Many of the improvements financed by the Board, however, could be viewed as replacements for incompetent earlier investment by the gas company.¹ In 1845 the company had five gasholders at the works, and two "district holders".² This outdated arrangement gave only 190,000 cu ft storage, and as early as 1850 a new 50,000 cu ft holder was built at the gasworks to replace the "district holders". In 1854 a telescopic 175,000 cu ft holder replaced two small gas-holders, and in 1862 a telescopic 250,000 cu ft holder replaced the remaining three. Continued capital outlay was therefore required up to 1870 when the Council took full control.³

TABLE 5.33 Extension of Paisley Gasworks 1845-70

	<u>1845</u>	<u>1870</u>
Retorts in use	48	60
Annual gas revenue	£8,606	£13,902
By-Product revenue	£ 192	£ 1,762
Coal consumed (Tons)	4,411	9,259
Gas Produced (Cu ft)	40,411,770	86,018,000

SOURCE: W.B. Watson, Abstract Statement (1870)
op. cit

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1. W.B. Watson, Abstract Statement of the Revenue and Expenditure of Paisley Gas Light Commissioners 31 May 1869 to 31 May 1870 (1870, Paisley), Paisley Ref. Library
 2. Vide supra 'Technology' p.263
 3. J.G.L. 27/3/1883. Gas sold at 6s 6d in 1845, 3s 9d in 1870.

D. Murray¹ convener of the 1844 Paisley Council Committee on gas, warned the Lord Provost of Glasgow in 1864 that a Board of Trustees like that of Paisley was not a suitable way of enforcing municipal control. Paisley Council had shown genuine concern to prevent the duplication of capital and ruinous competition in the town, which would ultimately have led to coalition at the expense of the public, as later became demonstrated in "the experience of Glasgow, Aberdeen, Perth and Dundee". Yet even in 1864 the Board of Trustees still held control of the operations in Paisley.

In the late 1860s the Board gave special concessions of gas to the Police Commissioners which were viewed by the public as a form of bribery to prevent the redemption of stock by the Town.² The Police received normal discount rates up to 1865 when the General Police Act (1862) was adopted and public lighting improved by having the lamps on from sunset to sunrise regardless of moonlight; swallow tails instead of single jets in main streets, and twenty-five new lamps. The Board supplied these for the same charge as in 1864, £600, instead of the commercial rate, £900. In 1867 the Police were charged £650 instead of £1,017 and Provost Macfarlane requested free gas for the lamps. Public opinion was aroused because only £8,000 stock, one-fifth of the total, had been redeemed for the Town, and the Board was subverting the Act by giving free gas instead of redeeming stock. This agitation led to complete takeover by the

1. Letter to Provost Campbell from David Murray. Glasgow City Archives Miscellaneous Papers, Vol. 18, p. 244.

2. Paisley Financial Statements - Reports (Paisley Library P.C. 601), item 14 "Memorial for The Board of Gas Light Commissioners" (1867). Some citizens considered appealing to the Court of Session against the Police action.

Council in a special Act of 1870.

Until 1876 when the Burghs Gas Supply (Scotland) Act was passed,¹ public authorities in Scotland could only acquire local gas companies with the specific permission of Parliament. Dundee² and Glasgow in the late 1860s pioneered this movement in Scotland, and a spate of Acts followed in the early 1870s until the general enabling Act of 1876. Thereafter municipalities only sought special Acts where exceptionally large activities were planned, as at Edinburgh, or where the company opposed the takeover, as at Falkirk.

In 1866 Dundee Old company suffered a serious fire,³ and the resignation⁴ of J.Z. Kay, the chief engineer to both Old and New companies whose position belied their supposed competitiveness. Both Dundee companies promoted Bills⁵ for additional capital in 1867 at a time when consumers were raising a subscription in praise of Mr Flintoff.⁶ New controversy was kindled⁷ while extensions continued at the gasworks.⁸ The Town Council was persuaded to negotiate to

1. Vide infra Appendix XVIII.2

2. F. Clifford, Private Bill Legislation (1887) Vol. 2 op. cit., p. 458; on Parliamentary attitudes to municipal action on gas and water vide ibid. (1885) Vol. I, p. 254 et seq.

3. Following storm damage to gasholders J.G.L. 9/1/1866, p. 19

4. J.G.L., 30/10/1866, p. 801

5. J.G.L., 22/1/1867, pp. 51-2.

6. J.G.L., 19/2/1867 p. 116, and at Perth, since they believed he had saved Scottish consumers £100,000

7. J.G.L., 16/4/1867 pp. 281-3 "The Gas Question in Dundee"

8. J.G.L., 29/10/1867 p. 911, 12/11/1867 p. 965, 10/12/1867 p. 996. Scaffolding collapsed by the new gasholder, killing one man and seriously injuring ten others.

to take over the works, but the companies objected and a lengthy Parliamentary inquiry¹ was held which cost the Gas Commissioners many thousands of pounds, and deterred other Scottish municipalities from taking the same steps.

Nevertheless, in 1869 when the two Glasgow companies proposed Bills for additional powers, the Corporation² proposed a separate Bill to build a gasworks itself, and used the report of a consulting gas engineer, Mr Barlow, to show how cheaper gas could be manufactured. Successful municipal takeover in Glasgow produced a large number of further applications to Parliament in 1871. Glasgow became known as the prime example of "gas and water socialism"³ to protect consumers "against monopolistic exploitation".⁴

By the 1860s Glasgow was by far the largest centre of gas consumption in Scotland, as it remained in 1914, and events there had a major impact on the outlook of other Scottish cities. Thus it served as the springboard for Flintoff's consumer agitation⁵, and although it was Dundee, Flintoff's northern base, which first took

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1. J.G.L. 9/6/1868 pp. 419, 422-7; J.G.L. 23/6/1868 pp. 490-500; J.G.L. 22/12/1868 p. 911 "Expenses of Obtaining the Dundee Gas Act" - law expenses by Town Council and companies, against Gas Commissioners, already £7,875
'Dundee Gas Arbitration' in J.G.L., 8/6/1869 pp. 459-65; 22/6/1869 pp. 523-8; 6/7/1869 pp. 548-58; 20/7/1869 pp. 587-91; 3/8/1869 pp. 620-3; 17/8/69 pp. 660-4; 12/10/1869 p. 801; 23/11/1869 pp. 898, 929.
 2. J.G.L., 16/3/1869
 3. J. Cunnison, Ed. Third Statistical Account - Glasgow (1958, Glasgow) J.R.Hume Industrial Archeology of Glasgow (1974) p.137
 4. G.P. Jones and A.G. Pool, A Hundred Years of Economic Development in Great Britain 1840-1940 (1963, London) p. 174
 5. Vide infra 'Consumer Relations' p. 1157
Financial details of Glasgow Old company in 1858-60 are extant, Vide Glasgow City Archives Miscellaneous Papers Vol. 18, pp. 240 - 2.

TABLE 5.34 Municipal Ownership
 (1) Municipal Gasworks acquired by Private Acts of Parliament

Take-over Date		Capital of Old Company (£)	Perpetual Annuities	Municipal Borrowing Powers (£)
1868	Dundee Gas Commissioners			40,000
1869	Glasgow Corporation			
	G.C. & S.	(150,000	9%	
		(50,000	6.75%	1,000,000
	G. Gaslight C.	(150,000	9%	
		(65,000	6.75%	
1870	Broughty Ferry Commissioners			
1871	Aberdeen Town Council	65,000	10%	25,000
1871	Arbroath Corporation	20,000	7%	20,000
1871	Kilmarnock Corporation			50,000
1871	Perth Gas Commissioners			
1871	Forfar Magistrates and Town Council			
1873	Dumbarton Town Council	6,000	9%	15,000
1875	Inverness Commissioners of Police			
1876	Campbeltown Council			(Purchase Price (plus £12,000
1876	Kirkcaldy Corporation			
1881	Irvine Corporation			
1886	Ardrossan Police Commissioners			
1888	Edinburgh and Leith Gas Commission:			
		Edinburgh 200,000	10%	300,000
		Leith 156,000	£9 6s 8d %	
1894	Falkirk Burgh Commissioners			120,000
1896	Edinburgh Corporation Portobello		£1,200*	
1904	Airdrie Corporation	33,976		**

SOURCES: Acts of Parliament, vide infra Appendix XVIII.3

N.B. Ayr Town Council in 1873 unsuccessfully proposed a Bill to purchase those works at £5,000. Hamilton Council¹ in 1868 took control of the gasworks under an earlier Act

* purchased works for £61,300: ** plus £2,500 cash payment; these works transferred in 1897 to Edinburgh & Leith Gas company.

1. In 1878 Hamilton Corporation confirmed their earlier takeover, made in terms of the special 1846 Hamilton Gas Company Act. Vide Hamilton Gas Act (1878) a. 131.

(2) Municipal Takeovers Under the 1876 Burghs Gas Supply Act

Date	Municipal	Date	Municipal	Date	Municipal
1876	Dumfries Cp.	1881	Wishaw Cp.	1901	Newmilns U.D.C.
1876	Alva G. C.	1886	Dunbar G.C. ⁵	1902	Newport Fife Cp.
1876	Darvel Police Cm.	1886	Gourock Cp. ⁶	1904	Old Meldrum G.C.
1876	Kilsyth G. C.	1887	Denny G.C.	1905	Monifieth Cp.
1876	Kirkintilloch G.C.	1888	St.Andrews G.C. ⁷	1906	Grangemouth Cp. ¹⁰
1876	Johnstone Cp. ¹	1891	Tain G.C. ⁸	1907	Largs Cp. ¹¹
1876	Portsoy G.C.	1891	Lockerbie Cp.	1909	Ferryport on Craig ¹²
1877	Invergordon G.C.	1893	N.Berwick Cp.	1910	Carnoustie Cp.
1877	Alloa G.C. ²	1895	Dunoon G.C.	1911	Kirkcaldy Cp.
1878	Peterhead Cp.	1896	Dunfermline G.C.	1911	Fraserburgh Cp.
1879	Burntisland G.C.	1896	Millport G.C.	1913	Motherwell Cp.
1880	Elgin Cp. ³	1899	Troon G.C. ⁹	?	Peebles G.C.
1880	Montrose G.C. ⁴	1899	Helensburgh G.C.		

Note : Cp. - town council or corporation ; G.C. - Gas Commissioners
U.D.C. - urban district council

1. A different date, 1879, was recorded in J.G.L. 28/1/1879 ; the works were built in 1824, and cost the council £22,957 J.G.L. 24/7/1882
2. Alloa company had £10,000 in £10 paid-up shares; the Council paid £23,250. J.G.L. 16/10/1877.
Third Statistical Account Stirling/Clackmannan (1966) op cit p.465
3. Elgin Council paid £12,170
Third Statistical Account Morar/Nairn p.89
4. Montrose proposed takeover in 1871. Jl. of Artificial Light 10/1/1880
5. Dunbar Company stock was £3,900 J.G.L. 20/4/1885
Third Statistical Account - E.Loathian p.394
6. Gourack company asked £12,000 but arbiters decided £7,800 for fixed equipment. The company had £4,000 stock and paid 7.5 per cent dividends for 20 years. The council paid in total £8,600
J.G.L. 6/10/1885, 15/12/1885, 16/3/1886
7. St. Andrews paid £13,250, or £31 5s for each £25 share, after a plebiscite had voted 3861 in favour and 3013 against.
J.G.L. 13/11/1888
8. J.G.L. 27/10/1891
9. Gas World 17/6/1899
10. Council paid £25,000 for gasworks. A.Porteous Grangemouth's Modern History (1768-1968) (1970,Grangemouth) p.111
11. Largs council paid £27,990 after arbitration by G.R. Hislop of Paisley acting for the Company and A. Yuill of Dundee for the Council under the 1845 Lands Clauses(Scotland) Act.
S.R.O. (B.T.2/4843)
12. Third Statistical Account - Fife (1952) p.789

Sources : Dates from C.W.Hastings Gas and Water Statistics (1901 et seqq)

municipal action, discontent was also rife in Glasgow. The City and Suburban Company in 1860 produced gas at 3s 9d per 1,000 cu ft, but sold it at 5s. The consumers¹ claimed that 1s 3d per 1,000 cu ft was used to pay dividends, and failed to make allowance for 12.759 per cent leakage from the distribution pipes. The Old company was found² to have no exhausters at their Dalmar-
and
nock station causing higher pressure leakage, and also inadequate station meters. Townhead works were believed to be quite out-dated and to require about £18,000 for modernisation. Two-thirds of the tar was used as furnace fuel,³ a loss of by-product revenue equivalent to 2s per ton of coal carbonized. The consumers' engineer believed Townhead would need to be replaced by an entirely new works, making about two million cu ft per day at a cost of £30,000, preferably at a site in Maryhill with good rail and canal access.

The consumers' action collapsed and the Council was not prompted to act until 1868 when Glasgow gas company proposed a Bill to obtain extra finances. Letters to the Glasgow Herald⁴ showed that opinion was divided, and some quoted Richard Cobden "that no Government should be allowed to manufacture any article which can be supplied through public competition."⁵ The Corporation proposals were

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1. Report by James McLelland, Glasgow City Archives Miscellaneous Papers Vol. 18 p. 226
 2. Report by John Cox to the Cheap Gas Movement 30/3/1861, Glasgow City Archives Miscellaneous Papers, Vol. 18, p. 261
 3. Vide supra 'Technology' pp. 438, 597, 546
 4. Glasgow Herald 21/12/1868 p. 6; 17/12/1868
 5. Company supporters showed that Manchester charged meter-rents, and if Glasgow companies had also done so the gas would have been 4½d more expensive, and revenue £18,000 greater.
Glasgow City Archives, Miscellaneous Papers, Vol. 18, p. 252

discussed in a series of Ward meetings,¹ similar to those of Flintoff's movement. Councillor W. Wilson showed that gas prices had been raised from 4s 2d to 4s 7d when coal was expensive but not reduced when it became cheaper, and that "many thousands of pounds of the surplus profits" had been spent on premises in Virginia Street. The gas was dearer than in other towns of equivalent size, and Wilson repeated earlier arguments² on the inefficiency of duplicate capital, management, and pipes which leaked by fifteen to twenty per cent. Even eight per cent annuities would leave the city with annual profits of about £25,000 to use in reducing lighting rates³ or the price of gas. The Gas Contingency Guarantee Rate became the main argument by those opposing Council control. J. Davidson claimed that "thousands of persons in Glasgow who did not burn gas would be subject to taxation for the benefit of those who were consumers", and others like Mr Stout claimed councillors were "hatching jobs in order to fill their own pockets." Municipal profits at Manchester gasworks were the main temptation for taking control, but Mr Kerr stated that their profits were largely from coke sales, whereas Glasgow coke was "almost valueless".

Potential public benefits outweighed these arguments, and Glasgow corporation commenced their vast gas undertaking with a thorough analysis of all the types of coal, and mixtures of coals they could

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1. Glasgow Herald 3/2/1869 Meeting of Fourth Ward Electors; 28/1/1869 Meeting of the Third Ward; 27/1/1876 Meeting of Ward Committees.
 2. Arguments used to refute Flintoff, and in the "Letter to the Honourable The Lord Provost, from Wm. Miller" 22/1/1869, Glasgow City Archives Miscellaneous Papers Vol. 18, pp. 254-7
 3. i.e. 2d to 3d in £1 on city rents.

use¹ and detailed estimates of the new equipment required.² Hugh Bartholomew, engineer of the City and Suburban Company since 1843 remained general manager for the Corporation³ in 1869, but was replaced by William Foulis⁴ that year, and many defects were found in the companies' equipment. In 1870 T.G. Barlow, a consulting engineer,⁵ stated that Bartholomew's 7 ft long iron retorts at Dalmarnock produced only 4,000 cu ft each, while the 6ft 6 inches retorts at the other stations gave 6,500 cu ft. He recommended major reconstruction there, with 100 new clay retorts, and more modern furnaces, followed by the conversion of 200 old retorts. Improved gas mains were required throughout the city so that "District Gasholders" could be discontinued together with private gas mains which some industrial premises had laid to them. Better integration of the distributive system was required. On extra land at Dalmarnock, Barlow proposed the erection of two large new gasholders each of 1.25 million cu ft, a Retort House to hold 400 retorts, and a tramway to Dalmarnock Railway Station.

He forecast an annual growth in demand of ten to twelve per cent in Glasgow, and thus the Corporation was immediately faced by the need to finance large scale extensions. Maximum daily consumption

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1. Glasgow City Archives Miscellaneous Papers, Vol. 15, pp. 435, 471-3 Vide infra Appendix XII.2 p.1652
 2. Ibid., p. 439
 3. The Gas Supply of Glasgow (1935, Glasgow Corporation Gas Department)
 4. W. Foulis, manager from 1869-1903, was the principal agent in unifying the Corporation gasworks into an efficient organization. Vide infra 'Labour' p.641
 5. T.G. Barlow "Gas Report" 14/2/1870, Glasgow City Archives Miscellaneous Papers Vol. 18, p. 258

in winter, when storage and production were faced by peak loads, had risen from 6.165 million cu ft in 1869 to 6.794 millions in 1870. Dalmarnock works were not extended until 1882, but during the 1870s Glasgow effectively met the growing demands for gas by constructing a new gasworks at Dawsholm in 1871 with direct connections to the North British and Caledonian Railways. Production at Dawsholm¹ rose from three million cu ft per day to eight million by 1883.

The efficiency² of Glasgow gasworks was greatly improved, and better technology enabled cheaper coals to be used. This success was a considerable encouragement to other municipal gas organizations, although the price of gas had to be raised from 1873-6 because of very high coal prices.³ From 1869-85, £479,783 was

1. In 1890 Glasgow Corporation purchased the adjacent 'Temple Gasworks' from Partick, Hillhead and Maryhill Gas Company, and constructed a tunnel beneath the Forth and Clyde canal to carry gasmains, foot and railway traffic between the two works, as part of a major extension programme. 512 extra retorts build at Dawsholm in 1892, and 512 in 1896.

Glasgow Herald 18/9/1896; Glasgow City Archives Miscellaneous Papers Vol. 27, p. 279. Vide infra 'Technology' p.387; also p.1585

2. J. Bell and J. Paton, Glasgow - its Municipal Organization and Administration (1896, Glasgow) p. 264 et seq.

Glasgow gas supply is described also in:

A. Shaw, Municipal Government in Great Britain (1895, London) pp. 120, 202; Lord Provost D. Richmond, Notes on Municipal Work (1899, Glasgow); Municipal Enterprises - Glasgow (1904, Glasgow. Handbook of 22nd Congress of the Sanitary Institute); Gas World 4/6/1887 p. 718 "Glasgow and Its Gasworks"; Municipal Glasgow - Its Evolution and Enterprises (1914, Corporation of Glasgow); Greater Glasgow - 1914 (1914, Glasgow) p. 95 et seq.; Statistics of Glasgow (1871-1885, Glasgow, annually); Facts and Figures Bearing on Glasgow Corporation Gas Works Purchase Bill, 7/1/1869, Glasgow City Archives, Miscellaneous Papers, Vol. 18, p. 252.

3. Gas World 24/10/1885, p. 542

written off for depreciation, but the Sinking Fund operated well and reduced the Corporation's debts from £534,265 in 1870, and £1,063,999 in 1875, to £600,924 by 1885.

TABLE 5.35 Improved Efficiency of Glasgow Gasworks
1869 - 96

(1) Capital equipment per 1 ton		
coal carbonized	(1869 - 70	£3 11s 10d
	(1870 - 71	£2 5s

(2) Coal Costs -

<u>Date</u>	<u>Tons Coal Carbonized</u>	<u>Cost per Ton</u>
1869-70	148,110	13s 5d
1895-96	516,351	9s 1.74d

SOURCE: Bell and Paton, Glasgow (1896) op. cit.

1874 was a year of crisis¹ for the municipal gasworks. The statutory maximum prices they could charge for gas² were inadequate to offset inflated raw-material costs, and many municipal authorities were obliged to apply rates³ against all householders to subsidise gas consumers. During 1874, as coal prices soared, Kilmarnock⁴ council reported a deficit of £221. At Arbroath⁵ the deficit was £1,347, and while gas cost 6s 10d per 1,000 cu ft to

1. Glasgow made a deficit of £14,378 in 1873-4, and was forced to use poor coal giving only 7,200 cu ft per ton. The Capital debt had increased by £510,374 since municipal takeover, to £1,044,639. The Journal of Gas Lighting declared them to be "second in efficiency to none in the United Kingdom", and with a producing power far in excess of current demand. But there was much dissatisfaction in Glasgow, since consumption had risen one-third while capital expenditure had risen fifty per cent, and the capital was excessive at £5 per ton coal carbonized. 5d per 1,000 cu ft gas sold went to pay the interest on loans. Municipal enthusiasm had exceeded expediency and gas prices had to be raised to 5s 5d. J.G.L. 8/9/1874 p. 330; 15/9/1874 p. 362

2. Vide infra p.1103

3. 'Gas Contingency Guarantee Rates' vide infra p.1095

4. J.G.L., 6/10/1874

5. J.G.L., 14/7/1874

produce it could not be sold for more than 5s 10d so that the gas contingency rates had to be levied at 7d in £1 on all ratepayers in the town. Renfrew council¹ reduced their discount from seven and a half per cent to five per cent for large consumers. In 1875 Arbroath had a deficit of £583, and Dundee² of £2,052. Aberdeen³ had a deficit of £1,291, but in confidence of lower coal costs, reduced gas prices from 5s to 4s 10d. The crisis did, however, serve to prove that municipal management was at least as efficient as that of gas companies which equally failed to anticipate the crisis, and in the absence of price controls recovered their heavy expenses through high gas prices. This action stimulated the demand for municipal control of gas in the late 1870s.

Municipal gasworks employed very similar accounting methods to the companies including some capitalization of profits. During 1874 Kilmarnock⁴ corporation experienced an increase of 13.75 per cent in the annual consumption of gas, but an overall deficit of £688 lls., of which £221 14s was caused by the high prices of coal and labour. £466 17s was caused by charging that amount to the revenue account instead of the capital account, for enlarged purifiers which cost in total above £966. The remainder was charged to capital, a common practice in ordinary companies. The Corporation decided against a costly appeal to the Board of Trade to allow higher gas prices under the Gas and Water Facilities Act. Instead the deficit was subtracted from reserve funds,⁵ carried forward from former years, reducing

1. J.G.L., 21/8/1874

2. J.G.L., 9/11/1875

3. J.G.L., 2/11/1875

4. J.G.L., 20/10/1874

5. A Sinking Fund to redeem mortgages was not due to commence until 31/10/1874

those funds to £604. Compared to a total "expenditure" of £44,600 up to 1874, which included £42,466 spent on the gasworks to date, Kilmarnock had £38,950 mortgage debentures and £4,500 Bonds, as well as a loan of £547 from the Bank. Until the proportion of low interest bonds and loans could be increased, the amount paid to annuitants and mortgagees made the financial position little different to that in a normal gas company.

The 1876 Burghs Gas Supply (Scotland) Bill¹ was promoted by Sir William Anstruther, MP for Lanarkshire, as a result of public consternation over actions by Brechin Gas company.² That company commenced in 1841 with a capital of £1,800 in £5 shares, and by 1870 had a capital of £2,700. It was prosperous, and besides giving ten per cent dividends had invested surplus profits in extending the works. When the local Commissioners of Police considered acquiring the gasworks, the directors proposed raising the nominal and paid-up value of shares from £5 to £10 in order to represent the capital actually invested, but the public vociferously complained.

The enabling Act of 1876 contained the same general regulations as other Municipal Acts regarding gasworks, but could be adopted without the heavy expenses of applying direct to Parliament, by a decision³ of the Town Council or Police Commissioners, and ratified by a

1. In 1874 the Burghs and Populous Places (Scotland) Gas Supply Bill was strenuously opposed by the Journal of Gas Lighting which attempted to organize gas companies to defeat it. J.G.L., 11/5/1874, p. 710

2. J.G.L., 13/6/1876

3. In the event of twenty ratepayers objecting to the decision, it had to be ratified by a plebiscite of ratepayers.
Burghs Gas Supply (Scotland) Act 1876, a. 2,3.

majority of two-thirds after the next municipal elections. The takeover was normally to be under conditions mutually agreed with the gas company,¹ but a Council could bypass an obstreperous company by applying to the Sheriff² for permission to make compulsory purchase.

In Dumfries³ public opinion in the early 1870s had favoured council control of the gasworks, but the cost of a private Act had deterred them. Moving the final resolution for takeover in 1876, as the first town to utilize the Burghs Gas Supply Act, Mr Wood stressed that Corporations managed gasworks as efficiently as did companies, and since gaslight had become "indispensably necessary" it could not be tolerated as "a monopoly, owned by a few, who give us good or bad gas, dear or cheap, just as they please". He showed the low gas prices charged by thirty-one English municipal gasworks which at that time far outnumbered those in Scotland, but the Scottish municipal gasworks on average gave a high candlepower of 28.35, for only 4s 5d per 1,000 cu ft. The Maxwelltown and Dumfries company gave gas of only 21.77 candlepower at 6s, and although it had recently been reduced to 5s 10d, the Police in Maxwelltown had been using oil lamps in protest. Mr Wood claimed that their poor gas was worth only 3s 5d, and with an annual consumption of 25 million cu ft it was a surcharge on the community of £3,000.

Burntisland was supplied from a gasworks owned by the North British Railway Company which raised the price of gas during the coal crisis. In 1875 they refused to reduce the price to its former

1. Ibid., a. 20

2. Ibid., a. 21

3. J.G.L., 3/10/1876, p. 495

TABLE 5.36 Quality and Price of Municipal Gas Supplies
(1876)

<u>Corporation</u>	<u>Candlepower</u>	<u>Price</u>
Perth	28.18	4s 7d
Greenock	29.43	4s 7d
Aberdeen	29.00	4s 10d
Kilmarnock	28.50	5s
Paisley	28.13	4s 2d
Dundee	27.83	4s 2½d
Glasgow	27.43	4s 2d

SOURCE: J.G.L., 3/10/1876 p. 495

level of 6s 8d, as retaliation for disagreements with the Town Council over building the town docks.¹ This produced popular agitation for municipal control of the gas supply, and the Burghs Act was used two years later to acquire the works.² Local grievances of this type produced a rush of municipal ownership schemes in the late 1870s, which slowed to a trickle by the late 1880s and onwards.

Wishaw³ police commissioners from 1874, were motivated to take control by high gas prices, sixty per cent above those of nearby Motherwell, equivalent to over £2,000 a year. Conversely Motherwell council⁴ a decade later was stimulated simply by the profitability of the company. Share values doubled in 1871-2, and in 1878 when the nominal value of shares was raised fifty per cent. The £1 Motherwell shares of 1871 had a market value of three guineas by 1883. Castle Douglas⁵ police only wanted cheaper gas, having paid 10s per 1,000 cu ft from 1872 to 1883.

1. J.G.L., 31/8/1875; 7/8/1875

2. Burntisland council paid £6,300 for the works; J.G.L. 11/12/1877, 17/6/1879

3. J.G.L., 30/3/1874

4. J.G.L., 20/11/1883

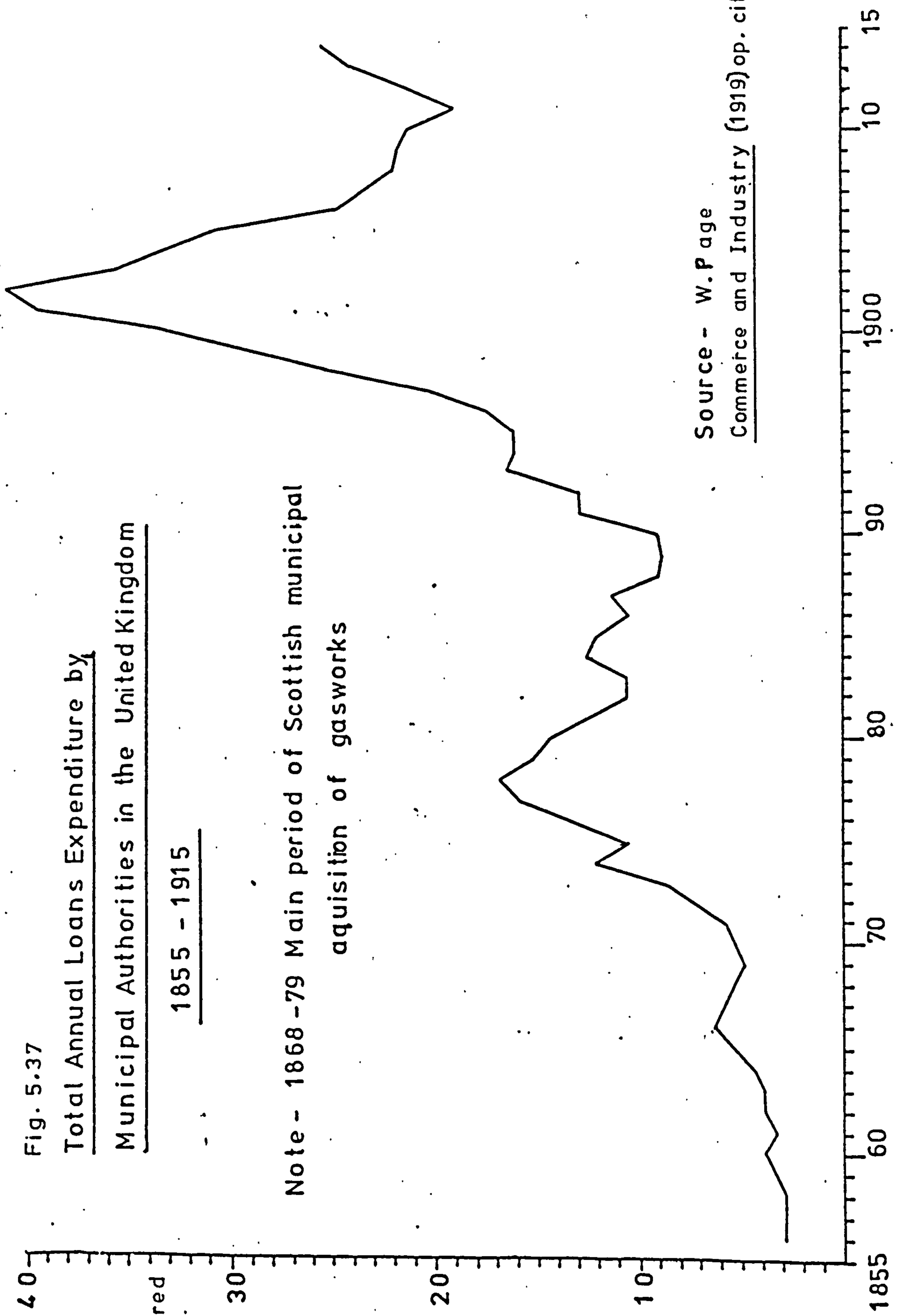
5. J.G.L., 11/3/1884, 11/12/1884

40
30
20
10
1855

£
hundred
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Fig. 5.37
Total Annual Loans Expenditure by
Municipal Authorities in the United Kingdom
1855 - 1915

Note - 1868 -79 Main period of Scottish municipal
aquisition of gasworks



Source - W.P. Page
Commerce and Industry (1919) op. cit.

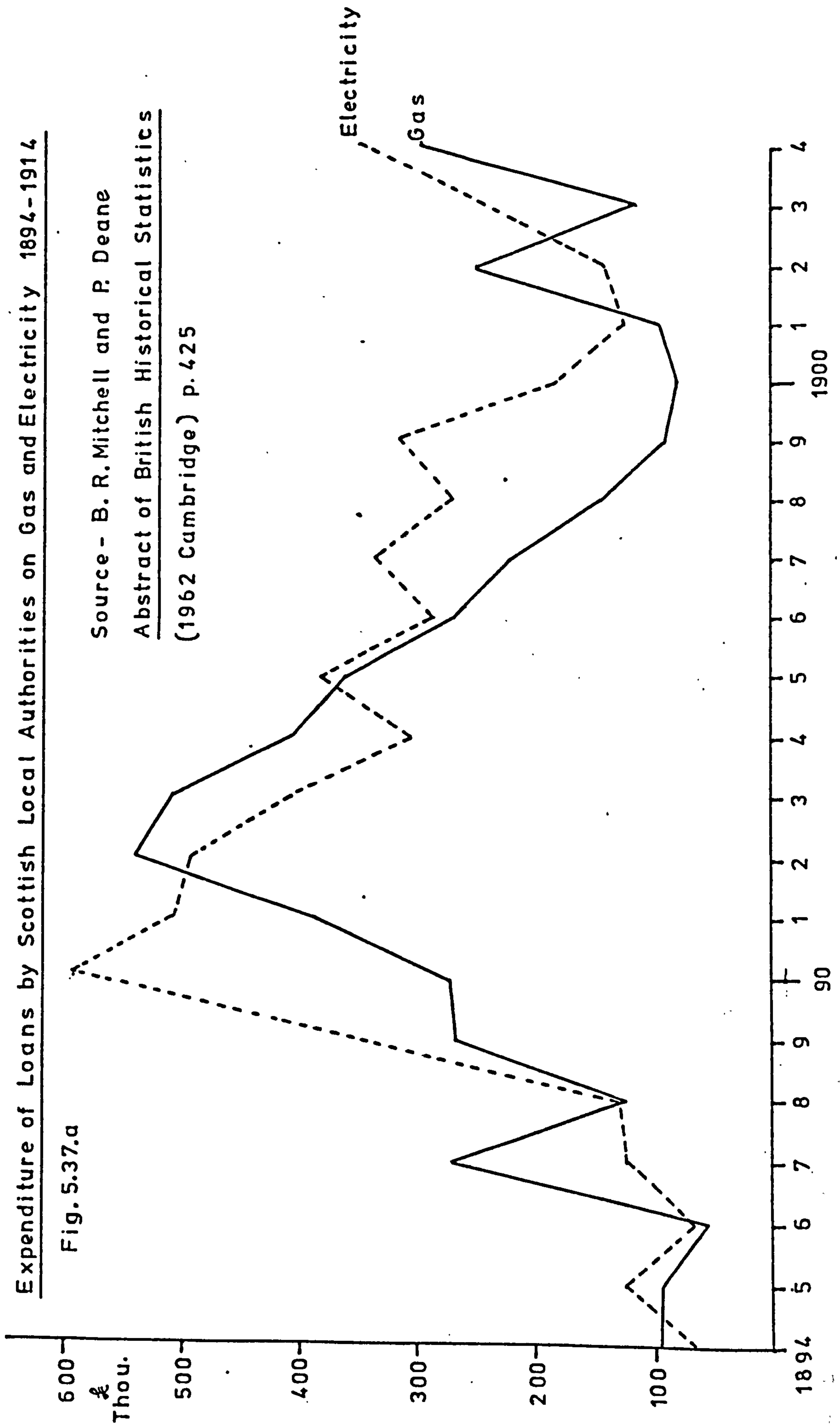
Expenditure of Loans by Scottish Local Authorities on Gas and Electricity 1894-1914

Fig. 5.37.a

Source - B. R. Mitchell and P. Deane

Abstract of British Historical Statistics

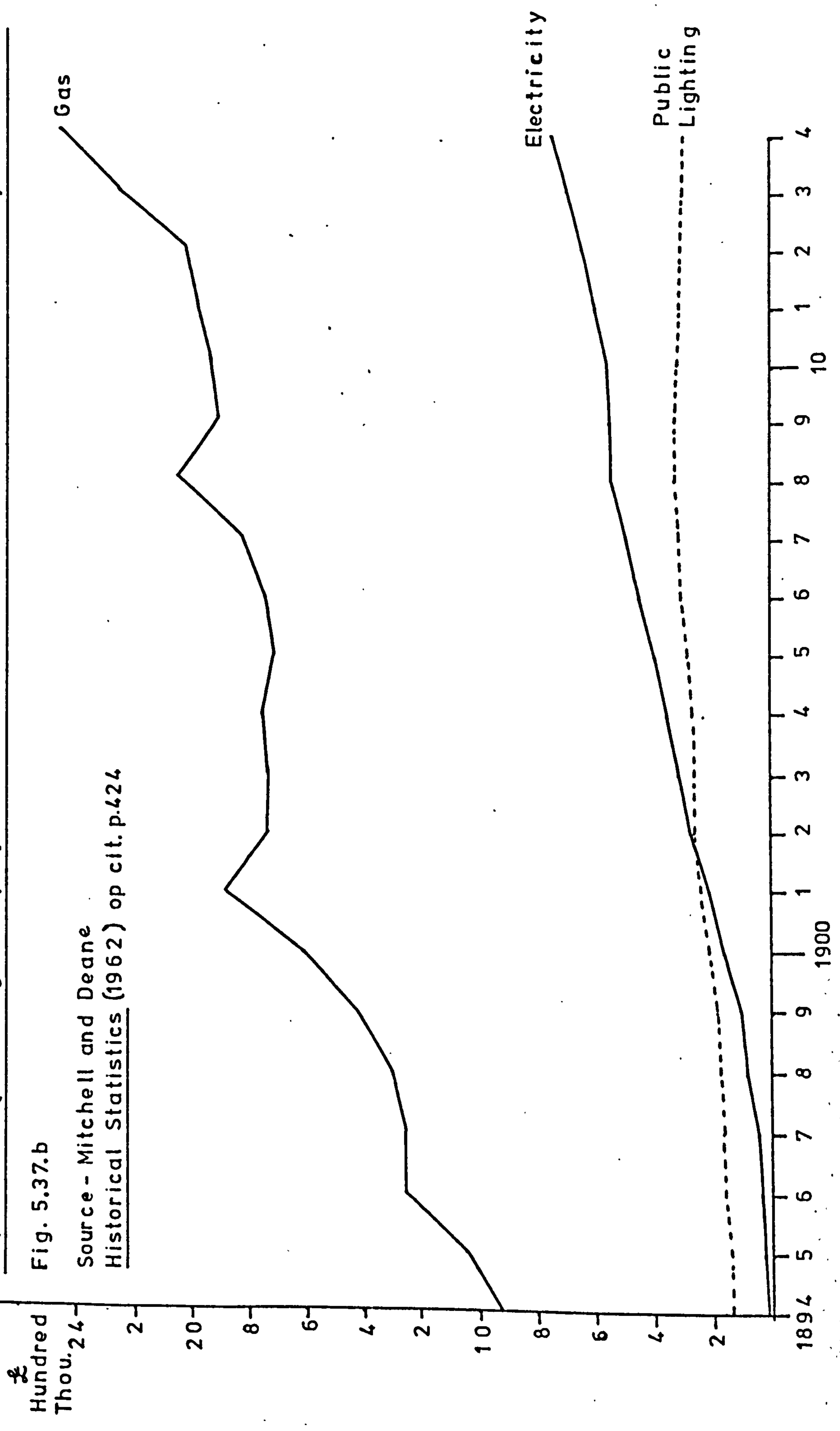
(1962 Cambridge) p.425



Expenditure (excluding loans) by Scottish Local Authorities on Gas and Electricity 1893 - 1914

Fig. 5.37.b

Source - Mitchell and Deane
Historical Statistics (1962) op cit. p.424



Gas companies profited handsomely from municipal takeovers, because they were made at the true value of the works, and not at the nominal value of stock as Brechin Council had hoped to do. When Kirkintilloch¹ works were purchased in 1878, the nominal capital was £7,000 in shares of £5, but the corporation was obliged to pay £10 per share. The market value of shares had recently been £10 5s to £10 11s 6d, and the purchase price was fixed by arbiters, Mr Foulis of Glasgow gasworks acting for the Burgh, and Mr Wilson of London for the company, with an "oversman", Mr Reid of Edinburgh and Leith Gas company.

Periods of low interest rates² on loans stimulated and coincided with those of municipal action. Considerable sums were involved.³ In 1872 Kilmarnock corporation⁴ sought a loan of £40,500 and the Standard Life Insurance Company offered to supply part of that loan at four and a half per cent interest. The Corporation⁵ first requested seven years before repayment, but finally agreed to take £28,000 at four and a half per cent repaid in three installments after five, nine,

1. Falkirk Herald 19/9/1878; J.G.L., 3/9/1878

2. Vide infra 'Finance' p.732 Fig. 4.4

Total Number of Municipal Gasworks Purchases in Britain

1844 - 67	13;	1869-78	68	including 29 in 1877-8;
1879 - 92	19;	1893-1903	67	

SOURCE: F.R. Jervis, The Evolution of Modern Industry (1960)
pp. 189-94

3. e.g. Perth council in 1871 paid £45,000. J.G.L. 16/7/1889

4. M.S.S. Standard Life Directors' Sederunt Book 9/1/1872 (courtesy of Dr. J. Butt, University of Strathclyde).

5. Ibid., 27/2/1872; 12/3/1872.

and twelve years. £8,000 was repaid¹ in 1881. Long-term arrangements of this nature ensured that corporations did not suffer unduly from fluctuations of the money market during the immediate interval after purchasing a gasworks. Dunbar² council was able to purchase the local gas company in 1886 after taking a loan of £7,000 at four per cent interest from the Scottish Legal Life Assurance Company of Glasgow. Although secrecy by municipal authorities prevented many such figures from being published, other commercial firms are known to have also provided loans. During 1886 Johnstone³ gas commissioners borrowed £3,600 at four per cent interest from Messrs. H. Salter and Sons of London to finance purifiers and other new equipment. In 1903 the large investment portfolio of a jute firm,⁴ H. Walker and Sons Ltd., included £15,000 to Dundee Gas Commissioners.

By 1887 the Burghs Gas Supply (Scotland) Act had been adopted⁵ by at least seventeen towns including Johnstone, Kirkintilloch, Wishaw, Kilsyth, Denny, Gourrock, Alloa, Burntisland, Peterhead and Elgin. The system worked well. Those who opposed the practice of English municipal authorities, which used the gasworks profits to reduce municipal rates and thus subsidize non-consumers, tried to

1. J.G.L., 15/3/1881

Kilmarnock council originally paid £40,500 for the gasworks, but by 1879 had spent a further £4,700 on extensions to meet rising demand. Output was 29 million cu ft per year in 1873, 47 millions in 1884, and 48.9 millions in 1885. In 1885 the Corporation still had a debt of £37,625.

J.G.L., 15/3/1881, 14/10/1884, 11/8/1885

2. J.G.L., 19/10/1886

3. J.G.L., 16/2/1886, 20/10/1885, 17/8/1886

4. B. Lenman and K. Donaldson, "Partners' Incomes, Interest and Diversification in the Scottish Linen Area 1850-1921", Business History 1971 Vol. XIII

5. Vide infra Appendix VIII.7 p.1568

TABLE 5.38 Municipal Purchases - Approximate Amount (or Annuities) paid per £100 Capital Stock

<u>Town</u>	<u>Date</u>	<u>£</u>	<u>Town</u>	<u>Date</u>	<u>£</u>
Aberdeen	1871	250	Forfar	1871	187
Alloa	1877	232	Glasgow	1869	209
Arbroath	1871	175	Inverness	1875	153
Broughty Ferry	1870	150	Kilmarnock	1872	150
Dumbarton	1873	225	Kirkintilloch	1878	200
Dumfries	1878	151	Paisley	1845	160
Dundee	1868	160	Perth	1871	156

N.B. Kirkintilloch was only £169 after allowing for £1,300 reinvested from profits.

SOURCE: T. Newbigging, The Gas Manager's Handbook (1883) 3rd edition, p. 302

persuade W.E. Gladstone¹ to place them all under the Scottish "self-supporting system" in which revenue was adjusted so that it did not exceed expenditure. In 1892 Parliament was informed that "the number of municipal gasworks largely preponderate in Scotland, and to some extent in Lancashire",² but fell to a third of all gasworks in the English Midlands, and a "very small proportion" in the south and east of England. Meade, in 1916, restated that "the supply of gas in Scotland is very largely in the hands of local authorities."³

The 1876 Act was ineffectual where large companies were at loggerheads with the municipal authority. Such disputes led to expensive Parliamentary action as the company promoted a Bill to

1. J.G.L., 26/6/1877 p. 1021

2. B.P.P. "Return of the Rates of Wages paid by Local Authorities ... To people Employed ... at Gas and Water Works" (1892) /Irish University Press, 1870 Industrial Relations Vol. 207 p. XXV / 885_7

3. A. Meade, Modern Gasworks Practice (1916, London) p. 6

protect itself, and the local authority opposed the Bill or prepared one of its own. For example, in 1894 Falkirk Police Commissioners¹ refused to pay £50,000 for the local gasworks, which they considered exorbitant. When the company prepared a Bill² which declared their capital to be £50,000 and gave power to increase it by £40,000, the Commissioners prepared a rival Bill³ for powers to borrow up to £120,000 and construct a new gasworks. The Council petitioned Parliament criticising the management of the company. Since the two competing Falkirk companies had amalgamated⁴ in 1888, the price of gas had risen from 3s 2d to 3s 4d, in 1891 to 3s 9d, and in 1891-4 to 4s 2d, while quality had deteriorated. Gas to public lamps was provided at a discount of twelve and a half per cent, but the police still found it too expensive.

Up to 1887, Falkirk Lighting Company had a paid-up capital of £8,000 in £10 shares, but in that year issued 400 additional shares with £1 already "paid-up". The Falkirk Joint Stock company in 1884 had a paid-up capital of £14,000 in £2 shares, but had previously often manipulated the supposedly paid-up capital, and in 1884 used £2,100 of capitalized profits to raise the nominal and paid-up value of shares to £2 6s., and the total capital to £16,000. In 1888

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1. Falkirk Herald 7/4/1894 pp. 4, 6. As at Brechin, the issue was really over the orthodoxy of capitalizing surplus profits.
 2. The Bill gave eight per cent maximum dividend on original £50,000 capital, and six per cent on new capital. It allowed mortgages of £12,000 secured against original and £10,000 against new capital, a maximum gas price of 4s 5d, and a reserve and insurance fund of one per cent capital value per year.
 3. Falkirk Herald 27/11/1893
 4. Vide infra p.221
One of these was a Consumers company from the 1840s, and illustrated the failure of such capitalist enterprise.

the company employed valuers who estimated the Joint Stock company to be worth £23,519 and the Lighting company £13,500. The Police Commissioners believed this to be inaccurate, and that the amalgamated companies in 1889 watered their capital stock by raising it to £50,000 in fully 'paid' shares of £2. They stated that the works were old and almost worn out, as a result of excessive competition at an earlier date, while the double or quadruple gas-mains in some streets were old or redundant and leaked nineteen to twenty-five per cent of the gas. The Police employed an analyst in the winter of 1890-1 who found the gas to be nineteen candlepower instead of the twenty-six candlepower advertised, and in 1894 they appealed to Parliament not to acknowledge the "watered" capital which was "to a large extent fictitious", or to grant further powers to the company. They believed the extra capital was required to build new gasworks, since the old were in such poor condition, and showed that the company had not published any accounts or balance sheet for many years, and refused to allow the Police to examine the books.

In turn, the company appealed against the Commissioners' Bill on the grounds that the Commissioners were trying to circumvent the 1876 Act which required them to offer fair remuneration to any existing non-statutory gas company before planning their own gasworks. They were also trying to depreciate the value of the gasworks by threatening competition subsidized by public credit. A petition by the ratepayers of Larbert, Carron, and Stenhousemuir opposed the Commissioners because they were well served by the existing company.

Before a House of Lords committee, H.E. Jones¹ showed how he

1. Engineer of the Commercial Company, London. Falkirk Herald
25/4/1894, 28/4/1894

could construct a gasworks in Falkirk for only £30,000. At 3½ per cent interest on that sum, it represented an annual saving to the Burgh of £3,025 compared to eight per cent on £50,000, as demanded by the company. A single set of mains would halve the leakage to fourteen or seventeen per cent, saving 4½ million cu ft a year, equivalent to coal worth £550. The reduced cartage, and wear and tear, on a new works could save 9d per ton of coal, or £4,721 per year. Mr Blennerhassett concurred, on the basis that for Central Scotland the capital invested in a gasworks at that date should not have exceeded £500 per million cu ft of gas sold, whereas at Falkirk it was £900 per million cu ft. Consequently, the price of gas was too high in Falkirk.

TABLE 5.39 (1894) Gas Prices related to Scale of Output

Town	Million cu. ft. gas output	Price per 1000 cu ft	Town	Million cu. ft. gas output	Price per 1000 cu ft.
Kilsyth	8	3s 9d	Paisley	272	2s 10d
Kilmarnock	79	2s 10d	Alloa burgh	42	3s 4d
Dumbarton	42	3s 3d	Dumfries	59	3s 6d
Dundee	509	3s 1d	Hamilton	70	2s 11d
Gourock	14	3s 10d	Greenock	229	3s 3d
Johnstone	26	3s 11d	Falkirk		4s 2d

SOURCE: Falkirk Herald 28/4/1894 ; vide supra p.864

Blennerhassett calculated that Falkirk could make gas at 2s 6d per 1,000 cu ft, and sell it at 3s instead of the existing price of 4s 2d. Falkirk gas company¹ was persuaded to abandon its Bill and sell its

1. The company later protested again over clauses in Falkirk Corporation Gas Bill. Total cost to the Commissioners was about £77,050. Falkirk Herald 23/5/1894, p. 4
Third Statistical Account - Stirling/Clackmannan (1966, p. 328

works more cheaply to the Police Commissioners. In cases involving technical details such as these, Parliament remained the final, if expensive, arbitrator.¹

At Edinburgh,² two gas companies³ continued to compete until about 1860 when a boundary line was drawn informally between their supply zones. The Edinburgh and Leith company in 1864-5 gave a dividend of nine per cent but in 1866 all dividend was cancelled and money used instead to renew competition.⁴ In 1887 the Old Edinburgh gas company promoted a Bill to increase its nominal capital

1. Similarly in the 1886 case of Ardrossan Gas and Water Company. These began in 1845, promoted by Lord Eglinton, as separate companies, but amalgamated in 1874 as a Limited company with £9,750 capital (vide infra pp.950, 1818) From 1874-86 average annual gas revenue was £1,610, and ten per cent dividends were paid. Gas output rose from 5.3 million cu ft in 1875 to 6.6 million in 1885, at 4s. 7d in 1883, and 4s 2d in 1882. Profits were heavily capitalized on extensions in the early 1880s, causing an apparent 'deficit' of revenue in 1882 and 1885, and when the company promoted a Bill for extra capital funds in 1886 it was opposed in Parliament by the Town Council who obtained permission to purchase the works. The Act, with this amendment, cost £800, but in Parliament they had employed two Senior Counsel, three Glasgow firms of solicitors, and many scientific witnesses, which cost the company £2,000 and the Burgh Commissioners £1,000.

J.G.L. 21/12/1886; 29/3/1887

2. Municipal takeover of the gasworks was first proposed in Edinburgh in 1839; W.H. Marwick, "Municipal Politics in Victorian Edinburgh" Book of the Old Edinburgh Club (1969-72) Vol. XXXIII, quoting The Scotsman 16/10/1839

3. Vide supra pp.988, 1011

4. In 1871 two Edinburgh councillors proposed the municipal control of the gasworks, and in 1874 another proposal was made on the grounds that gas was too expensive and of poor quality. Instead, the City Public Analyst, J. Falconer King, was employed to test the gas regularly from 1875 and he found the quality very high, 31 candlepower by the Edinburgh company and 26 by Edinburgh and Leith company. The 1871-4 agitation is closely related to the wave of support for municipal control throughout Scotland at that time.

Edinburgh City Archives Council Record Vol. 303, p. 385 7/2/1871; Vol. 304 p. 420 10/7/1871; Vol. 13 p. 307 22/12/1874; Vol. 315 p. 276 18/10/1875; Vol. 315 p. 388 16/11/1875.

from £200,000 to £400,000, and to provide gas at a maximum price of 3s 6d per 1,000 cu ft subject to a sliding scale of dividends. Dividend was set at ten per cent per year, but as gas prices fell below, or rose above the set price, dividends were increased or reduced by 5s on each £100 stock. Additional gasworks were to be built at Niddrie, and Portobello council attempted to extend the burgh boundary to prohibit that construction.¹

During 1886 the prosperous company had paid £40,000 in dividends, or ten per cent plus twenty-five per cent bonus; the 1829 Act imposing a maximum ten per cent had been abolished by an Act of 1840. Hence Edinburgh town council reconsidered purchasing the company in return for perpetual annuities, but the value of company stock, nominally worth £25, was inflated by this suggestion from £57 to £64 per share.² Musselburgh council³ petitioned against the Bill, which would enable the Edinburgh company to destroy Musselburgh gas company which was more amenable to local control. Both Edinburgh corporation, and the Edinburgh and Leith gas company,⁴ petitioned against the Bill. The company had made excessive profits instead of reducing gas prices, and was not competing rigorously with the Leith company. There was inadequate protection for the

1. Sheriff Crichton refused this boundary change. The new 97 acre site was to be half a mile south of Musselburgh; J.G.L. 18/1/1887.

Vide supra 'Technology' p.388

2. J.G.L. 18/1/1887;

3. J.G.L., 25/1/1887

4. Members of Edinburgh town council in 1887 included the Lord Provost, Sir Thomas Clerk, who was chairman of the Edinburgh and Leith Gas company, and Mr Clapperton a director of the Edinburgh Gas company. Although they were not present on Council committees discussing the Bill, considerable lobbying must have occurred: J.G.L. 15/3/1887; The Scotsman 4/2/1887 p. 5

corporation, and no power to audit the accounts which were never published.¹ Corstorphine and Portobello were included in the supply zone although they had independent gas companies. New land at Niddrie was superfluous as there was no deficiency in supply, and the proposed friendly society for gas workmen should be financed by shareholders and not the public.

Edinburgh corporation were provoked into arguing that the public would be served better by municipal control of the works. Conversely, the Edinburgh and Leith company, with 162 miles of mains and an annual output of 400 million cu ft, argued that the new competition would be unfair. Since Parliamentary Committees had recommended monopolies in gas supply, and Edinburgh was the only remaining town in the United Kingdom with unrestrained competition between Incorporated gas companies, the best solution was for Parliament to draw boundaries between the two companies.

The Scotsman² campaigned fervently in favour of municipal takeover, with articles describing its success at Birmingham, Glasgow, Aberdeen, Dumfries, Greenock, Carlisle, Manchester, and Arbroath. The Gasworks Clauses Acts of 1847 and 1871 were criticised³ because "the clause restricting the rate of dividend was frequently evaded (1) by converting loans into share capital; (2) by issuing new capital to shareholders at par, although it was worth a considerable

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1. The proposed legislative controls were to be even weaker than those in the private Acts of 1818 and 1840.
 2. The Scotsman 18/1/1887 p. 7, 19/1/1887, 20/1/1887, 21/1/1887, 22/1/1887, 25/1/1887, 27/1/87, 29/1/87 respectively.
 3. The Scotsman 7/1/1887 p. 4, with review of Gas Acts since 1809.

premium". Only since 1877 had Standing Orders required new private gas Acts to compel sale by auction to the highest bidder, a maximum five per cent dividend if loans were converted into share capital, and a sliding scale relating dividends to the price of gas.¹ The Edinburgh company claimed that of all chartered gas companies listed in 1886 it had the second smallest share capital in proportion to the gas sold. £55,548 gained as premiums under the 1840 Act, and £77,478 accumulated from up to two per cent annual profits, had been invested in extending the works but carried no burden of dividends to raise the price of gas.

By 1887 Glasgow Corporation had raised the gas output by 250 per cent. They paid only seven per cent annuities^{*} from 1869, because the financial climate prompted the companies to accept whereas a few years later they would have requested ten percent. The Corporation had financed improvements with capital loaned at only three and a half per cent interest, and had abandoned those sub-stations which were badly deteriorated. New works and extensions at Daws-holm, Dalmarnock and Tradeston cost £600,000 but almost all was achieved by reploughing profits.² Loans, excluding annuities, had only risen from £115,000 at the start to £140,000, yet the gas price had been reduced from 4s 7d to 3s. Total profits from 1869 to 1887 were £22,391 of which two and a half per cent, or £15,108 was written off for depreciation, and £5,000 used by the Corporation for

1. The Edinburgh Gaslight company defended its position in The Scotsman 18/1/1887.

The sliding scale of gas prices related to dividends had been adopted by all large gas companies since the Metropolitan Gas Select Committee of 1876.

2. The Scotsman 19/1/1887 p. 7. Vide infra Appendix IX.3

* 9 per cent paid on Old stock. Vide infra p. 1085

£21,000. £25,000 was raised on mortgage at $4\frac{1}{2}$ per cent interest, repayable in forty annual installments. Arbitration and conveyancing expenses were £1,200, leaving only £2,800 as working capital. In the first year £1,696 was spent on interest and repayment of mortgages, and the gasworks made a loss of £1,006. The gas manager, A. Malam, advised the corporation that the main pipes were up to fifty years old and leaky, and the retorts defective because the company had allowed them to fall into disrepair in anticipation of municipal action.¹ Even high quality expensive coal gave only 5,371 cu ft gas per ton. Malam accompanied a corporation committee which visited gasworks at Carlisle, Galashiels, Kilmarnock and elsewhere. Their experience led to the adoption of three hour instead of four hour charges of the retorts and closer supervision which resulted in a profit of £792 in 1880. Bulk gas contracts² with large discounts were discontinued, gas sales increased by £1,040, and coal costs reduced by £1,900.

Thereafter Dumfries was able to keep the works successful.³ Gas cost 5s 10d in 1878, but this was reduced to 5s in 1880 despite allowing £300 to a Reserve Fund, 4s 2d in 1881, 4s in 1882, and 3s 9d in 1883-7. This was achieved despite the collapse of the by-product market in 1886 when the value of residuals fell from 4s 7d to 11d per ton of coal carbonized. Gas consumption rose from 24,905,437 cu ft in 1878 to 40,892,555 in 1887, and the corporation

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1. This type of 'sabotage' was by no means unusual before municipal takeovers.
 2. In 1886 only £96 was allowed in discounts, up to a maximum five per cent given to large consumers like woollen mills.
 3. Dumfries was managed by A. Malam until his death in 1883, and thereafter by his son, George Malam.
- Vide infra pp. 333, 636

had enlarged the gasworks without placing an excessive burden on the consumers. During the period 1878-87 £15,000 was spent on extensions, paid partly out of surplus profits, and no extra loan was required until 1886. In that year a new 150,000 cu ft gasholder, and exhaustor, led the corporation to take a new loan of £4,000 but because much of the first loan was already repaid, the total loan was only £1,000 more than in 1878. The output of gas per ton of coal was raised from 5,371 to 8,726, while a better mixture of coal reduced the average price from 19s 10d to 18s 4d per ton. Coal consumption rose by fifty tons, but total expenditure in 1886 was £300 less than that in 1878.

At Arbroath¹ Provost Muir, who was also chairman of the Gas company, suggested municipal takeover of the gasworks to devote part of the surplus revenue "to street improvements and other public purposes." The Council agreed to pay annuities of seven per cent, equal to the normal dividend of £1,400 a year on a capital of £20,000, and an Act was obtained in 1871 despite strong opposition from spinning-mills and factory owners who enforced a maximum gas price of 5s 10d. By careful management, under R.S. Carlow, municipal ownership was most successful. The value of the works,² and gas output rose rapidly.

Simultaneously the price of gas was reduced. From 1871 to 1877 gas cost 5s. 10d, and during the "coal famine" the Gas Contingency Guarantee Rate had to be used for two years. In 1874 it was

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1. The Scotsman 29/1/1887. Vide infra p. 1079
The municipal takeover was back-dated to 30/6/1870.
 2. Large extensions in 1877 and 1881.

levied at 6½d in £1 and gave £1,436 to cover a deficit of £1,347, and in 1875 it was reduced to 2½d and gave £578 to meet a deficit of £582. It was never again used, but had proved adequate to handle the emergency conditions.

TABLE 5.40 Improvement of Arbroath Municipal Gas Works
1872 - 86

(1) Value of Arbroath Gasworks

1870	£20,000
1872	£24,200
1875	£39,427
1880	£43,418
1886	£44,357

(2) Gas Output

1872	30.2 million cu ft.
1875	33.873
1880	37.697
1886	43.4596

SOURCE: The Scotsman 29/1/1887

TABLE 5.41 Gas Prices at Arbroath (1878 - 86)

1878	5s 5d
1879-81	5s
1882	4s 9½d
1883	4s 4½d
1884	3s 11½d
1885-6	3s 9d

SOURCE: The Scotsman 29/1/1887

In 1887 gas price was raised to 4s. 1½d because of the fall in value of by-products, but the enterprise still brought considerable benefits to the town. Half of the annual profits were used for the 'common-good', and amounted to £9,105 since 1871, and half was used to reduce gas prices. The Gas company had obtained a fair price for their works, and the community benefited from extending the gasworks at a cost of only three and a half per cent interest on

loans secured against the gas rates. The opening of streets, and control of public lighting were also much improved under the municipal arrangement.

In April 1887, a committee of Edinburgh corporation¹ successfully negotiated for the purchase of the Edinburgh Gas company,² for ten per cent annuities on a capital of £200,000 to be redeemed by the corporation after twenty-five years at twenty-eight and a half years' purchase price. The corporation was to purchase stock on hand³ at valuation, and also pay all compensation and pensions. The company also received a cash payment of £27,000 as compensation for loss of profits, and retained all unexpended capital, reserve funds and the cash balance which amounted to £63,000.

Later that month a corporation committee⁴ examined the gasworks in detail and decided that a new site really was necessary, preferably with access to sea transport and two separate railway companies. They recommended the Granton area, because railways and suburbs were expected to develop westwards when the Forth Bridge opened, but showed that an alternative site was available cheaply at Niddrie for £36, 000. Not until a decade later,⁵ however, when the Edinburgh

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1. Chaired by Lord Balfour of Burleigh; J.G.L. 5/4/1887 p. 622
 2. Edinburgh company finances were "probably unsurpassed" in Britain. The works had been "largely extended out of revenue." In 1884 a bonus of £45,000 had been distributed among shareholders. J.G.L. 3/7/1888 p. 20
 3. Stock on hand was about £30,000. In total the shareholders received payments, during the year of takeover, amounting to £157,965 on a nominal capital stock of £200,000; besides the right to future annuities. J.G.L. 3/7/1888
 4. J.G.L., 12/4/1887
 5. T.R. Cameron, "A History of Gas Manufacture in Edinburgh", (1951 Typescript) Edinburgh Ref. Lib.
W.R. Herring, "New Gasworks at Edinburgh" Gas World 1899, pp. 90-4.

town site was so crowded that the only alternative to a three-storey gasworks¹ at New Street, was the Granton site developed under the supervision of W.R. Herring.²

In July 1887 the corporations of Edinburgh and Leith decided to take full control of gas production and negotiated successfully to purchase the Edinburgh and Leith gas company. Their gasworks* had been extensively reconstructed since 1881 under the manager F.T. C. Linton, with Siemens regenerative furnaces and other new technology which was about to raise profits. In 1886-7 the revenue had risen by £3,000 on gas consumption, and a saving of £3,000 made with the new retorts. Consequently although annual dividend had only been eight per cent for many years, the company gave ten per cent in 1887 and demanded annuities of ten per cent.

All premiums from the sale of shares had been spent improving the works, and a recent bank loan of £11,700 had all gone to improvements. £32,000 spent on mains and service pipes since 1869 had reduced leakage to 8.72 per cent, compared to 11.82 per cent for the Edinburgh company, and although the Leith gasworks sold only 400 million cu ft per year, the plant was designed to make 750 millions. The new plant allowed cheaper coals³ to be used. In 1884 the coal used cost 15s 2d a ton and processing cost 6s 10d, a total 22s per ton carbonized. In 1887-8 the coal cost 11s 1d, and processing 5s 8d, a total of 16s 9d. On 39,744 tons used annually this represented a saving of £10,433. Since 1858 the North British Rail-

1. Like that built in Manchester by Hawksley, King and Livesey.

2. Vide infra 'Labour', 'Technology' pp. 378, 640

3. J.G.L., 17/7/1888

* Vide infra Appendix IX.2.viii p.1579

way had been under an obligation to the company to remove refuse free of charge. On 14,500 tons of refuse per year at 1s a ton, as other gasworks paid, it was a saving of £725.

TABLE 5.42 Financial Condition of Edinburgh and Leith Company Gasworks (1887)

(1) Profit and Loss Account 1886-7:

Revenue	£74,667	Dividend 10 per cent
Profit	£18,491	Carried Forward £8,253
Brought Forward	£ 4,375	

(2) Total Expenditure on Edinburgh and Leith Gasworks to 1887

Capital	£150,000	0s	0d
Debenture Loan	20,000	0	0
Bank Loan	11,700	0	0
Premium on Shares	6,883	9	11
Capitalized Profits	118,979	15	5
TOTAL	307,563	5	4

SOURCE: J.G.L., 17/7/1888

£97,500 had been spent within the past nine years on extensions, and the company was therefore in a strong bargaining position. It received £11,000 for loss of profits, £20,000 for stores on hand, and retained the reserve funds of £21,723 in addition to 9.33 per cent annuities. Within twelve months, shareholders received a total £82,410, over half the nominal value of the whole capital stock.¹

The Edinburgh company had allowed New Street gasworks² to fall into disrepair and the Edinburgh and Leith Commissioners were immediately involved in expensive alterations supervised by Robert Mitchell,

1. J.G.L. 3/7/1888 p. 20

2. The □ retorts, 21 inches by 15 inches by 9 feet long carbonized about 21 cwt per day each; J.G.L. 5/2/1889
Vide infra 'Technology' p.260

their engineer. This included a new bench of forty ovens, each with eight retorts, heated by carbonic-oxide combustion from producers. Nevertheless, the Commissioners managed their enterprise profitably from the start¹ despite the vast scale of the undertaking.

TABLE 5.43 First Annual Balance Sheet of Edinburgh & Leith Gas Commission, 1888

EXPENSES - (nearest £)		Annuities 1/8/1888 to	
Coal	66,683	Whitsun 1889	26,501
Purifying material	4,278	Interest on Mortgages &c	3,232
Salaries & Wages	25,863	Expenses of Takeover	1,081
Maintenance	<u>6,278</u>	Expenses of Mortgages	<u>557</u>
	103,052		31,371
Distribution Costs	124,887		
INCOME -		Gas	169,993
		Meter Rents	6,527
		Rent of Property let out	403
		Residuals	18,381
		Transfer fees	<u>20</u>
			195,324
PROFIT -			
	70,437		

SOURCE: J.G.L., 2/7/1888

N.B. Edinburgh and Leith companies' accounts appear elsewhere: vide Appendix IX.2 and J.G.L. 26/6/1888, 17/7/1888

The achievements of municipal gasworks may be judged by two criteria, their ability to introduce new technology and hence improve

1. Despite regular problems from water seepage, which was pumped away from a twenty-four foot deep well, and a law suit made by George Mackay & Co., brewers, over pollution of water supplies.

J.G.L., 12/3/1889, 4/3/1896.

efficiency, and their concomitant ability to sell gas at least as cheaply as gas companies of an equivalent size. Small municipal gasworks¹ faced all the technical problems of small companies, and in some cases gave little improvement² to the consumers. Occasionally unprofitable works were purchased simply to keep them open, as at Tain,³ where the company in 1890 made a loss of £65, and paraffin had to be used for street lighting.

Lockerbie gasworks, established in 1854, was another inefficient company when purchased by the Town Council⁴ in 1891 for £5,182. The output in that year was two million cu ft, and despite a fairly high price of 6s 8d per 1,000 cu ft, the Council made a trading loss. Gross profit was £97 but the interest on loans and mortgages amounted to £152. An outside consulting engineer was employed the following year, and the Council had to borrow an additional £600 for the improvements he advised which included rebuilding the retort-bench, and purchasing larger second-hand purifiers, and a condenser and scrubber.

The original works had been under-capitalised, and the Council was left to make the best of them. Nevertheless, the Gas Contingency Guarantee Rate had to be employed continuously to avoid raising gas prices above those charged by the former company, and the

1. Economies of scale, vide infra pp.872, 1150

2. e.g. Port Glasgow in the 1870s; vide infra Appendix VIII.4.ii p.1563

3. In 1891 the deficit rose to £98. The Police offered a purchase price of £1 10s per share in 1890, but during the 1880s the nominal value of shares had been raised from £2 10s to £3 10s to reflect the reploughing of profits.

J.G.L. 30/9/1890, 7/10/1890, 27/10/1891

4. R.W. Cowie, "The Financial Difficulties of a Small Municipal Gasworks" N.B.A.G.M., 1908.

gas price still remained very high compared with other towns. The police-rate payers were forced to subsidize the gas consumers, yet the works remained starved of capital and consequently very inefficient. There was no exhauster until 1897, when it was purchased by capitalizing profits, and two years later £244 was abstracted from revenue to finance part of the cost of a nearby house built for the manager. The remainder was charged to capital.

Because of rising demand, the works remained far too small until major extensions in 1901 when storage capacity was increased from 14,000 to 30,000 cu ft, and a new governor and station meter installed. Of 1,680 yards of mains laid that year, however, most were to replace worn-out pipes, and only 400 yards went to extend the supply. Not until the period 1904-7 was better technology properly implemented. The dilapidated retort-house, which gave 7,900 cu ft gas per ton of coal instead of 10,000, was replaced by a new retort house and coal store. Patent regenerative ovens by Waddell were installed to raise gas productivity, a steam boiler fitted for producer gas and motive-power to the pumps, and new annular condensers and purifier to improve gas quality. The reserve fund of £431 was exhausted, and £1,500 borrowed at three and a half per cent interest, but the impact of these improvements illustrates how great the former disadvantages of under-capitalization had been.

A similar problem arose at Kilsyth where influential residents in 1884 proposed to start a new, competing company. The Old company tried to encourage the Police Commissioners to purchase their works for £1,400, but the New company persuaded them to turn this

TABLE 5.44 Improved Efficiency by Technological Change
at Lockerbie Gasworks (1905 - 8)

Date	<u>1905-6</u>	<u>1907-8</u>
Gas Made	6,825,000	7,568,500
Tons Coal carbonized	862	735
Cu ft gas per ton coal	7,917	10,289
Tons Coke sold	187	239
Tons lime used in purifiers	39½	24

SOURCE: N.B.A.G.M. 1908

TABLE 5.45 Financial Problems of Lockerbie Municipal
Gasworks (1892 - 1908)

<u>Year to 15 May</u>	<u>Gas Price per 1,000 cu ft</u>	<u>Gas Contin- gency Rate levied in Town</u> (Old Pennies in £1)	<u>Gas Sold (Thousands cu ft)</u>	<u>Loans Outstanding</u> £
1892	6s 8d	1	2,227	5,400
1893	6s 8d	2	2,254	5,400
1894	6s 3d	5	2,220	5,265
1895	6s 3d	5	2,649	5,730
1896	6s 3d	5	3,168	5,575
1897	5s 10d	4	3,490	5,420
1898	5s 5d	3	3,775	5,265
1899	5s	3	4,163	5,110
1900	5s	3	4,421	4,955
1901	5s	3	4,968	4,800
1902	5s	3	5,423	6,145
1903	5s	3	5,505	5,930
1904	5s	3	6,110	5,715
1905	5s	2	6,281	5,500
1906	5s	2	6,106	5,285
1907	5s	2	6,392	6,570
1908	5s & 4s 2d	2	6,606	6,295

SOURCE: N.B.A.G.M. 1908

down.¹ Hence, in terms of the Burghs Gas Supply Act, they could not adopt the Act for the next three years, but local opinion swung in favour of municipal control which was effected late in 1884 by the Commissioners giving personal security for a bank loan in order to purchase the old works from Brown, Frew and White, for £1,675. Their plans to rebuild the works were therefore postponed.

The Police borrowed £2,000 for twenty-five years, repayable in instalments of £40. They were soon faced with operating problems² and employed a consulting engineer, Mr Wilson of Coatbridge, who showed that wastage was due to old equipment and inadequate condensation. In 1886 rich coal produced only 7,789 cu ft gas per ton, though the works had earlier given 9,289 cu ft. The Commissioners followed Wilson's advice and purchased a new tar tank, station meter, governor, gasholder and retort bench for £1,100 from Messrs Laidlaw, Sons and Caine of Glasgow. Despite this virtual reconstruction of the works, leakage in 1888 was twenty-three per cent, while annual gas revenue and meter rent was only £837. Gas output per ton of 14s coal reached 9,900 cu ft., but for economy the Commissioners switched to poorer gas from cheap coal at 8s a ton, giving 7,520 cu ft which reduced production costs from 1s 9d to 1s per 1,000 cu ft.

Larger municipal works at Broughty Ferry and Forfar achieved

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1. J.G.L. 25/3/1884, 15/4/1884, 22/4/1884, 18/11/1884. Gas & Water 31/10/1885. The two principal shareholders in the Old company were William Brown, manager of Maryport Iron Co., Cumberland, and John Brown oil and paint manufacturer of Whitehaven. They attempted to sue the Police Commissioners, but were refuted by Lord McLaren.
 2. J.G.L. 8/5/1883, 13/5/1884, 20/4/1886, 4/5/1886, 8/2/1887, 8/3/1887, 6/9/1887, 14/2/1888, 5/6/1888

considerable success in increasing the supply of gas whilst lowering the price, and at the same time minimising the cost of annuities and loans in relation to each thousand cu ft sold.

TABLE 5.46 Financial Efficiency at Broughty Ferry Municipal Gasworks (1870 - 1911)

<u>Date</u>	<u>Gas Sold</u> (cu. ft)	<u>Annual Expenditure on</u> <u>Annuities, Interest, Sink-</u> <u>ing.Fund, and Suspense A/c</u>	<u>Productivity (per</u> <u>1,000 cu ft. Sales)</u> <u>of Loan Capital and</u> <u>Annuities</u>
		(Old Pennies)	(Old Pennies)
1870	8,278,950	206,524	24.9
1880	17,629,552	255,946	14.5
1885	21,631,500	259,791	12.0
1890	25,291,235	322,436	12.7
1895	31,075,094	373,436	12.0
1900	45,530,778	424,416	9.3
1901	56,590,308	269,131	4.8
1902	60,105,116	552,644	9.2
1903	57,476,359	313,336	5.5
1904	52,906,921	148,856	2.8
1905	52,318,485	1,033,493	19.8
1906	53,110,110	1,132,542	21.3
1907	54,786,001	1,251,763	22.8
1908	55,886,754	877,749	15.7
1909	57,955,400	924,400	15.9
1910	60,773,631	734,008	12.1
1911	61,824,100	717,233	11.6

SOURCE: N.B.A.G.M. 1912

In 1870 interest on loans each year cost thirty-four per cent as much as total expenditure on raw materials and manufacture. This was reduced to about twenty-four per cent by 1880, and did not exceed that even when heavy loans were taken in 1905. Within six years, the sinking fund enabled such loans to be well over half repaid. The exceptional circumstances of 1903-5 were caused by a rise of £2,500 in raw material and manufacturing costs, and although minimum gas prices were raised from 2s 6d in 1903 to 3s 6d by 1906, loan capital prevented consumers immediately facing the full price of the

change as they would have done with a commercial company. Falling gas sales in 1903-5 were partly a result of electricity competition.

Forfar¹ municipal gasworks in 1876-85 illustrate the success of municipal management in reducing the price of gas without using appreciably cheaper coals. Leakage was greatly reduced, and although this was a period of rising by-produce revenue, reduced gas and meter revenue more than offset by-product gains. Cheaper purification was introduced, but the principal factor was greater efficiency of operations. From 1876 to 1885 gas prices were reduced from 6s 8d to 4s 4d, and although sales increased from 17.9 million cu ft in 1876 to 23.8 millions in 1885, total gas and meter revenue was lower in 1885.

Paucity of data, and the combined effects of economies of scale and geographical location relative to coal supplies, make it difficult to compare the prices charged by municipal gasworks and commercial gas companies. In the early twentieth century, differential prices for different types of consumption, preclude any comparisons. However, in the period up to 1901, the price of gas supplied by municipal undertakings was not consistently below that of companies and often, as at Dumbarton, reflected the skill of the gas engineer rather than the ideology of cheap gas.² The overall effect of municipal control reducing prices and thereby obliging companies to follow suit to avoid consumer agitation, cannot be gauged.

1. Gas World, Vol. III 1885, p. 25

2. Other municipal financial projects sometimes adversely affected municipal gas management. Elgin municipal gasworks was obliged to use Lossiemouth port for coal shipped from Grangemouth, though Burghead port was cheaper, as Elgin council held £4000 stock in Lossiemouth Railway and Harbour. In 1887, for this reason, shipping costs of 9s6d a ton were paid in preference to the overland rate of 7s6d offered by Highland Railway Company.
J.G.L. 31/5/1887, 5/7/1887

TABLE 5.47 Managerial Efficiency at Broughty Ferry Municipal Gasworks

Date	Total Capital* Expenditure on Works and Plant	Fixed Capital per Million Cu. Ft. Sold	Annual Expenditure			
			Maintenance Manufacture and Raw Materials £	Annuities and Interest £	Sinking Fund £	Annuities as percentage of other Working Costs
1870	11,011	1,334	1,952	665	-	34.1
1880	19,961	1,132	3,285	800	100	24.4
1885	25,421	1,175	4,288	887	175	20.7
1890	24,207	952	3,727	830	175	22.3
1895	26,554	848	4,962	867	430	17.5
1900	35,791	770	6,330	1,066	677	16.8
1901	37,208	653	8,493	1,594	787	18.8
1902	41,236	679	7,006	1,209	846	17.3
1903	48,175	838	8,254	1,393	934	16.7
1904	48,705	917	9,588	1,551	1,143	16.2
1905	49,799	953	6,612	1,526	1,152	23.1
1906	52,597	992	6,692	1,506	1,328	22.5
1907	52,855	966	6,577	1,472	1,349	22.4
1908	53,150	953	7,834	1,492	1,369	19.1
1909	53,097	922	7,164	1,429	1,384	19.9
1910	52,837	874	7,734	1,402	1,382	18.1
1911	52,043	857	7,989	1,360	1,344	17.0

SOURCE: N.B.A.G.M. 1912

* Total Capital Expenditure less monies redeemed out of surplus profits (other than Sinking Fund).

TABLE 5.4.8 Municipal Management of Forfar Gasworks, 1876 - 85

Date	Coal (£)	Coal Per Ton	Lime etc. for Purifier (£)	Percentage Leakage	Gas Sold (Thou. Cu. Ft.)	Gas Price per 1,000 cu. ft.	Gas & Meter Rent (£)	Coke & Tar Revenue (£)
1876	2,548	22s 3d	86	13.6	17,901	6s 8d	6,199	186
1877	2,082	21 0	102	13.8	17,222	5 0	4,545	191
1878	2,218	22 6	111	10.0	17,506	5 10	5,355	129
1879	1,972	21 3	84	7.85	17,266	5 5	4,939	106
1880	2,167	20 9½	116	10.0	18,002	5 0	4,750	133
1881	2,331	18 11½	66	7.5	20,808	5 5	5,899	427
1882	2,400	19 5½	32	6.0	21,637	5 5	5,870	510
1883	2,140	19 7	17	6.0	20,330	5 0	5,083	611
1884	2,373	19 3	16	5.5	21,016	4 7	4,825	822
1885	2,627	20 0	17	4.0	23,815	4 4	5,160	980

SOURCE: Gas World 1885 p. 25

Apart from a rise in gas price in 1878, there is no clear relationship between gas prices and coal prices.

TABLE 5.49 Comparisons of Municipal and Company Gasworks (1884 - 1901)

	1884		1890		1895		1901	
	(i)	(ii)	(i)	(ii)	(i)	(ii)	(i)	(ii)
Arbroath (M.1871)	41,631	4/2	43,703	4/2	46,316	4/2	62,887	4/2
Dunfermline (M.1896)	43,000	3/9	54,400	3/5	59,901	3/0½	82,900	3/9
Broughty Ferry (M.1870)	22,056	4/2	25,776	4/2	29,930	3/9	44,142	2/6
Alloa (M.1877)	22,831	4/2 to 6/8	29,856	3/4	44,276	3/-	70,560	2/6
Dumbarton (M.1873)	17,500	4/7	20,445	4/4½	18,000	4/7½	19,500	5/-
Brechin	29,750	3/6	40,000	3/3	46,500	3/-	70,000	2/9
Inverness (M.1875)	30,880	5/-	40,000	4/2	50,000	4/7	75,000	3/11½
Galashiels	44,200	3/2	52,968	2/11	52,225	3/4	55,090	3/9
Perth (M.1871)	65,084	3/6	79,681	3/4	96,567	3/9	160,539	3/6
Coatbridge	48,673	3/4 to 3/9	65,896	3/4	77,051	3/4	119,173	2/8½
Renfrew (M.1855?)	8,000	4/7	10,554	4/2	12,054	3/9	20,994	3/1
Bathgate	8,100	4/7	7,000	4/2	9,000	4/7	11,000	4/2
Hamilton (M.1868)	38,165	3/6½	48,983	3/4	80,623	2/1	132,400	2/1
Kilmarnock (M.1871)	49,109	4/2	63,000	3/6½	84,000	3/1½	138,896	2/8½
Denny (M.1887)	7,000	5/-	7,815	4/2	10,387	4/2	11,433	5/-
Lanark	9,000	4/2	10,000	4/2	12,160	3/9	15,120	3/4
Forfar (M.1871)	22,500	4/4	25,000	4/4	28,000	4/3	32,228	3/9
Motherwell (M.1913)	16,500	3/9	20,480	3/7	38,000	3/6	70,391	3/9
Kirkintilloch (M.1876)	18,353	4/7	22,624	4/2	25,782	4/-	32,468	3/9
St. Andrews (M.1888)	17,932	4/2	22,142	3/7	26,194	4/2	38,000	3/9

(M) Municipal Gasworks: (i) Thousands Cu. Ft. (ii) Normal Price per 1,000 cu. ft. (iii) Prepay Price

SOURCES: Gas Works Directory and Statistics (annual, incomplete series. Scottish National Library)

Like gas companies, the municipal gasworks frequently used gas profits not only for maintenance and depreciation of equipment, but also for reploughing. Consumer agitators who had challenged the right of companies to use their profits in that way, consequently were denied cheaper gas by the removal of such charges.

TABLE 5.50 Capital Depreciation at Glasgow Municipal Gas and Chemical Works

(i) <u>Gross Capital</u>				
Date	Gas Sold (Thou. Cu. Ft)	Expended (£)	Per Million Cu. Ft. (£)	Per 1,000 Cu. Ft. Gas Sold
1869-70	1,010,117	559,791	554	11s 0.99d
1879-80	1,577,466	1,270,940	806	16 1.34
1889-90	2,752,989	1,553,901	564	11 3.44
1899-1900	5,399,536	2,712,398	502	10 0.54
1909-1910	6,374,950	4,119,914	646	12 11.09

(2) <u>Book Value after Depreciation</u>			
Date	Capital Less Depreciation ¹ (and Property Realized)	Per Million Cu. Ft. (£)	Per 1,000 Cu. Ft. Gas Sold
1869-70	532,317	527	10s 6.47d
1879-80	987,071	626	12 6.16
1889-90	637,132	231	4 7.52
1899-1900	1,400,921	259	5 2.25
1909-1910	2,245,557	352	7 0.51

NOTE: Includes cost of pipes, meters and stoves, and by-product chemical works owned by the Corporation.

SOURCE: Transactions of the Institute of Gas Engineers 1911, p. 68

In 1911 the Glasgow manager still maintained that consumers could "not be allowed to pay only the manufacturing and other present costs ... but their fair share of the continuous deterioration ... and also

1. The Book Capital (i.e. Capital less Depreciation and Property Realized) in a municipal gasworks could be reduced indefinitely by depreciation and repayment of loans, until new loans were required for extensions; in contrast the Book Capital of a company was not allowed to fall below the Capital Stock, because reploughing was used to offset depreciation.

the contingency of having to scrap parts of the plant to make room for improved methods.¹ Municipal authorities faced by electricity competition tried to write-off the capital by depreciation as quickly as possible, by increasing 'profits' for this purpose, in order to reduce the burden of capital interest or sinking funds which would be necessary at a later date, when cheaper gas became vital to maintain sales.

The Glasgow accounts reflect heavy expenditure on new equipment in 1869-80, little in 1880-90, much reconstruction in 1890-1900, and thereafter construction of the new Provan gasworks. Until 1906, Glasgow calculated depreciation as a percentage of the book-value of the works, but thereafter calculated it on the total capital investment and not the reduced book-value.

TABLE 5.51 Depreciation Allowance on Various Types of Equipment at Glasgow (1910)

<u>Items</u>	<u>Percentage Depreciation</u>	<u>Amount (£)</u>
Gas Works	1½	22,093
Chemical Works	3	2,881
Pipes	2	10,472
Meters	6	15,930
Stoves	10	8,369
Premium	2½	4,358

SOURCE: Transactions of the Institute of Gas Engineers (1911)
p. 56

1. Evidence of A. Wilson, Transactions of the Institute of Gas Engineers, 1911, pp. 53-6.

cf. A. Murray, "The Glasgow Corporation Accounts, with special reference to Depreciation and Sinking Funds", Transactions of the Royal Philosophical Society of Glasgow Vol. xxxiv, p. 79

Between 1870 and 1900, Glasgow Corporation made a cumulative 'profit'¹ of about £3,120,000 which was spent on depreciation, renewals and extension of the works, and frequently extracted a 'profit' against the book value² of the works far higher than a Chartered company was permitted to do.

TABLE 5.52 Percentage 'Profits' of Glasgow Corporation Gasworks

<u>Date</u>	<u>%</u>	<u>Date</u>	<u>%</u>	<u>Date</u>	<u>%</u>
1870	11.6	1880	11.6	1890	15.6
1871	11.4	1881	11.8	1891	8.5
1872	8.3	1882	14.1	1892	4.7
1873	3.7	1883	16.3	1893	11.4
1874	7.3	1884	15.0	1894	9.8
1875	10.2	1885	18.9	1895	12.2
1876	10.5	1886	17.6	1896	11.4
1877	9.6	1887	15.7	1897	8.2
1878	7.7	1888	16.1	1898	8.3
1879	9.6	1889	17.9	1899	9.5
				1900	8.8

N.B. % of Book Value (after Depreciation)

SOURCE: Calculation of 'Profit' from Annual Gross Revenue minus Gross Expenditure in statistics published by J.D. Marwick, Glasgow - The Water Supply of the City with Notes on Various Developments of the City (1901, Glasgow) Appendix 76

The varied financial and therefore technological resources of different municipal gasworks produced considerable differences in the burden of costs charged to the public.

1. i.e. the difference between stated 'Gross Revenue' and 'Gross Expenditure': Vide infra Appendix IX.3.v
2. The Book Value was the Gross Capital value less Depreciation and "Value of Property sold". The Corporation apparently allowed excessive depreciation, which possibly inflated the percentage 'profit' in Table 5.52 below.

J.D. Marwick, Glasgow - The Water Supply of the City with Notes on Various Developments of the City (1901, Glasgow) Appendix 76.

TABLE 5.53 Comparison of Revenue and Expenditure at Ten Municipal Gasworks (1884)

All sums stated in Old Pence per 1,000 cu. ft. gas sold

Municipal Works	A	B	C	D	E	F	G	H	I
Revenue									
Gas	41.25	35.5	39.75	37	37	43.5	38.5)	39.75	39.9
Meter Rent	1.5	1.7	1.25	0	0	1	1)	-	0
By-Products	6.75	5.75	5.75	6	6.5	6	5.75	7.5	6.1
Total (inc. Misc.)	49.75	43	54.25	43.25	43.75	50.75	45.25	47.5	46.1
Expenditure									
Coal	23	20.75	17.75	13.25	14.75	16.25	17.75	20.25	15.75
Wages	6.25	3	6.75	4.25	5.75	6	6	7.5	5.75
Salaries	1	1.75	1.75	2.25	1.75	3	1	2.5	1.25
Purifying Material	0.5	0.5	0.75	0.75	0.75	1.5	0.25	0.5	1.25
Feu Duty/Taxes/Insurance	2	2.25	2	0.5	2.25	2	2.75	2.75	3
Mains/Service Pipes	0.25	0.75	0.5	0.2	1.25	0.5	1	0.25	0.5
Repairs	2.25	2.25	2	2.25	8.5	3.75	3	2	2.75
Total (inc. Misc.)	42.5	31.75	31.75	33.25	36	33.5	32.75	36.25	30.9
Gross Profits	7.25	11.25	22.5*	10	7.75	17.25	12.5	11.25	15.25
Payments out of Gross Profits									
Interest on Loans	1.25	3.75	0.25	5.25	1.9	7.25	3.5	0.75	7
Sinking Fund	0	4	0	3.25	1.5	3	0.75	2.5	2.75
Contingent Fund	0.25	0.25	0	1.5	1.75	3.75	2.25	0.25	0.5
Annuities	0.5	5.25	2.25	0	3.5	0	2	10.25	0
Total Payments	6.5	13.25	-	10	8.75	14	8.5	13.75	10.25
Percentage Leakage									
	12.7	10.7	-	17.4	11.8	9.8	12.4	-	9.9

Municipal Works: Aberdeen (A) Dundee (B) Dumfermline (C)
 Dumfries (D) Glasgow (E) Kilmarnock (F)
 Paisley (G) Perth (H) Greenock (I)
 Edinburgh refused to supply statistics which were kept secret.

* Includes premium on sale of stock (8d. per 1,000 cu. ft.)
 Glasgow allowed 4.25d for repairs, and another 4.25d for depreciation.

SOURCE: Greenock Police Board Confidential Minutes, (December 1885)
 (Greenock Ref. Library).

In two respects municipal ownership disadvantaged gas consumers at the end of the nineteenth century. In several cases gasworks were under-financed out of fear of electric lighting, despite a continued increase in the sale of gas and gas-fittings. Inverness¹ in 1892 had a holder capacity of 180,000 cu ft, but on foggy nights 270,000 cu ft was consumed, and the mains pressure was greatly reduced. The works required an extra £15,000 of equipment, while the low pressure actually reduced potential sales by about 50,000 cu ft. In 1889 Arbroath² corporation postponed the construction of a new gas-holder and purifiers in reaction to the new electricity station at Deptford. The degree to which consumers suffered is difficult to estimate.

In addition, municipal authorities which undertook to supply electricity, often did so by raising loans on mortgages over gas rents, at the expense of improving gas supply.³ At Paisley⁴ by 1906, out of £205,000 borrowed on the security of the gasworks under a series of Orders and Acts, only £70,000 had been spent on the gasworks themselves and the remainder on electricity under the 1891 Paisley Electric Lighting Order.⁵

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1. Gas World "The Policy of Municipal Authorities Owning Gasworks" 16/1/1892. See also Lanark; infra p. 1170
 2. Gas World 4/5/1889, p. 493
 3. This source of capital for the electricity industry has been ignored by historians who see investment in the gas industry as a factor dissuading local authorities from encouraging electricity development.
Vide F.R.J. Jervis, The Evolution of Modern Industry (1960) pp. 189-94.
 4. Paisley Act 1906; Vide infra Appendix XVIII.3
 5. Made under Electric Lighting (Scotland) Act 1890 which permitted such mortgages over gas rates.

TABLE 5.54 Paisley Electricity Finances Borrowed
against Gasworks Security

<u>Date</u>	<u>Total Borrowing Powers</u>	
1870	£ 15,000)	
1879	£ 45,000)	for Gasworks purposes only
1899	£ 70,000)	
1900	£150,000)	
1901	£175,000)	extra loans for electricity
1902	£205,000)	
1906	£300,000)	only £45,000 extra for gas- works extensions
1910	£385,000)	extra loans for electricity

SOURCES: Paisley Acts and Orders. Vide infra Appendix XVIII.3

Other towns like Hamilton¹ used the general Electric Lighting Act of 1890 in a similar way.

The large municipal gasworks absorbed many of their lesser neighbours, as a result of municipal boundary extensions and especially through the lower prices possible by large-scale manufacture. Glasgow corporation purchased the distribution equipment of Rutherglen Gas company² in 1874, but was elsewhere faced by a fierce resistance movement in wealthy residential suburbs which saw the extension of Glasgow gas supply as a threat to their municipal integrity. The early and incompetent Maryhill Gas company³ was purchased in 1871 by the new Partick, Hillhead and Maryhill gas company,⁴ a consumers

1. e.g. Hamilton Gas Order 1904; 1901

2. The origin of Rutherglen company is obscure. Glasgow Gas Act (1910) Preface.

3. Run by J. Paxton, a local grocer and postmaster; R. Thomson, Maryhill 1750-1894 (1895, Glasgow) p. 173

4. Vide infra 'Consumer relations' p.1192

company protesting against proposed higher gas rates by Glasgow corporation compared to those charged in the city centre. New gasworks were built at Temple, Maryhill, and in 1874 after purchasing Bearsden Gas company,¹ the old Maryhill works closed. By that time they had largely defeated the supply from Glasgow.²

In 1873 the company promoted a Bill of incorporation which was quashed, and neither could the Burghs Gas Supply (Scotland) Act of 1876 be adopted because the company was inside Glasgow's legitimate supply zone. Glasgow in 1873 attempted to bring Hillhead and Kelvininside within the municipal boundaries, and the gas company enjoined successful opposition to the move. A government inquiry in 1887, however, supported the boundary extension but in 1888 the company again appealed for statutory recognition and purchased the Dalmuir, Kilpatrick and Bowling Gas company³ at an excessive price of £11,000 to strengthen their case. Their application was rejected, though the company was one of the largest in Scotland without Parliamentary sanction at that time. Ordinary shares totalled £85,000, preference shares £28,500, and debenture stock £69,490, while the net revenue was £12,000. Glasgow corporation claimed a lost revenue of £30,000 because of the company's existence.⁴

1. J.G.L., 1/9/1874 p. 308

2. Glasgow City Archives Miscellaneous Papers, Vol. 22, p. 306

3. Dalmuir company sold gas at 5s and gave five per cent dividend, but in an attempt to sell at 2s 6d it became insolvent and would otherwise have been absorbed by Glasgow corporation: Glasgow City Archives Miscellaneous Papers Vol. 22, p. 205.

4. Company dividends were modest - 1883 5 per cent; 1884 5½%, 1885 2½%, 1886 0%, 1888 5½% Pref, 6% Ord, 1890 5½% Pref, 6% Ord.

Hillhead Commissioners were often directors, and used the company to bar egress to Glasgow corporation.

In 1891 the Partick company made a final, unsuccessful appeal to Parliament for incorporation, an increased capital of £120,000, the right to supply twenty candle gas at 2s 6d, and the right to either continue trading or sell out to Glasgow corporation if the area was absorbed into that city. By that time, however, speculators had purchased shares in anticipation of obtaining annuities, so that local ownership of the company had declined¹ from seventy-five per cent to twenty-five per cent, and when Hillhead turned in favour of entering Glasgow,² the city was able to purchase the company³ for £202,500. Also in 1891 Glasgow purchased the Pollokshaws gasworks⁴ for £14,500, followed⁵ by Milngavie gasworks⁶ in 1902, and

1. Glasgow City Archives, Miscellaneous Papers Vol. 22, p. 205

2. Ibid., Vol. 22, p. 207; Glasgow Herald 6/3/1891

3. Standard practice was to pay nineteen to twenty-one years' purchase price for a non-statutory company, and twenty-six to twenty-eight years' price for a statutory Company. However, had the Company again opposed Glasgow's municipal extensions the action could have cost the city about £25,000.

The company in 1891 had a nominal £130,000 in 20,000 ordinary shares of £5, and 6,000 preference shares of £5 fully paid up; also a debenture debt of £14,390, and had raised £55,000 by debenture stock, and were about to issue £24,900 debenture stock to shareholders to pay off the debt. Holders of debenture stock agreed to sell it to Glasgow corporation for £12,500. Vide Glasgow Gas Act (1891).

4. Pollokshaws Gas company commenced 1836 with £2,300. No street gas-lights until 1846; took Limited Liability in 1882 with nominal and paid-up capital of £6,000. In 1887 reduced gas from 4s to 3s 10d, but residents found Glasgow had laid pipes nearby with gas at 2s 10d. Glasgow sent supplies from Tradeston, and local gasworks demolished in 1900:

A. McCallum, Pollokshaws, Village and Burgh 1600-1912 (1925, Paisley)

J.G.L., 27/9/1887; S.R.O. (BT2/1132)

5. Part of the distribution plant owned by Busby Gas company in Eastwood and Cathcart parishes was purchased by Glasgow in 1908. Glasgow Gas Act (1910) preface.

6. Milngavie gas was previously expensive, 8s 4d in 1873, 6s 8d in 1875, 5s 10d in 1876. In 1885 the company sold 7.25 million cu. ft. at 5s 5d, and paid five per cent dividends. Glasgow corporation later also acquired Baillieston gas company in 1923, and

Thornliebank in 1916.

The Edinburgh Gas Commissioners similarly absorbed the Corstorphine Gas company in 1895. That company had operated with limited liability¹ since 1879 with a capital of £850, a fifty per cent call on 1,700 shares of £1 held almost entirely by residents of Corstorphine. In 1896 when the burghs of Leith and Portobello were engulfed by Edinburgh, Portobello gas company was purchased by Edinburgh council² and later was transferred to Edinburgh and Leith Gas Commissioners. Portobello was at first supplied by the Musselburgh gas company of 1831, but at differentially high prices. Portobello gas company³ commenced in 1845 with £3,000 in £2 10s shares. It took limited liability⁴ in 1889, with a paid-up capital of £17,500 which was raised in 1890 to £20,000, but shareholders were almost entirely residents of Portobello.

Although large-scale production was thus shown to have considerable advantages, centralization and integrated gas 'grids' were not

Newton Mearns in 1925.

Glasgow supply zone was so large that the Act of 1910 included specific provision to forbid competition in some areas, viz. parts of Cambuslang already supplied by Cambuslang Gas company, parts of Old Monkland supplied by Coatbridge Gas company, parts of Carmunnock already supplied by Busby Gas company, and Renfrew parish south of R. Clyde already supplied by Renfrew corporation. But Glasgow was allowed to tender gas to the Clyde Navigation Trustees at Renfrew harbour.

J.G.L. 20/6/1885, 20/7/1887. The Gas Supply of Glasgow (1935) op. cit.

Glasgow Gas Act 2 E 7Ch. CLXXXV, Part II

1. S.R.O. (BT2/911)
2. Edinburgh paid £2,500 cash plus £1,200 annuities, and cash value of stock on hand. After 1916 the annuities could be compulsorily redeemed at 20 years' purchase price: Edinburgh Extension Act (1896)
3. Shares issued preferentially to consumers of gas: Prospectus in The Scotsman 14/5/1845 p. 3. Vide Infra 'Consumer Relations' p.1148
4. S.R.O. (BT2/1886).

developed until after the First World War. Lanarkshire County Council¹ proposed the first such scheme in Scotland, connecting Bothwell and Uddingston, Holytown and Carfin, but their 1914 Gas Order was postponed by the War.

Parliamentary controls imposed on municipal gas undertakings in the late nineteenth century were quite unlike those concerning chartered companies in the first half of the century, but were similar to the rules for new companies which became incorporated in the same period.² The two principal features were financial controls governing the corporation and its annuitants and mortgagees, and regulation of the quality of gas being supplied.

The precise payment to be made to the company was rarely stipulated in the Act. Kirkcaldy³ for example, allowed for a cash payment, or annuities, or both, though Kilmarnock⁴ set the price at £40,500. Outright purchase could be made by borrowing money on low interest or mortgage normally under five per cent, and was usually preferable to paying annuities which were annual payments resembling dividends and of comparable value. Nevertheless, at Forfar⁵ annuities of seven and a half per cent were paid on a capital

1. Third Statistical Account - Lanarkshire (1960, Glasgow)

2. Considerable uniformity was achieved by including large sections of many General Acts on property and finance, in the Private Acts of both Companies and Corporations.

Vide infra Appendix XVIII.4

Private Acts in the following section are identified by Town, Date, and the relevant Article (a.) within the Act.

3. Kirkcaldy 1876

4. Kilmarnock 1871. Price included £36,000 paid-up capital and £4,500 mortgage debt.

5. Forfar 1871; equivalent to £675 a year, paid out of gas revenues.

of £9,000, and at Perth¹ annuities of £6 5s per cent to the Old company on £30,000 capital and the same percentage to the New company on £15,000 capital stock. Broughty Ferry commissioners² agreed to annual six per cent annuities of £500 on a capital of £8,350, commencing in 1871. The disadvantage of outright purchase was that compensation had to be paid for any profits ploughed back by the company. At Inverness³ the Police agreed to pay £153 for each £100 of stock, plus £5,210 for excess profits which had been capitalized up to June 1874. Elsewhere the price was to be agreed by arbitrators named in the Act, and paid by a specific date.⁴ Municipal authorities were given powers to borrow set sums, by mortgage or cash credit, either to make the purchase or as working capital. The use of such money, and of gas revenue, was closely controlled by Parliament,⁵ and both annuities and interest on loans became preferential

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1. Perth 1871; equivalent to £1,875 to Old and £937 10s to New company, each year.
 2. Broughty Ferry 1870 a.19. c.f.
Glasgow (1869 a.x) initially paid to the Old company 9 per cent on £150,000 and 6.75 per cent on £65,000 raised after 1857; and to the City and Suburban 9 per cent on £150,000 and 6.75 per cent on £50,000 raised after 1857. But in 1873 a special Act allowed the creation of 'Glasgow Corporation Gas Consolidated Stock' with four per cent annual interest. By Mutual agreement, annuitants could replace their annuity by a quantity of this Stock which would give an annual interest equal to their original annuity. This type of agreement was not made by any other Scottish town. Another Act in 1879 allowed the Corporation to enforce a change from annuities to Stock but this power was in fact never exercised.
 3. Inverness 1875. The cash had to be paid by 1/2/1876 or would be increased by 5 per cent per year interest. Any defect in pipes or plant reduced the price by £750.
 4. e.g. Ardrossan 1886. Arbitration by R.C. Reid of Edinburgh for the company, and J.M. Gale of Glasgow for Corporation. Cash paid by Whitsunday 1887, or interest charged at 5 per cent per year.
 5. Vide infra Appendix VIII.1-3

burdens on the gasworks.¹

Normally the municipal authority took responsibility for all long term debts contracted by the company, together with other liabilities.² In 1871 Arbroath³ corporation agreed to pay the company's mortgage and bond debts of £4,450, and all interest due from the previous year. The practice varied. At Dundee⁴ the companies were to pay off all debts, wages and contracts up to the transfer date, though the Commissioners did shoulder the mortgage debts of the New company. In Kilmarnock⁵ the company had to pay off all debts, and even continue to handle any pending law suits after the corporation takeover. Normally legal actions were transferred to the municipal authority as the new owners.

An equitable agreement for the change from private to municipal ownership was an important feature in negotiations for the transfer. Dundee⁶ Corporation took responsibility for a large number of separate mortgages, ranging from £150 to £1,000 and held by individuals who largely resided in north eastern Scottish coastal towns, which totalled £11,850. Perth⁷ conversely required the companies to pay

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1. e.g. 1868 Dundee a. 49. Loans under early Acts were also given preference over those under later Acts, e.g. 1877 Dundee a. 13; 1899 Dundee a. 11.
 2. e.g. materials contracts and law suits were transferred to the municipal authority: Vide Campbeltown 1876 A. 35; Edinburgh/Leith 1888 a. 54; Airdrie 1904 a. 11, 12.
 3. Arbroath 1871 a. 24. Similarly Campbeltown (1876 a. 33,36) where the corporation also retained the company's cash reserves, as at Dundee (1868, a. 22).
 4. Dundee 1868 a. 22, 24.
 5. Kilmarnock 1871 a. 93.
 6. Dundee 1868 Schedule A, 11. Full list of mortgagees.
 7. Perth 1871 a. 36.

off all debts, mortgages, and wages up to 1 January 1872, and any which remained and had to be paid by the Commissioners were subsequently charged to the company. All gas on hand was purchased by the Commissioners at 6s 6d per 1,000 cu ft., and all stores and meters on hand purchased by them within two months at a valuation price fixed by D. Laidlaw and J. Milne, meter manufacturers of Glasgow and Edinburgh respectively.

Arbroath compensated the company for its premium and reserve funds,¹ and solved the evaluation problem by back-dating the transfer one year before the Act.² Kilmarnock³ paid £1,000 compensation to the local company for loss of profits, out of the common good of the burgh, and took the burden of £4,500 mortgage debt from the company. All other debts remained binding on the company, however, even after transfer. Forfar⁴ agreed to pay £250 debt owed by the company to a local farmer, but all other debts and obligations were terminated at the date of transfer. Inverness⁵ agreed to relieve the gas company of a mortgage debt of £8,000 and purchase all stock on hand at arbitration under the terms of the 1845 Lands Clauses Consolidation Act. Broughty Ferry⁶ took a simple solution and took

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1. Arbroath 1871 a. 23. Payment of £200 in September 1870, and £1,000 a month after the Act. Also £700 as two half-yearly dividends in 1870 and 1871.
 2. Ibid., transfer date 30/6/1870; but Act in 1871.
 3. Kilmarnock 1871 (a. 85, 93, 194). The price paid to the company had not been agreed at the time of the Act, but had to be paid in cash in June 1871, or 1872.
 4. Forfar 1871 a. 20, 18. Again the price had not been fixed when the Act was obtained.
 5. Inverness 1875 a. 11,14.
 6. Broughty Ferry 1870, a. 17.

the entire property, assets and bank deposits of the company at a pre-existing date, as well as undertaking to pay off all mortgage and bond debts owed by the former company within one year.

Edinburgh and Leith Commissioners in 1888 paid £27,000 to the Edinburgh company and £11,000 to the Edinburgh and Leith company in cash as compensation for loss of profits, in addition to the regular annuities. All cash and securities held by the Edinburgh company, and all income outstanding, was retained by the company. The Leith company retained a Bond of £12,500 loaned to Leith Harbour Commissioners, £723 invested in the Edinburgh Water Annuities, heritable property worth £8,500 in St Andrews Square, and all outstanding revenue. The Gas Commissioners took the burden of £23,000 mortgage and debenture debts¹ from the Leith company, and also a bank debt of £11,700 which had been spent by that company on improvements. They agreed to purchase all gas, residuals, raw material and loose equipment on hand at the date of transfer, and refund all capital expenditure made by the two companies since the date of evaluation the previous year.² Pension arrangements were also made for the staff, and several large municipal takeovers included similar agreements.³

Evaluation of the stock on hand at the time of transfer was

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1. Edinburgh & Leith 1888 a. 18-19; Schedule D shows these debentures were all from private persons, and varied from £100 to £2,400.
 2. Ibid., viz 1/4/1887 for Edinburgh company; 29/6/1888 for Leith company.
 3. Ibid., Schedules D and E.
See also 1875 Inverness - pension to manager of 22 years' standing: 1871 Aberdeen - £2,000 compensation to G. Gordon, manager and secretary of company, for loss of office.

normally at the sight of an engineer mutually agreed upon, and was a payment in addition to the value of the works.¹ Sometimes the transfer price included all stock² present at a previous date. After the date of transfer the company could only exist to recover gas and other rents already due,³ and to secure the appropriate annuity certificates⁴ or cash payments before dissolving. The Act functioned as a conveyance of the gasworks property.⁵

Normally the town council or police commissioners took control of the gasworks,⁶ but in some cases special public bodies were incorporated. The 'Dundee Gas Commissioners'⁷ of 1868 comprised the Provost and First Bailie of Dundee, the Dean of Guild, the Convener of the Nine Incorporated Trades, five Town Councillors elected by

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1. e.g. Dundee 1868 a. 23 as at 11/11/1868; Kilmarnock 1871, Schedule 6 a. 11. Equipment etc. on hand purchased by Police at evaluation by G.R. Hislop of Paisley gasworks, or J. Hislop of Ayr gasworks.
 2. e.g. Perth (1861 a. 16) as at 9/3/1871, though transfer was 1/1/1872.
 3. At Kilmarnock the Police collected the gas debts for the company at 5 per cent commission.
 4. e.g. Perth 1871 a. 41.
Dissolution of chartered companies and limited companies had to be published in the Edinburgh Gazette.
 5. A copy had to be sent to the Inland Revenue, and the municipality had to pay ad valorem stamp duty; e.g. 1904 Airdrie a.68, 1871 Arbroath a. 27, 1868 Dundee a. 22, 1894 Falkirk a. 22, 1871 Kilmarnock a. 92, 1871 Perth a. 16, 1886 Ardrossan a.94
 6. The Irvine Burgh Act of 1881 which proposed municipal control, had to conform to the 1876 Burghs Gas Supply Act in addition to its own special regulations. Thus the takeover had to be approved by two-thirds of the town council, and a majority of rate-paying householders at a special meeting convened by the Provost or Chief Magistrate.
 7. Dundee 1868 a. 7; from 1872 (Dundee 1872 a. 6) the ballot election of Commissioners of those bodies ceased except in case of disputes.

that body, four members of the Guildry Incorporation, two members of the Nine Incorporated Trades, one person from the Three United Trades, and five members of the Chamber of Commerce. The Commission could, however, still function if any of these organizations defaulted. Annually, upon the application of the Commissioners or of any three annuitants, ratepayers or consumers, the Sheriff¹ had to appoint an accountant to audit the Commissioners' books to ensure fair dealing. In 1894 Dundee town council² superseded these Commissioners.

In 1888 the Edinburgh and Leith Gas Commissioners³ were similarly incorporated, to comprise the Lord Provost of Edinburgh with fifteen persons elected by Edinburgh Corporation, and the Provost of Leith with six persons elected by Leith Corporation. No Commissioner⁴ or corporation member could hold a salaried post under the Commission until twelve months after leaving that position. Annually⁵ five Edinburgh commissioners and two from Leith had to retire. The Commissioners could appoint sub-committees, but decisions on the price of gas, borrowing money or using requisitions could only be made by a full meeting. The Treasurer had to make an annual abstract of statistics, but a professional auditor⁶ had also to be employed. However, as at Paisley in 1845, the accounts could only be seen by the Commissioners or their creditors⁷, and although copies had to be lodged at the Commission offices and with the town

1. Dundee 1868 a. 19

2. Dundee 1894 a. 34.

3. Edinburgh & Leith 1888 a. 6.

4. Edinburgh & Leith 1888 a. 12.

5. Ibid., a. 7

6. Ibid., a. 97

7. Ibid. a. 98

clerks, the public were required to pay 1s to inspect them.

Unique local provisions were also stated before Parliament. At Edinburgh,¹ if gas leakage from holders at Meadow Flats affected the well of Holyrood Brewery, owned by Wm. Younger and Co. Ltd., within twelve months of the takeover, the Gas Commissioners had to provide an equivalent "supply of water suitable for brewing purposes". In Arbroath from 1899, £250 per year of gas profits could be used for the town Harbour.² At Airdrie since 1899 the Coatbridge chartered gas company had supplied one tenement of houses and one gas engine, but in 1904 Airdrie corporation³ was empowered to purchase by agreement all equipment within the burgh owned by Coatbridge company. At Arbroath,⁴ the Council was empowered to use the trust disposition of D. Duncan, who in 1864 vested money in the Council for charitable purposes, for purchasing gas stock, provided four or five per cent interest was paid on the trust money.

Because Parliament largely prevented the reploughing of profits, all large extensions of municipal gasworks required borrowed money, but the restrictions placed upon finance meant that a new Act⁵ was necessary to authorise this. The benefit of low interest rates was therefore offset by expensive and repeated Acts requesting greater borrowing powers. Priority for repayment was accorded to all earlier mortgages⁶ and annuities. Loans repaid, other than through

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1. Ibid., a. 107. Any disputes were to be settled by arbitors mutually chosen, or appointed by the President of the Institute of Civil Engineers.
 2. Arbroath 1899 a. 17; in terms of 1897 Aberborthwick Harbour Finance Act.
 3. Airdrie 1904 a. 18
 4. Arbroath 1871 a. 53.
 5. Vide infra Appendix VIII.1 enlarged borrowing powers.
 6. e.g. Arbroath 1871 a. 8; Edinburgh & Leith 1895 a. 16; 1898 a.35. Falkirk 1894 a. 15.

a Sinking Fund provided under the Act, could be re-borrowed¹ at a later date. To provide working capital, short-term loans secured against the predicted annual revenue were granted to several municipal authorities.² These had to be borrowed and then completely repaid³ during each financial year, commencing usually on 15 May. To prevent confusion with other municipal enterprises, a separate 'Gasworks Account'⁴ with special books was usually required.

The municipal authority had to keep a Register of Annuities,⁵ which were moveable or personal estate and were transferable.⁶ They could be redeemed periodically, but only at a price agreed to by the annuitant.⁷ At Perth the price could not be higher than current

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1. e.g. Arbroath 1899 a. 4; Falkirk 1894 a. 34; Greenock 1871 a. 60; Perth 1888 a. 36; Hamilton 1902 a. 1.
 2. e.g. 1901 Ardrossan (a.89); 1906 Perth (a.12) where loans were up to two-thirds of estimated annual revenue. Short term loans had to be borrowed and then completely repaid during the same twelve month period, normally May to May.
 3. e.g. Aberdeen 1881 a. 42, maximum £25,000; Airdrie 1904 a. 94, maximum two-thirds of anticipated revenue, as also at Edinburgh & Leith 1894 (a.15); Falkirk 1894 a. 36.
 4. e.g. 1886 Ardrossan a. 106, 1869 Glasgow a. lxxiv, 1871 Arbroath a. 63; 1876 Campbeltown a. 115; 1871 Forfar a. 10,14; 1871 Greenock a. 86; 1875 Inverness a. 100; 1881 Irvine a. 172; 1871 Kilmarnock a. 205; 1870 Perth a. 11; 1894 Falkirk (a.6) books open to "any person interested therein" gratis; 1904 Airdrie (a. 5) separate accounts showing all cash transactions; 1871 Arbroath (a. 11) separate Minutes of all meetings of Gas Committees.
 5. Perth 1870 a. 27-34; Glasgow 1869 a. xxii to xxv; Arbroath 1871 a. 22; Dundee 1868 a. 31; Edinburgh & Leith 1888 a. 34; Forfar 1871 a. 24; Perth 1871 a. 23; Broughty Ferry 1870 a. 20.
 6. e.g. Dundee 1868 a. 32,33; 1871 Perth a. 24; Edinburgh & Leith 1888 a. 37.
 7. e.g. Arbroath 1871 a. 22; Aberdeen 1871 a. 81; Dundee 1868 a. 41; Glasgow 1869 a. 34.

market value, while at Forfar¹ transfers of annuities, like share transfers in unincorporated companies, were not allowed until an offer was made to sell the annuities to the Council instead of the company, though at a set price of 22½ years' purchase. Annuities of Edinburgh and Leith Commissioners² also had a maximum repurchase price of 28½ years' purchase.

Irvine gave exceptional concessions to annuitants.³ Any one of them by giving twelve months' advance notice, could demand that the Corporation would purchase the annuity at twenty-one years' price, and if necessary the Corporation could reissue them at twenty-five years' purchase price. However, by also giving one year's notice, Irvine Corporation could compel annuitants to sell out, in blocks of over £1,000, or alternatively it could negotiate privately to purchase individual annuities at twenty-four years' purchase price.

This manoeuvre was first practised in Scotland at Paisley in 1870, to break the deadlock over the 1845 Public Trust. That Board had only redeemed 1,391 fully paid shares of £5, and 651 of £2 10s, but from 1870 the Town Council took full control and unredeemed shares were replaced by annuities at the same rate of interest. Any annuitant after one year's notice could compel the Corporation⁴ to purchase his annuities at twenty-five years' purchase price, but by

1. Perth 1871 a. 35; Forfar 1871 (a. 65). Council had fourteen days in which to decide whether to purchase the annuity.

On share transfers in companies, offered for sale first to the company, vide infra p.910

2. Edinburgh & Leith 1885 a. 47, 33.

3. Irvine 1881 a. 92.

4. Paisley 1870 a. 43-6; 17-20.

the same notice the Corporation could make compulsory purchase of the annuities at twenty-five years' purchase price in blocks of at least £5,000. If necessary they could also re-issue them at that upset price, or negotiate privately to redeem annuities, though not at a higher price.

Mortgages were also moveable or personal estate,¹ and could be transferred.² At Dundee, debentures³ were created which could be used to redeem annuities of equal value. The debenture was personal estate, in £10 units, and could be redeemed at par, by agreement, with money from the Sinking Fund. Glasgow, Greenock, Kilmarnock and Inverness⁴ created a 'Funded Debt', under which money was raised by issuing transferable certificates in return for cash payments. Separate account books were kept of the Debt, which was paid like an annuity at rates fixed by the corporation, and holders could not demand the return of their deposits. For the protection of all persons to whom the municipal authorities owed interest or the return of loans, Parliament stipulated that when arrears exceeded a threshold level, application could be made to the Court of Session or Lord Ordinary of the Bills for a Judicial Factor or official receiver to ensure that repayment was made.⁵

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1. 1868 Dundee a. 81; 1871 Arbroath a. 56; 1871 Forfar a. 58; 1871 Perth a. 78; 1894 Falkirk a. 41; 1904 Airdrie a. 57.
 2. 1871 Greenock a. 69; 1894 Falkirk a. 39; 1904 Airdrie a. 55.
 3. 1882 Dundee a. 3, 6, 7; Dundee 1894 a. 37. Mortgages could not be issued in place of those annuities redeemed by debentures.
 4. 1869 Glasgow a. 73; 1871 Greenock a. 64-7; 1875 Inverness a. 89-94; 1871 Kilmarnock a. 196, five per cent annual payment on Funded Debt, used to redeem mortgages, which could not be borrowed.
 5. Vide infra Appendix VIII

A safeguard in case revenue was insufficient to meet annual expenditure¹ or interest on loans, was the Gas Contingent Guarantee Rate² which the municipal authority was empowered to levy on all property owners listed in the Valuation Rolls. This tax on lands and heritages was normally for emergencies only, and no limit was usually set to the amount which could be raised, though at Greenock and Glasgow it could not exceed 6d in £1, and in Kilmarnock³ the 'Public Gasworks Rate' could not exceed 3d in £1. Nevertheless, inefficient municipal gasworks like Lockerbie levied a rate continually.

A 'Sinking Fund' was imposed by Parliament on each municipal

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1. Expenditure of revenue was dictated in a specific order of priorities, and at Greenock (1871) and Inverness (1875) expenditure of loans was also strictly controlled; e.g. Ardrossan Gas and Water 1886 a. 108 use of revenue: -

- (1) costs of management and maintenance of gasworks
- (2) annuities and interest on money borrowed
- (3) sinking fund and paying off of mortgages
- (4) extending and improving gasworks
- (5) surplus to reduce gas price.

See also 1871 Forfar a. 52; 1894 Falkirk a. 29;
 1881 Irvine a. 173; 1871 Kilmarnock a. 206;
 1876 Kirkcaldy a. 123; 1871 Perth a. 72;
 1888 Perth a. 45; 1897 Perth a. 74;
 1871 Greenock a. 63 (loans), 87 (revenue)
 1875 Inverness a. 82 (loans), 101 (revenue)
 1912 Arbroath a. 13; 1901 Ardrossan a. 27;
 1906 Perth a. 13; 1870 Broughty Ferry a. 50;
 1871 Paisley a. 71.

At Greenock (1871, a. 63) no loans could be used for maintenance of the gasworks; similarly Broughty Ferry (1870 a. 61).

Loans borrowed under an Act, could only be used for the purposes of the Act; e.g. Forfar 1871 a. 61; Ardrossan 1888 a. 105; Falkirk 1894 a. 49.

2. Airdrie 1904 a. 47; Arbroath 1871 a. 48; Dumbarton 1873 a. 48; Dundee 1868 a. 70; Broughty Ferry 1870 a. 47; Edinburgh & Leith 1888 a. 80; Falkirk 1894 a. 31; Glasgow 1869 a. xlii; Forfar 1871 a. 49; Perth 1871 a. 67; Ardrossan 1901 a. 29.
3. Greenock 1871 a. 71; Kilmarnock 1871 a. 154.
 At Paisley (1870 a. 51) it could not exceed 4d in £1.

venture to ensure that annuities or loans were repaid at a reasonable speed. The Sinking Fund had to be increased annually by a specific sum stated in the Act, and invested in government securities, or deposited in chartered banks. Alternatively, the municipal authority had to calculate the necessary payment required at compound interest to repay annuities and loans within a specific time period, seventy years in the early 1870s as at Ayr, reduced to fifty years in the mid 1870s at Inverness, and only thirty years by 1900s as at Hamilton.¹

Parliamentary restrictions became increasingly complex. At Inverness in 1875, money from the Sinking Fund could be used to pay off mortgages, cash credit, or annuities, but the annual amount placed out of revenue into the Fund had to remain at the same level, as if nothing had been repaid, until the entire amount was repaid.² However, once interest from the Fund equalled interest paid for loans, it could be used for that payment. At Greenock³ in 1882, if money was abstracted from the fund to repay mortgages, the council had to add to the Fund a sum equivalent to the interest which that money would have earned had it not been expended. After 1888 Perth⁴ even

1. Ayr 1873 a. 110; Inverness 1875 a. 97; Hamilton 1902 a. 5.

2. Similarly Perth 1871 a. 47.

3. Greenock 1882 a. 42.

4. Perth 1888 (a. 48) and 1897 (a. 76). At Falkirk from 1900 (a. 11) and Kilmarnock (1901 a. 17) if interest on the Sinking Fund fell below 3 per cent the deficit had to be made up from revenue.

Some towns were compelled to request the Sheriff annually to appoint an auditor to check their accounts; e.g. Paisley 1870 (a. 83) required two auditors from the Sheriff.

Broughty Ferry (1870 a. 16) the Commissioners or three annuitants could request the Sheriff to appoint an auditor, who remained in office until succeeded by another. See also - Forfar (1871 a. 16), Inverness (1875 a. 105), Perth 1871 a. 15.

Annual returns to the Secretary for Scotland, showing payments

had to send an annual record of payments for the Sinking Fund to the Secretary for Scotland, who through the Court of Session could force the Commissioners to pay into the Fund double the amount of any deficit detected.

Under special circumstances, Parliament allowed an intromission of payments to the fund. In 1898 when Edinburgh and Leith companies¹ began to construct a new gasworks, all contributions to the Sinking Fund were suspended for five years. Both Sinking and Reserve Funds were allowed to be used as capital for those new works, and were shown in special audit accounts. At Falkirk² in 1900, the Sinking Fund contributions were omitted for one year when a new gasworks was being built.

'Contingency Funds' were only specified for a few towns. In 1871 Forfar³ was to place two and a half per cent of annual revenue into a Fund as security against "risks and losses by fire, explosions, and decay or destruction of works other than by ordinary tear and wear, and for permanent additions and improvements". Dundee⁴ in 1872 could also use up to two and a half per cent revenue this way, while Arbroath⁵ in 1899 had to accumulate at least two per cent as a Contingency and Depreciation Fund, used for extending and repairing the works. Edinburgh and Leith Commissioners were allowed to

to the Sinking Fund, later became standard practice, e.g. 1912 Arbroath a. 11; 1901 Ardrossan a. 97; 1899 Arbroath a. 10.

1. Edinburgh/Leith 1888 a. 32-5.
2. Falkirk 1900 a. 11.
3. Forfar 1871 a. 64.
4. Dundee 1872 a. 16
5. Arbroath 1899 a. 12.

accumulate up to £100,000 as a 'reserve fund', Airdrie £15,000, and Falkirk¹ up to £20,000 at compound interest to meet any deficiency in annual revenue or "renewals or any extraordinary claim or demand". Perth² in 1871 was allowed to set aside up to £300 a year out of profits, until a contingency and depreciation fund of £6,000 was available to extend or repair the works. Elsewhere, depreciation had to be met out of annual revenue at the discretion of the municipal owners.³

Gas had to be supplied only within a definite geographical area⁴ defined in the Act. There, gas and meter charges had to be "as far as possible uniform to all persons under the same circumstances, and requiring the same extent of supply", with prices as low as

1. Edinburgh & Leith 1888 a. 86; Airdrie 1904 a. 45; Falkirk 1894 a. 29.

2. Perth 1871 a. 83.

Paisley had a unique Contingency/Depreciation Fund which could be used to finance extensions to the gasworks. In 1906 this took two per cent of annual revenue (1906 a. 3). In 1910 (a. 4) the earlier fund was abolished and replaced by another. During the first year over £2,400 was placed in this and a ratio calculated between that sum and the total gas consumed. In subsequent years, the same ratio could be added to the Fund.

3. A variety of other "Funds" were allowed in a few cases early in the twentieth century. Perth in 1906 (a. 25-27) was empowered to set up a Fire Insurance Fund, to a maximum £10,000, to pay for rebuilding after accidents, but insurance had also to be taken with a Fire Insurance Office and increments to the Fund were to be the same rate as was paid for Insurance. An Accident Fund, up to £6,000, was permitted in case of claims under the Employers' Liability and Workmen's Compensation Acts. Pensions were also permitted to aged or disabled employees, and dependents, at up to 5 per cent of their previous wages, provided they had been employed for over ten years, and that the Pension Fund did not impose above $\frac{1}{2}$ d per 1,000 cu ft on the price of gas.

4. Airdrie 1904 a. 7; Ayr 1873 a. 73; Dumbarton 1873 a. 23; Dundee 1872 a. 8; Falkirk 1894 a. 8; Broughty Ferry 1870 a. 25; Forfar 1871 a. 27; Greenock 1871 a. 42; Inverness 1875 a. 4; Irvine 1881 a. 104; Kilmarnock 1871 a. 98; Kirkcaldy 1876 a. 61; Perth 1871 a. 46.

In 1906 Perth (a. 4) obtained an extension of supply zone to seven miles radius beyond the burgh boundary.

possible but adequate to meet the costs of production, annuities, and other provisions in the Act¹ like interest on loans, and sinking and contingency funds. Frequently a supply of gas was compulsory within the zone, and the gasworks had to provide a certain length of service pipe,² provided the owner or occupier gave reasonable security for his rents, paid the costs of pipes, and paid in advance if necessary.

Gas could be supplied for public lighting within the zone,³ but several towns were empowered to sell gas in bulk to individuals or public authorities beyond the boundaries⁴ of the Act. Greenock could do so provided it did not impair supply inside the zone, but could not supply gas within the police boundaries of Port Glasgow or Gourock without police permission.⁵ Gas price differentials were

1. e.g. Aberdeen 1871 a. 104 & 126; Airdrie 1904 a. 36; Forfar 1871 a. 48; Falkirk 1894 a. 25; Perth 1871 a. 65.

2. At Aberdeen (1871 a. 88) the person had to be within fifty ft. of gas mains; and at Arbroath (1871 a. 46), Greenock (1871 a. 53) and Perth (1871 a. 51) had to supply fifty ft. of pipe; Dundee (1872 a. 13) thirty ft.; Forfar (1871 a. 29) twenty feet; and Kilmarnock (1871 a. 105) twenty yards but could only lay pipes over private ground with the owner's consent.

In 1901 Ardrossan (a.23) had to supply anyone within 100 yards of mains who requested gas, they paying for all the service pipe; 1870 Broughty Ferry (a.30) 100 yards, but Council to give twenty-five ft. pipe without charge; 1870 Paisley (a.78) fifty feet; 1869 Glasgow (a. 64) fifty feet.

3. e.g. Arbroath 1871 a. 32; Ayr (1873 a. 74) at prices at least as low as to any other consumers, as also at Campbeltown (1876 a. 50); Inverness 1875 a. 59; Irvine 1881 a. 105; Paisley 1845 a. xcii; Perth 1871 a. 50.

At Glasgow (1869 a. 65-6) gas for public lights not to be less than the lowest price charged to normal consumers, though this rule was revoked in 1910.

4. e.g. Airdrie (1904 a. 22); Kilmarnock 1871 a. 122; Falkirk 1894 a. 16; Edinburgh & Leith 1888 a. 69.

5. Greenock 1871 a. 58,59. Even when the new Inch Green gasworks were built, Port Glasgow resolved to continue its own separate works. J.G.L., 24/8/1875.

permitted by Parliament under certain conditions. Dundee and Perth¹ were allowed to give five per cent annual discount for prompt payment of rent, while Perth could also allow it to large consumers, taking over 100,000 cu ft per year. Other towns also gave unspecified discounts² to both categories, and at the end of the century the system was extended to provide cheaper gas for power or cooking and heating,³ compared to lighting, in order to boost demand.

Price differentials were also allowed where the gas had to be transported a long distance⁴. Dundee⁵ was allowed to supply bulk gas outside the zone of the Act, at mutually agreed rates up to 1s per 1,000 cu ft above the price in Dundee. Similarly, Perth⁶ could supply gas to New Scone village at prices up to 1s above those in Perth. In 1875 Dundee proposed to supply all of Broughty Ferry with gas, at 1s above Dundee prices, and began to negotiate to purchase

1. Perth 1871 a. 71; Dundee 1872 a. 15.
Other specified discounts were -
Arbroath (1910 a. 17) and Falkirk (1910 a. 14) ten per cent for prompt payment; fifteen per cent to large consumers;
Perth (1906 a. 18) five to fifteen per cent to large consumers.
2. e.g. Airdrie 1904 a. 40; Irvine 1881 a. 99.
3. e.g. Glasgow 1882 a. 5; Airdrie 1904 a. 25; Arbroath 1912 a.15.
Gourock (1909 a. 324, 325) even took powers to supply, separately, non-illuminating gas if desired.
4. Gas companies earlier used similar differential charges. In 1889 Falkirk Joint Stock company charged 3s 9d in Grahamstown, Bainsford and Camelon, but 4s 2d in Larbert, Carron, and Stenhouse-muir. Dunfermline in 1878 charged 4s 4½d in the town, but an extra 2s for gas sent to Townhill, where a new supply had been installed upon a petition from inhabitants. J.G.L., 2/7/1878, 26/11/1889.
5. Dundee 1872 a. 9, 10. By 1888 Dundee charged 3s 8d to city consumers and 4s 8d to residents of Harecraig, Invergowrie and Downfield. Payments made within twenty-eight days of date due received five per cent discount.
J.G.L., 26/6/1888.
6. Perth 1871 a. 66. In 1884 gas was retailed at 3s 9d in Perth and 4s 7d in Scone. J.G.L. 24/6/1884.

the pipes before Broughty Ferry Commissioners vetoed the plan. They claimed that although Dundee gas would be 10d cheaper it was of inferior quality to their town gas, and Dundee had earlier given inadequate water supplies to the town. Ten years later, though a dormitory town for Dundee, Broughty Ferry extended its gasworks and municipal boundaries and purchased many of the outlying Dundee gas pipes to enlarge its own supply zone.¹

Many towns acting under the 1876 Burghs Gas Supply Act also operated price zones. In 1884 Alloa council² provided the Burgh with gas at 3s 9d, but charged 4s 7d in Cambers and Sauchie villages, 5s 10d in Clackmannan, and 6s 3d to Lord Balfour's Kennet House. In 1885 Arbroath³ extended the gas supply to Woodville village, but charged 2s 6d more for gas than in the town. Rothesay⁴ corporation sold gas in bulk to the Kamesburgh Gas company which retailed it in Port Bannatyne, Isle of Bute, at the high price of 6s 3d in 1885. From 1913 Airdrie⁵ charged an extra 3d for a new supply of gas to the neighbouring villages of Glengowan, Caldercruix and Chapelhall.

Glasgow operated the most complex zoning system, which commenced in 1891 with a differentiation⁶ between the "city supply district",

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1. J.G.L., 21/8/1875, 2/11/1875, 15/7/1884, 17/6/1884
c.f. In 1889 Renfrew council unsuccessfully requested bulk-supplies of gas from Paisley municipal gasworks; J.G.L. 16/4/1889.
 2. J.G.L. 22/7/1884
c.f. Broughty Ferry Police made a surcharge of 10d on gas sold to Barnhill district in 1889; J.G.L., 4/6/1889
 3. J.G.L., 15/9/1885
 4. In 1877 Rothesay laid two miles of new mains pipes to the "watering place" of Port Bannatyne. J.G.L. 20/11/1877, 22/10/1885.
 5. Airdrie 1913
 6. Glasgow 1891 a. 3. Vide infra p. 1589

including Clydebank, and parts of New Kilpatrick south of a line running west from Dougleston Loch, and the "supplementary supply district" including Old Kilpatrick west of a line from Dougalston Castle towards the Clyde.

Parliament frequently set a maximum price for the sale of gas, as at Arbroath¹ with 5s 10d in 1871. There, any surplus revenue was to be divided, half to the council for public purposes, and half used within two years to reduce gas prices. However in 1899 the regulations changed and, as at Dundee² from 1868, Arbroath³ was brought into line with the standard practice in Scotland whereby the Treasurer had to estimate the coming year's expenditure and revenue, and fix prices of gas "so that revenue shall as nearly as possible meet the expenditure for each year". Any surplus was used to reduce gas prices the following year, and specifically not for the common good of the burgh.⁴

1. Arbroath 1871 a. 47, 65

2. Dundee 1868 a. 16, and Schedule A. a. 11.

3. Arbroath 1899 a. 15.

4. See also Ardrossan 1901 a. 22

At Broughty Ferry (1870 a. 46) revenue was not to exceed expenditure, but compulsory reduction of gas prices only occurred if surplus revenue exceeded ten per cent total.

Paisley was unique in retaining permission in 1870 (a.85) to use surplus revenue for "improving existing streets, opening up new streets", and erecting "public buildings, baths and washing houses, making sewers, and otherwise improving the town."

Perth (1906 a. 13) was most exceptional in being allowed to retain up to £250 of surplus annual revenue for the common good of the burgh provided gas was sold at less than 3s. In contrast to these restrictions, Greenock (J.G.L. 23/9/1884) in 1881-4 paid a total £17,000 surplus gas profits to the common good of the burgh. Even in 1909 (a. 151,152), Greenock was permitted to use gas profits for enlarging the gasworks as much as the Corporation thought "it reasonable to charge", to place up to £2,000 per year to the common good of the burgh, and to have a reserve fund of up to £25,000 to meet any deficiency in income or for

TABLE 5.55 Statutory Maximum Municipal Gas Prices
(per 1,000 cu. ft.)

<u>Date</u>	<u>Town</u>	<u>Price</u>	<u>Date</u>	<u>Town</u>	<u>Price</u>
1865	Greenock	5s 0d	1873	Dumbarton	6s 0d
1869	Glasgow	4 7	1875	Inverness	8 4
1870	Paisley	4 2	1876	Ayr (proposed Act)	7 0
1871	Kilmarnock	6 0	1876	Kirkcaldy	6 0
1871	Arbroath	5 10	1876	Campbeltown	10 0
1871	Greenock	5 0	1881	Irvine	6 3
1873	Paisley	6 0	1886	Ardrossan	5 3
1873	Glasgow*	6 0			

* Glasgow price raised for only two years from 1873 by Provisional Order of Board of Trade.

SOURCES: Private Acts of Parliament. Vide infra Appendix XVIII.3

At the junction of service pipe and mains, gas had to be supplied at a pressure of at least six-tenths inch from midnight to sunset, and eight-tenths inch from sunset to midnight.¹ A minimum candlepower standard was also imposed on each town, and a test burner to prove this had to be set up at the gasworks within six months of the Act.²

"renewing" equipment. Falkirk "Reserve Fund" (1910 a. 7) could be used for reploughing (other than meters and stoves), and was placed on a sliding scale related to the gas price per 1,000 cu ft., i.e. 2d if gas sold at 3s 3d, 1½d if 3s 3d to 3s 6d, 1d if above 3s 6d.

1. Aberdeen 1881 a. 76; Airdrie 1904 a. 29; Ayr 1873 a. 70; Campbeltown 1876 a. 47; Dumbarton 1873 a. 20; Dundee 1877 a. 7; Edinburgh & Leith 1888 a. 75; Falkirk 1894 a. 21; Hamilton 1878 a. 132; Inverness 1875 a. 55; Irvine 1881 a. 101; Kirkcaldy 1876 a. 58; Perth 1888 a. 28; Ardrossan 1902 a. 18; Greenock 1909 a. 319.
2. The exceptions were Hamilton (1878) with three months; Kilmarnock (1871) twelve months.

The test burner was almost always a Union Jet, burning 5 cu. ft. per hour at five-tenths inch pressure, but Dundee (1868) used a 15-holes Argand with 7-inch chimney, as did Forfar (1871) and Kilmarnock (1871). Hamilton (1878) used a Sugg's London No. 1 Argand with 6" by 1½" chimney. Later the tests used a Metropolitan Argand No. 2, and compared this with Harcourt's 10-candle pentane lamp.

e.g. 1912 Arbroath; 1904 Perth a. 16; 1910 Glasgow a. 31.

TABLE 5.56 Statutory Minimum Gas Quality at
Municipal Gasworks

Candlepower from Gas consumed at 5 cu. ft. per hour in a Test Burner

<u>Date</u>	<u>Town</u>	<u>Candles</u>	<u>Date</u>	<u>Town</u>	<u>Candles</u>
1868	Dundee	18	1880	Glasgow	20
1869	Glasgow	25	1881	Aberdeen	20
1870	Broughty Ferry	18	1881	Irvine	20
1870	Paisley	25	1882	Greenock	20
1871	Greenock	25	1888	Edinburgh/Leith	20
1871	Arbroath	25	1894	Falkirk	20
1871	Aberdeen	30	1897	Perth	20
1871	Forfar	18	1901	Ardrossan	16
1871	Kilmarnock	24	1901	Kilmarnock	15
1871	Perth	25	1904	Perth	16
1873	Ayr (proposed)	20	1904	Airdrie	15
1873	Dumbarton	20	1909	Greenock	14
1875	Inverness	20	1910	Glasgow	14
1876	Campbeltown	26	1910	Falkirk	14
1876	Kirkcaldy	20	1912	Arbroath	14
1878	Hamilton	16	1913	Airdrie	14

SOURCES: Private Acts of Parliament.
Vide infra Appendix XVIII.3

During the 1870s and early 1880s, these candlepowers were far below the quality of gas being supplied in most cases, and protection of the consumers was largely illusory. The "twenty candle standard" was not widely adopted until the 1890s, because of expensive cannel coals, and towns like Aberdeen and Perth which wished to reduce their gas quality were willingly permitted to do so by Parliament.

Nevertheless in many towns, any five gas consumers could make a written appointment of another person to test the gas, with the apparatus at the gasworks. Inadequate candlepower, or refusal to allow the experiment carried a fine of up to £20 plus the cost of the experiment.¹ This was sometimes made harder, as at Kilmar-

1. e.g Glasgow 1869 a. 55; Paisley 1870 a. 76; Broughty Ferry 1870 a. 44; Arbroath 1871 a. 44; Greenock 1871 a. 46; Perth 1871 a.63.

nock¹ where the consumers had to use above £10 gas per year, and the gas-tester had to be appointed through the Sheriff, thereby greatly increasing their expenses if the gas was up to standard. At Dundee the Town Council or Local Board of Health, and at Forfar the latter also, could similarly appoint a person to test the gas.²

Normally pipes could not be laid through or against buildings without the consent³ of the owner or occupier, but at Paisley, Falkirk, Airdrie, Edinburgh and Leith, pipes could be laid up common stairs⁴ without the consent of other occupiers or owners, in order to supply tenements. Airdrie was permitted to lay pipes also in private streets and to specify the size and material for all service pipes⁵. Gas normally had to be consumed by meter,⁶ which could not be seized by landlords for distress,⁷ and was open to inspection by the gas authority.⁸ The consumer had to give twenty-four hours

1. Kilmarnock 1871 a. 116

2. Dundee 1868 a. 66; Forfar 1871 a. 43.

3. e.g. Ayr 1873 a. 67; Campbeltown 1876 a. 44; Falkirk 1894 a. 19; Greenock 1871 a. 48; Inverness 1875 a. 52; Perth 1871 a. 52; Kilmarnock 1871 a. 99; Kirkcaldy 1876 a. 55; Broughty Ferry 1870 a.33.

4. Airdrie 1904 a. 28; Edinburgh Leith 1888 a. 73; Falkirk 1894 a.20; Paisley 1845 a.xciii; Ardrossan 1901 a.17.

5. Airdrie 1904 a. 26, 39. Airdrie (a.31) also compelled consumers to have meters within the walls of new houses and not outdoors.

6. Arbroath 1871 a. 34; Forfar 1871 a. 33; Kilmarnock 1871 a.100; Perth 1871 a.53; Greenock (1871 a. 49) had to provide meters free of charge. Glasgow supplied free meters up to 1910, when hire charges were allowed. Gas supplied through pre-payment meters had to be the same price as to other consumers, but the corporation e.g. Greenock (1909 a.315) could make a meter-rent surcharge of up to 10d. per 1,000 cu. ft., or 1s if fittings included rent of a cooker, provided the maximum rent so charged did not exceed ten per cent of the meter purchase-cost (without fittings) per year.

7. e.g. Dundee 1868 a. 59; Falkirk 1898 a. 18; Forfar 1871 a. 36.

8. e.g. Dundee 1868 a. 56; Arbroath 1871 a. 34.

notice before connecting or disconnecting a meter,¹ and was responsible for its maintenance and repair.² The gas authority could remove any meter for testing, and charge that expense to the consumer if it proved faulty.³

Several municipal authorities⁴ took extra powers to sell or hire out gas engines, cookers, apparatus and fittings, or even to manufacture them.⁵ They could require consumers to provide security for the payment of gas or meter rent, but had to pay interest on that money every six months,⁶ at the rate of five per cent on every 10s. At Forfar and Dundee⁷ the authorities could not refuse

1. e.g. Dundee 1868 a. 57; Arbroath 1871 a. 35; Forfar 1871 (a.34) on penalty of 40s as at Perth (1871 a. 54); Kilmarnock 1871 a.101; Broughty Ferry 1870 a. 35 (or 40s fine).
Unauthorised pipes at Paisley (1845 a. xcvi) carried a penalty of £5 plus 40s per day, and at Dundee (1872 a. 14) £5 plus £2 per day and damages.
2. Failure to comply led to the supply being disconnected; e.g. Dundee 1868 a. 58, Arbroath 1871 a. 36; Forfar 1871 a. 35; Kilmarnock 1871 a. 102; Perth 1871 a. 55. At Broughty Ferry (1870 a. 36,40) wilful injury carried a fine of £5 plus damages. When gas engines became common, consumers were forced to install effective anti-fluctuators at their own expense, to prevent pressure fluctuating in gas mains.
e.g. 1904 Airdrie a. 27; 1906 Perth a. 7; 1910 Glasgow a. 43.
3. e.g. Ardrossan 1901 a. 15; Arbroath 1871 a. 37; Dundee 1868 a. 58; Forfar 1871 a. 35.
4. Airdrie 1904 a. 24; Arbroath 1871 a. 37; Falkirk 1894 a. 18; Edinburgh/Leith 1888 a. 71; Forfar 1871 a. 31; Greenock 1871 a. 43.
5. e.g. Kilmarnock 1871 a. 95; Perth 1871 a. 48; Broughty Ferry 1870 a. 29.
6. Aberdeen 1881 a. 79; Ayr 1873 a. 69; Campbeltown 1876 a. 46; Dundee 1877 a. 8; Inverness 1875 a. 54; Irvine 1881 a. 100; Kirkcaldy 1876 a. 57; Perth 1888 a.30.
Airdrie (1904 a. 33) paid only four per cent, but could demand deposit or prepayment only of supplies for under four months.
Perth 1906 (a.14) only four per cent.
Greenock in 1865 (a. 294) could take a deposit for meters, but paid four per cent interest on that money.
7. Dundee 1872 a. 11; Forfar 1871 a. 45.

to supply persons giving security, or disconnect them, upon a penalty of £5. Similarly at Kilmarnock,¹ where the amount of security could be determined by the Sheriff, and supply had to be given within ten days of request on penalty of £2.

In the event of failure to pay gas rent, the municipal authority could disconnect the supply and sue in court for recovery,² and also if there was a wilful wastage of gas.³ Fraudulent injury⁴ of meters or fittings carried a penalty normally up to £5, and disconnection, but Kilmarnock in 1871 charged £10 plus damages. Municipal authorities therefore obtained the same powers of redress against misdemeanours by consumers as had been granted to the chartered companies.

Municipal gasworks fulfilled a social ideal but not an economic revolution. By 1884, when incomplete Board of Trade records showed 361 private gasworks in the United Kingdom, and 150 municipal gasworks, F. Clifford reflected contemporary opinion that this indicated the "growth of wealth and public spirit"⁵ in provincial towns in contrast to their early nineteenth century corruption and jobbery.

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1. Kilmarnock 1871 a. 106, 108.
 2. Falkirk 1894 a. 26; Greenock 1871 a. 56; Kilmarnock 1871 a. 109; Paisley 1845 a. xcv. Dundee (1865 a. 301) was allowed ten per cent more in lieu of costs, and could disconnect supplies if gas debts were unpaid for three days.
 3. Dundee 1868 a. 63; Arbroath 1871 a. 41; Forfar 1871 a. 39; Greenock 1871 a. 52; Perth 1871 a. 60.
Paisley (1845 a. xcix) set a penalty up to £5.
 4. Arbroath 1871 a. 40; Dundee 1868 a. 62; Forfar 1871 a. 39; Greenock 1871 a. 51; Paisley 1845 a. xcvi; Perth 1871 a. 59; Kilmarnock 1871 a. 110.
 5. F. Clifford, Private Bill Legislation (1885) Vol. I, op. cit., p. 255.

In most cases, however, the public obtained only very marginal financial benefit from municipal control of gasworks. Because both factual and intangible events produced this result, considerable weight must be given to the outspoken testimony of Alex Wilson,¹ Glasgow municipal gas manager and consequently the foremost gas engineer in Scotland.

In 1911 Wilson stated that, even where large sums were not taken from gas profits for rates relief,² working costs were only "usually rather less in the municipal undertaking, though in some cases the payments towards interest, sinking fund, and depreciation often bulk nearly as large as dividends." A local authority could obtain extended powers and way-leave more easily than a company, and paid lower local rates, but faced more "onerous conditions" over public lighting in which they were restricted from fair competition against municipal electricity undertakings. Companies had greater advantages than municipal undertakings in taking independent action, "to push, in all legitimate ways, the hire and sale of all gas appliances", and had greater freedom over "the employment and control of their staff" in a more "liberal spirit", providing in some cases profit-sharing schemes.³ Boards of Directors provided a continuity of experience and of policy which was not present in local authorities. Because municipal works always had to take tenders, "no

1. Presidential Address by A. Wilson, Transactions of the Institute of Gas Engineers 1911, pp. 57-9.

2. e.g. Greenock; vide supra p.1016

3. The history of profit-sharing schemes is given by W. Page, Commerce and Industry - A Historical Review of the Economic Conditions of the British Empire (1815-1914) (1919) pp. 432-3.

bargaining" was possible so that traders "by a quiet arrangement among themselves, are often able to obtain better terms than those ruling in the open market". So many "departments and traders all well represented on the council and committees", prevented the gas committee from pressing the best advantages of the gasworks. The large number of municipal employees during elections exercised "considerable pressure on candidates for municipal honours" and thereby obtained not only "good wages", but employment conditions under which it was "difficult to obtain the same value in work or interest that can be secured by a Company." Wilson, who had worked under both municipal and company regulations concluded that "gas companies possess the greater powers and qualifications for making their undertakings successful."

Nevertheless, municipal management of gasworks, under the close financial supervision¹ of Parliamentary regulations, in most cases achieved the provision of adequate supplies of gas at the cheapest prices² possible without permitting the physical deterioration of the capital equipment. The delicate balance between adequate re-investment for growing demand, and gas prices which did not place an excessive burden upon consumers, was achieved far more successfully under municipal ownership than by the Consumers' companies which preceded this. Municipal control produced a virtual monopoly over gas supply, and was used at Greenock and Paisley in the

1. F. Clifford, Private Bill Legislation (1887) Vol. II op. cit., pp. 519, 520.

2. Dundee council, for example, reduced gas to 3s 6d in 1883-6 but misjudged working costs and had to charge 3s 10d in 1886-8 to make good a trading deficit of £7,086. J.G.L. 5/6/1888

mid-nineteenth century to subsidise other municipal activities in a way which many considered an abuse of power. Consequently, in the 1840s and 1860s those citizens who demanded social justice from gas companies sought the solution not in municipal action, but in a restoration of "socialism from above" through the promotion of Consumers' Companies, run by the consumers, for the consumers. These were expected to oust their unjust highly priced predecessors by the operation of a free market economy. They generally failed, largely because the heavy capital investment of established companies meant that they could not seek new markets elsewhere and were obliged to enter cut-throat competition with any New company, whilst allowing their equipment to deteriorate. When the market became divided between two companies, the economies of large-scale production were lost to both, and consequently the price of gas rose, to the ultimate disadvantage of consumers. Municipal gasworks, by exercising monopoly, obtained the full advantages of large-scale operations, of rationalization, and of consumer support. The fact that these advantages were not pursued until the 1870s reflects both upon the distrust of residents for municipal action, and their strong belief in the justice of a free market economy.

Chapter VI The Cheap Gas Movement, Consumer Relations,
and Markets

(1) The Consumers' Cheap Gas Movement

The development of pressure groups among consumers, and their growing awareness of the organizational and technical feasibility of reducing the price of gas for the benefit of all consumers, produced a 'Consumers' Movement' which had considerable effect upon the Scottish gas industry, and in which ideas and tactics passed with growing sophistication from one town to another throughout the nineteenth century. Early gas companies, which required a large capital outlay, posed not only the threat of monopoly in non-mobile markets, but could also intrude their regulations into the private lives of all consumers.¹ Small consumers had no choice about the quality and price which the company dictated. They had personally to finance their own service pipes, meters and fittings, or pay the Company's rents if fittings were available for hire. Many companies stipulated the precise fittings which consumers could use, and naturally demanded that these were kept well maintained. Where gas was sold by time units instead of meters, company Inspectors were given a right to enter private property at will to examine fittings and prevent illicit use.²

Disconnection and the cessation of supplies was used to enforce Company rules, even against Town Councils and public bodies which delayed payment.³ Together with possible oil pollution and smells from

1. vide A.Coote and L.Grant Eds. Civil Liberty - The N.C.C.L. Guide (1973) pp. 52, 220 Vide infra p. 990

2. Time-unit consumers were obliged to agree to this before obtaining a supply of gas. Vide infra pp. 1773, 1774

3. E.g. Lochgilphead company cut off the supply to public lamps in 1884 after a disagreement with the Council over prices. J.G.L. 20/1/1884.

the gasworks, and the hazard or inconvenience of trenches for placing pipes under the public streets, this produced a wide zone of potential conflict between gas companies and their consumers. Company bye-laws,¹ usually initiated by the Directors, were applied both to company servants and consumers, yet Acts of Parliament² for gas companies, and the articles of co-partnery which closely copied these in unincorporated companies, provided few safeguards for consumers. Consumer welfare was therefore entrusted at first to Directors of high local standing, often magistrates or councillors promoting social welfare. As these became displaced by shareholders with more concern for financial profit, more tangible restraints were demanded by consumers.

Competition, or the threat of competition in supplying gas, was the traditional and only overt method of exercising consumer pressure upon Companies.³ Consumers were unable to judge simply what constituted a reasonable price for gas, even by comparison with neighbouring gasworks, because of the numerous external factors affecting the manufacturing costs.⁴ Consequently they could not distinguish poor management from excessive profits, without some means of forcing companies to reveal more information when prices appeared excessive. The financial gains from new technology, usually at a time which sponsors claimed to be one of inexpensive iron and labour for the initial construction work, provided the trigger for several distinct waves

1. Vide supra pp. 930, 1773

2. Vide supra pp. 992, 1098

3. The initial pattern of share distribution among local residents who were consumers, made them at first quite responsive to consumer requirements, and most Companies remained open to the social pressure of consumers' interests as expressed through their shareholders. They were not manipulated simply for the financial benefit of absentee capitalists. Parliamentary regulations for chartered companies were always too lax to provide, unaided, protection of consumers, and hence for example, a second company formed in Glasgow. Although Town Councils controlled the public lighting revenue and the right to open streets, these weapons were not used to enforce concessions for the average gas consumer. Vide supra pp. 953, 967, 1010

4. Vide supra p.866

of consumer unrest and support for competition.

The background to official attitudes towards consumers' grievances was always the situation in London,¹ which was usually examined for reference by Parliamentary and local government committees examining the "gas question". During the 1820s, attempted competition in Scotland was out of phase with London monopolies where 'district' agreements² and the 'Congreve Compact' of 1823-30 had replaced the outright competition of 1810-23. Competition flourished in Scotland in the 1830s, just as it did in London with price-cutting and Government approval in 1830-40. The Commercial Company³ there in 1836 was a "consumers' company" formed by Whitechapel tradesmen who were dissatisfied with the existing supply. When London relapsed into monopoly conditions in 1840-8, Scotland continued to produce authentic consumers' companies. No general historical account is available on English Consumers' Companies other than those in London.⁴

The renewal of competition in London⁵ in 1848-60, with John

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1. Chronology of London developments based upon -
W.J. Liberty "The Century of Gas Lighting and its Historical Development" - The Illuminating Engineer 1913, Vol.VI, pp.184, 191-4.
H. Chubb "The Supply of Gas to the Metropolis" - Journal of the Royal Statistical Society (1876) Vol.III, p. 355.
D.A. Chatterton "State Control of Public Utilities in the Nineteenth Century : The London Gas Industry" - Business History 1972, Vol.XIV, p. 166.
 2. From 1825 the Home Secretary could fix boundaries between London companies, as with the Chartered and Imperial companies that year.
 3. King's Treatise (1878) Vol.I, op. cit., p. 51.
 4. c.f. In Liverpool, the Guardian Society for the Protection of Trade campaigned for cheaper gas in 1840, and in 1845 unsuccessfully promoted a Coke Oven Gas Company, but Liverpool Gas Consumers Association was not formed until 1869.
S.A. Harris Gas Supply of North Merseyside (1956 op.cit.), pp. 49, 82.
 5. Vide infra p. 1148

Thwaite's Surrey Consumers' Company of 1849, and the Great Central Gas Consumers Company,¹ was disliked by Parliamentary committees.² The Gas Consumers' Mutual Protection Association opposed the development of 'district' agreements which even Consumers' Companies³ began seeking. Despite campaigns by Flintoff⁴ for continued competition, the 1860 Metropolitan Gas Act initiated a period of monopolies which, after the amalgamation of companies in 1868-83, led to the statutory monopolies of 1883-1907. In contrast, during the 1860s Scotland was convulsed with projects for competition, and in the 1870s projects for municipal control.

The main periods of effective consumer action in Scotland by the formation of rival companies in 1842-5* and 1858-63, and by municipal action in 1868-74 and later, coincided with periods of low Bank Rate and Bill Discounts, as previously explained.⁵ Free Trade agitation was also harnessed to the consumers' cause in the 1840s, because gas had become a "necessity of life".⁶ Thus a Dundee radical in 1844 requested "Free Trade in this commodity, as well as in corn, sugar,

1. Promoted by A.A. Croll, gas-meter manufacturer, and G. Pearson the former solicitor to the City Gas Company.

2. D.A. Chatterton has emphasised that Government did not adopt a laissez faire attitude towards gas and water companies after 1850, but continued to restrain their actions by social legislation. Business History (1972) op. cit.

3. e.g. Surrey Consumers' Company in 1853, from fear of undercutting by rivals.

4. G. Flintoff was secretary of the Great Central Gas Consumers' Company, London, until 1853 when he assumed the same position in the Sheffield Gas Consumers' Company. The Builder 1853, p. 392; vide infra p.1802.

5. Vide supra p.731 Fig. 4.4; pp. 740, 1048

6. Whereas oil and candle could compete with gaslight in villages, it was argued in 1843 that large modern buildings, like warehouses in Reform Street, Dundee, were designed in a way which made only gas-lighting feasible.

Dundee, Perth and Cupar Advertiser 24/11/1843, p. 3 (Dundee Ref. Lib.).

* Partly stimulated by railway developments in the 1840s. Vide infra p. 1804

or any other necessity".¹

Discontent appeared first in Glasgow, in 1819. Letters to the press revealed that shares in the Chartered company fetched a seventy five per cent premium, and accused it of deciding to maintain high prices and profits to gain from share sales.² The Police Board was believed to have been infiltrated by Company partners, and purchased gas for public lighting at an annual cost of £263 more than oil lamps,³ while the Company opened trenches without adequate warning to nearby residents. Premiums continued to rise because ownership of the company had contracted to 200 individuals who thought they were "secure as a monopoly",⁴ but the gas supply was inadequate. Impurities prevented gas from being used in dwelling houses, and during the winter of 1819-20 mains pressure was so low and pipes so narrow that the three and a half inch jets in street lights were reduced to under one inch of flame.

The 'Glasgow New Gas Light Company',⁵ formulated about April 1819, hoped to abolish Sunday labour and to build "at a proper distance from the city" to reduce the 'nuisance' caused by operations.

1. The writer wanted public balance sheets to be compulsory for gas companies as for railways, but significantly was in favour of Municipal purchase of the gasworks, though that had not been forthcoming. Dundee, Perth and Cupar Advertiser, 24/2/1844, p. 2.

See also Free Trade Comments by Bailie Moyes, Dundee Advertiser, 5/4/1844, p. 2.

2. Glasgow Chronicle, 24/4/1819, 10/2/1820.

3. Glasgow Chronicle, 4/5/1819. Total lighting costs £1725, or one shilling and threepence in one pound rates.

4. Those who took the considerable initial risk had therefore left, and should not have attracted public sympathy. One shareholder paid seventy eight per cent premium, because a ten per cent dividend was forecast, and he observed the profit made by others "buying and selling shares in the two Water Companies". Glasgow Chronicle, 10/2/1820, 3/6/1819.

5. Glasgow Chronicle, 27/4/1819, 5/6/1819. Promoters vide infra p.1804

More fundamental proposals,¹ however, contained the quintessential basis of the Consumers Movement. The Company was to be organized so that "every Shop-keeper, or others who use the Gas, may, at small expense, become a Member, and have the Gas at the cheapest rate, besides his share of the profits". Better technology would provide a cheaper and more efficient works. The price of gas would be reduced to prevent maximum annual profits from exceeding ten per cent. Each shareholder was to have only one vote, and an abstract of accounts was to be published annually to prevent secret funds being accumulated. Competition like that between water companies, steam boats and bakeries, would "prompt both parties [companies] to civility and discretion" while providing the cheapest gas possible. The number of consumer-shareholders was a guarantee of markets for the Company, and a source of continuing promotional support which would make gas as essential as tap water in dwelling houses.

In reply, the Glasgow Gaslight Company claimed that "the principal Merchants and Inhabitants of the City" who were shareholders,² would uphold the public's interests. For the risk of building a gasworks, they felt entitled to public support, especially since "no return" had yet been paid upon the £40,000 share capital and obligations had been taken for another £10,000 in loans.³ With forty miles of main pipes they gave a comprehensive supply of gas, and promised

1. Prospectus in Glasgow Chronicle, 4/5/1819. Capital stock £20,000 in £5 shares, Glasgow Chronicle, 12/6/1819. By 1820 the Company claimed 12,000 supporters, Glasgow Chronicle, 10/2/1820; House of Commons Journal 1819-20, Vol. 75, 8/12/1819, pp. 34, 56, 272. Like most private Bills and Committees before 1836, no records are extant in the House of Lords Record Office.

2. Traditionally, only wealthy capitalists could be entrusted with management in joint-stock enterprises, vide infra p. 743

3. Glasgow Chronicle, 5/6/1819.

to reduce prices whenever possible.¹ Public lamps, at twenty three shillings each, were supplied at the lowest prime cost of gas, and the Consumers Company had grossly overestimated total revenue.² The lack of published statistics enabled the Old company to claim falsely their gas was cheaper than "in any other town on the Island", and that the pipes had to be laid with "mathematical precision" so that rival excavations would probably extinguish "a thousand lights" by causing water blockage in disturbed pipes, and "miles" of pavement would have to be excavated to locate such a blockage.

Monopoly was stated to benefit consumers.³ A second company would duplicate the expenditure on capital equipment, pipes, repairs, and labour, and double the leakage and the disruption caused by trenches to repair leaks and transfer consumers from one set of mains to another. But it would halve the market served by each enterprise with the result that prices would have to rise to give adequate profits on the heavy capital outlay, despite reduced sales, and competition would soon prove so ruinous that price-fixing was inevitable between the companies. By 1819 three London companies had reached district agreements because competition was so wasteful.⁴

A substantial price reduction⁵ was made by the Glasgow company⁶ in June 1819 to deflate the complaints, and together with the promise

1. Glasgow Chronicle, 5/2/1820.

2. The New Company estimated £16,000 a year, but the Old company obtained only £10,000 of which £6000 was absorbed by expenses.

3. Glasgow Chronicle, 3/6/1819, 2/12/1819.

4. Glasgow Chronicle, 17/6/1819.

5. Glasgow Chronicle, 5/6/1819. Vide infra p. 1745

6. Fears were expressed by the Old company that Parliament would sanction competition - vide Glasgow City Archives (D.G.E. 180), Letters to R. Grahame of Whitehill, resident in London.

of lower prices in future and a reduction of share premiums below fifty per cent, this constituted a successful challenge by consumers against the "Demon Monopoly" even when their Bill was withdrawn from Parliament. In 1823 another abortive attempt was made to compete in Glasgow¹ using oil gas,² but the next important step was taken in Edinburgh.

Leith oil gas company extended pipes into Edinburgh in 1824, but the following year changed to coal gas, and although Edinburgh city council prohibited further extensions, this was the first Scottish town with two suppliers of coal gas. When the insolvent Edinburgh Oil Gas Company was purchased by Edinburgh coal gas company³ in 1828, renegades from the former agitated against the new monopoly, and during the same year promoted 'The Union Gas Light Company of Edinburgh' to supply coal gas.⁴

1. In 1824 the Old Glasgow company drafted a petition to the House of Lords against the proposed 'Glasgow Oil and Coal Gas Light Company', and in 1825 organized, anonymously, a public petition to the Commons against that Company. Glasgow City Archives (D.G.E. 49), 12/5/1824; (D.G.E. 50) 1825. Vide infra p.1513

2. The Old Glasgow company in 1823 employed J.B. Neilson, a pupil of Dr. Ure, and also John Hart, to confirm the quality of their gas in comparison with other towns in what was probably the first attempt to apply an accurate "method of comparisons". They carried their own equipment, a single-jet burner, and candles (6 in 1 lb), and used a 3 inch flame to apply the "method of shadows" to calculate luminosity in many English towns. This showed that English gas was in the ratio of between 3 to 5 and 5 to 6 compared to Glasgow gas. The illumination of gas from a single Glasgow retort, through more rapid generation of gas, was 100 to 40 compared to a London retort. A. Ure, A Dictionary of Chemistry (1823) pp. 343-5; A. Clow, "Scotland's Contribution to Industrial Development" (1944), op. cit., p. 64. Glasgow City Archives (D.G.E. 122) Memorandum on Gas Company, p. 17.

3. Edinburgh city council provided an illegal monopoly to the company. Vide supra p.1011. Edinburgh City Archives, "Edinburgh Council Record" 28/1/1824.

4. Nominal capital £100,000 in £10 shares, with £1 called up in January 1829. Interim committee comprised J. Alexander merchant, W. Allan banker, J. Hill merchant, D. Clyne writer, W. Alexander wine-merchant, T. Edmonstone merchant, A. Wright advocate, and J. Stoddart W.S. Edinburgh Evening Courant, 19/4/1828; S.R.O., Sheriff Court of Midlothian (S.C. 37/7/1635, S.C. 39/7/1891) date 1/8/1832.

They argued that the old Edinburgh company was owned and run by only 279 persons, of whom "about 100 are ladies and non-residents", and most of the others neither consumed gas nor paid Police Tax for lighting, and had no incentive to provide cheaper gas. Excessive capital had been used to build the original works, with primitive technology, in a period of high labour and material costs and at "a populous neighbourhood" site. More was wasted buying the defunct oil gasworks. The new company expected to build a new works of equal capacity to the old for only £30,000, and "active competition in trade alone can secure a supply of any commodity at a fair price, and of the best quality", with better "courtesy and attention" for the consumers.

The established Edinburgh company successfully quenched this attack with arguments later used in the defence of many Scottish gas companies. With sixty miles of mains pipes, including many supplied gratis for street lamps, the Company provided a comprehensive supply which in public lights alone saved £2660 a year compared to oil lamps. Equipment costs were not lower in 1828 than in 1817-18 when construction took place, and no equipment was antiquated because new designs had been purchased as the works expanded. There were no secret funds hoarding surplus profits, and capital expenditure was not excessive, since it was useful, for example, to use the oil-company's gasholders to provide correct pressure in the lower part of the town.¹

While this controversy developed, the 'Dundee New Gas Light Company' was also formed, to provide better service to consumers, but was denied an Act² and dissolved. Duplicate investment in gas or water undertakings, despite the inconvenience of duplicate trenches,

1. Tanfield 'holders' Vide infra p.263

2. Vide supra p.953

offered a short seductive period of cheap supplies. But Parliament foresaw that this would rapidly erode the fixed and reserve capital of both, and result in a long period of very excessive prices while the victorious company recouped its losses. The special circumstances were first summarized by a Parliamentary committee on the London Water Companies in 1821, and the theory remained of great importance throughout Britain until at least the 1850s. It was quoted by the Edinburgh company, and subsequently adopted elsewhere in Scotland by defendants and civic leaders to oppose laissez faire views.

Competition in ordinary cases adjusts the supply to the demand, through the liberty whichthe sellers have to go out of the market, as well as to enter it; but in trades carried on by means of large capitals, vested in fixed machinery and furnishing a commodity of no value but for consumption on the spot, the sellers are confined to the market by the nature of the trade; and if the new-comer has to seek immediate employment for large works, by taking custom from the established dealer, then, as there can be no great difference in the quality of what they sell, they must vie in lowness of price, and will probably be driven to underbid each other down to the point of ruin; because it is better to take anything than to take nothing for that which cannot be taken away, this must go on until both are worn out, or one has outlasted the other, and succeeded to a real and effective monopoly; or until by some arrangement [of price-fixing] between themselves they can put a stop to their mutual destruction.¹

1. Edinburgh Evening Courant, 26/4/1828.
B.P.P., 1821 (706) V, Report of the Select Committee on the Supply of Water to the Metropolis, pp. 3-4.
Urban Areas - Water Supply (1968, Irish University Press) Vol. I. The argument against double capital, double wear-and-tear, double labour, and double leakage, was stated before numerous Parliamentary committees on gas-lighting, and before the Commissioners of Enquiry into the State of Large Towns and Populous Districts, by Mr. Hawksley, engineer of Nottingham Waterworks. When a second company formed in Glasgow, Hawksley predicted, incorrectly, that price-fixing would later raise gas prices by 1s 8d per 1000 cu.ft.
 Vide
Chambers' Edinburgh Journal 1844, Vol. II, p.154.

Renewed popular agitation in Glasgow during 1835 was directed against the practice of reploughing surplus profits. Five "Commissioners"¹ appointed at a public meeting² obtained access to the Gaslight company books, and claimed that in addition to legitimate working expenses, depreciation and dividends, the Company spent £353 to oppose a projected rival company³ in 1826, and had illegally reploughed £53,779 from reserve for "very great extensions to their works". They demanded the repayment of this money to consumers, by a fifty per cent reduction in gas prices for five years, under the threat of forming "another gas company", although this did not materialize.

The attack produced a remarkable response by Glasgow Gaslight Company, which admitted to non-compliance with a strict interpretation of their Act, and yet claimed indulgence on the basis that it operated as, virtually, a Consumers' Company. "When the undertaking was first projected it was found next to impossible to raise the Stock of £40,000 either by public sale of shares or by private subscription",⁴ but as soon as the works opened demand rose rapidly. Under the first Acts of 1817 and 1822 the Directors⁵ interpreted their "engagement with the public" to warrant the use of some surplus profits and share premiums for "keeping in repair and extending the works". Under the

1. The 'Commissioners' were approved by the Magistrates and Town Council, who as shareholders were able to provide them with information, though the Magistrates had no special jurisdiction over the company. They were Robert McGavin, Henry Brock, Henry Paul, John B. Gray and George Ord. Glasgow City Archives (D.G.E. 150), (D.G.E. 144).

2. The "First Report of the Commissioners" was published 30/7/1835. Glasgow City Archives (D.G.E. 150) and Miscellaneous Papers, Vol. 18, pp. 215-7; Bell and Patton, Glasgow - Its Municipal Organization (1896), op. cit. Vide supra p.824

3. Possibly the Oil Gas Company, originally promoted 1823. Vide infra pp. 426, 1513

4. Glasgow City Archives (D.G.E. 122), "Memorandum Relative to the Affairs of the Glasgow Gas Light Company, 1834", p. 4.

5. Ibid., pp. 22; The Directors received no salary.

1825 Act when "the risk which the original subscribers had undertaken had disappeared", the Company voluntarily imposed a maximum ten per cent dividend, but the Act also restricted total triennial profits to a maximum ten per cent. The Directors evaded the latter restriction, to replough surplus profits as capital equipment for the public benefit.

Consequently, "the consumers are in fact substantially the proprietors of the works, subject only to the expenses of keeping them in repair and extending them so as to supply the city and suburbs with Gas".¹ Reploughing enhanced the premium received for shares such that a ten per cent dividend was only five per cent on the market price, and Parliament ensured that no dividend could be paid upon either the premium or upon the reploughed profits. Unlike unchartered companies, the nominal value of shares could not be raised at the whim of the proprietors. By reploughing premiums and profits, the Company made "a kind of copartnership with the Consumers of Gas, [and] by placing surplus profits to the credit of a dead Stock account, and Gas Meter account"² they saved the consumers from paying dividends which would be necessary if that capital had been raised instead by new shares. Moreover, as the maximum dividend was already being paid, reploughing profits did not increase partners' annual receipts,³ and benefitted the consumers⁴ far more than if, as a reserve fund, it had been retained as cash or invested elsewhere as required by the Act.

1. Glasgow City Archives (D.G.E. 122) op. cit., p. 10.

2. Glasgow City Archives (D.G.E. 150) "First Report of the Commissioners for the Examination of the Glasgow Gas Light Company's Accounts", 30/7/1835.

3. It did, of course, raise the market value of shares if partners wished to sell them.

4. Glasgow City Archives (D.G.E. 122) op. cit., p. 20.

Apart from these legitimate reserves, the "Commissioners" detected only £5891 surplus gas revenue reploughed in 1826-34, a sum which was less than dividends of £6250 which would already have burdened consumers if their own method of issuing stock had been undertaken, as shown in Table 6.1.

Table 6.1 Theoretical Capital Stock Increase required by Glasgow without Reploughing 1826-34

<u>Date</u>	<u>Number of £25 shares required for extensions</u>	<u>Capital Raised at £50 upset share price (£)</u>	<u>Dividend on New Shares</u> £
1831	250	6250	625
1832	250	6250	1250
1833	250	6250	1875
1834	250	6250	250
Total	1000	50000	6250

Source:- Glasgow City Archives (D.G.E. 150) op. cit.

Glasgow company largely retained the approval of its consumers during 1835, although at nearby Tolcross a new Gas and Water Company was formed in 1836, apparently to capitalise upon the aroused public opinion. It collapsed within a year, despite the support of many eminent Glasgow residents.

Table 6.2 Shareholders in Tolcross Gas and Water Company (1836)

		<u>Number of £20 shares</u>
John Wilson, Clyde Ironworks,	Ironmaster	40
Colin R. Wilson, Clyde Ironworks,	Ironmaster	20
Andrew Bannatyne, Glasgow,	Writer	20
Colin Dunlop, Tolcross,	Ironmaster	100
Dugald Bannatyne, Glasgow,	Writer	20
John Tait, Glasgow,	Coal Agent	20
Colin M. Frew, Glasgow,	Merchant	20
David Ralston, Tolcross,	Iron Merchant	20
George Dunlop, Edinburgh,	Writer to the Signet	20
John McIlquhan, Tolcross,	Agent	20

Source:- Glasgow City Archives "Tolcross Gas and Water Company Minute Book". See also B.F. Duckham Scottish Coal Industry (1970) op.cit. p.181
Vide infra pp. 829, 1365

The shareholders, who paid a call of five pounds for Parliamentary¹ expenses, included Andrew Bannatyne² and his father Dougald a founding member³ of the Glasgow Gaslight company, and George Dunlop, a director of Edinburgh Oil Gas Company in 1824.

Aberdeen⁴ emerged in 1836 as the new focus of activity, after a dispute between the Council and Company over public lighting. 800 public gaslights were in use, but to supply a further 200 in forty one suburban streets which still used oil, the Company requested price increases from twenty five to eighty five per cent to reimburse the expense of five miles of new mains pipes which this required. The Aberdeen company, which supplied gas⁵ to public lights at thirty seven and a half per cent below the standard rate of eleven shillings, was obliged to retract this demand, but the Council nevertheless published a controversial and technically incorrect report on gas-light researched by Mr. Sim, a Police Commissioner. Of the total £475 annual cost for gas street lights in Aberdeen, Sim claimed that £145

1. An Act was obtained, and costs included £556 to Messrs. Deans and Dunlop, solicitors in London, £106 to A. and D.J. Bannatyne, solicitors in Glasgow, £24 to D. MacKain engineer, £8 to Neil Robson engineer, and £10 to Joseph Swan engraver; Glasgow City Archives, Tolcross Minute Book, op. cit.; Vide supra p.973

2. Andrew Bannatyne, like Colin Dunlop, James Lumsden, Charles and his son John Tennant of St. Rollox, Robert Grahame of Whitehill and James Oswald, was part of the leading Whig clique of moderate, "upper middle class men", who had been particularly active in Glasgow in support of Parliamentary reform, and took a strong interest in the gas-supply industry; Memoirs and Portraits of One Hundred Glasgow Men (1886, Glasgow) Vol. I, p. 57.

3. Dougald Bannatyne was a Director of Glasgow Old Company in 1836. Glasgow City Archives (D.G.E. 24).

4. Aberdeen Journal, 11/5/1836, 18/5/1836, 25/5/1836, 25/3/1836. c.f. At Forfar in 1836 gas cost 13/11d, but a second attempt to form a new, rival gas company, failed; Aberdeen Journal, 13/7/1836, p. 3.

5. Aberdeen gasworks sold 9.396 million cu.ft. at 11/-, with a discount of 5 to 25 per cent for large consumers, and 37.5 per cent for street lamps.

was in excess of equal public lighting in Edinburgh even after allowing for higher coal prices of £40 in Aberdeen.

The Company was drawn into public debate, and justified itself by demonstrating that Sim had miscalculated the cost of gas consumed in street lamps because each town stated the price per 1000 hours but not the quantity consumed by different burners. He had also misrepresented coal and other equipment costs which gave Edinburgh an advantage of seventeen and a half per cent over Aberdeen, and other central Scottish towns had similar advantages.

Table 6.3 Public Lighting Costs in Various Towns compared to Aberdeen (1836)

<u>Town</u>	<u>Sim's Statistics per lamp (per 1000 hours lighting)</u>	<u>Aberdeen Gas Co. Statistics (per 1000 cu.ft. consumed)</u>
Aberdeen	6s. 10½d	6s. 10½d
Edinburgh	4 2	5 7
Glasgow	4 4½	8 2
Perth	5 6 (including lamplighters)	6 6
Dundee	6 11½ (including 60 feet pipe)	6/8d. to 7/6d.
Greenock	7 6 (including lamplighters)	8/11d. to 11/2½d.

Source:- Aberdeen Journal 11/5/1836 et seq.

Table 6.4 Expenditure in Various Towns compared to Aberdeen Gasworks

<u>Town</u>	<u>Parrot coal (per ton)</u>	<u>Fuel coal (ton)</u>	<u>Other advantages</u>
Aberdeen	18s. 11d.	11s. 7d.	
Edinburgh	15 0	7 9	Cheaper fire bricks, retorts, ironwork
Glasgow	13 6	8 0	Good market for tar and ammonia liquor.
Dundee	14 6	-	
Greenock	12 7	-	

Source:- Aberdeen Journal 11/5/1836 et seq.

The publication of objective factual information produced a degree of

public accountability in the company at this early stage.

In June 1836 the Aberdeen Union Gas Light Company¹ was promoted, with many ideas similar to those earlier expressed in Glasgow. "If the Consumers generally would associate themselves, not for the sake of a large and direct profit, but for the purpose of procuring Gas-Light on the best and lowest-possible terms, with a reasonable return on the capital", it could be sold more cheaply. The Company contract was designed to ensure this by publishing an annual statement of accounts, restricting dividends to a maximum six per cent, and providing that once a "reasonable sum" had been allowed for sinking, deterioration and contingency funds, "the whole surplus profits of each year shall be applied to the further reduction of the price of Gas". After five years, the company would be sold at 'book' value to the Police Board if they obtained a suitable Act and upheld the objective of cheap gas. The Promoters "entirely disclaim any interested or invidious motives", and explained in advance that the price of gas would depend considerably upon economies of scale:² eight shillings at ten million cubic feet output, seven shillings at fifteen million, or six shillings at twenty millions. The more support consumers gave, the cheaper gas would become.

Besides quoting Parliament on the London Water Companies, the old Aberdeen company reduced³ the price of gas by ten per cent to ten shillings, and reduced meter rents to three shillings. To absorb the remaining momentum of the Consumers Movement, it announced motives⁴

1. Prospectus in Aberdeen Journal 8/6/1836, Capital Stock £25,000 in £5 shares, Proposed meter rent 2/- or 3/- a year, or sold outright at prime cost.

2. Vide supra p.798

3. Aberdeen Journal, 22/6/1836, 17/8/1836.

4. Aberdeen Journal, 15/6/1836, 22/6/1836, 29/6/1836, 6/7/1836.

as pure as those of the new Company, and reorganized the entire capital stock. Each old share was divided¹ into six new five pound shares, and £10,000 of additional stock with an "immediate" dividend of four per cent was offered for public sale. This was purchased rapidly, and mopped up many investors who would otherwise have joined the Consumers Company, which rapidly collapsed.

Popular discontent with the old Edinburgh Company's "excessive" ten per cent dividends, which gave twenty five pound shares a market value of sixty pounds, led the Lord Provost and Lord Dean of Guild to join the provisional committee of the 'City of Edinburgh New Gas Light Company'² promoted in 1839. They claimed that expensive gas provided profits for a small proprietary, "chiefly non-resident... to the exclusion of the inhabitants, especially of the middle classes, who are the consumers". The aim was therefore to "enable the consumers of Gas to participate in the profits, and thus insure the success of the undertaking, by interesting the community generally in the support of the scheme". Although shares were allocated preferentially to potential consumers, no strict regulations were adopted for consumer protection.

The Principal promoters³ of the company were T.L. Abernethy wool-len draper, and John Anderson junior, but the Committee appointed in April 1839 to allocate shares included the Lord Provost, Bailie Ramsay, Richard Alexander wine merchant, William Alexander W.S., G. Bookless

1. Reductions in nominal share values, vide supra p.744

2. Nominal Capital £100,000 in £5 shares; 66,000 shares subscribed by April 1839, and capital stock raised to £150,000, maximum 100 shares per person; one vote per 5 shares; £1.10/- called up on shares in November 1839 to finance the Bill. The Scotsman, 20/3/1839, 3/4/1839.

3. The Scotsman, 3/4/1839.

glazier, Robert Clark merchant, George Grant advocate, E. Henderson seedsman, James Hill Master of Merchant Company, A. Jamieson Deputy Chairman of the Chamber of Commerce, William Johnston engineer, John Learmouth of Dean, Andrew Millar merchant, Ralph Richardson tobacconist, J. Robertson music-seller, E.D. Sandford advocate, James Smith architect, and William Tait bookseller. The earlier Provisional Committee¹ also included such notables as the Lord Dean of Guild, Bailies Grieve, Campbell and Richardson, Councillors Dobson and Ponton, James Anderson Baron Bailie of Portsburgh, Bailies Hill and Scott of Portsburgh, Deputy Commissary-General Wemyss, J. Clark Convener of the Trades, W.K. Aitchison brewer, Dr. D.B. Reid lecturer on chemistry, P. Kelland Professor of Mathematics, and Professor Lizars.

Great difficulty was found in obtaining permission for a gasworks in Edinburgh, until the small existing supply from the Leith company was exploited as a flaw in the defensive monopoly of the Edinburgh company.² The Leith shareholders agreed to sell their works, and in November 1839 the new Edinburgh company promoted a "Bill for the better Lighting with Gas the City of Edinburgh and Town of Leith". The Edinburgh and Leith Company thereby became the first competing Scottish coal-gas company committed to providing cheaper gas, and improved quality and service, for the welfare of the public.

Amongst the partners named in that Company's Act³ of March 1840 were Sir James Forrest of Cormieston the Lord Provost of Edinburgh, Sir Alexander Maitland Gibson, Sir Francis Walker Drummond, Robert

1. The Scotsman, 20/3/1839; Vide infra p.1804

2. The Scotsman, 21/9/1839; An unidentified^{Edinburgh} gas company applied for Letters Patent in 1836, vide B.C. Hunt, The Development of the Business Corporation in England 1800-1867 (1936, Cambridge, Mass.), p. 57.

3. 3 Vict. Cap. XII, 23/3/1840. Vide supra pp. 988, 1366

Auchinleck (Cheyne of Kilmarone), Thomas Henderson of Press, Joseph Baird merchant, John Jardine advocate, John Ford glass manufacturer, Sutherland Mackenzie manager of the Scottish Union Insurance Company, John Wood manager of the Hercules Insurance Company, several Solicitors to the Supreme Courts like M. Lothian, T. Johnstone and I. Bayley, as well as Hugh Auld banker, George Crosbie banker, and James Cochran brass-founder and gas-fittings manufacturer, all of Edinburgh. Partners resident in Leith included James Reoch the Provost, Adam White of Fens the former Provost, Henry Johnstone and James Ker bankers, and John Macfie and A. Schultze sugar-refiners.

Edinburgh's success led to reappraisals elsewhere, and the 'City and Suburban Gas Light Company of Glasgow'¹ which was promoted in October 1842, generated sufficient publicity to inspire attempts at consumer-oriented competition in many other Scottish towns in the mid 1840s. Nevertheless, the promoters had mixed motives of profit and public duty, and besides highly priced shares which severely restricted consumer participation, had no specific rules to promote the consumers' welfare. The distinguished interim committee comprised Alex Baird² from Wm. Baird and Company, ironmasters of Gartsherrie, William Dixon

1. Glasgow City and Suburban Company is considered here, rather than in the previous section on Chartered Companies, as it inspired many subsequent, unincorporated Consumers' Companies. The promoters noted that in Edinburgh the old company's stock still obtained 100 per cent premiums and the new company 50 per cent premiums. Liverpool, Leeds, Manchester, Birmingham and Sheffield were noted to have competing companies. Glasgow C. and S. had a nominal capital of £150,000 in £10 shares.

Prospectus in Glasgow Chronicle, 7/10/1842.

2. Director of the City of Glasgow Bank, and a founding partner in the Clydesdale Bank.

J.M. Reid The History of the Clydesdale Bank (1838 - 1938) (1938) p.105

of Calder and Wilson town Ironworks, James Lumsden,¹ James Merry iron and coal master of Monkland Canal Basin, William Mutrie fancy silk and velvet manufacturer and printer, George Douglas lead merchant, Robert Fleming of P. & R. Fleming merchants, John Fleming merchant, Thomas Kennedy probably the silk and calico printer of Little Govan, and John Mitchell probably a cork manufacturer and merchant. Compared to London with eight gas companies, and "leading Towns throughout the Kingdom" which all had two companies, the "second city of the Empire" seemed to them poorly supplied.

The new company maintained that competition would provide "Purity of Gas, - Attention to the Wants of the Consumer, - and Moderation in Price". A saving of "not less than twenty five per cent" would be made through improved technology in construction and operating costs, while "Iron, the chief expenditure in the construction... [is] lower in price than it is believed ever to have been". Rapidly expanding suburbs around Glasgow would acquire an adequate gas supply for the first time. The venture met enthusiastic support, and by the end of October all the stock had been allocated, giving preference to residents "from Glasgow and the neighbourhood, or those locally connected

1. James Lumsden (1778-1856) was a leading promoter, and was also on the 1819 Consumers Committee. The son of a Glasgow stationer and publisher of the same name, he became a Town Councillor (1822), Police Commissioner, and Lord Provost (1843-6). A Whig philanthropist in connection with Glasgow Royal Infirmary, and Model Lodging Houses, he was a strong supporter of 1832 Reform Act, experimented early with steam power, and owned Clyde river steamers in partnership with W. Mirrlees. A founding member of Glasgow Union Banking Company (1830), and Clydesdale Banking Company (1838) in which he was the first Chairman, and founder of the City of Glasgow Life Assurance Company. His son James (1808-79) was on the Board of Glasgow and S.W. Railway from 1849, and Lord Provost of Glasgow 1866-9; Glasgow Chronicle, 12/6/1819, p. 3.: J.M. Reid, The History of the Clydesdale Bank 1838-1938 (1938), pp. 41-5, 156.: Memoirs and Portraits of One Hundred Glasgow Men (1886, Glasgow), Vol. II, p. 179: J.S. Samuel Ed., The Lord Provosts of Glasgow From 1833 to 1902 - Biographical Sketches (1902, Glasgow), pp. 86-90.

2. Meeting at Black Bull Hall; Alex Baird chairman. Motion accepting engineering estimates proposed by Mark Sprott of Garnkirk and Mr Brooks, and passed. Mr Lamont secy. to Co. Eleven directors chosen to replace interim committee. Glasgow Chronicle 31/10/1842

with the district - in all cases rejecting mere speculators, where known".¹

The old Company had no new defences. Population had risen from 120,000 to 300,000 since the gasworks began but, carefully purchasing iron during periods of low prices, they had enlarged Tradeston and provided a new Partick supply quite adequate for the demand.² Public opinion was not satisfied, and a Bill by the new Company was accompanied to Parliament by a favourable petition signed by 13,000 householders and 3400 artizans "representing a rental of above £43,000",³ The new Company promised to supply free gas-meters to remove the main complaint voiced by small consumers.⁴ Parliamentary support for competition was granted only after two important testimonials which validated the new company's case. Mr. Liddell,⁵ gas apparatus manufacturer of Glasgow, showed that factories like his own manufactured their own gas⁶ because the Company refused to provide daytime pressure on the mains to reduce their losses by leakage. Consequently most consumers had to burn oil lamps on dull wintry days. A. Kellar, a

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1. Engineering estimates were then taken from Mr. Errington. Glasgow Chronicle 31/10/1842
 2. Through an interlocking directorate, the Old gas company persuaded Glasgow Water Company to oppose the new Bill, and accused the new company promoters of being unscrupulous speculators. Glasgow Chronicle 28/10/1842.
 3. Glasgow Chronicle 27/3/1843 p.3 (list of 14 M.P.s on Committee including J.J.Hope Johnstone, Dennistoun, Lockhart, and Capt. Dalrymple). Co. solicitors Lamont & Monteith (Glasgow), Deans, Dunlop & Hope (London), vide Glasgow Chronicle 2/11/1842. Despite acceptance of New co. by Commons, Old co. spent c.£2500 fighting it again before the Lords; vide Glasgow Courier 3 /4/1843 ; 10/4/1843, 28/4/43, 1/5/43, 5/5/1843. Vide supra p. 948
 4. Free meters were supplied at York and Birmingham, and were suggested to the City and Suburban Co. by Mr. Ritchie, gas manager at Greenock. Ritchie believed they could construct a gasworks for only £144,704. He claimed that Glasgow gas was of poor quality, but the Committee established this was not correct : evidence of J. Hedley, London gas engineer (a consultant who originally trained in Scotland in 1820s) vide Glasgow Chronicle 1/5/1843
 5. In 1819 Andrew Liddell & Co. of Gallowgate was a retail outlet for coal-fire grates, copper and iron gas pipes, and English and Scottish gas fittings. Glasgow Chronicle 15/5/1819 p.1
 6. Liddell also supplied some gas to Messrs Pinchar, Gray & Co., sugar refiners, who faced the same problem. He had supported the 1819 consumers' movement in Glasgow. Glasgow Chronicle 27/3/1843. Supra p. 1115

Commissioner of Police, agreed that the Company gave poor service, refused to supply street lights if they considered there were "too few houses in the street", like Kelvin Street in 1838, and even refused to supply Sauchiehall Street in 1839 because there were no houses on the North side, thereby also refusing a supply to the "immense number of houses just beyond that Street".

The new gasworks built by the City and Suburban Company for £114,520 at Dalmarnock¹ were technically a great success, but the benefit for consumers was far less than had been expected, and by the late 1840s the new company was competing in the rate of profits rather than prices. Although most original shareholders in Glasgow City and Suburban Company were local residents, some evidence suggests that large numbers of shares were later purchased by Edinburgh residents and other outsiders. Share certificates recording ownership in 1869, at the time of municipal takeover, have recently been catalogued by Glasgow City Archives² and state the date at which those persons purchased shares. The Aitchison family of Edinburgh appear, for example, to have acquired considerable interest in the Company. In 1855 Dugald Bannatyne,³ merchant of Rothesay, sold fifteen shares in the Company to Alex. Aitchison of Portobello through the agency of I. Wood, an Edinburgh sharebroker, and Aitchison also purchased a further fifteen new shares. By 1869 he held £2200 stock. During 1858 George Aitchison, baker of Edinburgh, purchased 100 shares from

1. 1844 dividend $3\frac{1}{8}$ per cent on £114,520 share capital, from 45 million cu.ft., 1845 $7\frac{1}{2}$ per cent from 67 million cu.ft., 1851 9 per cent from 160 million cu.ft. The new Company never grew as large as the old company in Glasgow. Hugh Bartholomew was the manager, Vide supra pp. 410, 633

The Scotsman, 11/9/1844; J.G.L., 24/2/1885.

2. Glasgow City Archives (D.G.E. 181).

3. Vide supra p.683; also p. 1124

two former partners. Isabella P. Aitchison of Edinburgh acquired four shares in 1858 and seventy six in 1868, and James Aitchison of Edinburgh purchased seventy five shares in 1844, and 114 in 1860. William Aitchison, confectioner of Edinburgh purchased eighty five shares from other partners in 1843, a further fifty in 1844 through A. Stevenson an Edinburgh shareholder, twenty five in 1867 and ten in 1868. Alexander Aitken of Edinburgh purchased 100 shares in 1862. This pattern suggests a considerable influx of persons unlikely to uphold the early ideals of the consumers movement.

Meanwhile in the early 1840s, idealists and speculators released a landslide of proposals for additional companies with consumer participation, which tapped a ready pool of capital by preceding the railway promotion boom.¹ Aberdeen was first, with a newspaper letter in 1843 which declared that "the days of all monopolies are now numbered", and invited support for a new gas company because of the "reduced price of iron and labour" and "late great discoveries" in gas technology.² The Aberdeen 'New Gas Light Company' was sponsored by a powerful legal firm of public benefactors, Adam and Anderson,³ who

1. Railway construction vide supra pp. 106, 108, 739

2. Aberdeen Journal, 22/11/1843. Clay retorts had greatly reduced working costs. Vide supra p. 282. "In the 'forties Aberdeen, like the rest of the country, had more money than sense". Town trade had flourished since the mid 1830s, but railway speculation, for example by Adam and Anderson in the 1844 Railway Company Line to Forfar and Arbroath, or the 1845 Great North of Scotland Railway Co., did not precede the new gas venture. A. Keith, The North of Scotland Bank (1936, Aberdeen), pp. 35, 33-4.

3. Adam Anderson (1802-1887) M.A. (Marischal College). Advocate. c. 1828 formed legal firm with William Adam (dissolved 1866), 1830s-40s promoted North of Scotland Bank, Northern Assurance Co., Wisconsin Marine Insurance Co., Aberdeen Market Co., G.N.S. Railway; 1840 New Market buildings (£50,000); and 1866 Cairnton Water supply. Lord Provost of Aberdeen. A. Keith, The North of Scotland Bank Limited 1836-1936 (1936, Aberdeen), pp. 14, 169.

Vide supra p. 872

gave preferential allocation of stock to persons who provided a written statement of their intention to become consumers. The first Directors¹ were William Adam advocate, G. Thompson junior merchant, D. Blackie merchant, J. Hadden manufacturer, A Cruichshank merchant, Alex Gibb civil engineer, and William Guthrie shipowner.

For two years no share transfers were permitted to persons residing outside the burgh. The new company expected to operate with only £30,000 fixed capital² whereas the old Company, profiting from massive premiums through the sale of fifteen pound shares at forty eight pounds, was overloaded with a nominal capital of £88,000 and paid a dividend of two pounds five shillings and sixpence on each share. Nevertheless, using the example of Manchester where lower gas prices raised consumption, they assured the parsimonious public that the old Company would not collapse entirely and thereby waste valuable capital.

Table 6.5 Competing Scottish Gas Companies compared to Aberdeen (1843)

<u>Town</u>	<u>Shares Paid Up</u> (£)	<u>% Dividend</u>	<u>Shares Market Price</u>	
			£	s.
Aberdeen	15	15	48	0
Edinburgh	25	10	58	0
Edinburgh & Leith	16	6½	26	15
Glasgow (Old)	25	10	48	0
Glasgow City and Suburban	2	None Yet	3	15

Source:- Aberdeen Journal, 6/12/1843.

The old Aberdeen company replied that, unlike Glasgow, they had

1. Aberdeen Journal, 13/12/1842, p. 2.

2. Nominal capital £50,000 in £5 shares, to be called up in installments of up to £1. Directors could raise stock to £100,000. Company formed once 4000 shares subscribed. Within one week 150 consumers had applied for 3400 shares, and although only local publicity had been given, many other, distant applicants had to be turned down. Aberdeen Journal, 6/12/1843.

not tried to restrict operations to the wealthy parts of the city. With seventy five miles of mains pipes they claimed to have raised overheads to supply poor districts, to have longer mains in proportion to consumption than "any Company in the United Kingdom", and to have fostered a more "universal use" of gaslight in the dwellings of all classes than was found in any other town.¹ When support continued to flow to the new company, a completely new tactic was devised to create a "legalized and public monopoly".

Before the new Company was officially formed,² the old Company was exposed in an attempt to use its "Directors and Partners in the Town Council and Police" to persuade the municipal authorities to purchase the gasworks.³ Complaints were made that the over-capitalized works, with heavy leakage, was a very poor municipal investment which would stifle private enterprise. A modest five per cent dividend in the old company required profits of £4400, but in the new company only £1500. The Police Board⁴ finally voted by five to four against purchasing the old gasworks for £70,000 or a seven shilling annuity on shares. Yet again the Old company sought protection through the Council

1. They also stated that the gas quality was high when tested by Dr. Fyfe on behalf of the new Glasgow C. and S. company; that coal was extremely expensive because of 25 miles of land carriage to Glasgow and shipment through the Forth and Clyde canal; and two companies would raise gas prices which were in "uniform proportion to the amount of the consumption". They admitted to heavy reploughing, and tried to justify the 15 per cent dividend on shares because it was only 8 1/6th per cent on the market price of shares. Vide supra p.495

2. The new Company was only declared to be formed, and directors chosen, on 9th December 1843. By then 3343 non-resident applicants had been refused membership, and 9341 local applicants had requested stock worth £46,705. A technical paper, originally prepared by the Glasgow City and Suburban Company, was examined describing the production of cheaper and better gas. Aberdeen Journal, 13/12/1843.

3. Aberdeen Journal, 6/12/1843.

4. Councillors Henderson and Torrie continued to press the Council to purchase the works even at £100,000. Aberdeen Journal, 20/12/1843.

with a proposal for annuities on a sliding scale related to annual revenue:

Table 6.6 Proposed Sliding Scale of Annuities for Municipal Purchase of Aberdeen Gasworks (1843)

<u>Annuity per Share</u> (shillings)	<u>Profits Applicable</u> <u>to Public Purposes</u> (£)	<u>Annual Revenue</u> (£)
5 Od.	0 to 499	12,475
5 6	500	12,500
6 0	750	18,750
6 6	1000	15,000
7 0	1250	31,250
7 6	1500	37,500
8 0	1750	45,750
8 6	2000	50,000
9 0	2250	56,250
9 6	2500	62,500
10 0	2750	68,750

Source:- Aberdeen Journal, 20/12/1843.

By February 1844 the Company also offered a reduced sale price of £55,500, but the firm of Messrs. John Gibb and Sons¹ offered to build a new municipal gasworks for £30,000. All delay and uncertainty operated to the disadvantage of the new Company, but the Police commissioned a detailed independent valuation of the old works by Mr. Ritchie, gas manager of Greenock.² He found that they had originally cost £70,000, but poor maintenance had reduced the value to £50,000, and a further £15,000 would be required as a reasonable compensation for loss of profits. On the total £65,000 the Police Commissioners could expect annual profits of £3000 plus four per cent to cover interest on debts. About two thirds of the profits could be abstracted for public benefit, and one third was required for extensions and depreciation.

1. Aberdeen Journal, 14/2/1844.

The cost of the new company's works, designed by Alex. Gibb C.E., had risen to £50,000, but the market price of their shares with 10/- paid-up had risen to 16/6d, and that of shares in the Old Company with £4 6/- paid-up had fallen to 16/6d. Aberdeen Journal, 7/2/1844, 31/1/1844.

2. Ritchie discovered many discrepancies from the published debates. There were only 20 miles of mains pipes, not 70, but leakage was low at 7 per cent compared to 30 per cent in Paisley and 28 per cent in Glasgow. Vide supra p.821

When the Police Commissioners again refused purchase, the New Company built its works, but ultimately the pessimists were correct because the two companies amalgamated in 1846 and restored high prices.

Table 6.7 Gas Prices at Aberdeen Before and After Competition
(1838-61)

1838	9s. 6d.	1846-52	7s. 0d.
1845	4s. 0d.	1852-61	6s. 6d.

Source:- J.A. Ross, Municipal Affairs in Aberdeen since 1833 (1899, Aberdeen), p. 120.

From Aberdeen the idea of competition¹ spread to consumers in Paisley and Dundee during 1843, Perth and Edinburgh in 1844, Stirling, Falkirk, Dumfries, Greenock and Ayr in 1845, and Hamilton and Ayr Newton in 1846.

Paisley New Gas Company made considerable progress, despite opposition from the Town Council who believed gas prices would ultimately rise by price-fixing. When Parliament favoured them, the old Company² joined with the Town Council as a 'Public Trust' which successfully enforced a legal monopoly with minimal benefits to the Council or consumers. The new Dundee company³ was more successful, and forced gas prices down from seven shillings and sixpence to six shillings.

1. Parliament was undoubtedly more sympathetic to consumers' complaints in the 1840s, than it had been earlier, as demonstrated over Hamilton and Dundee. Vide supra pp. 954 et seq.

2. Paisley company by 1844 had a called-up capital of £40,000, annual revenue of about £9000, and large funds made from surplus profits - a contingency fund of £3000 and a deterioration fund of £5387. The Trust spent £3600 opposing the New Company in Parliament, and £4800 on its own Act, despite vigorous local protests against the Town Council. Vide supra pp. 960, 1033

3. Promoted by T. Neish, J. Whitton and J. Doctor merchants, J. Wilson corn-merchant and G. Fyfe shipowner, who comprised the Interim Committee. Nominal capital of £40,000 in £10 shares in November 1843, altered to £40,000 in £5 shares in February 1844. Prospectus in Dundee, Perth and Cupar Advertiser, 10/11/1843. Amended Prospectus in Dundee, Perth and Cupar Advertiser, 23/2/1844.

The size of Dundee had doubled since the old Company began, and several suburbs lacked supplies. The new company hoped to use cheap labour and raw materials to build a works at half the cost of the old, and by issuing shares preferentially to consumers allowed "consumers of all classes...a voice in regulating the supply and price [and] reaping the profits of their own expenditure". With the consent of the Town Council construction commenced immediately, before prices could rise, without waiting for an Act. The Old company failed to persuade the Town Council to purchase their works,¹ and by 1846 the new Company claimed to be saving consumers £5625 per year. Later, however, price-fixing commenced and in 1852 the two companies amalgamated.²

In Edinburgh a new 'Union Gas Light Company'³ began in 1844 to ensure a three-cornered fight, since the Edinburgh and Leith Company had apparently negotiated with the old Edinburgh company "a mutual understanding to maintain its price at a most exorbitant rate".⁴ Manchester was served with gas at about five shillings and sixpence and high profits, compared to the Edinburgh price of seven shillings and sixpence by meter, or up to eleven shillings per 1000 cubic feet for poor consumers on time-contracts. The Union Company promised an Act with safeguards for consumers including a maximum of six per

1. Another scheme, for ratepayers to finance a new Company at a cost of four years' Poor Assessment and use the profits in place of Assessment, was also defeated. Dundee, Perth and Cupar Advertiser, 26/4/1844, 10/5/1844, 15/12/1843.

2. Gas World, 4/7/1885, p. 10; J.G.L., 5/7/1887.

3. Nominal capital £100,000 in £5 shares. No partner to hold above 100 shares. Employed Messrs. Deans, Dunlop and Hope as Parliamentary agents. The Scotsman, 14/2/1844, 29/3/1845. Promoters Vide infra p.1806

4. The Edinburgh and Leith Company was accused of paying a "premium of 100 per cent" to purchase Leith gasworks. The market value of stock in the old Edinburgh company had risen to £224 for £100, and in the new company a premium of 10 guineas was paid for shares with only £16 5/- called-up.

cent on dividends, sale of new stock only by public auction, and the use of all premiums in a "sinking fund" or reserve fund for reducing gas prices. Shares were to be allocated preferentially to persons giving a written statement of their intent to become consumers. "The low price of iron, and labour of all kinds" was expected to reduce construction costs, and gas mains pipes with clumsy joints which used to cost fourteen pounds per ton were replaced in new Companies like Glasgow City and Suburban with pipes having turned and bored joints at three pounds fifteen shillings a ton.¹

The two existing Edinburgh companies immediately reduced gas from seven shillings and sixpence to six shillings and ninepence, and the new project achieved negligible publicity,² until March 1845 when a fourth and a fifth gas Company were proposed. The 'Edinburgh New Gas Light Company'³ hoped to obtain cheap coal supplies at a location adjacent to the new Caledonian railway, and to profit from the additional building and population in the city which was expected to accompany railway developments. The 'City of Edinburgh Gas Light Association'⁴ was more closely allied to the Consumers' Movement. Partly inspired by the municipal gasworks of Manchester, the Association believed "that the profits derivable from lighting the Houses, Shops and Streets of this City, should be shared by the Inhabitants". Private capital was to be harnessed for public benefits. Two thirds

1. Vide supra p.276

2. The Scotsman published a letter predicting failure like the Oil Gas Company and Forth Marine or Union Canal. The Scotsman, 5/6/1844, 14/2/1844.

3. Nominal capital £100,000 in £10 shares. Directly inspired by the second companies in Paisley, Perth, Stirling and Aberdeen. The Scotsman, 13/3/1845, 19/3/1845. Promoters - vide infra p.1806

4. Nominal capital £100,000 in £10 shares. Partly inspired by new, competing companies in Sunderland and Paris. The Scotsman, 19/3/1845. Promoters - vide infra p.1806

of the Board of Management was to be elected by shareholders, and one third by the Town Council and Police. By restricting the dividend to a maximum six per cent, about four per cent of surplus profits would be available for "reducing the Police Tax to the Inhabitants". Later that month,¹ the City company absorbed the 'New' company, without changing its rules except in excluding the Town Council from electing Directors; but despite support from some magistrates, the entire venture collapsed.

The Perth new company² in 1844 attributed new competition in other Scottish towns to "public spirited individuals" who were taking advantage of "the abundance and cheapness of labour", better technology, and particularly "the unprecedentedly low price of iron". The old company was accused of building "on a scale of unnecessary magnitude and expense", when labour and iron were expensive. Gas was too expensive, at twelve shillings, yet company shares of twenty five pounds had a market value of about fifty pounds, and dividends were excessive at seven per cent. Accounts were never published, and there was suspicion of a secret reserve fund. The New company allocated shares to consumers "in proportion to the probable extent of their consumption". Because a second company had been projected³ in Perth in 1826, they claimed this was the consumers' last chance to obtain fair treatment, since a third attempt to break the monopoly was most unlikely. The alternative was expensive gas, "defective supply,

1. The Scotsman, 29/3/1845.

2. The promoters stated that altruism was behind the new companies of Edinburgh, Glasgow, Aberdeen, Paisley and Dundee. Perth New company had nominal capital of £15,000 in £5 shares. Perth Old company in 1844 had a capital stock of £20,000. Gas cost 15/- in 1824, 12/- in 1844. Perthshire Courier, 29/2/1844, 14/8/1845 (Perth Ref.Lib.)

3. Apparently a reference to the Portable Gas Company, which was to have been based in Dundee and to supply Perth, vide supra pp. 433, 844

Perthshire Courier, 15/5/1845.

- inferior quality, - irregular and highly charged meters, - complaints and appeals for redress unheeded, - refusals to pay the most apparent overcharges met by simple threats of a stoppage of farther supply". The New company promised good quality gas at seven shillings and sixpence, price reductions when possible, meters at only one shilling and sixpence rent a year, and inspection of any faults discovered by consumers, plus a free change to their mains for supply.

Moral indignation was the immediate response by the old company, in Perth as later in Falkirk and Hamilton.¹ To serve the public,² they had been forced to purchase early equipment at high prices, for example gas meters in 1824 at three pounds three shillings compared to only one pound five shillings for meters in 1844, and because they took the initial risks the public had a duty to continue to support them. The Perth company also reduced the price of gas from twelve shillings to eight shillings and reduced dividends to four per cent. They offered a permanent limit of five per cent on dividends if the new Company dissolved, and warned consumers that rival companies at Exeter and York³ had collapsed after a few years, resulting in expensive gas. When arguments failed, they delayed construction of the New gasworks with two attempted interdicts during the winter of 1844-5. The New company had inadequate support to fulfil the promise of cheaper gas, and soon lapsed into price-fixing agreements with the old company.

Falkirk company, faced by competition in 1845, claimed that it commenced "more for the purpose of getting the Streets of the Town

1. Vide supra p.960

2. Perthshire Courier, 14/8/1845.

3. Perthshire Courier, 25/7/1844, 15/5/1845; reprint from the West of England Conservative.

lighted, and to enable the inhabitants to keep pace with the improvements in other Towns, than with a view to the private emolument of the subscribers".¹ But prices and dividends were high. In 1844 gas was reduced from ten shillings and sixpence to nine shillings. Dividend over the previous six years averaged 10.4 per cent, and over the entire length of operation, eight pounds two shillings per cent. Although they warned consumers that iron was now highly priced, and gas would cost more when the market was divided, the new promoters obtained many pledges of consumption for twelve months, and the new Falkirk Joint Stock Company² commenced in May 1845. It remained a strong competitor, and finally absorbed the older company in 1887.

Disillusionment with the performance of Glasgow City and Suburban Company, led to the promotion of 'Glasgow and Suburban Consumers' Gas Company'³ in 1845, with a Committee which included William Baird M.P., James Baird of Gartsherrie, and James Aitken ironfounder. They aimed to provide cheap gas, at a site with the best transport facilities, "solely for the benefit of consumers" and house proprietors who were given a preferential allocation of shares. An Act was proposed to allow Glasgow Corporation to purchase the works at one year's notice,

1. The Scotsman, 23/4/1845; Stirling Journal, 25/4/1845; Vide infra p. 1216 ; also p. 1234

2. Formed 15/5/1845; Nominal Capital £4000 in £2 shares. Took Limited Liability in 1859 (BT2/6)
Vide supra p. 221

By competition, gas was reduced to 4/2d in 1862, but price-fixing began in 1867 with gas at 5/10d. Third Statistical Account - Stirling (1966, Edinburgh), p. 328.

3. Nominal capital £200,000 in £20 shares. Deposit £2 per share. Glasgow C. & S. stock sold at 80 per cent premium, but that company had only achieved a "trifling reduction" in gas prices, and disappointment amongst Glasgow consumers resembled that in Edinburgh over the Edinburgh and Leith Company. Glasgow S.C.G.C. used the City of Glasgow and Western Banks, employed Adam Monteith as solicitor, and Messrs. Law and Anton as Parliamentary Agents. The Scotsman, 18/10/1845.

at a price agreed by arbitrators, but no additional consumer safeguards were stated, and the project was short lived.

Table 6.8 Promoters of Glasgow and Suburban Consumers' Gas Company (1845)

William Baird, M.P.	Mathew Dick, of Meikle Earnock
George Anderson, merchant	William Dixon
Archi. Alison, iron merchant	Patrick Dawson, Distiller
James Aitken, iron-founder	T. Leadbetter, lead merchant
James Baird of Gartsherrie	Robert Monteith jn. of Carstairs
Thomas Brownlie, Deacon Convener	John Mann, iron master
William Bankier, merchant	Andrew McCulloch, merchant
William Church, merchant	William Robertson, builder
Alex. Couper, cotton spinner	

Source:- The Scotsman, 18/10/1845.

The presence of William Dixon and other iron masters, dealers, and a builder among the sponsors, strongly suggests that an attempt was being made to harness public support for a project to bring them private remuneration.

Dissatisfaction with municipal control of Greenock gasworks led to the formation of 'Greenock and Suburban New Gas Light Association'¹ in April 1845, which also aimed to provide the first gas supply to Gourock, and to compete for Port Glasgow. Gas was supplied at nine shillings and twopence, or "from 40 to 100 per cent" more than in other large towns, which gave the corporation a clear profit of £3800 or twenty one per cent on the capital invested, £17,550. The town council had betrayed the trust originally placed in it, and the new

1. Company led by William Crawford of Cartsburn, James Wilkinshaw of Overton and James M. Scott of Greenock. Nominal Capital £40,000 in £5 shares. Deposit 5/- per share, plus 5/- upon signing Parliamentary contract. All shares were subscribed between 19th and 21st April, but list kept open to increase the number of consumer-partners. Prospectus in Greenock Advertizer, 22/4/1845, 29/4/1845.
Vide supra p.1020

company believed that it could reduce prices by thirty per cent and still give a dividend of about ten per cent. Shares were issued preferentially to consumers, or potential consumers, in the three towns, and "those interested in the trade and proprietary of these quarters", but the Association planned to obtain a private Act before operating, and never commenced.

As at Paisley, the lack of gas supplies to nearby populous manufacturing villages, at Bannockburn and St. Ninians, and rising urban population were among the reasons for a new 'Stirling and Suburban Gas Company'¹ in 1845. Within a week, applications equalled the total stock, and only consumers were granted shares.² Promotion of the company was largely by local manufacturers, bankers, and other professional people who could obtain direct benefit from an improved supply of gas, rather than through the sale of equipment to the Company.

Table 6.9 Promoters of the Stirling and Suburban Gas Company
(1845)

Bailie Smith	P. Connal, banker +
Bailie Prentice	J. Sawers, banker +
James Wilson, manufacturer, Bannockburn +	P.G. Morrison, writer +
John Wilson, manufacturer, Bannockburn +	W.H. Forrest, surgeon
W. Wilson, manufacturer, Bannockburn	A.L. Moodie, surgeon+
J. Dick, gent. of Craigengelt +	R. Taylor, soap manufacturer +
M.M. Stevenson, gent.	G. Mouat, manufacturer +
W. Knox, gent. of St. Ninians +	Wm. Rankin, merchant
J. Smart, gent. of St. Ninians	J.P. Traquair, merchant

Source:- Stirling Journal and Advertiser, 28/2/1845, p. 1;
21/3/1845.

Note:- + denotes Directors chosen 19/3/1845. In addition, R. Smith manufacturer and W. Reid merchant became Directors.

1. Nominal Capital £5000 in £5 shares. Complaints were made against excessive gas prices, dividends, premiums on stock and heavy reploughing surplus profits by the old Company. Stirling Journal and Advertiser, 21/2/1845. (Stirling Ref. Lib.)

2. Stirling Journal, 28/2/1845, 7/3/1845.

Anonymous authors¹ declared the old gasworks to be badly constructed, the gas poor, the capital stock not paid-up, and that large secret funds had been created from concealed profits. The old company replied² that the work was hazardous and could not be insured, there were no secret funds, the ten pound shares never sold above twelve pounds and dividends over the past ten years had averaged only 4.75 per cent. In the continued absence of national statistics they could also claim to provide gas superior to any other in Scotland in "purity and brilliance", and that although the town did not permit all the advantages of large-scale production, their charges were similar to those in "other Gas Companies in towns of the same size".³

Meanwhile the price of gas in Stirling was reduced dramatically to stifle the opposition, and the old company reorganized its capital stock.⁴ The nominal value of all ten pound shares was restored from their upset value of twelve pounds, and each was then split into five shares of two pounds. New stock was then created, and 1500 of the new, low priced shares offered for public sale to absorb investors who would otherwise have supported the new venture. At first the new company maintained momentum, called-up seventeen and sixpence on shares,⁵ obtained Town Council permission for laying pipes, and at

1. Industries of Stirling and District (1909, Stirling), p. 109.

2. Stirling Journal, 7/3/1845. The old company quoted Hawksley's arguments against competition. Vide supra pp. 965, 1120

3. The "Method of Comparisons" had long been used by Company directors, but consumers had far greater difficulty in obtaining technical data for suitable comparisons. Vide supra p. 785

4. Vide supra pp. 744, 1127
Stirling Journal, 2/5/1845. Gas prices were reduced from 10/6d in 1842, to 10/- in 1843, 9/- early in 1845, 8/- in May 1845 backdated to Martinmas, 7/- at Whitsunday 1845, and 6/6d in June 1845.
Stirling Journal, 7/3/1845, 20/6/1845.

5. Stirling Journal, 7/3/1845, 27/6/1845.

one stage considered purchasing the entire old gasworks.¹ They promised to reduce public lighting costs by £100 a year, and to sell gas at five shillings and sixpence, to which Dr. Harvey for the old Company retorted that they would still be undercut by gas sold at five shillings.

Enthusiasm waned by the end of the year, and in February 1846, three months after a plea² to the Town Council to purchase the old company and circumvent attempts to burden the public with the excessive new capital outlay, the new Stirling company amalgamated with the old.³ During 1845 the ideas of the Consumers Movement reached Ayr where the earlier private gasworks was purchased by "a joint Stock company of an extensive propriety formed in such shares as to give as many...shareholders as possible an interest in the undertaking".⁴ Though pledged to supply cheaper gas, the company was soon challenged in October 1845 by a rival 'Ayr and Newton Consumers Gas Company', the second in Scotland to assume the "Consumer" appellation. The following year, Newton council prohibited pipe-laying by the Ayr company, which applied for a Bill to supply the entire area. Expensive Parliamentary conflict was only avoided by "Districting

1. In April 1845 they decided instead to build a new works, and by September employed Stewart Kerr of Glasgow to design it, and requested tenders for equipment. Stirling Journal, 2/5/1845.

2. In November 1845 'Civis' urged municipal control of the Old company, and profit from the rising gas profits produced by increased consumption, and the urban growth expected in the train of railway developments. This would have prevented dividends being paid on capital wasted in the new company. If the Council was unwilling to take the burden of gas management, a public meeting could instead have appointed 6 'Conservators' to operate the works as a 'Trust Fund' for the public good. Stirling Journal, 21/11/1845.

3. Industries of Stirling (1909), op. cit., p. 111.

4. Vide supra pp.164, 174
S.R.O., Ayr Gas Company Minute Book, op. cit., 7/4/1845, 17/10/1845, 3/12/1846. In practice, however, the 4115 shares were subscribed by only 132 applicants.

Agreements" in December, 1846. Newton company¹ agreed to lay no pipes in Ayr, and the Ayr company to lay none in Newton or Wallace-town.

Further south, Dumfries gas company gave inadequate supplies for the growing city, and in 1845 the Maxwelltown and Dumfries Company² was formed to compete with it. In 1846 a new gas company in Hamilton won Parliamentary approval to supplant the old company.³ All of these Scottish developments in the 1840s preceded, and possibly precipitated, growing consumer action and government legislation in England in the late 1840s. Popular opinion was in favour of free-trade in the 1840s, and the Government's sustained and increasing control over Chartered gas companies, observed by Chatterton,⁴ was not a substitute for free-trade competition as it appeared from observing the London gas companies, but simply another market restraint in addition to those provided by free-trade. Hence the Government did not defend existing companies at Glasgow, Hamilton or Dundee against the justified competition from their rivals.

The national mood in favour of ownership by "the people" was also evident elsewhere. Alva⁵ town had been supplied from a local factory since 1832, but fifty one consumers at a public meeting in 1844 resolved to form a company, which purchased the old gas apparatus at £528 and set up its own gasworks. Portobello was supplied by

1. Newton later developed a different market by supplying Prestwick holiday town. J.G.L., 24/1/1885.

2. S.R.O., Maxwelltown and Dumfries Gaslight Company, op. cit., Nominal capital £5000 in £5 shares. Vide supra p. 901

3. Vide supra p. 965

4. Vide supra p. 1113

5. Gas cost 10/- in 1832, and the gasholder stood in a wooden tank built by Mr. Small of Kirkcaldy. New company formed 21/9/1844. J.G.L., 4/4/1882.

Musselburgh gas company three miles away, from 1832, but a new Portobello Gas-Light Company¹ was promoted in 1845. Inhabitants were urged to produce "good Gas at a cheap rate for themselves" instead of relying on the inadequate supply at excessive price which was available. Thereafter, both companies competed vigorously in Portobello, until 1885 when, in return for compensation, the Musselburgh pipes were cut at Magdalen Bridge.²

In 1847 two Parliamentary survey officers in England pronounced commercial gas companies to be "at variance with the interests of the community",³ especially the working classes, and proposed that Government Loans⁴ should be issued for the purchase of companies, like the toll roads of South Wales, and then new shares "sold in each town among the gas consumers". Only residents should have held shares, up to a fixed maximum number, and a maximum dividend of five per cent would have discouraged speculators, making the new organizations into virtually Consumer Companies. Parliament should also have taken firmer control, by forbidding discounts on gas sold to large consumers or public lamps, and enforced public lighting in the poorer sections

1. Prospectus in The Scotsman, 14/5/1845, p. 5. Nominal £3000 in £2 10s shares. Preferential issue of shares to persons agreeing to become consumers.

2. J.G.L., 18/11/1884, 25/11/1884. Total output was then 20 million cu. ft. at Portobello, and 21 million at Musselburgh. Musselburgh had owned a 25 ft. dia. gasholder, 3000 yards of 5 inch mains and 3000 of 3 inch, in Portobello, and sold £700 gas per year there. Musselburgh company was accused of mismanagement in 1885, and local residents tried to form a new Company to compete with it, (J.G.L., 29/1/1885) in Musselburgh.

3. B.P.P., 1847 XXII, p. 95 et seq. Local Acts - Preliminary Enquiries, "Observations on General Report on the Existing System of Lighting Towns with Gas, by Messrs. Jones and Clegg, Surveying Officers, under the Act 9 & 10 Vict. C. 106 for the Towns of Wolverhampton, Ashton-under-Lyne, Shipley, Bingley and Wakefield", p. 95.

4. The Private Acts' restriction of dividends to 10 per cent had been frequently circumvented, and private individuals were unable to detect the frauds by local Companies. Ashton company had built a chapel, theatre and public house from excess profits. B.P.P., 1847, XXII, op. cit., p. 98.

of towns where it was lacking. The old companies had preferred "a limited trade producing sure returns, to a more extended trade requiring more expenditure, trouble and attention".¹ Chadwickian social reformers were warned that without cheap gaslight, the working classes could not keep themselves or their dwellings clean, whilst the bright lights of gin palaces remained one of their main attractions.²

Many errors were found, both in the original construction and the existing methods of manufacture at gasworks.³ The officers suggested that Government inspectors should be appointed to supervise extensions, advise upon technical matters, check financial accounts, and provide impartial replies to consumer complaints.⁴ To illustrate their argument, they produced a detailed analysis of construction and working costs for gasworks in medium and small towns, and initiated the factual approach which became of greatest importance in Flintoff's 1860s campaigns.

1. B.P.P., 1847 XXII, op. cit., p. 98.

2. Ibid., p. 95.

3. Even rough estimates of leakage placed it above 10 per cent of output in most towns. Initial construction mistakes caused the wastage of capital for reconstruction, and many gas companies by the 1840s were, in that sense, "over-capitalized" relative to their gas output. B.P.P., 1847, XXII, op. cit., p. 62.

4. Consumers still believed, for example, that only poor gas smoked, whereas the best cannel coal gas smoked if burned with incorrect 'burners'. B.P.P., 1847, XXII, op. cit., p. 99.

Table 6.10

Average Cost of Gasworks (1848)

(1) Town of Above 40,000 Inhabitants Apparatus for maximum 100,000 cu.ft. in 24 hours, average 28 million cu.ft. per year		(2) Small Town Maximum 24,000 cu.ft. in 24 hours, average 4.38 million cu.ft. per year
Engineer's expenses during construction	£ 400 0 0	£ 200 0 0
Act of Parliament	800 0 0	500 0 0
Gasometer and Cast-Iron Tank (150,000 cu.ft.)	3500 0 0	1000 0 0
Fifty retorts fitted up (Hydraulic Main &c)	1000 0 0	Twelve retorts &c 240 0 0
Condenser	200 0 0	50 0 0
Purifiers	300 0 0	60 0 0
Station Meter, Governor, &c	335 0 0	(No governor) 30 0 0
Valves &c	150 0 0	20 0 0
Retort House, Coal Stores, &c	1500 0 0	} Retort House & Build- ings 1000 0 0
Chimney	120 0 0	
Office, Manager's House &c	700 0 0	
Boundary Walls	250 0 0	
Land	400 0 0	150 0 0
5% Interest during Con- struction (2 years)	1025 10 0	(1 year) 197 10 0
Sundries	400 0 0	200 0 0
Street Mains and Branch pipes	6500 0 0	2000 0 0
Interest on Mains during laying	650 0 0	100 0 0
Trading Capital	2000 0 0	500 0 0
Total Cost	20230 10 0	6247 10 0

Gas Price per 1000 cu.ft.

Manufacturing Cost ¹ per 1000 cu.ft.	1s 4.75d	1s 11.75d
Leakage, Waste, Out- door Expenses	0 4.5	0 4.5
10% dividend on capital	1 3.5	2 10.75
Selling Price	3 2.75	5 2.5

Source:- B.P.P., 1847, XXII, Tables B and C.
Note - based on English Examples.

The principal cause of extra expense in small companies here was not manufacturing costs, but the extra capital required.

1. These are the statistics given, but recalculation shows the first figure to be inaccurate - manufacturing costs (prime cost) in the large company was 1s 9.059d after deducting the sale of by-products other than gas.

Table 6.11 Annual Manufacturing Costs of Gas (1848)

	<u>Large Town 28 million cu.ft. year</u>				<u>Small Town 4.38 million cu.ft. year</u>			
	Total cost		Cost per 1000 cu. ft.		Total cost		Cost per 1000 cu.ft.	
	£	s. d.	s. d.	s. d.	£	s. d.	s. d.	
Coal 3586 tons	1783	7 8	1 3.3	(547.5 tons)	273	15 0	1 3	
Lime 3586 bushels	89	6 0	0 0.76		9	12 4	0 0.5	
Retorts wear and tear	300	0 0	0 2.57		50	0 0	0 2.74	
Wages	430	0 0	0 3.68		100	0 0	0 5.5	
Salaries	330	0 0	0 2.83		60	0 0	0 3.28	
Taxes	200	0 0	0 1.7		50	0 0	0 2.74	
Stationery	30	0 0	0 0.25		10	0 0	0 0.5	
Sundries	100	0 0	0 0.86		50	0 0	0 2.74	
Furnace coal	400	0 0	0 3.43		41	2 0	0 2.2	
Total	3662	13 8	2 7.394		644	9 4	2 11.313	
By -Products Sold								
Coke	1075	16 0			200	5 0		
Tar	83	0 0			10	0 0		
Lime	20	0 0			3	0 0		
Ammoniacal Liquor	25	0 0			0	0 0		
Total By-Prod. Revenue	1205	16 0			213	5 0		
Total Expenditure	2456	17 8	1 9.059		431	4 4	1 11.6	

Source:- B.P.P., 1847, XXII, Tables B and C. Note - English examples only. The original tables showed Cost per 1000 cu.ft. only for the gross figure of total expenditure per year minus by-product revenue; but other statistics, calculated here, could just as easily have been deduced also.

From 1846 to 1855 Scottish consumers voiced only muted complaints, whilst in England the Consumers Movement was in hue and cry. While Councillor Miller¹ unsuccessfully urged Edinburgh Council to support any new consumers' company because of the "universal complaint and dissatisfaction" with the high price, London shares plummeted in a panic caused by "the mania for cheap gas or...dread of the electric

1. Edinburgh City Archives, Edinburgh Council Record, 13/12/1849.

light".¹ The Builder² championed consumer interests, and used detailed Parliamentary statistics³ which had been collected from Chartered gas companies for the first time in 1848, to show that coal prices were not the only factor affecting gas prices. Improved technology had reduced gas prices despite higher coal costs, but shareholders had benefited more than consumers through higher dividends.⁴

Table 6.12 Independence of Dividend and Gas Price from Coal Prices

Chartered Company	Coal per ton		Gas Price		Dividend	
	Old Price	New Price	Old	New	Old	New
Edinburgh	19s	29s 6d	8s 6d		£6	£6 10/-
Glasgow	16s	22s 6d	6s	5s	£3	£7 10/-
Paisley	21s	26s 3d	10s 4½d	5s 9¾d	£3	(£6 8/- £8

Source:- The Builder, 1848, p. 170.

Amidst heated debates over the wastage of capital⁵ in competition, several English consumer companies⁶ were formed in the early 1850s,

1. Journal of Gas Lighting, Vol. I, p. 1, 10/2/1849. The concern felt by shareholders in gas-companies, and their desire for information from a sympathetic source, was probably of great importance in the successful launching of the Journal of Gas Lighting.

2. The Builder, 1848, Vol. VI, p. 170.

3. B.P.P., 1847 (734) XLIV, 359.

4. Previously, gas companies always met complaints of expensive gas with a statement about the effect of rising coal costs.

5. Edwin Chadwick opposed competition for gas supply, using data from Northern England and France. In Paris the government amalgamated several companies in 1855, and produced better gas at a price 30 per cent cheaper for consumers, yet raising the value of the companies by 24 per cent on the market price of shares.

E. Chadwick, "Results of Different Principles of Legislation and Administration in Europe; of Competition for the Field, as compared with Competition within the Field, of Service", Journal of the Royal Statistical Society, 1859, Vol. 22, p. 387.

6. e.g. A.A. Croll and Great Central Gas Consumers Company, J.G.L., 10/11/1851, 18/8/1857. Marylebone Gas Consumers Company, J.G.L., 10/2/1852, p. 280. "The Low Price Gas Movement", J.G.L., 10/3/1853, p. 282. Sheffield Gas Consumers Company, J.G.L., 10/3/1853, pp. 53, 58; 10/5/1853, p. 121.

and George Flintoff emerged as the eccentric, leading advocate of competition. In 1855 he advertized in Midland newspapers - "THE CHEAP GAS MOVEMENT - All existing companies are monopolies, and new companies, by availing themselves of modern improvements, may erect works at about one third of the sum expended by most existing companies, while the price of gas may be considerably reduced - For plans, working drawings, and other information, apply to George Flintoff and Co., 27 Benson Street, Liverpool".¹

To benefit consumers, the Government produced the first statutory control over gas-meters in the 1859 Sale of Gas Act, which unlike previous legislation was applicable to sales made by both statutory and unincorporated companies. Meter Inspection Districts were established by the magistrates of each Royal Burgh and County town, and Inspectors appointed by them and financed by assessment on the Valuation Rolls, were empowered to test meters using "Models of Gasholders" and other devices supplied by the government. The maximum error allowed was two per cent in favour of the seller and three per cent in favour of the consumer, and meters were also tested for leakage at three inches pressure. The maximum leakage permitted was one half cubic foot per hour on meters carrying up to 100 cubic feet per hour. Once tested, accurate meters were stamped, marked and recorded. One year after the Act, no meter could be sold unless it had been tested, and any consumer could insist on having his meter tested, though at his own expense. Within ten years, all meters already in use had to be tested.

1. J.G.L., 10/8/1855. George Flintoff's career is not recorded by modern biographies (e.g. Dictionary of National Biography) although from 1853 when he was Secretary of the Sheffield Gas Consumers Company, until 1869, he was the much maligned centre of the Consumers' Movement which catalysed improvements and new attitudes, as well as lower prices, throughout the British gas industry. Vide infra p. 1802

The Act¹ was passed hurriedly and expected the testing centres to be established within three months, but problems occurred in designing the government test apparatus and another Act² in 1860 left Scottish Commissioners of Supply with no fixed date for implementing the controls. By 1861 the Act had been applied³ in Aberdeen, Dundee, Inverkeithing, Edinburgh and Perth, though the test apparatus was bulky and expensive.⁴ Lanark, Ayr and Greenock had also appointed Inspectors⁵ by 1862. The 1859 Act made no realistic financial provisions for testing, and by 1883 Glasgow had a deficit of £6000, and Edinburgh a surplus of £7000.⁶

During 1864 R. Dalglish⁷ promoted a Sale of Gas (Scotland) Bill

1. The Act was sponsored by Lord Redesdale after Wm. Crosley of Burnley demonstrated the prevalence of inaccurate meters in English towns. The legal unit to measure gas became the "Cubic Foot containing 62.321 Pounds Avogirdupois Weight of Distilled or Rain Water", weighed in air at 62° F and 30 inches barometric pressure. Fines were up to £10 for counterfeiting meter marks, and £5 for selling meters (after 1 year) without testing. Only very large meters, measuring over 5 cu.ft. per revolution, were excluded from testing because the removal of water altered their accuracy, but consumers who used them had to sign a special contract with gas companies. The Glasgow and West of Scotland Society for the Protection of Trade petitioned Parliament in favour of the Act. Glasgow Herald, 16/7/1859, 4/10/1859, 26/8/1859. Victoria Cap. LXXVI An Act for Regulating Measures Used In Sales of Gas, 13/8/1859. 'Altruism', Gas Consumers Manual and Trade Directory for Gas Fittings (1882, Manchester), p. 10.

2. An Act to Amend the Act for Regulating Measures Used in Sales of Gas, 28/8/1860.

3. List of towns enforcing the Act vide J.G.L., 8/10/1861, p. 690.

4. Holders of 10 cu.ft. and 5 cu.ft. were required at Aberdeen. Description vide J.G.L., 10/9/1861, p. 639; T. Newbigging, Gas Manager's Handbook (1883) op. cit., p. 212.

5. All had only one Inspector, except Edinburgh with nine. List of 44 Inspectors with Exchequer stamps vide J.G.L., 28/1/1864, p. 40. "Duties of Gas Inspector" at Greenock vide J.G.L., 2/7/1861, p. 482.

6. J.G.L., 6/2/1883.

7. J.G.L., 28/6/1864, p. 469.

to get the earlier Act implemented. Despite this Parliamentary¹ encouragement, implementation remained permissive,² and Scotland was very slow³ to adopt the Act, partly because inaccurate meters were less of a problem in the North. Unlike English companies which often manufactured their own meters, Scottish meters were very largely supplied by specialist companies in Edinburgh and Glasgow with very high standards of accuracy.

High coal prices⁴ in the mid 1850s produced an increase in gas prices which triggered dissatisfaction amongst consumers. Renewed agitation in Scotland again expanded from activities in Glasgow. Both companies there presented Bills in 1857 to increase their capital stock, but were opposed in Parliament⁵ by the Lord Provost and Magistrates, and by a pressure group of consumers. A new Consumers Company⁶ was proposed, but the Town Council instead hoped to restrict the existing companies to a maximum six per cent dividend, or to purchase them at £600,000 or four per cent annuities. Promoters of Glasgow Consumers' Gas Company⁷ included W.S. Dixon jr. of Govan,

1. An Act to Enable Certain Royal and Parliamentary Burghs in Scotland to avail themselves of the Provisions Regulating the Sale of Gas, 29/7/1864.

2. J.G.L., 31/5/1864, p. 393; 29/11/1864, p. 806.

3. By 1884 only ten Scottish districts had adopted the Sale of Gas Act (1859), and of these one, Lanark, did not implement it. The others were Edinburgh, Glasgow, Dundee, Aberdeen, Leith, Greenock, Ayr, Perth, and Perth County. Companies did not make regular 5-year checks on meters, and only applied the Act in cases of consumer complaint. J.G.L., 14/10/1884.

4. Vide supra p. 514

5. J.G.L., 2/5/1857, 1/9/1857, 26/5/1857.

6. Cheap gas movement supported by the Galaway Vindicator and The Builder, 1857, p. 137.

7. Nominal capital stock £250,000 in £10 shares. Deposit 2/6d per share. Used City of Glasgow Bank; Messrs. Reddie and Crichton law agents; Messrs. Bell and Miller, engineers of Glasgow. Glasgow Herald, 4/5/1857.

John Houldsworth¹ of Cranstonhill, William McLaren² and John Tennant³ of St. Rollox.

Table 6.13 Promoters of Glasgow Consumers' Gas Company (1857)

Sir James Campbell of Stracathro	John Bain of Morriston
W.S. Dixon jr.	Mathew Dick of Meikle Earnock
Henry Dunlop of Craigton	Alex Harvey of Govanhaugh
Laurence Hill of Barlanark	A.G. Kidston of Newton
John Houldsworth of Cranstonhill	D. Macdonald of D. & J. Macdonald
Wm. McLaren of W. McLaren, Sons	& Co.
& Co.	J. McGregor of Finnart
John Tennant of St. Rollox	Peter Murdoch of Longbank
J. Twigg of Arnott, Cannock & Co.	James Scott of Kelly
W.S. Wilson of Port Eglinton	R. Wylie of Wylie & Lohead
Spinning Co.	

Source:- Glasgow Herald, 4/5/1857.

In defence, the City and Suburban company claimed to supply suburbs⁴ within a radius of three and a half miles despite the absence of any public-lighting contracts, and to have remained in active competition with the other Gaslight company. Both charged the same rates because it was inevitable in the same market, but the Suburban company provided cheap factory gas despite the reduction in total sales caused by the recent 'Early Closing Movement'. The Factory

1. John Houldsworth (1807-59), and his brother William (1793-1853), and Henry II (1797-1867) an important Manchester cotton spinner, were sons of Henry Houldsworth senior, a supporter of the original Glasgow gas company. Memoirs and Portraits of One Hundred Glasgow Men (1886, Glasgow), p. 165. Vide supra pp. 30, 138, 156

2. Possibly of Robert McLaren & Co., gas pipe manufacturers. A. McLean, Local Industries of Glasgow and West of Scotland (1901), op. cit., p. 80.

3. John Tennant (1796-1878), like William Dixon, and Thomas Houldsworth of Coltness (a relative of John Houldsworth), was a promoter of the Caledonian Railway Company in 1844. Vide Butt and Ward, "The Promotion of the Caledonian Railway", Transport History (1970), op. cit., p. 188.

4. The number of houses rated at £10 rose from 24,000 in 1843 to 38,925 in 1857, usually occupied by several tenants, as "flats" off a common staircase. Most were gas lit through "a large portion of the old town, and the whole of the new buildings, with the exception of a few houses". "Gas is as common in the large towns of Scotland, as candles are in England. Even the best houses are generally lighted from top to bottom", J.G.L., 26/5/1857.

Act of 1847 reduced working hours, and reduced gas consumption by thirty per cent in some works, but a Glasgow cotton spinner, G. Grant, testified that during the 1840s most factories had abandoned their private gasworks in favour of the increasingly reliable public gas supply.

Glasgow Corporation was misled into a provisional agreement for purchasing the gas companies at £624,000, plus one year of guaranteed profits grossly in excess of expected profit.¹ The Corporation withdrew, and the Bills were passed. A "Gas Consumers Committee" was formed by Adam Pringle² to fight the Companies, and a lecture by George Flintoff was arranged at the Trades Hall in August, 1859. Another meeting followed,³ as well as a press campaign,⁴ and canvassing in several city districts which culminated in a public meeting called by the Lord Provost at the City Hall⁵ in September 1859, when it was attended by dignitaries including R. Dalglish, M.P.

No historical analysis has previously been made of Flintoff's work, largely as a result of the contempt shown towards him by the contemporary Journal of Gas Lighting, yet his campaign in Scotland was probably the main reason for the widespread programme of municipal ownership⁶ of gasworks there in the 1870s. Dundee and Glasgow, two of his principal centres of operation, had the first municipal

1. Glasgow Council voted by 26 to 10 against the purchase. The detected deception would, however, have only resulted in a higher "price" of £6000.

2. Member of Okell, Pringle and Selkirk. Glasgow Herald, 15/8/1859; J.G.L., 16/8/1859, p. 458, 30/8/1859, p. 469.

3. At the Baronial Hall, Glasgow on 15/8/1859. Glasgow Herald, 16/8/1859.

4. Flintoff denied any connection with the 1857 Consumers' Movement in Glasgow. Glasgow Herald, 6/9/1859.

5. Glasgow Herald, 15/9/1859.

6. Vide supra pp. 1035 et seq.

gasworks. Flintoff's campaign, designed for the proletariat, educated both them and the middle classes to a far greater appreciation of the benefits and technical feasibility of cheaper gas. He proposed to use Limited Liability, or bluff, to demolish the large profits which many companies clearly did make at the expense of small consumers. He publicised the different complaints which already existed in many towns against the companies, and the engineering estimates which he produced were feasible and, despite severe criticism from vested interests, they did take account of local coal prices and by-product revenue.

The problems and their technical solutions were impressed upon the public. Only the financial solution¹ failed. Many groups of consumers, despite their enthusiasm, found it too difficult to form a new Company with stringent social safeguards. Flintoff believed that the consumers' capital could defeat the old companies. Experience proved, however, that success was only possible by harnessing existing social institutions. Municipal control alone provided an organization which gave continuing public accountability, and could raise the finance to implement its resolutions.

Flintoff's ebullient accusations and over-simplified arguments were designed specifically to appeal to the working classes. He described the high gas prices in Glasgow as a conspiracy. They were far higher than in London, despite cheaper labour, rents and taxes, and far lower coal transport costs. Rich Scottish cannel gave more gas and by-products, but less wear and tear, so that prime manufacturing cost should have been one shilling and threepence halfpenny in Glasgow, one penny farthing less than in London.

1. 'Socialism from above' Vide supra p. 1004

Table 6.14 Flintoff's Comparison of Coal Distillation Products in Glasgow and London (1859)

<u>Town</u>	<u>Cu.ft. Gas per Ton Coal</u>	<u>Gallons Tar per Ton Coal</u>	<u>Gallons Ammonia Liquor per Ton</u>
London	9,000	10	10
Glasgow	12,000	14	14

Source:- Glasgow Herald, 15/9/1859.

Coal royalties to the Duke of Hamilton were stated to increase gas rates by £15,000 per year, but Flintoff claimed that recently increased coal prices were "trifling", and were not a valid excuse for raising gas prices since contracts were placed "for a series of years".¹ The rise in gas prices,² from four shillings and sevenpence to five shillings in 1857, was costing Glasgow consumers £12,000 a year, whereas other companies had reduced gas prices by up to fifty per cent in recent years, and faulty meters increased the burden in Glasgow.

The City and Suburban gasworks were antiquated according to Flintoff, who believed that for £200,000 he could build a works to produce more gas than both the existing works, at a prime cost of one shilling and fivepence halfpenny per 1000 cubic feet. After allowing fourpence halfpenny leakage and one penny bad debts, the gas could be sold at only two shillings and elevenpence. Ignoring the raison d'etre of the Suburban company, he accused both companies of using surplus profits to supply unremunerative areas instead of reducing gas prices, and claimed that his scheme would save Glasgow consumers £50,000 a year.³ Because their maximum dividends were stipulated by Parliament, the existing Companies had no incentive to make cheaper

1. This was inaccurate; most coal contracts were annual. Vide supra p. 875

2. Flintoff also claimed that the Glasgow gas was not 26 candlepower, as stated, but really below 20 candlepower.

3. Flintoff claimed to have saved Sheffield consumers £15,000 a year, and to have saved English and Irish consumers a total of £250,000 a year, "without injuring existing interests".

gas, which would increase demand, and involve them in the "trouble and expense" of enlarging the equipment, without any benefit to the shareholders.

Pringle blamed lax Parliamentary controls upon the early view of gas company shareholders as "little short of benefactors of their species". In the absence of competition, reckless squandering of capital and inefficient machinery had been charged directly upon the consumers. Reploughing of excess profits in Glasgow had occurred on a massive and illegal scale.¹ The Glasgow companies were believed to have "secret funds, known by a variety of names - 'reserve funds', 'suspense accounts', 'depreciation funds', 'loan from income to capital account'", and others in excess of the £5000 contingency funds allowed by Parliament. Active municipal supervision was required, as in Liverpool where the Town Council monitored the quality of gas and annually audited the company accounts. Flintoff and Samuel Clegg had evaluated the existing "worn-out and decayed works" at £200,000 and not £680,000 which the Council had been expected to pay for them in 1857.

Dividend² controls imposed by Parliament³ were self-defeating. A ten per cent dividend enabled stock⁴ to be sold at a premium of 100 per cent, but a seven and a half per cent dividend reduced the premium to seventy five per cent. Consequently, to raise £100 cash a Company had to sell seventy five pounds stock instead of fifty

1. Pringle maintained that Parliament did not expect consumers to pay both for gas and capital equipment. Gas companies "should repair and rebuild and reconstruct...in the same manner as any other owners of property viz. out of their own pockets".

2. Vide supra p. 808

3. Vide supra p. 979

4. Glasgow Herald, 15/9/1859.

pounds stock, and thereafter had to pay dividends on the increased number of shares. Flintoff also rejected the possibility of municipal ownership as inefficient, and showed that even the famous Manchester municipal gasworks made a surcharge of £74,000 a year compared to the prices charged by the well organized Liverpool company. The consumers could gain most through a company run by themselves, with a capital stock of £191,650 which would provide a ten per cent dividend and gas at two shillings and ninepence.

Table 6.15 Flintoff's Estimate for Glasgow Consumers' Gasworks
(600 million cu.ft. per year)

	£	s.	d.
Engineering Expenses	500	0	0
Act of Parliament, if necessary	2,000	0	0
Legal Expenses	600	0	0
Gasometers (1.6 million cu.ft.) and Tanks	18,320	0	0
200 Double clay retorts with hydraulic main and connections	6,000	0	0
Condenser	730	0	0
Purifiers, with valves and lifting apparatus	1,540	0	0
Exhauster with engine	725	0	0
Station Meter and Governor	745	0	0
Scrubbers	420	0	0
Weighing Machine	150	0	0
Experimental Meters and Apparatus	65	0	0
Tar cistern, tar and water tanks	780	0	0
Retort house and Buildings	3,200	0	0
28,200 meters and service pipes (various sizes)	61,500	0	0
Sundries	1,000	0	0
Mains Pipes (157½ miles) and Trenching	79,023	13	4
Repairing roads after trenching (237,000 yards at 1/- a yard)	11,850	0	0
Irregular Pipes (additional 5%)	2,501	3	8
Total Cost	191,649	17	0

Source:- Glasgow Herald, 15/9/1859.

Note - high cost of service and mains pipes compared to manufacturing apparatus.

Table 6.16 Estimated Annual Working Costs at Proposed Glasgow Consumers' Company (1859)

	£	s.	d.
60,000 tons cannel coal (14/- per ton)	43,500	0	0
Lime ($\frac{1}{2}$ d per 1000 cu.ft. gas)	1,250	0	0
Labour, wear and tear, Inspectors (6d per 1000 cu.ft.)	15,000	0	0
Salaries - Engineer £400			
Secretary 300			
Cashier 200			
Book-Keeper 150			
Clerks 250			
Porter 52			
Office Boy 26			
Directors 500			
	<hr/>		
	2,328	0	0
Rent and Taxes (Land rented to avoid purchase costs)	2,500	0	0
Stationary, printing &c.	420	0	0
Sundries	583	0	0
Coke for heating Furnaces (15,000 tons)	5,000	0	0
	<hr/>		
Total Expenditure	70,581	0	0
 <u>Revenue -</u>			
Coke, Tar Ammonia ($\frac{5}{8}$ d per ton coal on 60,000 tons)	17,500	0	0
Spent lime sold	250	0	0
Gas (600, million cu.ft. at 1s 9d)	52,831	0	0
	<hr/>		
Total Revenue	70,581	0	0

<u>Gas Price</u>	s.	d.
Prime Manufacturing Cost per 1000 cu.ft.	1	9
Allow for Losses, Leakage and Bad Debts	0	5
"Interest" of 10% on £150,000 share Capital (Dividends)	0	7
of 5% on £50,000 loan Capital		
Selling Price of Gas	<hr/>	<hr/>
	2	9

DEBIT ('Charge' or receipts):-

	£	s.	d.
600 million cu.ft. gas sold at 2s. 9d.	82,500	0	0
	<hr/>		

CREDIT ('Discharge' or payments made):-

Cost of Manufacturing 600 million cu.ft. gas	52,831	0	0
Leakage, Losses and bad debts	12,166	13	4
10% dividend on £150,000 share capital	15,000	0	0
5% interest on £50,000 loan capital	2,500	0	0
Surplus carried forward	2	6	8
	<hr/>		
	82,500	0	0

Source:- Glasgow Herald, 15/9/1859.

The second public meeting appointed a "Committee of Consumers", including R. Dalglish and John Tennant of St. Rollox, but the Committee was unable to gain access to the books of either company. They later persuaded the Sheriff to appoint a chartered accountant to investigate the City and Suburban Company, acting as an independent observer under that Company's Act, and the Town Council commissioned Mr. Miller to make a survey of gas quality and prices elsewhere in Britain for comparison with Glasgow. This delay cooled the enthusiasm for Flintoff's campaign.

Miller was trained hurriedly by officials of the Glasgow companies, and the amateurism of his technical conclusions¹ was severely criticized by independent gas engineers. The accountant, moreover, found considerable justification for higher gas prices² in 1857. Coal prices had risen dramatically, local rates doubled, Income Tax was first applied, and the worker's wages had risen by twenty per cent since 1844. There was a definite incentive for selling more gas. Total revenue in 1857 was sufficient for only 7.457 per cent dividends, so the Company had sold 685 extra shares to provide a premium "profit" to raise the dividends to ten per cent.

Table 6.17 Analysis of Glasgow C. and S. Company Accounts
by J. McLelland, C.A.

<u>Date</u>	<u>Gas Price</u>	<u>Average Coal Price</u> <u>per Ton</u>	<u>Dividends %</u>
1854	4/7d	9/10d	10
1855	4/7	13/0 $\frac{3}{4}$	10
1856	4/7	9/9	10
1857	5/-	17/7	10
1858	5/-	16/6	10

Source:- Glasgow City Archives, Miscellaneous Papers, Vol. 18.

1. Alfred King, gas manager at Liverpool, rebuked Miller's statistics in the Journal of Gas Lighting; but Miller's non-technical observations were largely correct. Flintoff declared the Glasgow companies improved their gas prior to Miller's tests in November, 1859, since in January 1860 Flintoff's tests showed it reduced by 16 candlepower. J.G.L., 3/1/1860, pp.6, 11; 17/1/1860, p. 33. Vide infra p. 1220

2. Glasgow City Archives, Miscellaneous Papers, Vol. 18. Vide infra pp. 1313 et seq.

When 'Glasgow Gas Consumers Company'¹ was finally promoted in December 1860, with Flintoff as engineer, Pringle's Committee dissociated themselves from the project which soon collapsed. Nevertheless, discontent remained among the Glasgow consumers and was finally expressed in municipal purchase² of the gasworks in 1869. Whilst in Glasgow, however, Flintoff cultivated pressure groups in Carluke, Ayr, Helensburgh, Dumbarton, and Bonhill during 1859. Carluke was a mistake for Flintoff, but perhaps a more typical, small Scottish company³ compared with the few large companies upon which he subsequently concentrated. Carluke sold gas at eight shillings and sixpence despite proximity to the Lesmahagow coalfield, and consumers began to charge the Company with taking twenty per cent profits and concealing this in secret funds. In reality the Carluke company was performing a public service, and the Directors published statistics to restore public confidence. 500 consumers used 1,232,340 cubic feet per year, and the Company had only two employees, a "gas-maker" and rent collector, yet the dividend was only five per cent on the original capital stock of £1500. The company was in debt for £400, had no sinking fund, and for many years after commencing had paid no dividend but reploughed all profit to extend the works.⁴

1. J.G.L., 26/2/1861. The Company aimed to take Limited Liability instead of a separate Act.

2. Vide supra p. 1039
Municipal control was not popular in Scotland around 1860, and Rutherglen inhabitants blamed their expensive gas (5/10d) on the ownership of most Shares by local Magistrates, who could prevent any competition. Glasgow Herald, 5/9/1859.

3. Vide supra pp. 741, 866
Glasgow Herald, 7/9/1859.

4. Expensive cannel coal from Auchinheath collieries, included 8 miles of land transport and 2 tolls. No depreciation was made until 1858, when £16 was written off meters. The Directors owned half the stock, and were willing to sell their works to any rival company at a valuation made by 2 competent engineers.

'Veritas' attacked Flintoff's callous attack on the companies, especially since London gas used in his comparisons was only 12 candlepower. At Sheffield a Consumers Company of £50,000 had expected to sell gas at 3/-, but after an annual loss of £1500, had raised the price to 4/-. Glasgow Herald, 10/9/1859.

By probing companies, however, Flintoff did reduce the price of gas and expose unfair trading. In May 1859 a proposed consumers company in Dalkeith complained of high price and poor quality gas, but Directors in the old company claimed equal quality to Edinburgh¹. They also printed and distributed to all consumers a detailed refutation of claims made in the new Prospectus,² and were not forced to reduce the gas price until 1861 when it fell from five shillings and tenpence to five shillings to conform with a reduction made in Musselburgh,³ as a result of consumer agitation, from five shillings and fivepence to five shillings.

Ayr Trades' Reform Association⁴ forced the Ayr and Newton companies to resume active competition in September 1859, and persuaded Provost Kennedy to call a public meeting⁵ at which Flintoff stated they could make gas at three shillings and tenpence halfpenny instead of six shillings and eightpence. At Helensburgh, James Orr presided over the "respectable audience" which Flintoff⁶ urged to form a rival Company to sell gas at four shillings and sevenpence farthing instead of the high price of eight shillings and fourpence which they were paying.

1. Dalkeith company offered to pay half the cost of an independent check upon gas quality. S.R.O., Dalkeith Minute Book, op. cit., 14/5/1859.

2. S.R.O., Dalkeith Minute Book, op. cit., 28/5/1859.

3. Public lights were reduced in 1862 from 5/- to 4/-. S.R.O., Dalkeith Minute Book, op. cit., 13/6/1861, 2/7/1862.

4. Under the threat of Competition, Ayr in 1860 reduced gas from 6/8d to 5/10d, and meter rent from 2/6d to 1/-d. Glasgow Herald, 3/10/1859, 5/10/1859. Ayr Minute Book, op. cit., 2/7/1860.

5. Flintoff spoke at two public meetings in favour of constructing a new £7097 gasworks to supply 54,000 cu.ft. per day, at 3/10½d, and pay 10 per cent dividends. Glasgow Herald, 8/10/1859.

6. The absence of national gas-price statistics for Scotland in 1859 prevented any objective assessment of Flintoff's claims by contemporary consumers. When Flintoff returned to Helensburgh in November 1861, however, only £27 had been raised towards a new company. Glasgow Herald, 6/10/1859; J.G.L., 5/11/1861.

Table 6.18 Flintoff's Estimates for Helensburgh Consumers Gasworks

Tank, retorts, buildings, limited liability, engineers fees	£ 2,050	0	0
Pipes	2,250	0	0
Sundries	237	10	0
	<hr/>		
Total Fixed Capital	4,537	10	0
Manufacturing Cost for 5 million cu.ft.	805	16	8
Revenue - Bye-products	125	0	0
Prime Cost of Gas	680	16	8

Selling Price of Gas per 1000 cu.ft.

Prime manufacturing Cost	2s	8 $\frac{3}{4}$ d
7 $\frac{1}{2}$ % dividend on £5000 capital stock	1	6
Losses, Leakage, Bad debts	0	4 $\frac{1}{2}$
	<hr/>	
Selling Price	4	7 $\frac{1}{4}$ d

Source:- Glasgow Herald, 6/10/1859.

At Bonhill¹ Flintoff claimed that gas could be sold for less than five shillings while the Leven company charged seven shillings and sixpence, and the public meeting appointed a deputation to lobby the company for cheaper rates. They complained that the five shillings deposit which was required before supply was granted, was "arbitrary and oppressive", the gas was of poor quality and too expensive, and the Sale of Gas Act should immediately be applied since the badly constructed meters gave false readings.² The Company made a full, written reply. They would not revoke deposits, but agreed that defective pipes had reduced gas pressure recently, and caused an admixture of air. Their gas was "as cheap as that supplied by

1. Glasgow Herald, 22/10/1859.

2. S.R.O., Leven Minute Book, op. cit., 25/11/1859. Many companies found a reduction to 6/8d to be adequate. The Deposit system is considered elsewhere. Vide infra p. 860

any other work of like dimensions, and any other Company similarly situated", but it would be reduced from seven shillings and sixpence to six shillings and eightpence "as an experiment and in the hope that increased consumption would materially mitigate the loss" or it would rise again. The meters were from "eminent makers", and any consumer who complained could have a meter tested by the gas company, who would pay the cost if the fault was proved.

At Dumbarton¹ the old company early in 1860 responded to consumer unrest by reducing the price from six shillings and eightpence to six shillings and threepence, and again five shillings and fivepence in February 1860, in a successful attempt to dissuade the promoters of a consumers company from proceeding. The following year a consumers gas company was promoted in Coatbridge,² with the object of also supplying the outlying areas of Whiflat, Rosehall, Coatdyke and Calder. The old Coatbridge company³ of 1843 responded in 1862 by raising its capital stock by £1500 to absorb consumers wishing to become partners, and mains pipes were extended to Whiflat, Rosehall and Calder Ironworks. The second company collapsed rapidly.

Two Consumers' Companies were a lasting success, at Lanark⁴ in 1860 and Denny⁵ in 1861. Both operated with Limited Liability, and a small capital stock in one pound shares; £1500 at Denny, and £2500 at Lanark where the vast number of shareholders, mainly weavers, craftsmen and shopkeepers, paid a deposit of two shillings, and then

1. Glasgow Herald, 2/2/1860.

2. Glasgow Herald, 16/3/1861, p. 41.

3. A. Miller, The Rise and Progress of Coatbridge (1864, Glasgow).

4. Analysis of share ownership in Consumers Companies. Vide supra p.199.

Lanark Consumers, S.R.O. (BT2/58).

5. S.R.O. (BT2/70).

three shillings per share every two months until shares were paid up. Flintoff underestimated the capital costs,¹ however, and a loan of £1000 was also required. Gas was only reduced from seven shillings to five shillings instead of the four shillings forecast, and the works were run by a lessee who guaranteed a dividend of five per cent, six per cent, and then seven per cent in the third year. During 1859 Denny old gas company sold 1,495,000 cubic feet of gas at seven shillings and sixpence to only seventy consumers. Expensive Lesmahagow coal was used, at twenty seven shillings and ninepence per ton, and the shareholders received a dividend² of six and a quarter per cent.

Denny old company³ remained in active competition until capitulating in 1875. In 1876 Denny Consumers⁴ increased their capital stock from £1500 to £2500 by 1000 additional shares with a preferential six per cent dividend for six years, to "relieve their present difficulties". However, in 1881 the Company paid out only its fourth dividend since commencing⁵. Thereafter prosperity commenced, with the construction of three new paper mills inside the supply zone⁶ which

1. Dundee Advertizer, 25/10/1861, p. 3. (Dundee Ref. Lib.)

2. Three factories were the main consumers, of 309,000 cu.ft. at 20% discount, 106,000 at 12½% discount, and 54,000 cu.ft. per year at 7½% discount. Glasgow Herald, 14/9/1859.

3. J.G.L., 14/9/1875, p. 440.

4. J.G.L., 18/7/1876.

5. J.G.L., 5/4/1881.

6. 1883 £146 reinvested from profits after gale damage; profits £261; 10% dividend. 1884 10% dividend. 1885 £258 from revenue for new pipes and station meter, £320 profits, 10% dividend though Directors recommended 7½%, reserve fund £822. 1886 10% dividend. 1887 10% dividend, £312 profit, £1022 reserve fund, £2500 capital stock. Vide J.G.L., 10/4/1883, 8/4/1884, 15/12/1885, 12/10/1886, 29/3/1887.

included two other paper mills, three iron foundries, and several small factories. In 1883-5, 3100 yards of new mains were laid, but the gas was expensive, five shillings and fivepence in 1883 and four shillings and sevenpence in 1885 with five per cent discount¹ above twenty pounds. Dividends were ten per cent in 1884 and seven and a half per cent in 1885, which outraged consumers² who sought municipal control³ in 1884 and achieved it for £5500 in 1886.

From 1861 until 1871 when the old Lanark company collapsed, the consumers there "had cheaper gas than in any other town in Scotland of the same size"⁴ yet the long-term evils of competition were soon apparent. Very little dividend had been paid, and the capital equipment had been allowed to deteriorate.⁵ After amalgamation leakage was over thirty per cent, equipment worth £2500 was written off, and gas was raised to eight shillings and fourpence. A new bank overdraft of £1000 was taken, and in 1874 when two and a half per cent dividend was paid, the Company⁶ still had an overdraft of £710, and also paid five per cent interest on £2400 Bonds. In 1875 the overdraft was repaid, and bonds raised to £2500, though another £1000 was required for renovations. In 1874-5 the expenditure on renewing pipes and reduced leakage alone enabled three per cent more gas to be sold from 11.5 per cent less coal.

By 1877 leakage⁷ was down to ten per cent, gas down to five

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1. Until 1885 5% discount only on quantities above £50.
 2. In 1880-4 the Company reputedly paid a total 10/- in dividends on £1 shares. J.G.L., 8/5/1883, 24/11/1884.
 3. Works evaluated for Council by J. McGilchrist of Dumbarton. J.G.L., 21/9/1886.
 4. J.G.L., 17/8/1875.
 5. J.G.L., 7/8/1877.
 6. J.G.L., 17/8/1875, 25/5/1875.
 7. J.G.L., 15/8/1877.

shillings, mortgages down to £1600 after repaying £400 that year, and dividend up to five per cent. The following year¹ another £1500 was required to reconstruct the works at Steel's Cross, in order to sell off the other gasworks at Potter's Wynd. About this time, Lanark Town Council² became the largest shareholder, and in 1886 hindered the construction of a new £1200 gasholder in the hope of developing electricity. Although dividends reached seven and a half per cent by 1889, the gas price remained four shillings and twopence in 1879-89. The Journal of Gas Lighting³ noted that this Consumers Company was no more successful than any commercial company in providing cheap gas. Even Carlisle, which produced only half as much gas and provided a free supply to seventy public lights, charged only three shillings and ninepence in 1889.

During the spring of 1861 Flintoff concentrated on the Edinburgh region. In Edinburgh⁴ he urged the reduction of gas from five shillings and fivepence to three shillings and sixpence, through a Co-operative Company with one pound shares, paid up at two shillings and sixpence per month, whereby "the working men of Edinburgh could thrash the two companies". The saving on gas bills was expected to cover the full cost of shares, and 'The Edinburgh and Leith Gas Consumers Association' was formed under the Chairmanship of Neil Macnish, and with the support of three Councillors.⁵ The normal bills of a

1. J.G.L., 13/8/1878.

2. J.G.L., 22/6/1886.

3. J.G.L., 20/8/1889.

4. First meeting at Brighton Street Chapel, 24/4/1861. Flintoff's illustrations included Manchester where 4/- gas gave annual £48,000 profits, and Rochdale where 4/- gas gave £5530 profit. The Scotsman, 24/4/1861, 25/4/1861; J.G.L., 7/5/1861, 24/4/1861.

5. Councillors Ridpath and Cochrane of Edinburgh and Adam of Leith.

local hotelier and shopkeeper showed rising expenditure despite the absence of any new burners.¹ Edinburgh council² failed to audit the gas company books, though it had been empowered to do so since 1829. Most gas company directors had "some connection with a coal pit", and purchased these coals regardless of price,³ but cannel coal could be purchased in Edinburgh at fifteen shillings a ton which gave 10,000 cubic feet gas. After allowing for by-product revenue, this was elevenpence per 1000 cubic feet, yet the gas was sold at five shillings and fivepence. There was "something very rotten" about the Edinburgh companies, because they had lower maintenance costs with three and a half hour charges instead of six and a half hours in London, and paid lower wages, twenty two shillings and sixpence a week to stokers compared to twenty six shillings a week in Liverpool, yet London gas cost only four shillings.

'Edinburgh Consumers Company'⁴ was promoted, and by May 1861 applications had been received for £30,000 stock. Flintoff then lectured in Leith, where he claimed that gas could be sold at about two shillings and tenpence from a company with £35,000 stock and seven and a half per cent dividends, plus £15,000 mortgage at five per cent interest. 'The Leith Gas Consumers' Company (limited)' was promoted there, with a nominal capital of £40,000 in £1 shares. The Company planned to restrict dividends to five per cent, to provide gas at three shillings, and to sell its works to the Town Council^{at} valuation whenever requested. Neither company progressed beyond

1. This was a false argument, since corroded burners would use more gas to give equal light, but the fault lay with the consumer who used them. Vide infra p. 1254

2. Flintoff's second public lecture. Edinburgh Evening Courant, 30/4/1861. Vide Supra p. 979

3. Again a false accusation. Vide supra p. 875

4. The Scotsman, 3/5/1861. Exceptionally little data is available on this Company.

the planning stage.

Flintoff believed that action in Edinburgh would cause the collapse of gas monopolies throughout Scotland.¹ He designed a new gasworks, and advertisements were even made for equipment tenders.² The established Edinburgh companies replied³ that fourteen candlepower London gas would be expensive at two shillings and fivepence compared to rich, twenty eight candle Edinburgh gas at four shillings and tenpence. They were "almost entirely dependent on private consumers", yet the heat and combustion products from poor gas would prevent its use in such houses. Edinburgh Council Lighting Committee⁴ examined Flintoff's claims, and announced that a single municipal gasworks was a better solution than competing companies. This delay, together with poor leadership by Macnish who fell into arguments with Flintoff,⁵ undermined the protest movement in Edinburgh.

At Musselburgh,⁶ a public meeting called by Provost Riddock was shown Flintoff's estimate for a new gasworks to supply gas at three shillings and twopence halfpenny. This was a rabble-rousing lecture, and when the Dalkeith gas manager, John Young,⁷ rose to refute

1. Edinburgh Evening Courant, 10/5/1861.

2. Edinburgh Evening Courant, 21/5/1861, 28/5/1861.

3. Edinburgh Evening Courant, 10/6/1861, p. 1.

4. The Committee assumed that gas could be manufactured and distributed for 3/- per 1000 cu.ft.; 10 per cent dividend on £200,000 capital (to manufacture 450 million cu.ft. year) would cost 1/0½d on 385.2 million cu.ft. (after 14.4% leakage), raising the cost to 4/0½d. 4/3d per 1000 cu.ft. would give 10 per cent dividend on the entire £248,000 existing stock of both Edinburgh companies if all duplicate facilities were abolished by compulsory amalgamation under corporation control. Alternatively, a Council "tribunal" should audit their accounts and enforce a reduction in gas price. Dundee Advertizer, 25/10/1861.

5. Flintoff gave a final Edinburgh lecture in November 1861. Dundee Advertizer, 5/11/1861; J.G.L., 5/11/1861, p. 769

6. Flintoff stigmatized gas managers as incompetent and lazy. Edinburgh Evening Courant, 20/5/1861; J.G.L., 13/8/1861, p. 579.

7. This incident was discussed by two other gas managers, Robson of Selkirk and J.C. Adamson of Galashiels, who were faced later by similar pressure groups. It catalyzed the formation by them of the first gas managers' association in Scotland, the Waverly Association, in August 1861, to debate problems of mutual interest. W.T.K. Braunholtz, The Institution of Gas Engineers - The First Hundred Years 1863-1963 (1963), p. 7.

Flintoff's statements; the audience was "dissatisfied with having to listen to a second lecture on gas-making" and his argument went unheeded. Flintoff subsequently toured southern Scotland founding consumer groups.

In June 1861 Jedburgh¹ consumers under Flintoff's direction demanded a large reduction in gas prices within six days, on the threat of forming a new company. A similar threat at Kelso, where the Company normally paid ten per cent dividends, produced an immediate reduction from seven shillings and sixpence to six shillings and eightpence. In July, Flintoff claimed that gas could be sold in Selkirk² for four shillings and sixpence instead of seven shillings and sixpence, and a new Company could still obtain a dividend rising from five per cent in the first year to seven and a half per cent by the third year. Later that month he addressed a public meeting in the Corn Exchange at Kirkcaldy³ and claimed that a new company with £7500 capital could sell gas for three shillings and ninepence. The old Kirkcaldy company that day reduced its price to four shillings and fourpence halfpenny.

The Kirkcaldy consumers' committee made a careful examination of Flintoff's estimates for a new works, and the absence of faults also encouraged Selkirk consumers at their second meeting⁴ in September. A resolution was passed by Bailie Johnstone and R. Turnbull,

1. Edinburgh Evening Courant, 29/6/1861, p. 2.

2. Selkirk old company supplied gas of 30 candlepower. J.G.L., 13/8/1861, p. 579.

3. In 1861 Dundee consumers' committee tried to form a new consumers company in Kirkcaldy, to reduce gas from 4/10 to 4/4½d, because Dundee prices were pegged by Parliament to those in Kirkcaldy and several other towns. Dundee Advertizer, 1/11/1861, p. 3. Edinburgh Evening Courant, 13/7/1861, p. 2.

4. Flintoff estimated a new Selkirk works to supply 3.5 million cu. ft. per year would cost £2500. Consumers quoted Flintoff's remarks from the Southern Reporter, 18/7/1861. Selkirk Minute Book, op. cit., 1/10/1861.

manufacturers, that gas should not cost above five shillings and tenpence, while two other consumers urged the Selkirk company to repay its loans by selling 200 shares to consumers to give them a voice in the company. The consumers' committee wrote to many small Scottish gas companies, and obtained information on coals and other expenditure which showed that Arniston coal usually gave 10,000 cubic feet of twenty eight candlepower gas, whereas Flintoff claimed 11,000 cubic feet with modern equipment. Because coal cost twenty eight shillings per ton in Selkirk, the prime cost of gas was only two shillings and ninepence halfpenny. The Selkirk company was accused of reploughing excess profits on a large, unreasonable and wasteful scale, as in building the manager's house, and a gasometer costing £14,000 which had been purchased without issuing extra shares.

Directors of the Selkirk company¹ replied that seven and a half per cent dividend was not excessive in a business with great risks which could not be covered by insurance, and which would collapse if science devised a better method of illumination. They finally agreed that, instead of immediately reducing the price of gas, they would reduce the price of gas by fivepence per 1000 cubic feet for each increase of one half per cent dividend on the market value of shares. This latter scale operated more to the advantage of the shareholders than the public. In 1862 gas was reduced from seven shillings and sixpence to seven shillings and one penny, and dividends raised to eight per cent "in terms of the implied agreement with the public".²

1. S.R.O., Selkirk Minute Book, op. cit., 1/10/1861.

2. In 1867 169 extra shares of £5, with a maximum 5% dividend, were sold at an upset price of £6 10/-, to "influential consumers" who were pressing the Company for a voice in its affairs. The price agreement later lapsed. When gas prices fell after 1864, dividends did not continue to rise, and in 1873 when gas was raised from 5/- to 6/8d the dividend remained at 10 per cent.

S.R.O., Selkirk Minute Book, op. cit., 10/6/1862, 9/6/1863, 8/6/1864, 21/1/1867.

In 1863 when gas fell to six shillings and eightpence, dividends rose to nine per cent, and in 1864 six shillings and twopence and ten per cent.

Collusion between the Perth companies was bitterly attacked by Flintoff in September 1861, en route to his winter headquarters at Dundee. At a public meeting in the City Hall¹ organized by the local consumers' leader, the Reverend J.P. St. Clair, he claimed that "the cost of gas, like the cost of a coal or a pair of boots, should be about the same everywhere". Best cannel coal in Perth cost twenty five shillings and sixpence, and produced by-products worth four shillings, as well as 11,000 cubic feet gas, equivalent to one shilling and elevenpence halfpenny coal per 1000 cubic feet. Cheaper coals could reduce that to one shilling and threepence. The sixty million cubic feet gas consumed annually in Perth could be supplied at three shillings and sixpence halfpenny, or even half that consumption at only three shillings and tenpence halfpenny. A committee² was formed to lobby for gas at three shillings and ninepence.

Numerous public meetings of support were held, and canvassing for the new company progressed through the municipal wards organization,³ with a co-ordinating Committee voted in each Ward. For the average working man who used about 4000 cubic feet per year, Flintoff promised a reduction of his gas bill from thirty shillings to seventeen shillings and sixpence. The Perth Gas Consumers Company Limited⁴ was quickly registered with the help of a few prominent supporters,

1. Perthshire Courier, 3/9/1861; J.G.L., 8/10/1861.

2. Perthshire Courier, 10/9/1861, 1/10/1861. Flintoff had to defend himself in one public lecture against charges of incompetence in the management of Sheffield Consumers Company.

3. Perthshire Courier, 8/10/1861, 15/10/1861, 22/10/1861, 29/10/1861.

4. S.R.O., (B.T.2/84). Nominal capital £25,000 in £1 shares. Dissolved 3/3/1862.

but the Prospectus¹ inviting a large number of small consumers to subscribe, was not issued until a month later.

Table 6.19 Founding Members of Perth Gas Consumers Company Limited

Andrew Graham	100 shares	J. Love, merchant	100 shares
H. Skeete, solicitor	100	J.P. St. Clair, minister	100
J.W. Lyall, newspaper proprietor	25	J.B. Deas, minister	20
J. Shielby, manufacturer	25		

Source:- S.R.O., (BT2/84)

The Consumers Company stipulated a maximum dividend of five per cent, and a maximum gas price of four shillings and fourpence halfpenny, to save the city² £4000 per year. Under this pressure, the Perth New Gas Company³ broke the domination of the Old company and reduced its gas price from five shillings and tenpence to five shillings. It also offered to sell the entire gasworks⁴ for £8000 to the Consumers Company, and despite protests by Flintoff, Skeete and Graham persuaded the Perth consumers that they would be unable to raise £25,000 for a new Company. Instead they entered an agreement by which the Perth New Company would supply gas of twenty two candlepower at five shillings for seven years, but would reduce the price farther as

1. Perthshire Courier, 15/10/1861.

2. The Consumers Movement always spoke of "saving" expense to a particular town, though in most cases gasworks shareholders lived in the same town, and profits used for reploughing or dividends were normally recycled within that town and not exported elsewhere. This depended, also, upon what quantity of gasworks equipment could be purchased locally.

3. Earlier in 1861 both companies reduced gas from 7/6 to 5/10d. The New Company had begun in 1844 as a Consumers Company. Dundee Advertizer, 11/10/1861.

4. Perth New company agreed to sell gas at 4/10d when consumption reached 17 million cu.ft., 4/6d when 18.5 million, and 4/4½d when 20 million cu.ft., taking advantage of economies of scale. Perthshire Courier, 22/10/1861. "End of Gas Agitation in Perth", Dundee Advertizer, 29/11/1861, p. 3. "Fight between the Old and New Gas Companies in Perth", Dundee Advertizer, 10/12/1861, 13/12/1861.

consumption increased. Consumer support dwindled, however, and in December 1866 the two Perth companies¹ again united and raised gas from four shillings and twopence to six shillings and eightpence. Many regarded this as symptomatic of the problems faced by consumer efforts, and renewed discontent was only solved by the programme of municipal takeovers in the 1870s. Perth Council bought the two gasworks there in 1871.

When Flintoff reached Dundee later in September 1861, he claimed that gas should be produced there as cheaply as in Liverpool, at three shillings and ninepence instead of five shillings and sixpence which would save the town £10,000 a year on 120 million cubic feet.² He claimed³ to have already saved consumers elsewhere about £250,000 each year.

Table 6.20 Towns in Which Flintoff Claimed to have caused Gas Price Reductions (1861)

Edinburgh	Kilmarnock	Galway	Bath
Leith	Dunfermline	London	Bristol
Glasgow	Dumbarton	Liverpool	Hereford
Stirling	Jedburgh	Dublin	Bolton
Selkirk	Perth	Sheffield	Ashton
Carlisle	Helensburgh	Manchester	Lancaster
Lanark	Denny	Blackburn	Oldham
Wishaw	Musselburgh	Cork	Newry
Bonhill	Hawick	Preston	Birkenhead
Ayr	Kirkcaldy	Burnley	Whitehaven

Source:- Dundee Advertiser, 1/10/1861.

1. Perthshire Journal, 27/11/1866; J.G.L., 9/1/1866, 10/7/1866, 11/12/1866.

2. Even a saving of 1/- per 1000 cu.ft., or £60,000, was equal to half the entire Police or Poor Law Assessment. "Movement for Cheap Gas in Dundee", Dundee Advertiser, 27/9/1861, p. 3.

3. Advertisement "The Oppressive Gas Monopoly", Dundee Advertiser, 1/10/1861. Flintoff stated that he had reduced gas by 1/8d in Perth, 7d in Edinburgh, and 5d in Glasgow Paisley, Arbroath and Montrose, Dundee Advertiser, 4/10/1861, p. 3.

Nevertheless, by comparing Scottish town prices for rich gas, with English prices for low candlepower gas, without stating the difference, he was misleading consumers.

Table 6.21 Gas Prices at Various Towns Compared to Dundee
(1861)

Dundee	5/6d	Bradford	2/6 to 3/4	Huddersfield	2/7½ to 3/6
Kirkcaldy	4/4½	Plymouth	3/-	Rochdale	3/3 to 4/-
Birmingham	2/10 to 3/6	Liverpool	3/9	Leeds	2/10 to 3/9
Blackburn	3/9 to 4/-	Manchester	3/8 to 4/-	Whitehaven	2/6
Bolton	3/- to 3/6	Sheffield	3/6 to 3/9		

Source:- Dundee Advertizer, 1/10/1861.

A packed public meeting at the Corn Exchange was chaired by D. Hunter,¹ of Blackness, who illustrated capital wastage in the old company with the enclosure of the gas-holder, "in a building, as if they were afraid it would run away". The building caused an accumulation of gas which exploded and tore off the roof, yet shareholders still received dividends on the capital expense of the entire building. Flintoff claimed that ninety nine per cent of Scottish gasworks were erected "at about twice or thrice the money" which would have been required for a more correct design, at a time when "one man often put up all the gas-works in a particular district, perhaps as many as... twenty gas-works", each repeating the same initial faults. In Dundee the original narrow pipes were still used, to convey larger quantities of gas at higher pressures which, combined with rusting, caused about thirty per cent leakage which was charged to the consumers. Reploughing by "greedy, selfish, calculating Directors" forced the consumers to pay the cost of extensions, quite unlike

1. "Gas Monopoly in Dundee", Dundee Advertizer, 4/10/1861.

other manufacturers¹ who demolished their old premises and themselves financed rebuilding on a larger scale as trade expanded. "With the exception of two or three rich millowners, the shareholders generally are [living] a long way off, and have no interest in the prosperity of Dundee".² Their shares with twenty three pounds ten shillings paid up had a market value of fifty pounds, which would be the price charged for any municipal takeover project.

No daytime gas pressure was available in Dundee, gas was "diluted" by using the exhauster to "pump air into the gas main", and expensive antiquated gas-holders which were only a quarter of the size of modern gasholders, gave a totally inadequate supply during peak demands in winter. If Dundee still desired municipal ownership of the gasworks, a Limited Liability Consumers Company would cause a depreciation in the shares of the Old Company from fifty pounds to ten pounds and in the New Company from five pounds to one pound, at which price the Police Commissioners could purchase their works.

In Flintoff's social philosophy, he described himself as "fighting the battle of progress and benefitting people who were so persecuted and oppressed as not to know they had the means of benefitting themselves...Such a contest lets the working men especially... know their power and feel their strength - and they would [soon]

1. This was a circular argument. Gas-companies reinvested profits directly, but in other industries where manufacturers invested their own money upon extensions, they could obviously have obtained that capital originally as profit. The importance of this in trades less exposed to public scrutiny than gas companies is shown by P. Mathias, The First Industrial Nation (1969), op. cit., p. 149.

2. Dundee Advertizer, 4/10/1861. Only the New company published financial accounts. The fixed capital of both gasworks was £122,755, Dundee Advertizer, 11/10/1861.

exercise it for other social improvements".¹ At a second public meeting,² he urged Dundee to form a Consumers Company which could obtain Limited Liability for only ten pounds, and to canvas consumers for three-year contracts to supply them with cheaper gas. A sixpence deposit on all shares could cover total expenses, and no further call would be necessary because the old companies would make concessions. The new company could then dissolve.

The Old companies responded by reducing gas from five shillings and sixpence to four shillings and tenpence, thus saving the town³ £4000 a year on 120 million cubic feet; and they expanded on the better quality of their twenty seven candlepower gas compared to twelve candlepower London gas. Still dissatisfied, a third meeting of consumers received Flintoff's estimates for a new gasworks, and requested the Police Commissioners for their active support.

The Dundee companies replied with a detailed statement about the failure of Sheffield Consumers Gas Company,⁴ but Flintoff maintained

1. Dundee Advertizer, 4/10/1861. Flintoff claimed that his lectures in England during 1854-5 had been the basis of the Sale of Gas Act (Vide supra p. 1154). He suggested a Government Inspector, with subordinate officials each responsible for testing the quality of gas in about 10 towns. Alternatively, Dundee Police could appoint a chemist at £20 per year to test gas twice daily. Both methods could raise the quality by more than 5 per cent, and save Dundee £1400 a year on the total gas bill of £28,000, Dundee Advertizer, 8/10/1861, p. 2.

2. Dundee Advertizer, 8/10/1861.

3. Dundee Advertizer, 11/10/1861, p. 3. The Dundee Advertizer, for which gaslight was one of the main working costs, noted that tradesmen were in the practice of writing to consumers in other towns to inquire the cost of 1000 cu.ft., but not the annual cost per burner or size of flame, and their failure to read accurately their annual consumption allowed the gas companies to manipulate the quality of gas to raise consumption and offset lower gas prices. Through this interest, the Dundee Advertizer gave detailed coverage of Flintoff's work.

4. Dundee Advertizer, 22/10/1861, pp. 2, 5.

that he had not engineered those works, although they had successfully reduced gas from five shillings and tenpence to four shillings and ninepence halfpenny in 1850, and even in 1861 the combined Old and Consumers Companies¹ gave very cheap gas at three shillings and ninepence. Subsequently the Dundee reformers became divided over the possibility of municipal control or of forming a consumers company. This negated all action, though at his final meeting Flintoff strongly opposed municipal control.² Greenock Council obtained coal³ at an average price of thirteen shillings and elevenpence three farthings, and yet charged four shillings and sevenpence for sixty million cubic feet gas, thus obtaining a clear profit of £3867 plus £1266 to pay interest. The fixed capital was £50,000, but reploughing had been used as a deterioration fund to reduce the 'capital' to £27,000 on the books. Instead of selling gas at three shillings and threepence, Greenock Council exacted twenty per cent profits which reduced local taxation at the expense of consumers.

Meanwhile Flintoff's campaign had made considerable impact in a wide area around Dundee. Many companies reduced their prices in anticipation of conflict, as at Newport, Fife,⁴ where gas fell from twelve shillings and sixpence to ten shillings. The editor of

1. Dundee Advertizer, 22/10/1861, p.4, 29/10/1861, p. 5.

2. Vide supra p.1161

3. 600 present at final meeting on 29/10/1861. Greenock coal at 13s 11³/₄d included 1/6d freight from Glasgow, and Dundee could obtain the same coal at 6/- freight from Glasgow by the Scottish Central Railway. At 19s 11³/₄d in Dundee, it was well within the price used in Flintoff's earlier calculations. Greenock Advertizer, 1/11/1861.

4. Dundee Advertizer, 8/10/1861. Newport company formed 1856. Price decision taken on advice of Mr. Martin, writer, the company auditor.

Peterhead Sentinel¹ obtained Flintoff's support in his campaign for a reduction of gas from nine shillings and sixpence to five shillings. In Aberdeen,² complaints of "poor gas" supplied at six shillings and sixpence produced agitation for a Consumers Company with one pound shares. At Broughty Ferry³ Flintoff lectured to an audience of 200 chaired by Councillor W. Nicoll. The original company there in 1839 had reflected consumer interests. "It numbered nearly all the householders in the village; and the shares were sold at £2 each in order that the humblest householder might obtain them".⁴ After two years without dividends, five per cent, six and a half per cent and later seven and a half per cent were paid and pecuniary interests increased. When their contract was renewed in 1861, each block of five two-pound shares was replaced by four new shares, each with four pounds thirteen shillings and ninepence "paid-up"; and yet the dividend on those remained at seven and a half per cent. Ownership had gravitated into a few hands, one director holding 560 shares, one 500, and another 400. Until 1861 they charged seven shillings and elevenpence for gas and the consumers were already trying to obtain an alternative gas supply from Dundee. Flintoff brought them renewed hope of cheap gas, and claimed that small towns should be able to produce gas for only about threepence per 1000 cubic feet more than large towns which had the advantages of scale. Cheaper land, taxes, labour and equipment outside large towns could reduce that difference further, to one and a half pence.

1. Dundee Advertiser, 8/10/1861.

2. "The Gas Question in Aberdeen", Dundee Advertiser, 11/10/1861, p. 3.

3. Dundee Advertiser, 18/10/1861, p. 3.

4. *ibid*

If consumption was only five million cubic feet, the gas would cost four shillings and fourpence halfpenny, and Flintoff advised that a contractor could easily be obtained to guarantee five per cent dividend and sell gas at five shillings. The feasibility of this scheme was illustrated by other small towns which already sold cheap gas, like Rothesay at four shillings and sevenpence, and Musselburgh and Portobello at five shillings. One speaker was applauded for suggesting municipal control of both gas and water in Broughty Ferry, and the meeting resolved to campaign for gas at five shillings. A second meeting in Flintoff's absence resolved¹ not to form a separate Company too hurriedly in view of the high costs experienced at Lanark compared to his estimate there, but lobbying continued. The consumers finally accepted² a gas price of six shillings and eightpence when the gas company agreed to erect thirty extra public lamps gratis, and supply all eighty public lamps free of charge.

At Alyth³ discontent arose over the poor street lighting caused by expensive gas at ten shillings, and a deputation sent to the Company to request cheaper gas was ignored. Another public meeting⁴ called for gas at seven shillings and sixpence, but a third which was attended by 200 residents under Bailie Japp, accepted Flintoff's call for gas at four shillings and sevenpence farthing.

1. Dundee Advertizer, 25/10/1861. Meeting held 23/10/1861. Councillor W. Nicoll accused the company of gross mismanagement before their present manager, Mr. Myers, and was in favour of a Consumers Company. Consumers again noted that early capitalists, like David Milne, a Dundee banker who promoted both the Dundee and Broughty Ferry companies [Dundee Advertizer, 11/10/1861, p. 3], had been regarded too eagerly as philanthropists.

2. Dundee Advertizer, 19/11/1861, p. 4. Meeting held 30/10/1861.

3. Dundee Advertizer, 18/10/1861, p. 3. A Meeting of inhabitants decided to adopt the Police Act, and levy 3d in £1 to finance public lighting.

4. Dundee Advertizer, 22/10/1861, p. 3. First meeting 14/10/1861, second 18/10/1861. Gasworks originally built in 1845. Company agreed to supply public lamps at 7/6d, but residents no longer satisfied.

Another consumers group emerged at Forfar.¹ In the original Forfar Company of 1832, no person was allowed to hold more than five five-pound shares to avoid any monopoly, and dividend was restricted to five per cent pending cheaper gas. The town Council² provided cheap land, and when the supply of gas commenced at thirteen shillings and fourpence "the consumpt. of gas at once became general... as fast as gas fitters could be obtained" to install it in houses. Profits were vastly in excess of initial expectations and instead of giving cheaper gas, wealthy shareholders bought extra shares at the upset price of seven pounds ten shillings, in defiance of the Contract until they were able to change it. Consequently, in the early 1840s "a portion of the working classes" tried unsuccessfully to start a rival company. The old company fortuitously obtained extra gains when Forfar and Arbroath Railway was built alongside the works, allowing direct tipping from coal waggons, but these gains had not been passed on to the consumers.

At Forfar, Flintoff taught that gas managers were normally unskilled,³ often former tinsmiths, tailors and cobblers, and that reduced quality was the only cause for a rise in gas consumption in the town. One resident used 2300 cubic feet in 1854, but 6000 cubic feet in 1860, yet claimed to have the same number of burners in use for the same length of time. Shareholders were a species of gamblers, paying six pounds ten shillings for shares of two pounds ten shillings in the hope they would rise further. Flintoff produced

1. Dundee Advertizer, 18/10/1861, pp. 5, 8.

2. Loss of construction plans caused by the death of the engineer during building had greatly increased construction costs in the old Company. The Town Council was obliged to offer the land at a public sale, but excluded other buyers by stipulating it could only be used for a gasworks. Dundee Advertizer, 1/11/1861, p. 7.

3. Vide supra p.645

statistics for a new company to sell gas at five shillings, and a committee was formed to press the existing company for a reduction to that price.

Forfar gas company offered a reduction in price¹ from seven shillings and sixpence to six shillings and eightpence, plus discounts, but the consumers demanded gas as cheap as at Brechin, five shillings and fivepence. The Company was accused both of invidious extensions of capital equipment from surplus profits, and of creating extra share capital when loan capital was less expensive. Brechin company often used loans at four per cent interest, but Forfar company always financed extensions with capital stock on which seven and a half per cent interest was paid in dividends. They had recently done this instead of mobilizing reserve funds which were invested in the New Cemetery. One issue of 360 five pound shares had only been half called-up, and the rest "paid-up" from reploughing, yet the shares later reached a market value of seven pounds, all at the expense of consumers.

J. Grant, a local manufacturer, demonstrated that the true position of consumers could only be analysed by a close inspection of company accounts. He stated that equipment extensions and taxes should not be charged against revenue from consumers, and therefore the real dividend of the Forfar company was twelve per cent on £1800 capital stock, and not the seven and a half per cent which they declared. Because of this, the meeting agreed to form Forfar Gas Consumers Company, with £6000 stock in one pound shares, protected by

1. Discounts remained unaltered at $2\frac{1}{2}\%$ for £10 to £20; 5% - £20 up to £40; 10% - £40 to £50; 15% - £50 to £100; 20% above £100. Dundee Advertiser, 1/11/1861.
Vide infra p.872 (discounts)

Limited Liability.¹

Table 6.22 Forfar Gas Accounts 1859-60 Showing Taxes and Capitalization of Surplus Profits Charged Against the Consumers

Expenditure -	£	s.	d.
Stock in hand in June 1859	276	6	1
Taxes	51	5	1
Coals purchased	855	10	10
Additions and alterations (reploughing)	58	18	0
Pipes and castings	47	10	8
Gas meters	31	18	0
Retorts, fireclay and bricks	43	2	10
Lime for purifiers	57	13	6
Salary of Secretary	30	0	0
Miscellaneous	41	13	7½
Profits	903	9	0
Total	2,658	9	0
Revenue -			
Gas	2,281	15	8
Coke, Tar, ashes	114	4	2
Interest on Bank deposit	12	7	7
Stock in Hand	250	1	7
Total	2,658	9	0

Source:- J. Grant, Dundee Advertizer, 1/11/1861.

Pipes and gas meters were being charged against current revenue as well as taxes and additions to the plant. Grant also described the two day champagne "dinner" which Directors financed for themselves and friends, at Dunkeld, out of the profits. The Consumers company soon had £4000 subscribed,² which forced the old company to reduce gas³ from seven shillings and sixpence to five shillings and five-pence, and although a vigilante committee⁴ remained, no further action was taken by consumers after this victory.

1. Forfar consumers objected to extra shares instead of loans for large capital-equipment alterations which the Company could not make simply by reploughing; but most Consumer groups elsewhere had the opposite objection and favoured extra shares instead of loans

2. Dundee Advertizer, 5/11/1861.

3. Dundee Advertizer, 1/11/1861.

4. Dundee Advertizer, 22/11/1861.

This growing awareness by consumers of the financial manipulations practised by gas companies was a large element in Flintoff's success. Arbroath¹ consumers in 1858 forced the gas company to reduce prices from five shillings and fivepence to five shillings, and in 1861 threatened to employ Flintoff to obtain a further reduction to four shillings and sixpence. At Blairgowrie² town hall a large public meeting in October 1861 accepted Flintoff's argument that eight shillings and fourpence was an unfair price. For £3500 capital he maintained that twice as much gas could be produced, and sold at four shillings. When one of the Company directors claimed that coal alone cost them three shillings and sixpence per 1000 cubic feet, he blamed it upon poor management and unsuitable coals. Coal could be obtained at twenty eight shillings per ton which would provide five shillings of by-products, and 11,000 cubic feet of gas at a prime cost of two shillings and one penny per 1000 cubic feet upon an annual output of seven million cubic feet. If only three million cubic feet was consumed, the price would be four shillings and fivepence halfpenny. A Committee was formed, including the Council and Police Commissioners, to lobby for cheaper gas, but eventually they accepted a statement³ by the Gas Company that they could not sell gas below six shillings and eightpence, and with that price achieved the Consumers' movement collapsed.

Many consumers at Kirriemuir⁴ complained that their annual gas bill was higher, with gas at nine shillings, than it had been when gas cost fourteen shillings, and they arranged a lecture by Flintoff

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1. Dundee Advertizer, 29/10/1861, p. 5.
 2. Dundee Advertizer, 1/11/1861, p. 3.
 3. Dundee Advertizer, 8/11/1861, p. 5, 15/11/1861, p. 7, 19/11/1861, p. 5.
 4. Dundee Advertizer, 1/11/1861, p. 5. Lecture on 5/11/1861.

who was hailed as "the people's engineer".¹ A special meeting of Kirriemuir company² shareholders agreed to reduce gas from nine shillings and twopence to seven shillings and elevenpence, despite speeches in favour of the high price by many of their number who lived in Forfar. The consumers retained their resolve, however, and in January 1862 promoted the Kirriemuir Gas Consumers' Company (Limited)³ to supply better gas at under six shillings and eightpence. Three quarters of all consumers favoured the new venture, which was to restrict dividends to five per cent, and supply meters at seven and a half per cent per year on the cost price, about one shilling and sixpence per year each. Despite this enthusiasm the project collapsed.

At Coupar Angus⁴ Flintoff warned consumers they should be paying six shillings instead of nine shillings and twopence. Earlier the company had charged ten shillings on the one million cubic feet consumed annually, a total of £500, against which the new price would have saved consumers £200. Flintoff could build a new gasworks for under £2000, and with a maximum five per cent dividend that would have saved consumers a further £110, while a reduction of leakage from forty per cent to ten per cent could also save £90. A Consumers company was promoted,⁵ but did not succeed.

In Carnoustie⁶ a public collection financed Flintoff's lecture. The Company had already been intimidated into reducing gas from ten

1. Dundee Advertizer, 8/11/1861, p. 5.

2. Dundee Advertizer, 29/11/1861, p. 8.

3. Prospectus in Dundee, Perth, Forfar and Fife People's Journal, 11/1/1862, p. 1. (Dundee Ref. Lib.).
Capital Stock £2000 in £1 shares. 1300 shares already subscribed.
Engineering estimates obtained from Mr. Grant. Dundee Advertizer, 13/12/1861.

4. Dundee Advertizer, 1/11/1861, p.5, 5/11/1861, p.5, Lecture on 30/10/1861.

5. Dundee Advertizer, 15/11/1861, p.7, 17/12/1861, p.8, 31/12/1861, p.8.

6. Dundee Advertizer, 15/11/1861, p.7.

shillings and tenpence to nine shillings and twopence, and Flintoff¹ claimed it should cost four shillings. A committee was formed to lobby for gas at six shillings and eightpence, but when the company refused, Flintoff designed plans for a Consumers Company with Limited Liability and £2000 stock in one pound shares, with a deposit of sixpence per share to finance the opposition to the old company. As one shareholder in that company revealed, the Directors had "ridiculed the idea of working men...being able to do anything to oppose their monopoly". Yet the Directors proved correct, and the opposition collapsed. In 1860-1 Carnoustie old company reploughed forty eight pounds of profit into new capital equipment, compared to £168 paid as seven and a half per cent dividend to partners from a total annual revenue of £644.

Table 6.23 Reinvestment from Profits in Carnoustie Gas Company
Accounts 1860-1

Revenue -	£	s.	d.
1,086,150 cu.ft. gas at 10/10d	588	6	7½
Meter rent (2/-)	47	6	8
Tar, lime, &c. sold	8	8	0
	<hr/>		
Total	644	1	3½
 Expenditure -			
Manufacturing Costs	406	0	11
Dividend 7½%	168	15	0
Discounts	20	15	0
Balance "added to stock"	48	10	4½
	<hr/>		
Total	644	1	3½

Source:- Dundee Advertizer, 26/11/1861.

1. Two public meetings on 15/11/1861, 25/11/1861. Carnoustie old company had 3000 shares with 15/- paid up, held by 114 shareholders. At the second meeting, Flintoff was joined by D. Hunter of Blackness, the Dundee consumers' leader, and J. Smieton of the Panmure factory in Carnoustie.
Dundee Advertizer, 26/11/1861, p. 3.

Flintoff was later invited to Froickham,¹ where the established company reduced gas from eleven shillings and eightpence to ten shillings, and his ideas inspired many independent consumer pressure groups of which records are no longer available. At Laurencekirk,² for example, gas cost twelve shillings and sixpence which included sixpence surcharge for public lighting, but Flintoff's published statistics were adopted by a pressure group to lobby the Company. Increasingly the consumers in large towns turned in favour of municipal action, and after opposing the proposed gasworks purchase in Aberdeen Improvement Bill,³ during March 1862, Flintoff's Scottish campaign ceased. His ideas were, however, still carried into effect in several towns. Stonehaven Gas Consumers Company,⁴ and Kirkwall Gas Consumers Company Limited⁵ in Orkney, were both registered during 1862 and dissolved as soon as concessions had been granted by the established companies.

Table 6.24 Promoters of Kirkwall Gas Consumers Company Limited (1862)

R. Easton, banker	50 shares	J. Hail, proprietor	50 shares
J.H. Baikir, Lloyds Agent	10	J. Cursison, general	
G. Peting, County Clerk	10	merchant	40
W. Pearce, bookseller	10	T. Pearce, merchant	15
J. Jamieson, baker	5	D. Morgan, watchmaker	10
		J. Walls, shipowner	20

Source:- S.R.O. (BT2/105).

In Stranraer, the old company in 1864 reduced gas to five shillings and tenpence after receiving a petition⁶ from consumers com-

1. Dundee Advertiser, 29/11/1861, p. 8.

2. Dundee Advertiser, 6/12/1861, p. 8; J.G.L., 17/12/1861, p. 851.

3. J.G.L., 11/3/1862, p. 141, 25/3/1862, p. 172.

4. Registered 28/7/1862. Nominal capital £2000 in £1 shares. 229 shares subscribed. S.R.O. (BT2/107).

5. Nominal capital £2000 in £1 shares. S.R.O. (BT2/105).

6. Galaway Advertiser, 7/7/1864. (Galaway Advertiser Offices, Stranraer).

plaining about the price and the management following public meetings in the George Hotel and Town Hall.¹ Shortly afterwards a prospectus² was issued for 'The Stranraer (New) Gas Company (Limited)' by promoters who were "all large consumers" and who undertook to purchase 200 of the 500 shares, to charge "no promotion money", and to provide an initial Secretary and Treasurer gratis, with the object of selling gas at five shillings and distributing ten per cent dividends. The Company had inadequate support and soon collapsed.

Once a sufficiently large number of established companies had reduced their charges as a result of consumer agitation,³ the "method of comparisons" produced a strong pressure on other companies to do the same. In 1862, for example, the Chairman of Boness⁴ company proposed to reduce gas from six shillings and eightpence to five shillings and tenpence to conform with lower prices elsewhere. Indeed, the "method of comparisons" was so fundamental to gas company management that it was probably the most powerful argument consumers could use to press for reductions, and produced an approximation to a "national market" for gas in terms of price despite the normal absence of direct competition. In 1852 when the inhabitants of Stranraer⁵ had petitioned for cheaper gas the Directors agreed to reduce it from ten shillings and sixpence to eight shillings, but claimed that the existing price was "as low, if not lower, than that charged by almost any company in Scotland having a similar consumption and

1. Galaway Advertizer, 16/6/1864.

2. Nominal capital £1500 in £3 shares. Interim secretaries Wm. Taylor and James Meikle. Galaway Advertizer, 20/10/1864.

3. In Newton Stewart gas prices were reduced by competition between two companies during the 1880s, but the origins of the second company are unclear. J.G.L., 13/11/1883.

4. Boness Minute Book, op. cit., 9/6/1862.

5. S.R.O., Stranraer Minute Book, op. cit., 9/3/1852.

placed at a similar distance from coal". When F.R. Hughes & Co., a large consumer from the Boness gas company, complained in 1872 over the rise in price from five shillings and tenpence to six shillings and threepence, compared to five shillings and fivepence in Edinburgh, the Company sent an apology and their Clerk was instructed to state that supplies were as cheap as gas from "other companies of similar extent and similar circumstances, and to quote if possible several cases".¹ The Annan company in 1877 refused cheaper gas for Messrs. Foster & Co. because "the price in Annan compared favourably with other small towns".²

The largest consumers' company to be formed in Scotland, appeared later in the decade when municipal ownership was entering the stage as the consumers' main ally. The Partick, Hillhead and Maryhill Gas Company Limited,³ was registered in 1871 to supersede a small existing company at Maryhill.⁴ It obtained the widespread, angry support of consumers in those burghs which lay within Glasgow Corporation's supply zone of 1869, because the Corporation proposed to charge a differentially high rate to supply that area.

The first Directors⁵ of the Partick, Hillhead and Maryhill company were Robert Bruce (50 shares) paper-maker, Henry Cowan (100), Patrick Dougall (100) merchant, and William Russell (100) all of Hillhead, Paterson Wingate (100) engineer and ship-builder, Robert Hunter

1. S.R.O., Boness Minute Book, op. cit., 10/10/1872.

2. S.R.O., Annan Minute Book, op. cit., 8/6/1877.

3. S.R.O. (BT2/351). Vide supra pp 199, 1081

4. Promoted about the 1830s by J. Paxton, a mason from Cromarty. A. Thomson, Maryhill 1750-1894 (1895, Glasgow) p. 173.

5. Company reserve funds limited to maximum £10,000. Depreciation fund never to exceed 25 per cent of the cost of Company Property. Shares of £5 nominal value.

S.R.O. (BT2/351). Articles of Association.

(100) timber merchant, and Robert Kay (60) all of Partick, and William Govan (50) merchant, John King (100) cabinet-maker, Andrew H. McLean (200) merchant, Andrew Paton (50) merchant, and James Shaw (120) all of Glasgow. Twenty six other investors each held more than 100 of the five pound shares in 1871, as shown in Table

Table 6.25 Investors (other than Directors) with 100 shares in the Partick Company (1871)

Partick residents -

Charles Connell, ship-builder	200	Moses Hunter, gentleman	100
William Lang, wine-merchant	200	Robert Robinson, timber merchant	200
David Tod, engineer and ship-builder	100		

Hillhead residents -

Miss Jane Cullen	100	Thomas Cullen, gentleman	100
George Edington, ironfounder	100	Joseph Gardiner, merchant	150
Alexander Mackenzie, merchant	100	John Pollock, gentleman	100

Glasgow residents -

Joshua Buchanan, ham-curer	200	David Carson, manufacturer	100
John Duncanson, builder	100	Thomas M. Ferguson, cotton yarn merchant	200
George Hamilton, merchant	100	Patrick Hamilton, merchant	100
John Knox, gentleman	100	Thomas Meikle, merchant	100
Joseph Murison, insurance broker	100	Robert Perry, M.D.	200
Thomas Reid, dyer	100	David Sandeman, gentleman	100
Andrew Stewart, buyer	100		
Thomas Watson, merchant/ Turkey Red Dyer	200		
Robert Watson, merchant/ Turkey Red Dyer	200		

Source:- S.R.O. (BT2/351) Board of Trade Records.

Among the large shareholders, G. Hamilton was probably¹ a member of P. & G. Hamilton, merchants, John Knox probably of J. Knox and Kennedy, cotton silk and woollen manufacturers, D. Sandeman probably a wine merchant, and James Shaw² possibly of J. Shaw and Company of Maryhill Iron Works.

1. Glasgow Post Office Directory, (1871).

2. James Shaw, ironfounder, was recorded a second time, with a further 50 shares making a total of 170.

The host of smaller shareholders included many distinguished men. Amongst them were Alex Stronach (20 shares) manager of the City of Glasgow Bank, R.J. Wells (25) bank-teller in Glasgow, J. Lamont (25) bank agent in Glasgow, Patrick B. Junor (30) banker, Thomas Baird (20) banker in Govan, G.N. Bennett (10) bank teller in Govan, G. Paisley (20) bank agent in Partick, Alex E. Murray (20) Sheriff Substitute, James Craig (10) account^{ant} in Glasgow, Wm. Drew (20) accountant, John Graham (10) C.A., Wm. Graham (10) C.A., F.J. Hallows (50) actuary, G. Miller (20) C.A., and A. Turnbull (20) actuary. Also, W. Burns (50) writer, Mrs. Harriot J. Ewing (50), G.H.B. Macleod (50) Professor of Surgery, and John Nicol (20) Professor of Literature.

On the industrial side were represented James Wilson (10) tube-manufacturer of Coatbridge, Alex G. Simpson (20) coal-master of Glasgow, James Alexander (40) oil-merchant of Glasgow, Robert Cook (20) engineer of Pollokshields, Samuel Fairley (10) colliery engineer of Glasgow, James R. Forman (20) C.E., Wm. Pride (20) engineer of Kilmarnock, Hugh Kennedy (50) contractor of Glasgow, Alex A. Ferguson (40) lead manufacturer of Glasgow, Thomas Wharrie (10) C.E. and surveyor, and John Watson (50) coal master of Glasgow. John Craig (20) and Robert Craig (20) shipowners of Glasgow were present, together with Henry Watson (20) ship-broker, John Ferguson (40) ship-builder of Partick, a few textile industrialists like Alex Drew (20) calico-printer, and James Greig (10) wool-broker of Glasgow, and finally some paper-makers including Robert Bruce (50), Ed. Collins (10) and John H. Collins (10) of Maryhill. Miscellaneous supporters included James Gilchrist (20) of the Caledonian Station in Greenock, F.W. Jones (80) R.N. Lieutenant at Dunoon, W. Easton (25) insurance broker at Dalry, Lewis Sofio (60) fruit importer of Dowanhill, John

Thompson (50) ironmonger of Dumbarton, and James Swan (60) retired merchant of Lochwinnoch.

In 1873 the Company helped to defeat a Bill to incorporate Hillhead and Kelvinside within the municipal boundaries of Glasgow.¹ The prodigious growth of the Partick company is shown in Table 6.26

Table 6.26 Financial Arrangements of Partick, Hillhead and Maryhill Company

Date	Nominal Capital Stock £	(£5) Shares Issued		Paid-Up Stock £	Unpaid £
		Ordinary	Preference		
1871	50,000	10,000	0	50,000	-
1872	100,000	?	0	-	-
1873	100,000	15,030	0	73,500	1,650
1874	130,000	15,327	6,000	105,705	930
1875	130,000	16,807	6,000	113,285	750
1876-90	130,000	19,906	6,000	129,415	115

Source:- S.R.O. (BT2/351).

The number of consumers with meters rose from 3596 in 1873 to 5015 in 1874 when the Bearsden Gas Company² was acquired. Three miles of ten and eight inch diameter mains were laid in 1876 to Bearsden, a rapidly growing residential district³ on the Glasgow and Milngavie Railway. There were altogether 7772 meters by 1877 when 8862 yards of mains were laid for the greatly increased demands of New Kilpatrick⁴ and Knightswood. Rapid residential growth necessitated 3554 yards of mains⁵ in 1883 and 2859 yards in 1884, whilst the number of meters

1. Several Hillhead Commissioners were Directors of the Gas Company. Glasgow City Archives, Miscellaneous Papers, Vol.22, p.205 et seq.

2. J.G.L., 1/9/1874.

3. J.G.L., 19/9/1876.

4. 400,000 cu.ft. holder also purchased for £5000, raising total storage to 1 million cu.ft. J.G.L., 4/9/1877, 9/10/1877.

5. J.G.L., 4/9/1883, 25/8/1885, 4/9/1884.

increased from 10,437 consumers in 1883 to 11,170 in 1885 when the annual output was 200 million cubic feet. A siding¹ to the North British Railway in 1887, had grown to a mile of internal lines by 1889, and retort capacity grew at a similar pace, with twenty five extra retorts in 1887, and 112 regenerative retorts² in 1889, making a total of 368 retorts³ by 1891.

The company was so efficient that in 1878 Glasgow Corporation⁴ was compelled to sell gas in Yoker at the same low rate as in the city centre, to defend itself from competition. By 1887 sales reached 236 million cubic feet per year.⁵ 3970 yards of mains were laid in 1889 and 6300 yards in 1890 when the Dalmuir, Old Kilpatrick and Bowling Gas Company⁶ was purchased for £11,000. Nevertheless the Partick company paid low dividends, and much of the extension to capital equipment was achieved through large quantities of loan capital similar to that which would be available to Glasgow Corporation. In 1876 the Directors⁷ were empowered to borrow up to £45,000 on debenture. By 1885 there was a Bank debt⁸ of £4466, and sundry other debts of £4654. Total capital equipment was worth about £175,756 in 1886 including £75,540 for the works, £80,839 for the pipes and the cost of laying them, £19,377 for meters, and £800 for gas stoves.⁹

1. J.G.L., 30/8/1887, 16/6/1889.

2. Hislop's experimental vertical retorts were tried in 1886; new 100 ft. dia. gasholder in 1888. Gas World, 3/4/1886.

Vide supra p. 375

3. J.G.L., 6/1/1891.

4. J.G.L., 17/9/1878.

5. From 24,662 tons of coal. J.G.L., 6/9/1887.

6. Glasgow Corporation had tried to purchase the Dalmuir works, and had forced the gas price down from 5/5d, sufficient for 5 per cent dividends, to only 2/6d. J.G.L., 10/3/1891.

Vide Supra p. 1081

7. J.G.L., 5/9/1876.

8. J.G.L., 25/8/1885.

9. Total capital and liabilities was £195,519. J.G.L., 7/9/1886.

Loans on debenture¹ then amounted to £60,810. By 1889 the Directors² had been authorized to take £48,290 on debenture loans and to issue £80,000 debenture stock. Only £3000 of the latter, at four per cent interest and virtually a non-terminable "annuity" without voting rights, was taken up during that year after being introduced by Directors who were extremely anxious over the possible recall of £50,000 in terminal debentures which had been issued. In 1891, the chief holders³ of debenture stock were John Walker, G.B. Wieland, and Sir C. Tennant, the General Manager, Secretary and a Director respectively of the North British Railway Company.

Table 6.27 Profits and Dividends in Partick, Hillhead and Maryhill Gas Company

Date	Annual Revenue (£)	Annual Profits (£)	Dividend (%)	
			Ordinary Shares	Preference Shares
1874	-	2,693	2½	5½
1876	-	4,686	3	5½
1877	-	4,653	4	5½
1883	-	7,562	5	5½
1884	35,489	8,431	5½	5½
1885	-	5,349	2½	5½
1886	33,094	Def.* 8,667	0	0
1887	32,884	10,370	0	0
1888	36,358	13,246	2½	16½
1889	37,666	11,784	6	5½
1890	42,116	10,831	6	5½

Source:- Journal of Gas Lighting, annual reports.

* Deficit in 1886, and subsequently two years without payment of dividends, was blamed upon manager J. Hislop who allowed a deficiency of £10,790 to accumulate over the coal stocks in hand. Hislop resigned that year and was succeeded by L. Monk. J.G.L., 7/9/1888, 22/6/1886.

1. £7000 debenture bonds repaid in 1887. J.G.L., 6/9/1887.

2. J.G.L., 27/8/1889, 9/4/1889.

3. J.G.L., 8/8/91. In 1890 the debenture loan was £29,490, and debenture stock £29,000, but plans were in hand to borrow a further £50,000. Vide J.G.L., 26/8/1890.

Despite direct competition with Glasgow corporation, the Partick, Hillhead and Maryhill company expanded to become one of the largest Scottish gas companies,¹ and provides proof that municipal ownership elsewhere during the 1870s was not caused by a lack of private managerial skills for controlling such a large scale 'service' industry. In 1891 the company² was denied a Bill to raise its stock from £130,000 to £250,000, and was finally purchased by Glasgow corporation for £202,500, during an extension of the municipal boundaries.³ Originally about seventy five per cent of the stock was held by local residents,⁴ who accepted dividends of only three and a quarter per cent to uphold their parochial pride.

Several new gas companies in the 1870s adopted regulations from the Consumers' Movement in order to obtain support. Newmilns New Gas Company⁵ of 1873 was one of these successful 'pseudo-consumers companies'. One pound shares were issued and 1126 subscribed by 273 local residents representing a wide spectrum of local occupations, while dividend was restricted to a maximum five per cent. The aim was "to prevent self-interested persons having the unrestrained control of gas, and to afford the inhabitants the opportunity of becoming

1. In 1873 an appeal to Parliament for Incorporation failed. Glasgow City Archives, Miscellaneous Papers, Vol.22 (205), p. 306.

2. Glasgow City Archives, Miscellaneous Papers, Vol.22, p. 306.

3. Evaluation of the works made by A.F. Phillips and George Livesey, gas engineers of London. J.G.L., 27/1/1891.

4. Speculation in shares just before Glasgow corporation's takeover reduced this to 25%, but by 1891 Hillhead was quite willing to enter the Glasgow boundaries. Glasgow City Archives, Miscellaneous Papers, Vol.22, pp. 207, 205. Glasgow Herald, 6/3/1891; J.G.L., 18/4/1886. Vide supra p. 1082

In 1891 the Company had £14,390 debenture debt, and £55,000 debenture stock; 55 & 6 Victoria Cap. 90, 3/7/1891, An Act to Provide for the Purchase, by the Corporation of Glasgow, of the Partick, Hillhead and Maryhill Gas Co. Ltd.

5. Nominal capital £2000 in £1 shares. Works sold in 1880 to Burgh of Newmilns and Greenholm for £4310. S.R.O. (BT2/521).

Shareholders...[with] the power to regulate the price".

Expensive coal causing high gas prices produced a new but minor wave of consumers' companies in the mid 1870s, the last remnants of a belief in the social probity of capital before municipal control proved the most successful solution for consumers' welfare. The Uddingston, Bothwell and District Consumers Gaslight Company,¹ was followed by the equally unsuccessful Helensburgh Consumers Gaslight Company,² and "pseudo-consumers" Buckhaven Gas Light Company.³ During 1875 the Gaberston and Sauchie⁴ districts of Alloa threatened to form a consumers company because of inadequate supplies from the town. At Dysart gas prices rose that year from nine shillings and twopence to ten shillings, whilst Pathead and Gallatown in the same parish paid only half as much, and the North British Railway tried to obtain Kirkcaldy gas for Dysart station.⁵ Kilbarchan Friendly Society Joint Stock Gas Company,⁶ operating during the 1880s in a Renfrewshire fishing village, was apparently another expression of the Consumers' Movement.

1. Formed in 1875; Works designed by J. Hislop, but never constructed. J.G.L., 20/4/1875, 18/12/1877.

2. Formed in 1874; Nominal £10,000 in £1 shares. 3641 shares issued and 10/- called up before the company dissolved in 1876. Helensburgh old company, led by ex-Provost Porenigan, was forced to reduce gas by 1/3d. J.G.L., 11/5/1874; S.R.O., (BT2/620). Complaints continued in 1875 with gas at 7/6d vide J.G.L., 16/3/1875.

3. (1879) Nominal capital £2500 in £1 shares. Formed largely in anger when the E. Wemyss and Buckhaven Company refused to light public lamps in Buckhaven even in return for a surcharge on consumption there. The Buckhaven company dissolved when E. Wemyss agreed to free gas for public lights if residents lit and extinguished them. J.G.L., 1879, p. 825; 7/10/1879; 30/12/1879. S.R.O., (BT2/939).

4. J.G.L., 16/2/1875.

5. J.G.L., 30/3/1875.

6. J.G.L., 13/11/1883. Gas 4/7d.

Several town councils supported the Consumers' Movement, especially after electricity developments in 1878 which made them reluctant to embark upon municipal ownership. "Hamilton Corporation and Gas Consumers Company"¹ was an early example, in 1868, which constituted a protest against the high gas prices charged by a company infiltrated by investors living in Edinburgh, Glasgow and London. Gas cost five shillings and tenpence, compared to four shillings and sevenpence in 1854. The established company tried to obtain an Action of Suspension from the Court of Session against its rival, but later agreed to sell the gasworks to the Town Council.

Table 6.28 Shares held by Promoters of Hamilton Corporation and Gas Consumers Co. (1868)

J. Meek, gentleman	500	W. Brown, solicitor	160
A. Nant, gentleman	200	W.A. Dykes, bank agent	210
T. Dryfield, solicitor	300	W. Naismith, publisher	50
J. Tainsh, confectioner	130	L. Taylor, plumber	70

Source:- A Century of Gas Supply (1931, Hamilton) op. cit.

Many companies took active steps to maintain local representation. The Muirkirk² company secretary, for example, was instructed in 1904 to write to all non-resident shareholders and to encourage them to sell shares to the numerous consumers who were anxious to purchase them.

At Stranraer³ consumer agitation in 1882 was led by the Town Council. A consumers' group led by W. Taylor, had petitioned for cheaper gas and better management in 1863, but was reconciled by

1. The Consumers Company had a capital stock of £7000 in £1 shares. Their Contract allowed municipal purchase at the cost of paid up capital plus 5 per cent interest and 5 per cent bonus. A Century of Gas Supply 1831-1931, (1931, Hamilton).

2. S.R.O., Muirkirk Minute Book, op. cit., 1/7/1904.

3. S.R.O., Stranraer Minute Book, op. cit., 13/9/1882, 31/10/1882, 1/7/1863.

explanations about the original difficulties of the company,¹ and statistics which showed that the competing companies in Perth were not successful. Stranraer gas cost five shillings and tenpence in 1882, but the Council examined information from several towns with similar population and claimed that the average of Alva, Ardrossan, Bathgate, Burntisland, Lanark and Stranraer was five shillings and eightpence. They demanded large discounts for all important consumers, and cheaper gas for all, while threatening to support a new gas company, or charge wayleave for gas pipes, or use electric lighting in the streets and harbour.

The Company agreed to give five per cent discount to the Council, but refused to extend discounts to other large consumers because it would raise the price of gas to small consumers. Stranraer provided cheap gas, since the average price of 173 Scottish towns was six shillings and sevenpence. Rivalry would not reduce the price. Newton Stewart² had gas at seven shillings and sixpence from two companies, one of which paid no dividend for ten years, and the other two and a half per cent for the past three years, preceded by no dividend for seven years. A comparison based upon town population was unreasonable, because consumption varied with the amount of industrial lighting³, and the cost of carriage of coals was a major financial factor. Nearby companies charged more than Stranraer; ten shillings at Castle Douglas, and six shillings and eightpence at Girvan which had easy access to coal. Campbeltown paid as much freight as Stranraer, but sold more gas and thereby obtained a relative reduction in labour costs, yet the gas was sold at six shillings there.

1. Vide supra p. 762

2. The second Newton Stewart company was apparently formed in 1872.

3. Vide supra p. 869

Table 6.29 Coal and Gas Prices at Various Towns compared to Stranraer (1882)

<u>Town</u>	<u>Gas Output (Thou. Cu.ft.)</u>	<u>Average Price coal (ton)</u>		<u>Cost Coal and carriage (ton)</u>		<u>Price of Gas</u>	
Stranraer	7,424	17s	1d	22s	10d	5s	10d
Alva corporation	7,000	16	4	16	4	6	3
Ardrossan	7,000	-	-	-	-	5	0
Lanark	7,881	14	0	14	0	4	2
Burntisland corporation	8,500	17	5	17	5	6	3
Bathgate	6,000	16	8	16	8	5	5
Saltcoats	5,053	8	11	8	11	-	-
Campbeltown corporation	10,000	-	-	-	-	6	0
Girvan	3,050	-	-	-	-	6	8
Castle Douglas	1,800	-	-	-	-	10	0

Source:- Stranraer Minute Book, op. cit., 31/10/1882, 13/9/1882

Table 6.30 Gas Prices at Various Towns compared to Stranraer (1882)

<u>Town</u>	<u>Price</u>		<u>Town</u>	<u>Price</u>	
Stranraer	5s	10d	Inverness	6s	8d
Newton Stewart	7	6	Peterhead	6	8
Wigtown	10	0	Jedburgh	6	3
Whithorn	10	0	Dunbar	6	8
Kirkcudbright	8	11	Haddington	6	8
Elgin	6	3	Maybole	6	8
Fraserburgh	7	6	Troon	6	8

Source:- Stranraer Minute Book, op. cit., 13/9/1882.

The Directors stated they were "anxious to deal fairly with their Consumers", but claimed that a higher percentage of profits than in other business ventures was justified by the rate of deterioration of equipment, and the "risk of loss of capital" in the event of "new inventions, such as Electric Light" superseding gas. They purchased a photometer¹ to allow the Council to test the quality of gas, and

1. At 10 guineas from David Grant & Co.

to improve illumination they impressed upon "the Consumers [the need] to pay more attention to the cleaning of the joints of their gas fittings, as well as to the cleaning and renewing [of] their jets". The consumers' agitation was pacified, though an "outcry"¹ over poor quality and inadequate supply in 1899 led the Directors to recognize "the alarming and steady loss of consumers during the past twenty years".

Despite the elastic demand for gas, which normally increased rapidly as prices were reduced, the cautious approach of Company Directors usually meant that a reduction of gas prices lagged far behind improved external conditions, like raw materials and technology, which reduced the manufacturing costs. When Stranraer reduced gas from twelve shillings to ten shillings and sevenpence in 1845 it was stated to be "a very low price considering the size of the work and the distance from coals".² The following year, Directors noted "a large increase not only in the consumption of Gas but, notwithstanding the reduction of price, in the total receipts therefore".³ From 1845-7 coal prices rose eight shillings per ton,⁴ and the gas price was not reduced again. In 1848 the Directors worried over the small increase in consumption,⁵ but despite reduced costs of coal, iron and brickwork, they did not try to encourage consumers through lower prices. A large increase in consumption in 1849 was caused by external factors, not cheaper gas, and rising profits resulted mainly from cheap coal, but partly from "an improvement in the manufacture".⁶ Increased

1. S.R.O., Stranraer Minute Book, op. cit., 3/2/1899.

2. S.R.O., Stranraer Minute Book, op. cit., 25/6/1845.

3. Ibid., 30/6/1846.

4. Ibid., 29/6/1847.

5. Ibid., 27/6/1848.

6. Ibid., 26/6/1849.

public lighting together with cheap iron and coal¹ raised profits in 1850, and record profits in 1851 were attributed partly to increased consumption and "more economical management", but "chiefly to the price of coals being much reduced".²

Reluctance to stimulate demand, whereby both shareholders and consumers could obtain the advantages of larger-scale operations, was partly related to the greater risk and expenditure involved in such an exercise. When consumers at Stranraer, as previously described, forced the price down to eight shillings in 1852, the Company³ reported a large increase in consumption both by old consumers and through "a large increase in the number of new ones". The increase in effective consumer action throughout Scotland from the late 1850s resulted from the growing availability of published statistics available both to consumers and to agitators like Flintoff. This considerably increased the public accountability of local gas companies, especially in small towns and villages where anomalous conditions had developed, and consumer agitation from the 1860s, backed by the threat of municipal action, was a powerful force in holding down gas prices.

Nevertheless, because the quality of gas in terms of the candle-power received, affected the value of gas to the consumer at least as much as small variations in the price per thousand cubic feet, actual competition by gas companies for markets was not in the best interests of consumers. Competing companies were likely to reduce the candle-power of gas, by using cheaper coal, or by over-carbonizing best coals to raise output in order to reduce coal expenditure and undercut their rivals' prices. But consumers required larger quantities

1. S.R.O., Stranraer Minute Book, op. cit., 25/6/1850.

2. Ibid., 24/6/1851.

3. Ibid., 9/3/1852, 29/6/1852, 28/6/1853.

of the poorer gas for equal lighting, and could in fact pay more in the same time period. Realization of this lent support to the public monopoly possible through municipal ownership.

Municipal action coincided with a widespread realization that coalfields supplying best quality coals were becoming exhausted, and attention was focused upon the design of improved gas-burners so that consumers could obtain adequate, cheap light even when "candlepower" was reduced in the mains supply. Improved 'burners', which achieved prominence when animal-oil gas threatened the industry¹ in the 1820s, had not become the object for further research by the few competing Scottish coal-gas companies. Nevertheless, they held the promise of increasing the light intensity from poor gas and, like other fittings, became of vital importance to sustain the economic competitiveness of the gas industry once electric lighting was developed.

1. Vide supra p. 416; also p. 1631

(2) Markets for Gas

Shops, factories, commercial premises, street lights and places of entertainment were the principal consumers of illuminating gas throughout Britain¹ in the early nineteenth century. In Scotland, however, unlike England, domestic consumption soon became as important as that of shops or factories. The low price of gas compared to other forms of illumination, at least until the late 1850s, and the disinterest expressed by gas-companies in 'fittings' which reduced the consumption of gas, inhibited research both into more efficient burners expressed in 'candlepower' per unit of consumption, and into alternative markets as a source of heat and power. Consumers were slow to recognize, without Company advice, that the precise design of gas burners and the efficiency of combustion, could be almost as important in determining the amount of light obtained from each 1000 cubic feet of gas purchased, as the 'candlepower' of gas supplied by a Company.² 'Candlepower', which until the 1880s remained the principal advertising slogan of Companies, was the illuminating standard of gas in the mains only when tested under quite specific conditions of pressure and with a correctly adjusted burner. With poor burners, consumers required more gas for equal light, but had no recourse to complain at the quality of gas being sold. The Consumers' Movement, suppliers of paraffin lamps in the 1860s, and

1. Shops and factories were the chief supporters of early private gasworks. Vide infra p. p. 37, 83.

2. Christison and Turner's research (vide supra p. 422) on the efficiency of burners was an accidental result of the 'candlepower' tests for which they were employed. Improved burners made from 1820-60 were chiefly by independent innovators, lacking financial encouragement from established gas companies. Inaccurate Photometry handicapped consumers and companies alike until the 1850s. R.H. Patterson, "Gas Burners and the Principles of Gas Illumination" in King's Treatise (1882), op. cit., Vol. III, pp. 74-186.

municipal gasworks in the early 1870s, all showed greater concern with consumers' requirements, but this did not produce the degree of change, or in fact reorientation, which followed the development of electric lighting from 1878. Total gas sales did not decline then, but after a rearguard action in which oil was used in place of scarce cannel coal to maintain 'candlepower', the incandescent mantle finally replaced open-flame burners. Already many gasworks had reduced the 'candlepower' of gas, to enable larger quantities at a cheaper price to be used for cooking, motive power and industrial heating processes, with corresponding profits from the economies of scale. The incandescent mantle produced a complete changeover from 'candlepower' to calorific or heating power, mainly between 1900-10, and the Scottish gas industry entered a new phase of twentieth century development with vastly increased output.

The advantage of gas-light over other forms of illumination was demonstrated by many nineteenth century engineers.

Table 6.31 Comparative Lighting Costs in Glasgow in the 1820s

	s.	d.
Light from tallow candles	1	0
Equal light from Argand Spermaceti-oil lamp	0	6 $\frac{1}{2}$
Equal light from coal gas	0	2 $\frac{3}{4}$

Note - Tallow candles used as the standard of comparison.

Source:- Table by W. Creighton, quoted by J.O.N. Rutter, Practical Observations on Gas Lighting (1833) pp. 42-3.

Table 6.32 Comparative Lighting Costs with Mineral Oil and Candles (1853)

Costs of illumination equal to 20 spermaceti candles, burning 10 hours at 120 grains per hour.

	s.	d.
Spermaceti candles	6	8
Wax candles	3	10
Sperm-oil lamp	1	10

	s.	d.
Tallow candles	2	8
Paraffin candles	3	10
American Rock Oil	0	6½
Young's Paraffin Oil	0	5
English Coal gas	0	4½
Cannel coal gas	0	3

Source:- Professor E. Frankland, Proceedings of the Royal Institution 1866, Lecture of 20/5/1853.

A. Anderson¹ in 1827 informed Inverness residents that they could expect economies as great as Perth where one ton of coal costing fifteen shillings produced gas with illuminating power equal to 500 lbs. candles, at ninepence per lb., costing eighteen pounds fifteen shillings. Comparisons were quite complicated because the time element was involved as well as light intensity. Using Rumford's photometer, Anderson estimated that a single gas jet produced light equal to four candles (of four to one lb.), a double jet was equivalent to six candles, a triple jet to eight, a batswing burner to twelve, and a ten-holes Argand² lamp to fifteen.

A single jet gas-burner in Perth consumed $\frac{5}{7}$ cubic foot gas per hour and cost one shilling and sixpence (100 cubic feet) for 140 hours. One candle, purchased at four in one lb. (ninepence), burned for ten hours, so that in 140 hours the gas burner produced light equal to fourteen lbs. candles costing ten shillings and sixpence. This was a price advantage of seven to one. A ten-holes Argand

1. "Advantages of Lighting by Gas", Inverness Courier, 3/1/1827, p. 3.

2. Subsequently, as a reflection of different 'candlepower' in gas supplies, Argand gas lamps requiring large consumption became most widely used in England, but exceptional in Scotland where low consumption Fishtail burners were most common. King's Treatise (1878) op. cit., Vol. I, p. 57.

burner consumed 2.25 cubic feet gas per hour and in 44.4 hours at a cost of one shilling and sixpence (100 cubic feet) produced light equivalent to 66.6 candles, or 16.65 lbs. worth 12.49 shillings. The Argand gave a price advantage for gas of 8.3 to one.

These calculations were difficult for consumers to follow, however, and even gas managers, like W. Lowry of Dumfries,¹ miscalculated the advantage by confusing 'candlepower' at a fixed point in time, with the duration of candles and hence their total cost. In 1826 Lowry stated that a ten-holes Argand gas burner gave light (candlepower) equal to seventeen candles (of six in one lb.) for thirty five shillings per year on a time-contract. Such a burner was used for at least 1000 hours a year, which was equal to 17,000 candle-hours. Lowry concluded that this was equal to 425 lbs. candles (ninepence per one lb.) worth fifteen pounds eighteen shillings and ninepence; in fact it was equal to 425 candles, each of which lasted forty hours, making a total of 70.83 lbs. worth 53.12 shillings. In both cases, however, the message was clear and consumption rose rapidly.

The efficiency of gas burners in actually producing light, remained an important problem in determining the relative costs of illumination. The flow of gas through burners could be adjusted manually, but each burner produced optimum illumination only at one specific rate of consumption. Below that rate, 'candlepower' fell more rapidly than did the quantity of gas saved. Consequently, for situations requiring only poor lighting it could be cheaper to use an alternative to gas which lasted for a longer time at optimum

1. Inverness Courier, 3/1/1827 quoting from Dumfries and Galloway Courier, 18/12/1826.

efficiency.¹ The immobility of gas lights compared to candles and oil lamps could also be a disadvantage. After 1857 James Young² developed a market for paraffin-oil lamps and in the 1870s these Argand oil lamps gave cheaper light than small coal-gas jets, and found a large market among the poorer classes. The increasingly competitive position³ of oil lamps is shown in Tables 6.33-4.

Table 6.33 Comparative Illumination Costs in Glasgow (1867)

Light Source	Retail Price per 1000 cu.ft.		Hourly Consumption in Experiment	Candle-power in Experiment	Relative Value (Old Pennies per Hour for 100 Candlepower illumination)
(1) GAS	s.	d.	cu.ft.		
Glasgow gas	4	2	5	30	0.83
English cannel gas	6	0	4	18.67	1.54
English coal gas	4	6	5	14	1.93
(2) OIL LAMPS	Per Gall.		Grams		
Paraffin Oil	3	0	265	7.11	2.37
Colza Oil	4	6	648	9.01	6.07
Best Sperm' Oil	12	6	686	10	16.63
(3) CANDLES	Per lb.		Lbs.		
Paraffin Candles	1	3	122	1.46	17.9
Composite Candles	0	10	144	1.08	19.05
Tallow Mould Candles	0	8	145	0.83	20.75
Sperm' Candles	1	6	132	1.35	25.14
Wax Candles	2	6	168	1.43	50.35

Source:- W. Johnstone, Proceedings of Glasgow Architectural Society 1865-7, p. 103.

1. E. Frankland, "The Employment of Chemical light for Artificial Illumination", Proceedings of the Royal Institution 1866. Lecture 20/5/1853. W. Johnstone, "Gas Lighting, and the Best Mode of Applying it to Buildings", Proceedings of Glasgow Architectural Society 1865-7, Vol. VI, p. 103.

2. J. Butt, "James Young" (1963), op. cit., p. 161.

3. For later relative prices, see T. Newbigging, The Gas Manager's Handbook (1883), op. cit., pp. 304-5.

Table 6.34 Comparative Illumination Costs in Edinburgh (1876)

Number of 'Candle Hours' obtained for 1d expenditure			
(1) <u>OILS</u>	In Flat-Wick Lamp	Argand Lamp	(2) <u>CANNEL GAS</u> (28 candlepower, 5/- per 1000 cu.ft.)
Sperm' oil	4.69	8.99	
Rape oil	7.18	14.17	
Whale oil	8.56	15.42	No 5 jet 93.33
Paraffin oil (2/- gallon)	-	53.33	No 4 jet 86.66
Paraffin oil (1/6 gallon)	-	71.11	No 3 jet 76.66
			No 2 jet 65
			No 1 jet 50
(3) <u>CANDLES</u>			No ½ jet 33.33
Tallow Candles (6d per lb.)	7.29		
Composite Candles (8d per lb.)	6.19		
Paraffin Candles (1/- per lb.)	6.39		

Source:- Dr. Stevenson Macadam, chemistry lecturer,
Chambers' Encyclopaedia 1876, Vol. IV, p. 639.

Note - gas consumed by burners proportional to size e.g. 5 cu.ft. per hour in No 5 jet, et seq.

In Glasgow,¹ Hamilton's high-class grocery shop² in 1818 became the first in Scotland to use a gas company's supplies. It was soon followed by the King's Arms Inn, Trongate, since gaslight provided valuable publicity, which became increasingly important with the development of plate-glass shop windows³ in the 1820s. During 1818 the Theatre Royal⁴ and the commercial centre of Glasgow, Gallowgate,

1. Critics expected gas to taint food. A comprehensive list of Glasgow gas-consumers in 1818 is given by P. Mackie, Reminiscences of Glasgow (1890, Glasgow), Vol. II, p. 145 et seq.

2. James Hamilton, a founding member of the Glasgow gas company; possibly the son of John Hamilton of Middleton, who in 1824 as a partner with Walter Buchanan, became an East India merchant, with offices in Singapore and Shanghai, Memoirs and Portraits of One Hundred Glasgow Men (1886, Glasgow), Vol. I, p. 57.

3. "Glasgow and its Gasworks", Gas World, 4/6/1887.

4. This was the first Scottish theatre lit by gas, on 18/9/1818, but was burned down on 10/1/1829 due to negligence by gas company workmen. Transactions of Old Glasgow Club 1937-8, pp. 49, 52. Edinburgh Evening Courant, 12/1/1829, p. 3. G. Eyre-Todd, History of Glasgow (1934, Glasgow), Vol. III, p. 460. London theatres consumed large quantities of gas, Vide

S. Everard, Gas, Light and Coke Company (1949), p.139.

Saltmarket, Princes Street and King Street consumed most of the new company's gas. The provisions markets in the last two streets paid £480 for gas, compared to thirteen pounds for Anderston village. Twenty local insurance agents¹ at first raised the premium for fire cover where gas was adopted, but were soon persuaded that the risks were less than where candles or oil-lamps were used.

Chemists largely underestimated the true risk of explosive-mixtures forming in confined spaces within rooms. W.T. Brande² in 1817 estimated that a twelve foot square room (1728 cubic feet) required an unlit Argand burner to be left on for sixty two hours (247 cubic feet gas) and the room to be airtight, before an explosive mixture was formed. Brande's statement was reiterated to the public by consultant engineers, like A. Anderson at Inverness in 1826, so that during the 1820s insurance premiums were not raised if gas was used in private houses, and were reduced if it was adopted by factories. Later, gas was occasionally employed for arson by owners seeking insurance money, often during trade depressions, but it remained safer than mineral-oil lamps, the "poor man's light". James Young in the 1860s sold paraffin with an ignition temperature of 130° F, but American imported oils lit at 110° F, only 2° F above the temperature reached by the brass fittings on oil lamps, so that accidents were far more common³ than with gas.

1. P. Mackie, Reminiscences of Glasgow (1890) Vol. II p.145.

2. W.T. Brande, "Application of Coal Gas to the Purposes of Illumination", The Repertory of Arts (1817) II Series, Vol. 30. The Journal of Science and the Arts (1816) Vol. I, p. 71. Inverness Courier, 3/1/1827, p. 3; 5/1/1827, p. 3.

3. The devastating Chicago fire of 1871 was caused by such an oil-lamp. B.P.P. 1867 (471) XI, Select Committee on Protection of Life and Property Against Fire in the United Kingdom, pp. 59, 63, 115, 124, 126, 128, 185, 168. W. Paterson, "Fires : Their Causes and Prevention", Proceedings of the Philosophical Society of Glasgow 1899, Vol. XXX, p, 16.

The chemical purity of gas¹ was much more easily tested than the lighting power² and both Companies and health authorities imposed rigorous tests from an early date. Hydrogen sulphide,³ the malodorous impurity most rapidly observed by consumers, in the 1810s was detected by bubbling coal gas through distilled water containing "sugar of lead", silver nitrate, "superacetate of lead" or "muriate of bismuth", which produced a black precipitate. Carbonic acid was present if blue litmus turned red, or the gas produced turbidity with "barytic water", or altered distilled water so that paper covered with silver nitrate became black in the water.

"Poisonous" Carbonic acid gas was the basis of medical opposition⁴ to gas-lighting, especially in dwelling houses, but water-vapour formed by combustion was a more immediate problem for many large

1. Sulphurous and other acid impurities by the 1840s were apparent through the destruction of leather furniture and book-covers at several Edinburgh institutes and at the London Athenaeum Club. Vide Mr. Burns' comments upon "Observations on Gasworks" made to the Royal Institute of British Architects in 1848, The Builder 1848, Vol. VI, p. 89. "Destruction of Leather by Gas", J.G.L., 4/7/1877, p. 884; 23/10/1877, p. 649.

2. Photometry vide supra p. 422; also p.1630

3. Lime removed hydrogen sulphide and carbonic acid, but English gasworks which began to use iron-oxide purifiers left the gas less pure than that used in Scotland. T.S. Peckston, Theory and Practise (1819), pp. 366-9. A. Anderson's lime purifiers gave gas pure enough for silversmiths. Inverness Courier, 3/1/1827, p. 3. Vide supra p. 247

4. This Carbon Monoxide from one gas light was claimed, in mistake for Carbon Dioxide, to be equal to the respiration products from 4 persons. Brande stated in 1819 that carbonic acid produced "difficulty of breathing, giddiness and faintness", but gas engineers retorted that gas employees, who spent hours cleaning purifier-boxes, suffered no injury to health. Vide Dr. Guy (King's College, London) on "Health Hazards" in Chamber's Edinburgh Journal 1847 New Series, Vol. 10, p. 62.

W.T. Brande, A Manual of Chemistry (1819), p. 149.
Inverness Courier, 3/1/1827, p. 3.

consumers.¹ Ventilated gas burners, invented by Maiben of Perth,² provided a partial solution to both problems: a pipe running from the lantern around a gas-burner to the outside of a building acted as a form of chimney for hot combustion products.³ Outdoor gas-lights⁴ with reflectors, on jointed arms which enabled them to be swung in front of windows at night, were used with little success to persuade the wealthy to use gaslight. Sombre early gas-lamps,⁵ resembling their ponderous oil predecessors, were soon replaced by delicate lamps which could be pulled down from the ceiling as required⁶ for reading or writing.

1. A London ironmonger, who placed lead combustion-gas tubes from above each gas-burner, to a water sump in the cellar, in 1821 condensed 2 ounces of water per hour per light. Condensation of water elsewhere, on ceilings and metal goods, produced great annoyance. Quarterly Journal of Science, Literature and the Arts 1821, Vol. X, p. 464.

2. Vide supra p. 75

3. Plagiarists throughout Britain made Ventilated Gas Lights extremely popular e.g. W.T. Brande (1816), I.H. Reddell (1817), Accum (1819) and M. Faraday. They were common in Newcastle and London even in the 1850s. F. Accum, Gas Works in London (1819), op. cit., pp. 278-80. The Journal of Science and the Arts 1816, Vol. I, p. 71 et. seq. (Brande). Repertory of Patents 1817, II Series, Vol. 30, p. 268 (Reddell). E.A. Parnell, Applied Chemistry (1844), op. cit., Vol. I, p. 117. (Faraday) Faraday's Ventiliating Gas Burner (diag.) vide

R. Routledge, Discoveries and Inventions of the Nineteenth Century (1876) p. 550. The Builder, 1854, pp. 17, 46, 133.

4. "New Method of Illuminating Houses with Gas", Edinburgh Philosophical Society 1822, Vol. 6. Mechanics Magazine 1833, Vol. 19, p. 80. London Encyclopaedia or Universal Dictionary of Science (1829), op. cit., Vol. X, p. 14.

5. In 1807 Clegg used such lamps, with the gas supply concealed in hollow chains above the 'Greek lamp', and James Simpson, a Scottish advocate, copied the design. Mechanics Magazine 1834-5, Vol. 22, p. 470. Rev. D. Lardner, The Cabinet Cyclopaedia (1834), Vol. III, p. 241. W. Johnstone, "Gas Lighting", Proceedings of Glasgow Architectural Soc. (1865-7), Vol. VI.

6. The mechanism at first involved a 'stuffing box'; and water-lutes after about 1830. The changes from water evaporation were removed when Mr. Finlay of Glasgow developed a piston arrangement in 1846. Several Edinburgh manufacturers made the water lute arrangement:- The Scotsman, 5/4/1845 (Brown), 9/4/1845 (Laidlaw), 12/4/1845 (Forbes). Finlay - vide The Practical Mechanic and Engineers Magazine (June, 1846) Glasgow, p. 234.

Nevertheless, the high 'candlepower' and purity of Scottish coal gas encouraged large domestic consumption¹ and resulted in the proliferation² of gas companies, even in small communities. The great increase of Scottish gas companies in 1829-30 coincided with a very poor whale catch in 1830 which caused the price of whale oil to double, British tallow to rise twenty five per cent, and Foreign tallow fifteen per cent. Candle manufacture was an industry run by small, independent journeymen, but a general meeting of Edinburgh candle makers³ was organized in 1830 to petition Parliament for relief from excise duty, which was not charged against the gas companies, their competitors. They claimed that candles were "almost exclusively consumed by the middle and lower orders, living in provincial towns and villages", while "the poor working classes" used oil lamps, and "the more opulent classes make use of gas". Expensive oil was forcing the working classes "to burn candles, at an expense of at least 150 per cent. above that of gas", which led them to support gas lighting. The candlemakers also observed that among the middle classes, "those who have the means of fitting up their dwelling houses with gas, fearing the results of future failures of the whale fishery, have already begun to take gas into all their rooms; and every town in the kingdom where coal can be produced [i.e. obtained] at a moderate

1. e.g. As an automatic test for hydrogen sulphide Mr. Massie, the Aberdeen gas manager, in the 1830s, passed a jet of gas onto a revolving disk moistened with lead acetate, New Statistical Account, Vol. XII, p.78.

2. Vide supra p. 110

3. The Scotsman, 11/12/1830, p. 788. The Scotsman, 29/12/1830, p. 829. According to Edinburgh candlemakers:-

"The Licensed Candle Works in the United Kingdom exceed 3,700 in number, which employ upwards of 20,000 workmen, and including their wives and children, may be said to give bread to forty thousand individuals; - while the whole gas establishments do not exceed one hundred, the shares of which are monopolized by persons in opulent circumstances". [1830].

expense, will be induced by the same reason to erect gas establishments".

Thus although the New Statistical Account placed most emphasis upon the importance of gas for street lighting, and to a lesser extent factory and shop lighting, in Edinburgh it had soon been "generally introduced into private houses"¹ and domestic consumption was increasing considerably in the late 1830s. Domestic lighting at first

Table 6.35 Markets for Gas Light delineated by the New Statistical Account (1836-42)

(1) Street Lighting -

Forres,¹ Stirling,² Dumbarton,³ Dalkeith,⁴
Bathgate,⁵ Haddington,⁶ Linlithgow,⁷ Kelso,⁸ Peebles,⁹ Dumfries,¹⁰
Kirkcudbright,¹¹ Strathaven,¹² Arbroath,¹³ Elgin,¹⁴ Cupar,¹⁵ Kirk-
caldy.¹⁶

(2) Churches -

Stirling, Kilsyth.¹⁷

(3) Private Houses -

Stirling, Inveresk (Musselburgh),¹⁸ Strathaven,
Cullen,¹⁹ Blairgowrie,²⁰ Elgin, Edinburgh.

(4) Shops -

Kilsyth, Falkirk,²¹ Penicuik,²² Inveresk, Strath-
aven, Blairgowrie, Elgin, Kirkcaldy.

(5) Factories -

Alloa,²³ Kirkcaldy.

(6) Offices -

Inveresk.

Sources:- New Statistical Account - 1. Vol.XIII Part II, p.178: 2. Stirlingshire, p.449: 3. Dumbartonshire, p.11: 4. Vol.I, p.509: 5. Vol. II, p.158: 6. Vol.II Part II, p.13: 7. Vol.II Part II, p.182: 8. Vol. III, p.334: 9. Vol.III Part II, p.16: 10. Vol.IV, p.334: 11. Vol.IV, p.36: 12. Lanarkshire, p.309: 13. Vol.XI, p.91: 14. Vol.XIII, p.27: 15. Vol. IX, p.20 : 16. Vol.IX, p.157: 17. Stirlingshire, P.168: 18. Vol. I, p.303: 19. Vol.XIII, p.321: 20. Vol.X, p.923: 21. Stirlingshire, p.17: 22. Vol.I, p.38: 23. Vol.III, p.50.

1. New Statistical Account, Vol. I, p. 758.

often developed more slowly than other uses. At Kirkcaldy in 1836, two years after the supply commenced, it was not used "as a general light for dwelling houses - being principally used for the lighting up of streets, public works [factories], and shops".¹ In contrast, at Elgin when the gasworks were built, "the subsequent winter the streets and shops, and many private houses, were lighted with gas".² Public lighting was the most obvious spectacle, and received most notice, yet domestic lighting by gas was a more significant and widespread application than authors indicated. At Blairgowrie³ gas was "very generally substituted for oil and candles both in the shops and private dwelling-houses", though the cost of fittings and the price of gas at fourteen shillings "retarded its introduction into general use among the poorer classes".

At Strathaven,⁴ "many of the private houses and almost all the shops" had gaslight, and almost all the streets. At Cullen,⁵ despite the price of gas at sixteen shillings, it was used in over eighty private houses in the village. In Dumfries,⁶ "most of the public buildings" had gaslight, while the Alloa⁷ company supplied Cambus distillery with over 100 lights. In Dumfries by 1826, "in addition to the kitchens, lobbies, &c. which are lighted [by gas] in dwelling houses, application has been made for it into the parlours and even the bedrooms of some of the inhabitants",⁸ yet at Inverness⁹ gas was

1. New Statistical Account, Vol. IX, p. 157.

2. Ibid., Vol. XIII.

3. Ibid., Vol. X, p. 923.

4. Ibid., Lanarkshire, p. 309.

5. Ibid., Vol. XIII, p. 321.

6. Ibid., Vol. IV, p. 13.

7. Ibid., Vol. III, p. 50.

8. Inverness Courier, 3/1/1827 (quoting Dumfries and Galloway Courier, 18/12/1826),

9. History and Description of the Town of Inverness (1847, Inverness), p. 48. Inverness Ref. Lib.

little used in private houses even in 1847. When Haddington gas-works was built in 1836, requests were made in the small town for "above a thousand lights", and the company believed "that the occupant of almost every House and Shop"¹ would soon use gaslight.

Table 6.36 Expanding Market for Gas in Aberdeen 1839-42

	<u>Numbers of consumers in</u>	<u>1839</u>	<u>1842</u>
Factories and weaving Shops		111	120
Shops and warehouses		1211	1350
Private Houses		1336	1536
Churches		27	30
Schools and Lecture Rooms		50	50
Public Institutions		33	38
Public Street Lamps		1075	1100

Sources:- New Statistical Account, Vol. XII, p. 78.
J.H. Wilson, The Bon Accord Repository of Local Institutions (1842, Aberdeen), p. 192.

In 1826 the Mechanics Magazine² recorded that in England gas was "chiefly used in coffee rooms, shops, taverns, and other public rooms", but not in dwelling houses, and by the 1830s "progress made in lighting private houses by gas has been much greater in Edinburgh than in London".³ A lecturer at Leicester in 1847 commented, with wry hyperbole that "it was notorious, that gas was even used in the bed-rooms in Scotland, and that not so much as a tallow-chandler's could be found".⁴ In Southern England at that time, shopkeepers who used gas

1. The Edinburgh Almanac or Universal Scots and Imperial Register for 1836 - East Lothian Supplement, p. iv. (Nat. Lib. Scot.)

2. Mechanics Magazine, 1826, Vol. VI, p. 62.

3. J.C. Loudon, Cottage, Farm and Villa Architecture and Furniture (c. 1833), p. 1027.

4. The Builder, 1847, Vol. V, p. 282. Delfries' lecture to Western Literary & Scientific Institute. c.f. In 1846 about four fifths of the inhabitants of Hamilton used gas, despite the Company being unpopular; compared to the average of one fifth of inhabitants in English towns, and one third in Liverpool which gave cheap supplies.

Evidence of T. Hawksley.

H. Commons, 1846, Vol. 102, Committee on Hamilton New Gas Company.

to illuminate their plate-glass windows, still used candles at home.¹
 A Southampton engineer who saw gas there being used inside the "best houses" for the first time about 1850, believed that for many years in most Scottish towns, in "every house from £5 per year rental upwards, gas [was] used in every room".²

Even in 1874 there was "comparatively little use of gas in the better class of houses in London and other English towns",³ and Dr. W. Wallace of Glasgow attributed the difference to the far higher purity of Scottish gas. The carbonic acid and combustion products were less than half those from common English gas for equal light, and 150 instead of 300 grains of sulphur was produced per 1000 cubic feet consumed.

The first special Scottish correspondent for the Journal of Gas Lighting⁴ in 1875 remarked immediately "how universally coal gas is employed in Scotland as the means of obtaining artificial light. Almost every village with a population of 1000 had its own gasworks", as did many smaller villages. A treatise on the gas industry in 1876 maintained that "there is no country in the world where, considering the number of inhabitants, the use of gas is so extensively

1. Some London companies introduced cannel-coal gas in an attempt to encourage domestic consumers through 'candlepower' comparable to Scotland. W. Burn who resided both in Edinburgh and London, remarked in 1848 that he used gas throughout his house in the north, but only in the passages and servants' apartments in London because of the poor quality. G.L. Taylor, On Gas Works and the Introduction of Cannel Coal Gas (Thoroughly Purified) into the Metropolis (1848, Royal Institute of British Architects), p. 4. J.O.N. Rutter (Brighton) Gas Lighting - Its Progress and Prospects (1849), p. 42. Minimal domestic use of gas in England - Vide comments by A.A. Croll to the Society of Arts in 1847. Gas Journal Centenary 1849-1949 (1949), pp. 86, 97; J.G.L., 10/5/1853, p. 106; Evidence of Jones and Clegg, reporting upon Wolverhampton, Ashton, Shipley, Bingley and Wakefield. B.P.P. 1847, XXII, p. 95 et seq.

2. J. Sharp, Observations on the Practical Advantages attending the Use of Coal Gas (1850, Southampton), p. 5. Birmingham Ref. Lib.

3. Dr. W. Wallace, "On the Economical Combustion of Coal Gas", Proceedings of the Royal Philosophical Society of Glasgow 1873-5, Vol. IX, p. 57 et seq.

4. J.G.L., 26/1/1875.

applied as in Scotland".¹ Companies sometimes supplied villages which had only 400 inhabitants, and one limited company supplied a community of 150 where the annual consumption was "about 334,000 [cubic] feet, or about 2000 feet per head per annum, which appears to be the average of towns throughout Scotland". In terms of 'candle-power' "the requirements of that country [Scotland] are, for the population, equal to those of London and far in excess of any English provincial town!"

Small consumers were far more important in Scotland than in England. In 1850, Dundee had 12,000 consumers and half the total revenue was from persons who paid under twenty shillings a year. Gas was used by poor inhabitants, even those living in cellars. A third of Edinburgh gas revenue was from consumers of less than twenty shillings a year, and "the smallest house would not be let in these places if it was not fitted up with gas".² In 1860 neither Liverpool nor Manchester had as many small consumers as Glasgow.³ From the 70,000 Glasgow consumers, 25,000 used less than 3000 cubic feet a year, compared to 5000 below that level in Liverpool. Manchester had about 40,000 poor houses with no gas supply at all.

During the 1820s-30s gas was sold in two separate units of quantity. By meter⁴ the price was stated per 1000 cubic feet, and in

1. W. Richards, A Practical Treatise (1877), op. cit., p. 333.

2. J.G.L., 10/1/1850, p. 162.

Some believed that poor Newcastle-coal gas would have made the cramped Glasgow apartments uninhabitable, since cannel-coal gas produced less fumes. J.G.L., 10/4/1854, p. 414.

3. Mr. Miller, "Report on the Cannel Coal Gas supplied in Glasgow, Liverpool and Manchester". J.G.L., 3/1/1860 Vide supra p. 1163

4. Consumers meters were first used in Glasgow in 1827. The Gas Supply of Glasgow (1935, Glasgow), op. cit.; Early use in Edinburgh and elsewhere vide supra p. 142

some cases per 100 cubic feet, and the precise quantity was measured. 'Time contracts' were also used, under which a consumer agreed to burn gas through a particular type of burner only during specified hours, for a fixed annual charge. At Kilmarnock¹ in 1824 gas was sold at thirteen shillings and sixpence per 1000 cubic feet by meter, or twenty shillings per year for cockscur burners with a four inch flame from sunset to 10 p.m. Port Glasgow² in 1829 sold gas only by contract, at an annual charge of nine shillings from sunset to 8 p.m., and twenty two shillings to 11 p.m. To prevent longer, surreptitious burning, gas managers made surprise visits to check burners, or a part-time official was employed to perambulate the town at night, and this "spying" caused the system to fall into disrepute in towns like Hamilton.³ In 1849 James Kirkpatrick of Dumfries gasworks invented a "Regulator"⁴ to be fitted to service pipes, whereby reduced mains pressure disconnected the supply to all time-contract consumers, but this was too late to resuscitate a system which had caused a great loss of gas to the Companies and resulted in far higher charges being made for contract gas, per unit of quantity, than for metered gas.

Especially low contract rates were introduced for handloom weavers,⁵ who provided a large domestic market in many towns. Perth weavers⁶ in 1826 were allowed the unrestricted use of a single jet, equivalent to five 'candlepower', for eight shillings a year. Each

1. J.G.L., 25/3/1884.

2. W.F. Macarthur, The History of Port Glasgow (1930, Glasgow), p.181.

3. Vide supra p. 963

4. The Practical Mechanics Journal 1849/50, pp. 19, 42. (diag.)

5. Vide infra p. 959

6. Estimate by A. Anderson. The candles cost for 10,000 candle-hours may be incorrect. For the problems vide supra p. 1208 Inverness Courier, 3/1/1827.

year such a burner was used about 2000 hours, giving light equivalent to 10,000 candles worth nine pounds seven shillings and sixpence. Paisley weavers¹ complained in 1844 that even a short over-use of gas beyond their contract led the company to pour wax into the fittings and place a seal on them, until they agreed to restore the supply. But the weavers did use excessive gas, and after purchasing burners for one penny from the gas company, many paid one penny to a local watchmaker to enlarge the apertures.²

Because the old Glasgow company refused time contracts, virtually no Glasgow weavers³ used gas in 1844. One weaver alone had metered gas in the area of Weaver and Taylor Streets and Rotten Row, while at Carlton and Brackton a few weavers had their own meters and fittings, especially those employing about five journeymen whom they charged a rent for the gas.

Dunfermline⁴ with a large number of weavers, provided them with special contract rates, which in 1836 included eight shillings and sixpence for a single jet with three inch flame, from 1 September to 1 May, burning from 6 a.m. to daylight, and sunset to 10 p.m. They could also use a single kitchen jet for twelve shillings and ninepence a year. In 1837 Dalry gas company declared its regulations

1. H. Lords 1844, Vol. 8, Paisley Gas Bill, 31/7/1844, p. 68.

2. H. Lords, 31/7/1844, pp. 63-5.
c.f. Kilmarnock gas company in 1822 found that time-contract consumers frequently widened the aperture of burners with a needle. J.G.L., 25/3/1884.

3. In weaving shops rented jointly by several independent weavers, each worked different hours, so that time-contracts were impossible and one meter per gaslight was also impractical. Such sheds therefore were frequently without any gaslight. Evidence of G. Miller, superintendent of Glasgow City and Suburban Company. H. Lords, 2/8/1844, p. 207.

4. J.G.L., 28/8/1883: The Edinburgh Almanac or Universal Scots and Imperial Register for 1836 - Supplement (Dunfermline Register) p. 25
 Nat. Lib. Scot.

to be "formed on Liberal principles",¹ and therefore refused a petition for cheaper gas from Dalry Committee of Weavers. Special concessions were introduced,² however, in 1841 when Weavers' Shops were allowed a time-contract from 15 September to 1 April, 6 a.m. to sunrise and sunset to 10 p.m., at eight shillings for a common jet or nine shillings for a Patent Jet. But it was "expressly stipulated that the gas is not to be burned by weavers except when they are actually working". Other consumers paid either nine shillings per 1000 cubic feet by meter, or almost twice as much as the weavers by time-contracts.

Table 6.37 Time Contract Charges for Gas at Dalry (1841)

Time from Sunset to	8 p.m.		9 p.m.		10 p.m.		11 p.m.		12 p.m.		
	s.	d.	s.	d.	s.	d.	s.	d.	£	s.	d.
Each Common jet	7	6	10	0	13	6	16	0	0	19	0
Each Patent Jet	9	0	12	0	16	2	19	0	1	2	8

Source:- Dalry Minute Book, 14/8/1841.

Stringent conditions were imposed and the company Collector could "seal up every light which is not paid for when ever he calls". Payment was made in advance in four equal periods by weavers, and eight equal periods for other time contracts, with an annual discount of one halfpenny in a shilling if payments had been prompt. The regulations also stipulated for both contract and meter consumers:-

Before Gas can be supplied the Company manager must be satisfied that the interior fittings are quite sufficient, and in case of their getting into disrepair the supply will be discontinued until they shall be put into proper order.³

No burners³ or meters to be used but such as are furnished by the Company, which must be paid for on delivery; and the Company's Inspector to have the full power to fix and regulate the height of the flames of the different

1. S.R.O., Dalry Minute Book, op. cit., 21/10/1837.

2. Detailed regulations with 11 clauses - Vide S.R.O. Dalry Minute Book, op. cit., 14/8/1841.

3. S.R.O., Dalry Minute Book, op. cit., 14/8/1841.

burners. And if in any Shop or House the Gas be used without the Jet or Burners being placed in their Sockets; or if the Company's Gas be in any manner wastefully consumed or used contrary to Agreement; the Company's Inspector to have power instantly to cut off the supply; and the Directors shall also be entitled to impose such fines against the persons in default as they shall judge proper.

At Lesmahagow also, in 1846, weavers received special consideration. The price of gas by meter was six shillings, and for normal time-contracts eleven shillings a year for 6 a.m. to sunrise, and sunset to 11 p.m., but weavers were allowed to contract for only part of the year when they required gas, 1 September to 1 April, and paid only six shillings to use gas from 6 a.m. to sunrise and sunset to 10 p.m. "Weavers burning gas when not working subject themselves to a penalty of two shillings and sixpence and discontinuance of the light until paid".¹ Company rules also gave their manager "right of free access to examine meters and fittings", and to prosecute "for defraud...those using more or larger jets than they contracted for".

Table 6.38 Special Rates for Weavers at Lesmahagow (1846)²

Time-Contract prices for a No. 1 swallow-tail burner

<u>Month</u>	<u>Dwelling House</u>		<u>Weaver</u>		<u>Month</u>	<u>Dwelling House</u>		<u>Weaver</u>	
January	1s	4d	1s	1d	July	0s	6d	0s	0d
February	1	2	0	9	August	0	8	0	0
March	0	11	0	6	September	0	11	0	6
April	0	8	0	0	October	1	2	0	9
May	0	6	0	0	November	1	4	1	1
June	0	4	0	0	December	1	6	1	4

Source:- S.R.O., Lesmahagow Minute Book, op. cit., 28/1/1846.

From 1849, Saltcoats³ gas company provided gas fittings on hire for

1. S.R.O., Lesmahagow Minute Book, op. cit., 28/1/1846.

2. This table also indicates the seasonal nature of the market for gas. Vide infra p. 760

3. J.G.L., 7/8/1888.

weavers' shops, instead of outright sales, which was a considerable benefit to local weavers.

By the late 1830s several consumers¹ claimed that on the time-contract system their gas rent was subsidizing shopkeepers and others who wasted large quantities of gas. This wastage led Scottish gas companies to enforce the use of consumers' gas meters during the 1840s. During the 1830s two thirds of Perth gas consumers used only one or two burners, under contract, from sunset to 10 p.m. or 11 p.m., or from 6 a.m. to sunrise, but meters were made compulsory² in 1844. Previously, large houses, shops and hotel keepers had been encouraged to purchase meters through the gas Company³ and companies took strict control over which meters could be used.

Table 6.39 Reduction in Use of Time Contracts at Greenock

<u>Revenue (£)</u>	<u>1839</u>	<u>1850</u>
Metered-Gas	2990	7008
Time Contracts	1383	155
Street Lights	1623	1314
Total	<u>5996</u>	<u>8477</u>
Gas Price per 1000 cu.ft.	11/3d	6/8d

Source:- J.G.L., 10/5/1851.

1. P. Pindar, "Unfair Consumption of Gas Without Meters", Mechanics Magazine 1837-8, Vol. 28, p. 286.

2. J. Reid (Perth) "Gaslighting in the Past and in the Present", Gas World 1884, p. 482. For the introduction of meters, and their manufacture in Scotland vide supra p.142; also p.1777
On the history of Gas Meter technology vide J.G.L., 10/10/1849, p. 114, 10/1/1850, p. 153, 10/4/1850, p. 187, 10/10/1850.
Wet gas meters of improved design were made by several Scottish gas managers e.g. J. Whimster of Perth, J.G.L., 10/6/1851, p. 111; and J.Z. Kay of Dundee, J.G.L., 10/7/1854. The design of the 'wet' gas meter was essentially a smaller version of the 'Station Meter' at the gasworks. Vide supra p.323

3. For metered gas, Perth first charged 15/-; and 12/6d from 1827.

Greenock town council¹ resolved to sell no gas by time-contracts after May 1840 except where consumers only had a single jet burner. To other consumers they sold meters at cost price, or loaned out meters² suitable for two to four jets.

During the 1830s-40s many Scottish gas companies attempted to impose themselves as the only retail outlet for gas-burners³ and meters. Tenders were taken from manufacturers of fittings, for example by Bathgate⁴ company which in 1834 purchased 300 jets, fifty swallow-tail burners, and twenty five Argand lamps, a rough indication of the popularity of various burners when the company commenced. The reliability of meters, however, was more important than small variations in capital cost, and many companies forced all consumers to use meters from a single manufacturer. In 1834 Bathgate⁵ took estimates from four Scottish meter manufacturers, before choosing Milne's meters for all future use during the succeeding decade or longer.

In 1837 Selkirk⁶ company refused to supply gas except by meter, and by 1844 allowed private houses only to use Laidlaw's meters.

1. Greenock Advertiser, 10/4/1840.

2. In the event of meter malfunction, charges were usually estimated from the record of previous years. Galashiels in 1863 took the average of the same Quarter for the past 3 years. S.R.O., Galashiels Minute Book, op. cit., 5/5/1863.

3. This was of great importance with time-contracts, where gas consumption was regulated by the burner e.g. S.R.O., Lesmahagow Minute Book, op. cit., 19/2/1847.

4. S.R.O., Bathgate Minute Book, op. cit., 25/9/1834, 5/5/1835. In 1834-5 burners worth £42 were sold to consumers.

5. Ibid., 4/9/1834, 25/9/1834. Estimates were obtained first from W. Liddell (Glasgow), Mr. Cowan (Glasgow), J. Milne (Edinburgh) and Neil and Glover (Edinburgh).

In 1835 the parish church, with large consumption, was specially permitted to use a meter by a different manufacturer, Dalgleish and Forrest of Edinburgh.

6. S.R.O., Selkirk Minute Book, op. cit., 4/3/1837, 15/10/1844.

Annan¹ company in 1838 forced all consumers to use J. Milne's meters, fitted by the gas company at cost price, or rented out at twelve and a half per cent and maintained by the company. In 1839 persons with only one gaslight complained of the meter rent, which was reduced to sixpence a Quarter, and the Directors² examined information from Beith gas company on the feasibility of time-contracts but again decided they were too difficult to enforce. The Leven³ company in 1839 began with meters by J. Cochrane & Co. of Edinburgh, and stipulated that all consumers had to use meters purchased through the gas company, unless the Directors gave personal permission for time contracts. The Dunse⁴ company of 1836 also expected most consumers to use meters.

Stranraer was less restrictive and purchased meters from several companies,⁵ but the Directors resolved in 1840 that it was to "the advantage of the Company to consume [sic] as much as possible of the Gas by meter".⁶ The meters were to be sold by them at prime cost "to those who are able and willing to buy, and to lend out [to] such as may be unable or unwilling to purchase", at ten or fifteen per cent of the cost per year. In 1846 consumers with hired meters

1. S.R.O., Annan Minute Book, op. cit., 15/5/1838, 20/6/1838. Gas supplied at 12/6d. The Company ordered 20 No. 0, 10 No. 1, and 5 No. 2 meters to commence, but when Milne supplied a certificate by the manager of Edinburgh Gas Company on the reliability of his meters, a further 80 No. 1 and 5 No. 2 meters were purchased.

2. Ibid., 29/3/1839, 13/11/1840. Only Milne's meters could be used. (ibid., 10/9/1841).

3. S.R.O., Leven Minute Book, op. cit., 11/11/1839.

4. S.R.O., Dunse Minute Book, op. cit., 21/1/1836. Gas at 15/-.

5. S.R.O., Stranraer Minute Book, op. cit., e.g. 1/7/1840 purchased 10 smallest size and 5 of second size from Crossley, London; 10 of 9 inches and 5 of No. 1 from Cochrane & Co., Edinburgh.

31/8/1840 - 13 meters from various Edinburgh companies.

9/9/1840 - 12 meters from Messrs. Milne & Son, Edinburgh.

21/9/1840 - 12 meters and a Testing Meter from Crossley, London.

6. Ibid., 31/8/1840. From 1848 (27/6/1848) a special fund was used by the Company for meter repairs.

were encouraged to purchase them by a discount of five per cent on every twelve and a half per cent already paid in hire charges.¹ From 1844 all "the Tenants of the Coy." at Boness² had to use meters made by Milne or Laidlaw, and installed by Mr. Miller, a local tinsmith.

Dalkeith³ company in 1842 decided to supply no gas without meters from 1841. In 1843 Cupar⁴ agreed to rent out gas-meters, at ten per cent of the cost per year, collected quarterly with the gas bills. Ayr company in 1849 forced all consumers to use meters under the threat of disconnecting supplies, and all "parties living on common stairs" had to entrust their gas rent to one person for payment, or all would lose the supply.⁵ Saltcoats⁶ company first hired out meters in 1849. Leven company⁷ at Alexandria refused to supply public houses by time-contracts in 1840, and in 1842 abolished all time contracts and supplied meters on hire at ten per cent of the cost price. At Eyemouth⁸ consumers could only use gas measured by Milne's meters, and other regulations imposed upon them were copied from those used at Berwick and Tweedsmouth.

Fraudulent use of gas was still possible with gas-meters⁹ manufactured in the 1830s. In 1845 Boness company¹⁰ complained to

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1. S.R.O., Stranraer Minute Book, op. cit., 17/12/1846.
 2. S.R.O., Boness Minute Book, op. cit., 7/11/1844.
 3. S.R.O., Dalkeith Minute Book, op. cit., 18/12/1840. From 1842 (30/12/1842) the company also refused to allow No. 0 meters to be used, because of inaccurate readings.
 4. S.R.O., Cupar Minute Book, op. cit., 4/7/1843.
 5. S.R.O., Ayr Minute Book, op. cit., 3/12/1849, 25/3/1850.
 6. Meters were not supplied on free loan at Saltcoats until 1883. J.G.L., 7/8/1888.
 7. S.R.O., Vale of Leven Minute Book, op. cit., 13/3/1840, 3/6/1842.
 8. S.R.O., Eyemouth Minute Book, op. cit., 27/2/1846.
 9. Parliament did not regulate meters until 1859. Vide supra p. 1153
 10. S.R.O., Boness Minute Book, op. cit., 28/1/1845.

Messrs. Laidlaw that some consumers had purchased old types of their meters for that purpose. One public house used 2300 cubic feet through four No. 2 fishtail burners during the first month of gas-lighting, but when the meter was read the second month it had been pushed back to a setting preceding the first reading. Laidlaws agreed that such meters could be altered without breaking the company's seal, and even the removal of some water produced an inaccuracy of fifteen per cent against the company. In view of the cost of modifications, they advised a complete renewal. During 1846 the Gas company¹ forced all consumers to sell their old meters, under the threat of disconnection, and began to hire out approved meters at twopence per month, collected with the gas rent. This also widened the market by accepting "those who have not yet taken in the gas but are willing to do so if meters are furnished to them".²

The provision of reliable meters became an important aspect of capital expenditure for many gas companies,³ which were compelled to replough profits continually for this purpose. Wear and tear produced inaccurate recordings, and Cupar⁴ company Directors, for example, in 1850 found "a great number of the old meters" inaccurate and agreed to replace them. Expenditure on gas-meters by Stranraer gas company in 1850-73 is given in Table 6.40.

Table/

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1. S.R.O., Boness Minute Book, op. cit., 24/1/1846.
 2. Ibid., 15/10/1846.
 3. When Dalry purchased Milne's meters in 1835, the smallest (No.0) were 26/6d each. S.R.O., Dalry Minute Book, op. cit., 7/9/1835.
 4. S.R.O. Cupar Minute Book, op. cit., 14/11/1850.

Table 6.40 Expenditure on Consumers' Gas Meters at Boness (1847)(1) Meter Prices

J. Milne & Sons	No. 1 meter plus stop-cock	27/-, less 5% for cash payment
Laidlaw & Son	Meter	27/-, stop-cock 2/-, less 2½% for cash payment

(2) Meter Expenditure by Boness Gas Company

	£	s.	d.
86 meters and stop-cocks from J. Milne	108	18	8
61 meters and stop-cocks from Laidlaw	80	6	4
	<u>189</u>	<u>5</u>	<u>0</u>
Transport of meters (4d each)	2	9	0

Source:- S.R.O., Boness Minute Book, op. cit., 7/6/1847.

Table 6.41 Expenditure on Gas Meters (for Hiring Out) by Stranraer Gas Company

Date	£	Date	£	Date	£
1850	-	1859	22	1868	60
1851	31	1860	-	1869	38
1852	17	1861	19	1870	30
1853	79	1862	-	1871	27
1854	42	1863	46	1872	19
1855	53	1864	17	1873	15
1856	59	1865	34		
1857	67	1866	20		
1858	27	1867	55		

Note - in 1848-50 meters were part of "miscellaneous" expenses.

Source:- S.R.O., Stranraer Minute Book, op. cit., 30/7/1873.

At Stornoway¹ the deterioration of gas-meters was so rapid that in 1851 the Directors abolished the existing system of charging interest on meters, and demanded full cash payment for all meters upon the threat of removing them and disconnecting supplies.

Dry meters,² using a flexible diaphragm to measure gas flow,

1. S.R.O., Stornoway Minute Book, op. cit., 12/8/1851.

2. Vide infra p.1777

were adopted very slowly in Scotland. John Hamilton of Glasgow was the principal supplier, and provided dry meters to Arman¹ company in 1853. The main advantage of these meters was their greater reliability in temperatures below the freezing point of water, and the prevention of fraud. Boness² installed an early type for the East Quay lights in 1847. A severe frost during the winter of 1861-2 was the principal stimulus for their increased use in Scotland. In Musselburgh,³ two persons were killed by an explosion after frost split a wet gas-meter, and Galashiels⁴ gas company threatened to disconnect several consumers who had fitted their pipes directly to the mains because meters were frozen. J. Hamilton advertized Thomas Glover's dry meters under the headline "Explosions of Gas Prevented",⁵ a few days after a large explosion was caused by a frozen wet meter in the South Western Station in Glasgow.⁶

In 1863 Galashiels⁷ gas company received its first request for a dry meter. The manager opposed their introduction, and in 1869 the company ordered all consumers with dry meters more than seven years old to replace them because of inaccuracies. Bathgate⁸ company allowed consumers to purchase dry-meters, but did not provide any for hire until 1881. Forfar⁹ had many applications for dry

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1. S.R.O., Arman Minute Book, op. cit., 12/9/1853.
 2. S.R.O., Boness Minute Book, op. cit., 8/7/1847, 8/6/1847. Gas supplied to the Harbour Trustees. Very little information is available on dry-meters.
 3. Glasgow Herald, 7/1/1861, p. 4.
 4. S.R.O., Galashiels Minute Book, op. cit., 8/1/1861.
c.f. A dozen gas-meters were shattered by frost at Cupar in the winter 1860-1 - S.R.O., Cupar Minute Book, op. cit., 31/12/1860.
 5. Glasgow Herald, 2/1/1861, p. 4.
 6. J.G.L., 1/1/1861, p. 19.
 7. S.R.O., Galashiels Minute Book, op. cit., 30/6/1863, 6/9/1869.
 8. S.R.O., Bathgate Minute Book, op. cit., 29/11/1881.
 9. J.G.L., 25/1/1881.

meters in January 1881 when an intense frost affecting wet meters caused the "bobbing" of lights.

The cost of service pipes and fittings prevented many of the poorer working classes from using gaslight. The consumers' movement, and especially Glasgow City and Suburban Company,¹ did much to improve their position through free gas-fittings. In 1844, however, less than one third of houses in Paisley used gas, and the cost of fittings meant that only a single gaslight in the kitchen was used in the small dwelling houses.² Many poor residents in Glasgow and Dundee rented their lodgings on a monthly basis, in case they changed jobs, and had no gas because landlords refused to install fittings, whilst they personally could not afford fittings.³

By the 1840s many companies resolved to provide about twenty feet of service pipe, from gas mains to a consumer's meter, free of charge. Stranraer in 1844 described twenty feet as "the usual extent allowed".⁴ Lesmahagow⁵ in 1846 agreed to provide twenty feet for a house with two burners, thirty feet for four burners, and forty feet for eight burners. Annan⁶ company required full payment, however, and in 1846 instructed their manager "to arrange with proprietors to

1. T.A. Hedley, "On the Importance to Gas Companies of Renting or otherwise Supplying Fittings", J.G.L., 10/10/1849, p. 120. Glasgow C. & S. Vide infra p.959

2. H. Lords 1844, Vol. 8, Paisley Gas Bill, 30/7/1844, pp. 31, 150.

3. Ibid., 2/8/1844, p. 207. Evidence of G. Miller, Superintendent of Glasgow C. & S. Co. By 1852, however, there were "hundreds of workmen's dwellings already fitted up with gas pipes, and burners for light" in Glasgow. Vide The Builder, 1852, p. 268.

4. S.R.O., Stranraer Minute Book, op. cit., 13/5/1844. J. Taylor had to pay for a further 10 feet required to reach his house.

5. S.R.O., Lesmahagow Minute Book, op. cit., 28/1/1846.

6. S.R.O., Annan Minute Book, op. cit., 28/5/1846.

fit up their houses with pipes on condition that repayment of the outlay be made within a reasonable time, with interest". Galashiels¹ in 1860 laid up to thirty feet of service pipe gratis, as did Cupar² in 1903. In 1835 Dalry³ company resolved that "a Service pipe should be introduced through the Wall of front Houses for one light at the Company's expense in the usual way", but people wishing "to fit up back houses with Gas Light" received only four feet of service pipe per light and had to finance the remainder themselves.

The rent charged for consumers' meters⁴ was relatively a far greater burden for poor consumers who used little gas, than for large consumers. The charge varied considerably between companies. T. Hawksley estimated in 1846 that meter rent should have been one eighth⁵ of the prime cost, because extensive repairs or replacement was required after eight years. The old Hamilton⁶ gas company charged one shilling and sixpence a year on small meters costing one pound five shillings and sixpence. Aberdeen in 1836 charged three shillings for the "common sized meter".⁷ Only rarely were special concessions made, as at Annan⁸ which in 1858 charged no meter rent in the summer if consumption was below one shilling of gas.

1. S.R.O., Galashiels Minute Book, op. cit., 22/3/1860. From 1888 Galashiels company employed a full time gas-fitter and all consumers had to use him alone for their service pipes (ibid., 7/8/1888).

2. Cupar also obliged consumers to use the Company gasfitter. S.R.O., Cupar Minute Book, op. cit., 4/5/1903.

3. S.R.O., Dalry Minute Book, op. cit., 12/10/1835.

4. Vide infra pp. 1777 et seq.

5. e.g. Liverpool and Nottingham companies charged 3/- a year on meters costing £1 5/-. Evidence of Thomas Hawksley. H. Commons 1846, Vol. 102, Hamilton New Gas Company Bill, 13/5/1846, p. 48.

6. Ibid., 13/5/1846, p. 28.

7. Aberdeen Journal, 17/8/1836, p. 3.

8. S.R.O., Annan Minute Book, op. cit., 10/9/1858.

The size of market served by an individual gas company was quite rigidly controlled by the heavy cost of piping, and the leakage¹ involved wherever consumers were not in close geographical proximity to the gasworks. Falkirk gas company in 1834 aimed to supply only "the High Street, Roberts Wynd and Kirk Wynd" and to extend to other streets "and even to the adjoining houses and villages if found advisable",² Kirkcaldy gasworks,³ located to provide a supply both to the town of Kirkcaldy and the villages of Pathead, St. Clairtown, Linktown, Nicol Street, Brighton and Morningside, was quite exceptional. Most gas companies were extremely cautious over any enlargement of their supply zone.

In 1914 most companies still expected large consumers, including railway stations, to contribute part of the heavy capital expenditure required to extend pipes any considerable distance required beyond the established system of gas mains. Alternatively, contracts stipulated a minimum level of consumption. In 1832 Dalkeith⁴ gas company was unwilling to lay pipes costing twenty three pounds to Waulk Mill unless the millowner paid fifteen pounds of the cost. Agreement was subsequently reached on the basis that if the Mill consumed gas worth above five pounds in the first year, fifteen pounds was due on the pipe, but that fell to ten pounds in the second year and five pounds in the third year; and provided the level of consumption was maintained over four years, the Gas Company agreed to pay the entire cost of the pipe. During 1833 a pipe costing £125

1. Vide supra p. 339

2. S.R.O. (BT2/6) Falkirk Contract of Copartnery.

3. S.R.O. (BT2/1200). New Statistical Account, Vol. IX, p. 157.

4. S.R.O., Dalkeith Minute Book, op. cit., 28/8/1832, 2/10/1832.

was required for Newbattle Abbey.¹ The Dalkeith company was only willing to pay a third of the cost, but eventually paid half the total, though the Marquis of Midlothian's estate was to pay four per cent interest on that expenditure if consumption fell below five pounds per year, and to refund the entire cost if consumption ceased.

Dalkeith² company in 1841 agreed to supply service pipes, and gas at the standard rate, to Lasswade village only if the villagers financed the mains pipes. This they refused to do and subsequently they formed a separate gas company. Dalkeith also paid for only half of the pipes to the Duke of Buccleugh's colliery at Thornybank,³ which contracted for a ten years supply or repayment for the pipe. Their consumption had to be above ten pounds a year under a penalty of five per cent interest on the pipe expenditure. In 1848 gas mains were laid to Gallowshall, only part way to the North British Railway⁴ which contracted for a six years supply at twelve pence above the prices charged in Dalkeith as part payment on that pipe.

In 1846 Boness⁵ gas company laid two inch diameter mains to the Engine House of John Wilson's Kinneil Ironworks. Wilson agreed to provide his own service pipes, and pipes for a gas supply to the houses of his workmen. The gas company at first requested a seven year contract guaranteeing annual consumption above twenty five pounds, in return for a twenty per cent discount on normal gas prices for all

1. S.R.O., Dalkeith Minute Book, op. cit., 26/2/1833.

2. Ibid., 3/10/1841.

3. Ibid., 20/4/1841.

4. Ibid., 22/11/1848.

5. S.R.O., Boness Minute Book, op. cit., 19/1/1846, 26/2/1846, 9/3/1846, 8/6/1846.

extra quantities. Wilson refused the guarantee, and took a discount on the entire consumption, after agreeing to purchase ten of the fifty new six pound shares which the gas company had to sell to finance the extension. In 1851 the Boness company extended pipes to supply Wilson's new residential developments at Snab and Dean, when he agreed to collect the monthly gas rent of his workmen, and to purchase the pipes at arbitration if he ever chose to manufacture gas privately.¹

Contracts were also imposed upon individual consumers. In 1847 Boness company financed pipes worth forty pounds to A. Hunter's house at Braehead² in return for guaranteed consumption over ten years at standard prices, plus five per cent interest paid on the cost of pipes. In 1856 Selkirk company³ financed gas mains to the local railway station, when the railway agreed to pay five per cent interest on the cost until other consumers also used the pipe. Dalkeith⁴ company in 1859 agreed to supply Cowdenfoot village only if the inhabitants paid for one third of the pipes, and in 1867 the company was only prepared to pay half of the twenty pound cost of pipes to the new Hardengreen station of the North British Railway. This was a general policy, since in 1854 Dalkeith company paid only half the eleven pound cost of pipes to Westfield Iron Foundry.⁵ Stranraer gas company in 1861 refused any discount on gas supplied to the

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1. S.R.O., Boness Minute Book, op. cit., 2/1/1851, 8/1/1851. "John Burnett to fit up single houses one Light, Double two lights, at Ten Shillings each to be paid by Mr. Wilson" in 1851. In 1854 Wilson's executors threatened to manufacture gas, but later accepted company gas at 5/- compared to 6/8d in Boness, and also took responsibility for payment of fittings; even in 1874 Kinneil works still collected gas rents for the Company from its workmen. S.R.O., Boness Minute Book, op. cit., 10/6/1854, 26/6/1868, 13/10/1874, 23/10/1874.
 2. Hunter ceased to pay extra in 1849 when other consumers used the same pipe. Ibid., 14/6/1847, 11/6/1849.
 3. S.R.O., Selkirk Minute Book, op. cit., 28/8/1856.
 4. S.R.O., Dalkeith Minute Book, op. cit., 31/10/1859, 1/3/1867.
 5. Ibid., 18/12/1854.

Portpatrick Railway company, but agreed to pay for the 150 pounds pipes required in return for a ten years consumption contract.

In 1861 Banff¹ gas company financed twenty four pounds pipes to Strathiston Railway station, upon which the railway paid six per cent interest per year. Lord Fife² also paid six per cent on pipes laid to Duff House in 1859. Banff company³ spent 600 pounds on pipes and an ancillary gasholder to the Lunatic Asylum in 1864, in return for a fifteen year contract for gas at ten shillings, compared to the seven shillings and elevenpence rate in Banff town, and a penalty clause of five further years if annual consumption was less than 400,000 cubic feet. Annan⁴ gas company in 1871 agreed to finance pipes to the factory of McKintosh and Jackson, in return for which they undertook to make arrangements with the Road Trustees, and to dig the trenches. They also guaranteed an annual consumption worth ten pounds, and agreed to pay six per cent interest on the cost of pipes for twenty years, less a rebate of one per cent for every additional consumer who used the pipe. This latter was apparently a general regulation at Annan.

Boness gas company reversed the normal financing procedure for pipes in 1878. Mr. Cadell agreed to spend 150 pounds on gas-mains to his workmen's houses at Bridgeness,⁵ and in return the Boness Gas Company undertook to supply meters and gas at the normal rate, besides

1. S.R.O., Banff Minute Book, op. cit., 26/7/1860, 5/6/1861, 1/7/1861.

2. Ibid., 4/7/1859.

3. Ibid., 4/5/1863, 6/7/1863, 15/10/1863, 1/4/1864, 21/5/1864. The Asylum was expected to use 582,000 cu. ft. per year.

4. S.R.O., Annan Minute Book, op. cit., 14/9/1871.

5. S.R.O., Boness Minute Book, op. cit., 28/2/1878, 5/3/1878. Cadell previously operated a private gaswork. Vide supra Chapter I. p.88

paying two and a half per cent interest on the pipe, and repaying thirty seven pounds ten shillings of the capital cost each year. Dalkeith¹ gas company in 1878 agreed to finance the entire cost of pipes to Messrs. Stewart Bros., carpet manufacturers of Eskbank, and to supply gas at normal prices, because of the large consumption expected. But they did obtain first a four year contract from Messrs. Stewart, and a penalty payment of ten pounds if consumption ceased after that date.

Alternative sources of illumination, and company rivalry in some mutual hinterlands towards the end of the nineteenth century, resulted in the loss of some potential consumers through pipe finance policies. In 1886 Dalkeith company offered to pay only half of the cost of a 960 yards pipe costing 125 pounds, to Lord Melville's Castle,² and thereby lost his custom to Lasswade gas company. Banff gas company³ in 1912 agreed to pay only half the twenty six pound pipe to the Ladysbridge Station of the G.N.S. railway, and refused to raise discounts from five per cent to ten per cent, so the railway decided not to use gas. In 1885 Galashiels company⁴ refused to supply the Waverley Hydropathic Establishment in Melrose, and in 1887 were only willing to supply the inhabitants of Melrose if they paid for the entire mains and service pipes, and collected their own gas rents at three and a half per cent more than the Galashiels prices to allow for leakage in transit. Leakage and the cost of mains effectively inhibited direct competition between gas companies in most⁵ neighbouring towns.

1. S.R.O., Dalkeith Minute Book, op. cit., 2/9/1878.

2. S.R.O., Dalkeith Minute Book, op. cit., 15/7/1886, 4/2/1887.

3. S.R.O., Banff Minute Book, op. cit., 11/12/1912, 10/6/1914.

4. S.R.O., Galashiels Minute Book, op. cit., 5/5/1885, 7/6/1887.

5. Vide supra p. 381

Discounts to large local consumers were used from an early period to increase consumption, but later became a source of annoyance to small consumers who subsidized the large consumers. Gas companies claimed that they were justified because the cost of service pipes, of checking meters, and of collecting accounts was far less with large consumers, who would manufacture gas privately unless offered special prices. Their custom raised the total gas output, and produced economies of scale¹ which eventually benefitted the small consumers also. By the 1840s, however, it was apparent that mill owners and other manufacturers consumed large quantities only during the two winter Quarters, and gas companies had to install much capital equipment which was only used during the winter. This was also the peak demand for small consumers, who still bought gas in the summer, and subsidized the equipment which was only used for discount gas production.² In 1850 Boness³ gas company allowed a five per cent discount on gas above twenty five pounds consumed by Messrs. J. Jamieson & Co., but when they refused a further reduction in 1851 that company set up a rival gasworks, which also supplied Boness Pottery Company,⁴ and Jamieson used his position on the Town Council to gain permission to lay pipes under the public roads.

Discount policy varied during the nineteenth century, and the

1. Vide infra p. 872

2. B.P.P., 1847, XXII, p. 98. At Aston-under-Lyne, small consumers paid 6/-, and large consumers as little as 4/- (30% discount on £500 consumption); yet 25% of all gas was consumed by mills at discount prices.

3. S.R.O., Boness Gas Co. Minute Book, op. cit., 3/10/1850, 3/9/1851, 4/9/1851, 11/12/1851, 8/1/1852. (Excerpt from minutes of Boness Town Trustees, 2/10/1851).

4. In 1859 J. Menshale of Boness Pottery ceased to use the private gas. S.R.O., Boness Minute Book, op. cit., 11/1/1859.

rate was usually curtailed when lower gas prices were introduced for all consumers. High discounts inflated the overall price of gas, to the disadvantage of small consumers,* and were often reduced or abolished by the 1860s.

Table 6.42 Discount Rates in Selkirk, Jedburgh and Hawick (1840)

0 to 10,000 cu. ft.	0%	20,000 to 29,000	10%
10,000 to 19,000	5%	Above 30,000	15%

Source:- S.R.O., Selkirk Minute Book, op. cit., 17/11/1840.

Selkirk supplied gas at fifteen shillings in 1840, but discounts¹ were abolished in 1850 when gas was reduced from twelve shillings and sixpence to eight shillings and fourpence to bring it more closely into line with prices in other towns. Cupar² gave no discounts until petitioned to do so by nine important local consumers in 1844, and discounts were conditional upon prompt Quarterly payment of bills. The company ceased to allow discounts in 1869, after a comparison with the practice at St. Andrews, Kirkcaldy, Dunfermline and Stirling, of which only Dunfermline still allowed discounts varying from two and a half to fifteen per cent.

Table 6.43 Discounts First Introduced in 1844 at Cupar

(1) Discounts Requested by Consumers		(2) Discounts Granted	
£5 up to £15 gas	10%	£10 up to £20 gas	5%
£15 up to £20	15%	£20 and above	10%
£20 and above	20%		

Source:- S.R.O., Cupar Minute Book, op. cit., 1/7/1844.

In 1838 Annan³ gas company supplied gas to Messrs. Douglas & Co. on a three year contract at nine shillings, compared to twelve shillings

1. S.R.O., Selkirk Minute Book, op. cit., 1/6/1850.

2. S.R.O., Cupar Minute Book, op. cit., 1/7/1844, 9/9/1869, 12/8/1869.

3. S.R.O., Annan Minute Book, op. cit., 28/8/1838, 3/10/1842, 7/10/1842, 29/5/1844, 4/10/1843.

* Vide supra p. 872

and sixpence for other consumers. Annan supplied a large factory in 1842, and took advice from Carlisle gasworks before fixing a discount price: nine shilling gas was supplied to J. Sawyer's Cotton Factory, whilst other consumers still paid the original rate.¹

Table 6.44 Discounts Introduced at Ayr (1845)

Consumption	Discount	Consumption	Discount
£5 up to £10 gas	5%	£20 up to £50	10%
£10 up to £20	7%	£50 and above	15%

Source:- S.R.O., Ayr Minute Book, op. cit., 17/11/1845
(Gas by meter 6/8d).

When Ayr² reduced gas from six shillings and eightpence to five shillings and tenpence in 1847, all discounts were abolished, and from 1849 only one exception was made, for the local railway company which was charged fivepence per 1000 cubic feet less than other consumers. Galashiels³ gas company apparently allowed no discounts at all, and Hawick⁴ allowed only four per cent discount in 1831. Boness⁵ company gave a twenty per cent discount on all consumption above twenty five pounds by the Kinneil Ironworks from 1846, and in 1855 allowed other large consumers like Boness Distillery to have a discount for the first time, of five per cent ^{on} consumption above five pounds, but they abolished all discounts even to Kinneil, later in 1855 when coal prices rose steeply.

Table/

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1. In 1843-4 normal consumers paid 11/-, and the cotton factory 8/-.
 2. S.R.O., Ayr Minute Book, op. cit., 7/6/1847, 31/12/1849.
 3. S.R.O., Galashiels Minute Book, op. cit., 8/7/1847, 16/11/1847, 1/3/1859.
 4. Hawick Gas Company history, Vide J.G.L., 7/7/1885. Gas sold at 15/-.
 5. S.R.O., Boness Minute Book, op. cit., 19/1/1846, 11/6/1855, 6/7/1855.

Table 6.45 Discounts on Gas Bills paid within 14 Days

	<u>at Vale of Leven¹</u>		
	<u>1842</u>	<u>1845</u>	<u>1849</u>
50,000 to 100,000 cu.ft.	5%	5%	3%
100,000 to 150,000 cu.ft.	10%	10%	6%
150,000 cu.ft. and above	15%	15%	10%
200,000 cu.ft. and above	15%	20%	10%

Source:- S.R.O., Vale of Leven Minute Book, op. cit., 3/6/1842, 17/6/1842, 25/3/1849, 30/5/1845.

Stranraer² company allowed no discounts until 1903, when three very large consumers with over seventy pounds gas per year, were granted a five per cent reduction. At Bathgate³ the original discount system was abolished in 1877, but a five per cent discount for consumption over ten pounds was introduced in 1879 and abolished in 1882, and a new three per cent discount for consumption above three pounds introduced in 1890.

Public street lighting⁴ with candles and later animal-oils, was reintroduced in the West at Paris in 1524, but remained a novelty in Scottish and other European cities until the mid eighteenth century. After 1807, when F.A. Winsor illuminated Pall Mall, London, gas companies encouraged the support of local authorities by offering reduced rates or free gas for public lighting in return for concessions to

1. S.R.O., Vale of Leven Minute Book, op. cit. Reduced discounts in 1849 were part of the financial reorganization. Vide supra p. 785

The Company commenced 1839, with gas 11/6d, but first discounts given in 1842 with gas at 11/-d.

2. S.R.O., Stranraer Minute Book, op. cit., 12/12/1903.

3. S.R.O., Bathgate Minute Book, op. cit., 16/6/1877, 3/6/1879, 15/6/1882, 2/6/1890. No details are extant of original discounts.

4. "Lighting the Streets", The Analectic Magazine 1816, Vol. VIII, p. 345. J. Beckmann, A History of Inventions, Discoveries and Origins (1846), Vol. II, pp. 172-85. L. Gaster and J.S. Dow, Modern Illuminants and Illuminating Engineering (1915) pp. 10-13. F.W. Robins, The Story of the Lamp (and the Candle) (1939, Oxford), p. 140.

open the streets and lay gas pipes.¹ In 1833 Rutter even proposed that for new companies "the amount of capital required will greatly depend on the space to be covered by the public lights - The number and situation of these being known, there will be no difficulty in estimating the probable amount of private burners"² which could be served by the same mains. Public gaslights were praised for reducing robbery and burglary, since the villains could be identified,³ but the low price charged for public gas was opposed by some as an indirect tax imposed by the Town Council on other gas consumers.⁴ Because street lamps until at least the mid nineteenth century were normally lit during only seven months of the year, and not during the fine moonlight nights in each of these months, the demand fluctuated considerably.⁵ In the long run public lights were an important market, but in the short term they raised the fixed capital outlay required to meet peak demand and consequently reduced profits. Few coastal towns used coal-gas for maritime lights, Troon

1. Town councillors and magistrates promoted several Scottish companies, partly with this aim in mind. Vide supra p. 1011

2. J.O.N. Rutter (Brighton) Practical Observations on Gas Lighting (1833), p. 29.

3. Ladders provided for earlier, ineffectual oil lamps, were frequently used in burglary. Vide W. Richards, Practical Treatise (1877), op. cit., p. 24. Crime reduction in London following gas-lighting was frequently quoted. Vide Inverness Courier, 3/1/1827, p. 3.

4. J.O.N. Rutter, Practical Observations (1833), op. cit., p. 8. c.f. Magistrates who were also Directors of Inverkeithing gas company, in 1880 threatened municipal takeover of the works unless large discounts were allowed for public lamps. J.G.L., 13/1/1880. Abuses were also common in England - Wolverhampton gasworks in 1847 supplied public lights (mainly in wealthy streets) at 2/4d when gas cost 3/2d to manufacture, and cost small consumers 5/-. Moreover, all-night street lamps raised company losses caused by leakage as mains pressure could not be reduced. In return Town Councils gave permission to open trenches, and prevented local and Parliamentary opposition to the company. B.P.P., 1847, XXII, pp. 97, 62.

5. J.O.N. Rutter, Practical Observations (1833), op. cit., pp. 29-33.

Pier¹ being an exceptional pioneer in 1837.

Gas street lighting commenced in Glasgow² in September 1818 as one aspect of a large expansion in public lighting.

Table 6.46 Expansion of Public Lighting in Glasgow 1815-47

<u>Date</u>	<u>Oil Lamps</u>	<u>Gas Lamps</u>	<u>Cost for Light alone</u>
1815	1380	0	£1357
1820	507	1091	£1 3/- per gas lamp, sunset to sunrise
1836	-	2097	17/6d per lamp
1847	-	5500	£7000

Sources:- J. Bell and J. Patton, Glasgow - Its Municipal Organization and Administration (1896, Glasgow), p. 158.
J. Cleland, The Rise and Progress of Glasgow (1820, Glasgow), p. 125.
J. Cleland, The Rise and Progress of Glasgow 1841-62 (1862, Glasgow), p. 53.

Note: The Police department undertook the cleaning, lighting and extinguishing of lamps themselves and public lighting was a statutory duty under the Police Act of 1800.

In 1820 Glasgow paid twenty three shillings a year for public gas lamps, burning sunset to sunrise, plus the expense of Police employees who lit, cleaned and extinguished the lamps. All had cockscur burners, made by Milne³ of Edinburgh and placed "into the globes which

1. Coal gas was used in continental lighthouses from 1823, and by many English lighthouses in the 1860s, and the Edinburgh Journal expressed surprise that it was so little used in Scotland. The Duke of Buccleuch used Leith gas in the 1830s to light Crammond Pier. F.W. Robins, The Story of the Lamp (and the Candle) (1939, Oxford) pp. 135-9; Chambers' Edinburgh Journal 1861, Vol. 15, p. 397; New Statistical Account, Vol. I, p. 601.

2. First street lamp 5/9/1818, New Statistical Account, Vol. VI, p. 162.

3. Milne later became principal supplier for Edinburgh public lights, and in 1822 received £223 for fittings, though public gas lighting was only just beginning to expand in the city. His block-tin tubes were a large factor in this success. Milne charged 9/- per lamp, and gave a 3 years guarantee, which offer was accepted by Edinburgh Council in preference to 8/- per lamp by Greenside Company. Edinburgh City Archives, "Minute Book of Edinburgh Lighting Committee", Vol. 8, 7/5/1822, p. 181; 15/6/1822, p. 183; 3/7/1823, p. 223; 24/11/1820, p. 88; 11/1/1821, p. 104; 13/8/1821, p. 125.

were formerly lighted with oil". Detailed information was supplied by J. Cleland of Glasgow¹ to enable Edinburgh council to apply the "method of comparisons". This method gradually produced national prices with regional variations. Eyemouth² gas company, for example, in 1846 based the charge made for harbour lamps upon those of Leith and Berwick.

Edinburgh followed Glasgow, with public gas lights along North Bridge Street³ in 1819, and in the High Street⁴ in 1820 using single 'cockspur' burners in oil lamp globes. Oil lighting costs⁵ had been rising steeply, from £4790 a year in 1806-12, to £5184 a year in 1812-18, yet many complained because lamps were frequently blown out.⁶ Labour costs were reduced by having fewer gas lamps than oil. The

1. Edinburgh City Archives, "Minute Book of Edinburgh Lighting Committee", 1820-6, Vol. 8, 1/4/1820, p. 10.

2. S.R.O., Eyemouth Minute Book, op. cit., 20/3/1846.

3. First lit in January to May, 1819, for £24. Edinburgh City Archives, "Minute Book of Edinburgh Lighting Committee", Vol. 7, 4/1/1819, p. 367; Vol. 8, 17/3/1820, p. 5. Edinburgh Evening Courant, 8/2/1829, p. 3. The date 1820 is given incorrectly for first lights in T. Adams, Ed., Edinburgh 1329-1929, p. 174 and The Scotsman, 3/9/1968. The 'Lighting Committee' stated that South Bridge lights were gas lit in September, 1818, but their 1820 Committee was probably mistaken since North Bridge was also ascribed to 1818 in definite error. Vide "Minute Book of Edinburgh Lighting Committee", 1/4/1820, p. 15; 31/10/1820, p. 76. The New Statistical Account (Vol. I, p. 758) also gave the incorrect date, 1818 for the North and South Bridges, and "next winter" when the Edinburgh Theatre was lit was in fact the winter 1819-20.

4. Edinburgh Evening Courant, 4/3/1820. For public lighting before gas Vide Edinburgh Evening News, 25/1/1936.

5. Minute Book of Edinburgh Lighting Committee, Vol. 7, Oct. 1818, p. 358; Vol. 8, 1/4/1820, p. 8. 2000 portable oil lamps were strung around city streets in the summer of 1820.

6. Also true of Glasgow - Vide H. Barclay, Rambling Recollections of Old Glasgow (1890, Glasgow).

Town Council¹ paid for the gas "pillars",² lanterns and globes, and service pipes; the Company provided gas mains. Cheap jets³ were chosen instead of batswings which used too much gas, except for the New Town. From 1820 that wealthy area had large batswing burners,⁴ because the straight streets allowed them to be more widely placed.

A cost benefit analysis⁵ of gas lighting prepared in 1821 showed that along Edinburgh High Street twenty seven oil-lamps were used on average in 1812-17 at an annual cost of twenty eight pounds, and were replaced in 1819 by nineteen single jets costing twenty five pounds, a saving of three pounds. Along North Bridge, seventeen batswing burners used for a thirty five week season in 1820 cost £104, whereas the previous seventy five oil lamps cost sixty three pounds, an increase in cost of forty one pounds which may have been caused partly by improved illumination. Fixed capital costs were also higher with gaslight. Eighty oil lamps in Prince's Street⁶ had cost eighty five pounds, but were replaced in 1821 by sixteen batswing gas burners costing ninety pounds to install, an increase of five pounds.

In 1821 Edinburgh Lighting Committee⁷ considered suspending the

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1. Minute Book of Edinburgh Lighting Committee, Vol. 8, 1/4/1820, p. 15; 22/6/1820, p. 14.
 2. Great detail of specifications and contracts. Minute Book, ibid., Vol. 8, 16/9/1820, p. 51; 23/10/1820, p. 61; 31/8/1820, p. 37; 24/11/1820, p. 88; 15/11/1823, p. 208.
 3. Minute Book, ibid., 28/8/1821, p. 136. Decision reached even although Batswings were "decidedly preferable to all others" for illumination. Old globes from oil lamps were used, at £1 11/- for conversion, instead of new globes at £2.
 4. Minute Book, ibid., 16/8/1820, p. 19; 2/9/1820, p. 42; 10/1/1822, p. 174; 14/2/1822, p. 177.
 5. Minute Book, ibid., 31/10/1820, p. 76; 28/8/1821, p. 136. The Police Act of 57 George III (section 24) only permitted the use of gas in public lights if the cost was less than the cost of oil light on the average of 5 previous years.
 6. Minute Book, ibid., 10/8/1821, p. 153; 13/10/1821, p. 159.
 7. Minute Book, ibid., 31/10/1820, p. 76; 10/8/1821, p. 153.

increase in public gas lighting, because of the higher fixed capital costs, and high cost of gas¹ compared with Glasgow. But after a spectacular display of large burners for the Royal Visit² of 1822, two hundred new "pillars" were ordered³ for the Grass Market and Canongate areas. Profits from the municipal Coal Weighing Fund⁴ were subsequently used to pay for the extension of public lighting which continued at an increasing pace from 1823.

During 1823 the Coal Weighing Fund paid £750 for 209 new gas lamps,⁵ and the Lighting Committee recommended the expenditure of at least £500 per year on fittings so that "the whole City may be lighted with gas".⁶

Table 6.47 Expansion of Edinburgh Public Lighting (1820-4)

<u>Date</u> (Winter season)	<u>Oil Lamps</u>	<u>Gas Lamps</u>
1820-1	4765	37
1821-2	4731	408
1822-3	?	c. 608
1823-4	?	c. 962

Source:- Edinburgh City Archives, "Minute Book of Edinburgh Lighting Committee", 7/5/1822, p. 180; 15/11/1822, p. 206; 23/2/1823, p. 213; 3/7/1823, p. 223.

The Lighting Committee considered that two gas burners gave light equal to three oil lamps.⁷ In 1820-3 the Gas Company undertook to

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1. Vide supra pp. 866, 1119
 2. Minute Book of Edinburgh Lighting Committee, 1/8/1822, p. 187.
 3. From Leith Walk Foundry. Minute Book, ibid., 15/11/1822, p. 206.
 4. Ibid., 15/11/1822, p. 206.
 5. Ibid., 23/2/1823, p. 213. In 1822 the Coal Weighing Fund paid for 200 new gas 'pillars'; Ibid., 15/11/1822, p. 206.
 6. Ibid., 3/7/1823, p. 223. The Committee claimed that their first objective had been fulfilled, to light the populous High Street, Canongate and South Bridge, followed by "all principal entrances to the city".
 7. Ibid., 13/5/1823, p. 217.

light, clean and extinguish the lamps¹ but after 1823 the Council appointed its own lamplighters.²

Despite good intensions, wealthy areas of Edinburgh obtained better public gas lighting than elsewhere, and this became a feature of many towns. In 1823 the Committee agreed that "the number and description of the population that haunts the High Street and other parts of the Old Town affords the most obvious reason for having them better lighted thro' the whole year than other parts of the city".³ But during 1822-3 only ninety 'pillars' and 134 cheaper 'irons' attached to buildings, were installed in the disreputable Old Town, compared to 320 'pillars' and ten 'irons' in the New Town.⁴

The outdoor illumination of clock dials by night was first achieved⁵

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1. Minute Book of Edinburgh Lighting Committee, 22/6/1820, p. 14; 24/10/1820, p. 71. The company charged 3/9d per week per lamp.
 2. One lamplighter for every 20 lamps, at 3/2d per week wages. Ibid., 13/5/1823, p. 217; 3/7/1823, p. 223. From 1822 special gas-lamp standards were placed in front of the houses of Edinburgh Councillors as a mark of distinction, which became a widespread custom. Stirling provided such a lamp for the Provost from 1856; as did Greenock up to 1884. Edinburgh Evening News, 5/8/1954. J.G.L., 23/10/1883, 9/9/1884. W. Drysdale, Old Faces, Old Places and Old Stories of Stirling (1899, Stirling), p. 233.
 3. Minute Book, ibid., 3/7/1823, p. 223.
 4. Ibid., 3/7/1823, p. 223. To combat strong winds, and water-condensation, Edinburgh later adopted special gas lanterns invented by J. Robison (possibly an early sponsor of Glasgow gasworks. Vide supra p.156) J. Robison, "On the Best Method of Burning Gas for the purpose of Illumination", Mechanics Magazine, Vol. 32, 1839-40, p. 340. Early gas lamp brackets and lamplighting are described in A Book of Airdrie (1954, Glasgow), p. 90. Messrs. Ford's glass works in Edinburgh subsequently supplied glass-globes for Edinburgh street lamps, J.G.L., 16/12/1890, p. 1302. Vide supra p.1129
 5. John and Robert Hart, the Glasgow bakers who devised this system, were members of Glasgow Philosophical Society and closely associated with the local gasworks. They used a "flash-pipe" for manually lighting the lantern with its parabolic mirror, from inside the tower; and an automatic mechanism to turn the gas off at daybreak. J. Cleland, Statistics of Glasgow (1828, Glasgow) 3rd edn., p. 199. "The Method of Illuminating the Clock Dial on the Steeple of the Tron Church in Glasgow", Quarterly Journal of Science, Literature and the Arts 1821, Vol. XII, p. 229. Annals of Philosophy 1822, Vol. III, p. 155. Edinburgh Philosophical Journal 1821-2, Vol. VI, p. 192. "Notice of the Inventions of Messrs. Hart of Glasgow", Mechanics Magazine 1828, Vol. 9, p. 365. John Hart (Edgefauld House, Glasgow), "On the Principles of Light Reflectors", describing work which developed from this project, The Practical Mechanic and Engineer's Magazine (1845, Glasgow), p. 92.

in 1821 at the Tron in Glasgow, a city which also developed the use of gas for advertizing: Provost Dalglish used 3000 jets for his exhortation to "Let Glasgow Flourish"¹ which greeted the 1832 Reform Bill. The clock on Edinburgh Tron steeple² was lit in 1823, and similar lighting was later adopted throughout Britain, as for Falkirk Town Clock³ in 1846.

The most popular public and private gas-burners were badly constructed for their illuminating power, relative to the quality of gas supplied, but they made it last for a long duration of time. The 'jet' or 'rat-tail' burner,⁴ with a solitary thin flame, used the least quantity of gas in a given time and was common in street lights and even domestic lights until the 1870s. Although cheap in relation to the length of time used, incomplete combustion made this weak light most wasteful in terms of illumination per unit volume. The

1. J. Cameron, The Parish of Campsie (1892, Kirkintilloch), p. 12. "Glasgow Illumination", The Scotsman, 30/3/1831, p. 3.

2. Edinburgh City Archives, Edinburgh Council Record 1823-5, Vol. 186. Letter from gas company offering to supply free gas, 22/4/1823.

3. Stirling Journal, 20/2/1846, p. 4.

4. A simple, single orifice burner often little different to those used by Clayton and Murdoch.

Open-flame burners have been described by several authors vide -

E.A. Parnell, Applied Chemistry (1844), op. cit., Vol.I, p. 104.

J.S. Dow and L. Gaster, Modern Illuminants (1915), op. cit., pp.31-53.

W.J. Liberty, The Illuminating Engineer 1913, Vol.VI, op. cit., pp. 211-31.

V.B. Lewes, Journal of the Society of Arts 1892-3, Vol. XLI, pp. 138-47.

D. Chandler, Outline History of Lighting by Gas (1936)

pp. 81-109 "Evolution of the Luminous Flame Burner"

pp. 125-40 "Argand Gas Burners"

pp. 141-9 "Gas Lighting and Ventilation"

pp. 149-71 "Regenerative Gas Lamps"

The relative luminosity of 10 historical open-flame burners is best shown in a photograph by F.W. Robins, The Story of the Lamp (and the Candle) (1939, Oxford) p. 118.

cf H. Drehschmidt, "Primitive Lighting Appliances", Gas World, 2/1/1897, p. 20.

Argand burner¹ gave brighter light and more efficient combustion, but consumed larger quantities of gas than small consumers could afford, and variations of construction affected the efficiency of lighting.² Burners with intermediate consumption and efficiency therefore became the most popular. The 'Fishtail' or 'Union Jet', devised by J.B. Neilson³ of Glasgow and J. Milne⁴ of Edinburgh was that most used. Neilson placed two single jets so that they impinged and produced a flattened flame which reduced the smoky unburnt portion of single jets. Milne combined the two jets, with their critical angle of incidence, into a single burner. The 'Batswing' burner was a simple modification of the 'Fishtail' made by cutting a slit across the orifice to increase the lateral spread of flame, and was also widely used. Little improvement was made upon illuminating gas-burners for

1. Argand's 1784 lamp (Pat. 1425) was first manufactured by Mathew Boulton. The Argand burner had an annular case supplying gas to 15 or 20 small holes in the upper metal rim, in the centre of which a ventilation hole enhanced combustion. Leslie's Argand used a series of small tubes, instead of the annular case, around a ventilation hole. J.E. Forbes, Short History of the Art of Distillation (1948), pp. 224-5. Proceedings of Glasgow Architectural Society (1865-7), Vol.VI, p. 95 et seq.

2. Vide infra Appendix XI (Christison and Turner). Gas World, 25/6/1892, V.B. Lewes, "A Century of Work on the Development of Light from Coal". In 1807 Murdoch used a burner with 3 apertures, each $\frac{1}{30}$ inch diameter, giving a "fleur-de-lys" or "cockspur" burner. It was modified in 1816 to give a "cockscomb" and then "batswing" burner with a low, thin sheet of flame. Vide supra p. 61

3. Vide infra p. 597

The Fishtail had a high, narrow flame, less susceptible to draughts than batswings, and easier to place in glass cylinders.

4. Vide infra p. 208

Early Jet Burners with an orifice $\frac{1}{40}$ to $\frac{1}{60}$ inch dia., Batswings, and Argands of 10, 15 or 20 candlepower desc. and diags. by H. Creighton in 1824, Encyclopaedia Britannica - Supplement (1824), op. cit., Vol. 4, p. 457.

over fifty years.¹

Gas was sold in units of quantity, which made Scottish gas appear far more expensive than English gas per 1000 cubic feet. Because the quality was also of great importance, however, a proposal was made in 1869 to convert the prices into a charge based upon quality instead of quantity. The unfulfilled suggestion produced a quite different, but more realistic appraisal of consumer expenditure, as shown in Table 6.48.

Table 6.48 Pricing by Volume and Quality (1869)

<u>Town</u>	<u>Volumetric Gas Price (per 1000 cu.ft.)</u>		<u>Candle-power</u>	<u>Quality price (cost per 1000 candlepower)</u>
Ipswich	3s	9d	14	16.07d
Sheffield	3	6	14	15.0d
Birmingham	2	9	14	11.78d
Manchester	3	2	17	11.17d
Edinburgh (Old)	4	10	28	10.35d
Glasgow (Old)	4	3	27	9.26d
Liverpool	3	0	22	8.18d

Source:- J.G.L., 20/7/1869.

The Scottish towns which sold gas at an apparently high price, in practical terms of illumination provided gas as cheaply as the best English towns, apart from a few exceptions like Liverpool.

'Enrichment' fittings, which held special chemicals on the supply

1. Aerated burners (vide infra p. 1273) were used inside ventilation flues, however, to increase ventilation as at Glasgow Fever Hospital in 1867. The "sun burner" devised by A. King of Liverpool, was positioned below ceiling flues to provide both light and ventilation. In about 1866 the Reading Room of Glasgow Royal Exchange was lit by 8 groups each of four No. 3 Fishtail burners, 4 groups each of five No. 3 fishtails, and 4 groups each of 12 jets. These were the same simple burners that were available in the 1820s, but later that year the Reading Room changed to 2 sunlights each with 100 burners, and 5 groups each with 18 sun-light burners. Dissatisfaction was growing over the candlepower of the old types of burners. W. Johnstone, "Gas Lighting", Proc. Glasgow Architect. Soc. (1865-7), Vol. VI, p.122. S.A. Harris, Gas Supply of N. Merseyside (1956), op. cit., p. 72.

pipe close to consumers' burners proved quite unpopular in Scotland. Glasgow City and Suburban company¹ in 1849 tried unsuccessfully to promote Lowe's process² in which a sponge held vapourizing naphtha near burners to increase luminosity. Gurney's 'Bude Burner'³ which passed the town gas through special purifiers and then into a well-ventilated 'Argand' burner was first used in Scotland at A. Rutherglen's new bookshop⁴ in Buchanan Street, Glasgow, in October 1842. In 1845 it was introduced into Dundee⁵ by Messrs. Sutherland and Murdoch, gas fitters in Reform Street. The local press welcomed it as a better light for harbours, railway stations and shops, but it was not widely adopted. Similarly Livesey and Kidd's 'Albo Carbon Light' using vapourizing naphthalene sticks, was popular in England but not in Scotland despite experiments conducted in Edinburgh⁶ during 1879 which showed its value. Six lights there were carburetted from one 'reservoir', which raised the illuminating power of a No. 1 burner consuming two and a half cubic feet per hour, from 8.5 candlepower to twenty candlepower. With gas at four shillings, the carburetting achieved for one shilling and sixpence produced illumination

1. Naphtha was supplied to the company by James Young from Riddings. J. Butt, "James Young" (1963), op. cit., pp. 59, 60, 65.

2. George Lowe 1832 (Pat. 6276).

3. Sir Goldsworthy Gurney (1793-1875), who introduced the Bude Light into the Houses of Parliament where he was superintendent of lighting (1854-63), was inventor of the oxy-hydrogen blowpipe and 'Drumond' lime-light, but better known for his steam-engine improvements (1823) and 'steam-jet'. The 'Bude Burner' used 2 or more annular tubes as a series of concentric 'Argand' burners all in one lamp. Dictionary of National Biography 1908, VIII, p. 801. J.G.L., 9/3/1875, p. 336. Mechanics Magazine 1842, Vol. 36, pp. 419, 392. S. Everard, Gas, Light and Coke Company (1949), pp. 107, 179. E. Ronalds and T. Richardson, Chemical Technology 1855, Vol. I, Part II, p. 671.

4. Glasgow Chronicle, 26/10/1842.

5. Stirling Journal, 10/10/1845, quoting the Dundee Courier.

6. J.G.L., 9/9/1879. G. Lunge, Coal Tar and Ammonia (1909) 4th Edn., op. cit., pp. 657, 661.

equivalent to gas worth twelve shillings. Most consumers, however, remained contented with mains supplies.

Because of the difference in gas quality, Scottish burners were constructed with a smaller orifice than those in England, while Scottish pipes and fittings were also designed to carry smaller quantities of the richer gas. The wide burners used in London or Birmingham were unsuitable for Scottish gas and gave a smoky flame and little light.¹ English gas engineers were largely unaware of the difference in fittings, and one published his mistaken views in 1875, claiming that because Arbroath supplied twenty eight candle gas, "we have little doubt that, as a consequence, the ceilings of houses in which it is burned are as black as the roof of a Highland bothy".² The problem of enlarging pipes and fittings was one reason for the reluctance of Scottish gas companies to reduce the candlepower of gas during the 1870s as supplies of good cannel coals dwindled. Instead, mixtures of oil-shale and cheap splint coal, or oil-gas enrichment, were used to maintain high candlepower.³

Expensive coal and municipal gas undertakings produced renewed concern over the efficiency of gas fittings in the 1870s. Inefficient burners used in Glasgow in 1874 gave only sixteen candlepower, or sixty per cent efficiency compared to the quality of gas, which caused a loss equal to £130,000 per year by incomplete combustion.⁴

1. Dr. W. Wallace, Proceedings of the Royal Philosophical Society of Glasgow 1874, op. cit.,

2. Editorial, J.G.L., 20/7/1875.

3. Vide supra p. 447 et seq.

4. Dr. W. Wallace, Proceedings of the Royal Philosophical Society of Glasgow 1874, op. cit., c.f. A Glasgow fish-tail burner using 4 cu.ft. gas per hour, in 1865 gave only 7 candlepower; and any increase of pressure reduced the quantity of light. W. Johnstone, "Gas Lighting", Proceedings of Glasgow Architectural Society 1865-7, Vol. VI, op. cit.

Three years later, "ordinary burners" used in England gave only five or six candlepower from a mains supply of fifteen candlepower, and many people had abandoned gas in favour of oil or candles due to "the ignorant gas-fitters on the one hand, and the ignorant users on the other".¹

In 1887, G.R. Hislop² estimated that twenty five per cent of Scottish gas sales were lost by incomplete combustion. T. Newbigging gave the same fraction of Britain's entire output, of about 92,637 million cubic feet a year which, at the minimum price of three shillings, was an annual loss of £3,473,887. The Dundee corporation gas engineer, B.M. McCrae, in reply to complaints of poor gas in 1876, explained that because of poor fittings, which were the consumer's choice and responsibility up to that time, on average "nearly one half of the light contained in the gas is never seen by the gas consumer".³ Dundee lost gas worth at least £15,000 a year by incomplete combustion.

The size of the gas-burner, and the pressure of gas at the burner, were critical factors. Experimentally McCrae showed that with gas of about thirty candlepower, the standard burners, Numbers 1, 2 and 3, only converted up to two thirds of the available illuminating power, whilst a correct burner could provide more light even if the

1. R. Wilson, Common Sense for Gas Users, being A Catechism of Gas Lighting for Householders, Millowners and other Large Consumers, Gas Fitters, Architects, Engineers &c. (1877), p. 14.

Because higher quality gas required greater skill in designing fittings, Wilson concluded that in England, "at the same price, 16 candle gas is preferable to 20 candle gas ... with the present state of knowledge found amongst gas fitters".

2. G.R. Hislop (Paisley). J.G.L., 26/7/1887.

3. B.M. McCrae, public lecture "The Economic Use of Coal Gas for Lighting Purposes", J.G.L., 1/2/1876, p. 164.

Dundee provided a rich gas of 26 to 28 candlepower, but many gas managers were seriously considering a reduction to 20 candlepower, using cheaper coals.

Dundee mains pressure was $\frac{14}{10}$ ths. inch.

price of coal caused the mains supply to be reduced to twenty candle-power.

Table 6.49 Efficiency of Gas Burners Used in Dundee (1876)

Type of Burner	Gas Pressure (Tenths Inch)	Gas Consumed (Cu.ft. Hour)	Light Produced (Standard Candles)	Light at 5 Cu.ft. Hour	Mains Supply Candle-power	LOST Candle-power
Bray's No. 1 Union	10	2.2	4	9	29	20
" No. 1 and No. 6	10	2.2	11.5	26.1	29	2.9
Bronner Burner	10	2.2	14	22	28	6
Bray's Iron No. 6 Burner	3	2.2	11.5	26.1	29	2.9
" No. 0 "	14	2.0	3.5	8.75	29	20.25
" No. 1 "	14	2.5	6.5	13	29	16
" No. 2 "	14	3.5	13	18.6	29	10.4
" No. 3 "	14	5.5	26	23.6	29	5.4
Bray's 0 Batswing	14	2.5	6	12	29	17
" 1 "	14	3.25	10	15.4	29	13.6
" 2 "	14	4.5	16	17.7	29	11.3
" 3 "	14	5.0	24	24	29	5
Bray's Iron No. 4 Union	5	2.5	9	18	27	9
" No. 3 Union	5	1.6	5.5	17	27	10
Olding Double-Slit Batswing	5	2.9	15	26	28	2
No. 1 Union Iron and large Steatite Batswing	14	2.6	13.5	26	28	2

Source:- Experiments by B.M. McCrae, J.G.L., 1/2/1876, p. 164.

One additional complication in explaining "candlepower" to consumers was the fact that standard 'candlepower' defined by the government involved a test in which five cubic feet of gas was burned per hour, which was far in excess of the consumption in consumers' burners. All figures had to be extrapolated to that standard rate, at which the candlepower of the mains gas supply was stated. At normal one inch pressure, or 2.2 cubic feet per hour consumption, for example, a Bray's No. 1 Union Burner produced four candlepower, and a No. 6 produced twelve candlepower. At the standard rate of five cubic feet per hour they were assumed to give nine candlepower and twenty six candlepower respectively, and their efficiency could then be judged against the mains candlepower, of twenty nine by statutory tests at Dundee.

McCrae advised consumers to use a regulator¹ on their service pipes to give a constant pressure, and to use large burners correctly

1. If gas pressure was too low at the burner, light decreased because the carbon particles were not heated to full incandescence; excessive pressure forced the carbon particles too rapidly away from the heat, with the same result. By 1872 a 'Regulator' was estimated to save consumers 15 to 20% on consumption. The regulator was a miniature 'governor', not widely used by ordinary consumers or public lights until the 1870s. One of the earliest "gas regulators" was developed in 1838 by James Milne of Edinburgh, for large factories where great problems were caused by the increase in gas pressure of $\frac{1}{10}$ inch per 10 feet vertical rise.

Minutes of Proceedings of Institutions of Civil Engineers, Vol. 1, 19/5/1840. 1840 British Association Handbook, Part II, p. 213.
The Civil Engineer and Architect's Journal, November 1840, p. 386.
 B.M. McCrae, J.G.L., 1/2/1876, p. 164. King's Treatise (1882), op. cit., Vol. III, pp. 44-55. 'Lumen', Gas and All About It (1872), p. 11. c.f. Armstrong gives 1880 as the date of early consumers' governors, but in Glasgow, "economizers" and "regulators" of varying efficiency were on sale by the mid 1860s, and consumers could have them tested by officers of Glasgow Corporation. W. Johnston, "Gas Lighting", Proc. Glasgow Architect. Soc. 1865-7, Vol. VI.
c.f. E. Armstrong, "Important Dates in the Development of Gas Lighting", J. Terrance, Ed., Notebook for Gas Engineers (1948), op. cit., p. 47. Vide supra pp. 90, 340

adjusted for that pressure.¹ The eight most commonly used burners in Dundee in 1876 consumed 3.6 cubic feet per hour, and produced an average 13.2 candlepower. At five cubic feet per hour they would have produced seventeen candlepower, a total wastage of twelve candlepower compared to the mains supply of twenty nine candlepower.

As demand for gas increased, distribution problems became a recurrent source of annoyance to consumers deprived of adequate supplies,² and demanded capital expenditure on longer mains pipes by the Companies. In 1863 inadequate supplies produced complaints by several Galashiels consumers,³ including Sanderson and Murray's skinworks, and A. Murray's joinery shop. The workshops of A. Herbertson and Son used up to forty lights from a half inch diameter main when a two inch pipe was required. The company agreed to finance the alteration, as well as replacing a one and a half inch pipe by one of two and a half inches from Ladhope Mill to the Brewery, followed by a two inch instead of a one and a quarter inch pipe to Sanderson's skinworks. During 1877-8 manufacturers in Galashiels⁴ consumed forty per cent of all gas produced, and their complaints of poor supply led to an extensive programme of mains enlargement. Again in 1880 the company spent £200 on a larger main to Messrs. Dicksons Mill and the King Street area,⁵ following complaints over the supply.

1. In 1895, Terrance reiterated that complaints of "bad gas" were still caused mainly by poor fittings and inadequate concern over gas pressure, but believed the problem was less in England than in Scotland. Rich Scottish gas was supplied at $\frac{5}{10}$ ths. inch pressure or more to reduce smoking, whilst English 16 candle gas could be supplied at $\frac{3}{10}$ ths. inch. High pressure combined with small gas-burners greatly increased the overall loss by incomplete combustion. D. Terrance (Middlesbrough), "Modern Gas Lighting", Proceedings of Cleveland Institute of Engineers 1895, pp. 290, 298.

2. Vide infra pp. 956, 1131

3. S.R.O., Galashiels Minute Book, op. cit., 3/11/1863.

4. Ibid., 26/6/1878.

5. Ibid., 4/5/1880.

At Annan,¹ the Port Street area in 1874 was supplied by six inch diameter mains laid in 1856, though consumption had risen from one to four million cubic feet. The factories of Messrs. Pool and Nicholson, and Foster & Story were expanding, yet Welldale Mill was "not half supplied" with gas, and nearby consumers "had no light whatever" while it was working. New eight inch pipes had to be laid. Similar problems arose in many towns by the 1870s. Cupar² gas company in 1872 also found "a considerable number of the Service pipes" badly corroded and began a comprehensive scheme of replacement.

In the 1880s, as electricity encroached upon gaslight, gas undertakings provided increased consumer advice, and even free gas-burners.³ Paisley⁴ gasworks first issued free burners in 1883, individually chosen to match the pressure at the consumer's house, and these saved about ninepence per 1000 cubic feet on gas sold at three shillings and ninepence. The Paisley manager advised other gasworks to test the pressure at every lamp pillar, and then deduct 2.5 tenths of an inch for friction in the gasmeter, and 1.5 tenths for service pipe friction, before advising nearby consumers on the burners to use. This was a great change of attitude compared to the apparent indifference of gas managers towards consumer problems up to the 1870s. Even the relationship of mains pressure to combustion was examined

1. S.R.O., Annan Minute Book, op. cit., 20/2/1874.

2. S.R.O., Cupar Minute Book, op. cit., 15/3/1872.

c.f. Invergowrie and the west end of Dundee grew very rapidly in the early 1880s but had a defective supply until 14 inch dia. mains were laid in 1884. Bridge of Weir grew so rapidly in the 1880s as a residential centre for commuters to Glasgow, Paisley and Greenock, that gas supply was quite inadequate in 1889-91. J.G.L., 14/10/1884, 17/11/1891.

3. e.g. Coatbridge and Milngavie, J.G.L., 14/8/1888, 18/6/1889.

4. G.R. Hislop (Paisley), "Gratuitous Supply of Burners by Gas Companies", N.B.A.G.M., 1887; J.G.L., 26/7/1887.

in detail.

Table 6.50 Mains Pressure suitable for Various Candlepowers of Gas Supply

Tenths Inch Pressure	Candlepower	Tenths Inch Pressure	Candlepower
4	20 to 22	7	28 to 29
5	23 to 25	8	30 to 31
6	26 to 27		

Source:- J.G.L., 26/7/1887.

Regenerative gas-lamps produced an important increase of candlepower during the 1880s. In 1886 J. Horton¹ opened a Glasgow factory producing 1000 regenerative lamps a week, which were being increasingly used in "shops and other places of public resort".² New gas-burners evolved so rapidly in the 1880s that members of the Scottish Society of Antiquaries³ urged the need for a national collection of old burners. Like the Siemens regenerative furnace and J.B. Neilson's Hot Blast, regenerative lamps used a pre-heated supply of air to the burner. Argand lamps with a double-glass cylinder to utilize waste heat were tried by W.R. Bower⁴ in 1854, but problems with glass breakage were not solved until the regenerative lamp of F. Siemens in 1879.

An important stimulus for the improvement of consumer service was the growing intensity of competition from paraffin-oil lamps during the 1880s. In 1880 Kennoway⁵ gas company in Fife reduced the price from ten shillings to nine shillings and twopence because of

1. J.G.L., 10/8/1886.

2. J.G.L., 20/12/1887.

3. Gas World, 14/1/1888.

4. Gas World, 25/6/1892. D. Macfie (Edinburgh), "Regenerative Gas Lamps", Gas World, 28/1/1891.

5. J.G.L., 11/5/1880. c.f. Public lamps at Culross, Clackmannanshire, used paraffin, J.G.L., 16/12/1879.

the loss of consumers to paraffin. At Comrie, where gas had been reduced from eleven shillings and eightpence to ten shillings in 1877, the severe winter of 1880-1 "prevented the supply of gas for several weeks"¹ which compelled consumers to purchase paraffin lamps. That weather caused a series of minor explosions in Edinburgh where, like Glasgow,² the low pressure caused by ice in pipes forced many consumers to use candles and oil lamps. Bridge of Weir³ found that many consumers changed to paraffin during 1881, as did Old Kilpatrick⁴ where gas cost eight shillings and fourpence.

Paraffin enjoyed another boom⁵ in 1887, when the competition forced Coupar Angus⁶ to reduce gas from six shillings and fivepence halfpenny to six shillings and a halfpenny, though in Dalry⁷ the loss of consumers obliged the company to raise gas from four shillings and sevenpence to five shillings to meet overheads. Johnstone Police in 1887 reported the loss of 100 consumers, and a decrease of 86,000 cubic feet in consumption by manufacturers, because of paraffin which was also "making considerable headway in Glasgow, and over the surrounding districts to which Glasgow Corporation gas is distributed"⁸ By 1891 oil rivalry appeared greatest in small towns distant from the coalfields, and Robertson⁹ saw the principal cause in the fact that

1. Comrie was a small company (£1700 stock), J.G.L., 9/8/1881.

2. J.G.L., 25/1/1881, 1/2/1882.

3. J.G.L., 19/4/1881.

4. J.G.L., 8/3/1881.

5. North Berwick changed to paraffin harbour lamps in 1886, J.G.L., 12/10/1886.

6. J.G.L., 12/7/1887.

7. J.G.L., 26/7/1887.

8. J.G.L., 20/12/1887.

9. D. Robertson presidential address to N.B.A.G.M., Gas World, 25/7/1891.

"a consumer can buy a bottle of oil for one and a half or two pence, but a quarter's gas account would appear ruinous to him".

Street lighting was a frequent source of public disputes.¹ Ayr company² in 1847 agreed to supply gas at five shillings in return for the right to open trenches in public streets, and that low price persisted until 1860, after which the discount was thirty per cent, reduced to five per cent only from 1878. Glasgow residents in 1877 believed every gaslight to be "better than two policemen",³ and criticized the Corporation over inadequate lighting compared to Leeds which required 340 policemen whereas Glasgow had 1000 policemen.

Table 6.51 Glasgow Public Lighting Compared to Manchester and Leeds (1877)

Town	Population	Public Lamps		Cost per Lamp	
		Number	Cost (£)	s.	d.
Glasgow	550,000	8,010	8,600	21	6
Manchester	200,000	10,762	18,823	35	0
Leeds	291,000	6,000	12,000	40	0

Source:- J.G.L., 2/1/1877, p. 7.

Millport gas company⁴ on Cumbrae, under the chairmanship of Lord Glasgow the Chief Magistrate, experienced particularly heavy losses upon public lighting. Up to 1882 a charge of twelve shillings per year was made for each lamp, with a No. 3 burner, but the loss on each was about six shillings equal to £600 since the burgh was formed. From 1882 meters were introduced and a five per cent discount agreed upon, but the Police refused to pay more than sixty pounds of the first

1. E.g. Aberdeen vide supra p. 1124

Vide infra pp. 1785 et seq.

2. J.G.L., 20/8/1878.

3. By 1883 the estimate was raised to be "equal to half-a-dozen policemen", J.G.L., 2/1/1877; 16/1/1883.

4. J.G.L., 11/9/1883.

bill for seventy nine pounds, and similar events were probably quite common elsewhere. Cupar¹ in Fife, lost large quantities of gas because the Police employed only one lamplighter, who consequently had to begin the lighting round during daylight.

The Vale of Leven company² raised gas from five shillings to five shillings and fivepence for all consumers in 1879, to cover the cost of providing public lights in Alexandria, Bonhill and Jameson. By 1884 the "free" gas which they supplied³ to public lights equalled £400 per year. "Free" gas to public lamps, which raised the cost to all consumers as at Mid and East Calder⁴ where the company charged eight shillings and fourpence in 1879, negates any comparison made between various towns in the late nineteenth century based only upon the retail price of gas. Elsewhere, public lighting was a heavy municipal expense. Although Edinburgh still extinguished⁵ most street lamps during the period of full moon even in the 1870s the city budget for lighting,⁶ about half of which was the cost of gas, rose from £11,586 in 1875 to £12,690 by 1879. Dundee Police⁷ in 1879 paid £5000 a year for gas, and even Arbroath⁸ paid £415 for 446 lamps at eighteen shillings and sevenpence halfpenny each. Gas companies⁹ favoured public lamps lit all night or twelve hours a day, 4380 hours per year, but when the hours were reduced or ceased during moonlight the total decreased to 2200 hours per year and by causing

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1. Town population 5000. J.G.L., 30/9/1884.
 2. J.G.L., 21/10/1879.
 3. J.G.L., 3/6/1884.
 4. J.G.L., 12/8/1879.
 5. J.G.L., 10/9/1878.
 6. J.G.L., 19/8/1879.
 7. J.G.L., 22/7/1879.
 8. J.G.L., 16/9/1879.
 9. King's Treatise (1879), op. cit., Vol. II, p. 275.

a variation in demand this produced considerable inconvenience for the manufacturer.

Around 1860, the public lights in most Scottish towns¹ still had a single jet, with a four inch flame, producing less than six candle-power from one cubic foot gas per hour. The situation remained virtually unchanged until the threat from electricity.² Glasgow in 1877 had 7916 street lamps with jets, "rat-tail burners", using 41,428,000 cubic feet annually.

Table 6.52 Glasgow Public Lighting with 'Jet' Burners in 1877

5155 at 1 cu.ft. hour, 2468 at 2 cu.ft., 285 at 3 cu.ft., 8 at 4 cu.ft.

Source:- Bell and Paton, Glasgow - Its Municipal Organization (1896), op. cit., p. 158.

The larger burners were entirely confined to the city centre.

Earlier, in 1868, only fifteen per cent of public lights were used at all in summer, and most of the burners used only one cubic foot per hour. When the electric light was exhibited at Glasgow railway station in 1879, the Corporation replaced many burners using three cubic feet per hour, by batwings using ten cubic feet, along the main streets. By 1885 many lamps along Argyle Street were altered from a single burner using three cubic feet, to a cluster of three burners each using twenty cubic feet, a total of ninety cubic feet per hour.

Unsuccessful experiments³ were also made during 1879 with Sugg's

1. J.G.L., 10/11/1857. c.f. Glasgow in 1837 had 47 street lights with 3 jets, and 2050 with only one jet. J. Cleland, Rise and Progress of Glasgow 1841-1862 (1862), op. cit., p. 53.

2. In 1881 street lights in Kirkcaldy only consumed on average $2\frac{1}{2}$ cu.ft. per hour, and in Edinburgh, $1\frac{1}{4}$ cu.ft. Glasgow public lights were vastly improved after 1879 by R. Hamilton, the new Inspector of Lighting. J.G.L., 20/8/1881, 24/11/1885.

3. "Public Lighting Statistics of Glasgow" J.G.L., 24/11/1885, p.98.

Argand burners each using thirty cubic feet per hour, Bray's lanterns in which groups of flat-flame burners used fifty cubic feet per hour, and Siemens Regenerative lamps using forty cubic feet and eighteen cubic feet per hour. Other towns made similar trials, and a vast improvement was made in street lighting as a result of the electricity threat.

Table 6.53 Glasgow - Improved Public Lighting with Larger Burners, in 1896.

4 using 1 cu.ft. hour, 8973 at 2 cu.ft., 3827 at 3 cu.ft., 237 at 5 cu. ft., 260 at 6 cu.ft., several at 6 to 20 cu.ft., 1 at 20 cu.ft.

Source:- Bell and Paton, Glasgow - Its Municipal Organization (1896), op. cit.

The Sugg,¹ Bray² and other very large open-flame burners proved too expensive and were discontinued in Glasgow, but other towns also tried the same remedy to combat electricity.³ Dundee⁴ in 1879 installed some sixty candlepower Sugg Argands, whilst Hawick⁵ tried eighty candlepower Brays burners and fifty candlepower Argands in the town centre. During 1880 Aberdeen⁶ experimented with eighty and 120 candlepower Brays burners, and Leith⁷ with a 220 candlepower Sugg's London Argand using thirty five cubic feet gas, worth twopence, per hour. Edinburgh⁸ installed some burners consuming fourteen cubic feet per hour in 1881, and in 1882 Dalkeith⁹ replaced the old, low

1. Obituary of William Sugg (1832-1907), Transactions of the Institute of Gas Engineers 1907, pp. 407-10.

2. Obituary of George Bray (1841-1905) of Leeds, Transactions of the Institute of Gas Engineers 1905, p. 355.

3. King's Treatise (1882), op. cit., Vol. III, p. 161.

4. J.G.L., 11/2/1879, 24/4/1879.

5. J.G.L., 22/4/1879.

6. J.G.L., 6/1/1880.

7. J.G.L., 2/3/1880.

8. J.G.L., 13/12/1881.

9. J.G.L., 29/8/1882.

candlepower cockscur burners with Milne's Composite Burners and Union Jets in the public lamps.

Electric public-lighting nevertheless commenced in Glasgow¹ in 1890. Two developments, however, saved gas street-lighting from a debacle : incandescent mantles and the labour-saving device of automatic lighting.² Glasgow³ in 1893 was perhaps the first European city to use Welsbach mantles for public lighting, and had 164 in use by 1896. Many Scottish towns followed this example. Selkirk⁴ police installed two incandescent lamps at the Scott monument in 1896, Galashiels⁵ company placed three equal to 600 candlepower in the Market Square in 1899, and Cupar⁶ first installed four in 1900.

Automatic lighting by Dobereiner's principle,⁷ using platinum,

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1. In 1895-6 £2850 was spent on electric public lighting; with 112 lamps around Sauchiehall and Argyle streets by 1896. J. Gunnison, Ed., Third Statistical Account - Glasgow (1958), op. cit., p. 145.
 2. D. Robertson (Dunoon) Presidential address N.B.A.G.M. 1904, p.20.
 3. Bell and Paton state that 10 were used in the autumn of 1893, yet Gaster and Dow claim Welsbach mantles were first used in street lights in Paris in 1894, soon followed by Ipswich, Winchester, Hamburg, Wiesbaden and Budapest; in 1896 Liverpool, Swansea and Dublin; followed later by London and Birmingham. L. Gaster and J.S. Dow, Modern Illuminants and Illuminating Engineering (1915), p. 17. J. Bell and J. Paton, Glasgow - Its Municipal Organization and Administration (1896, Glasgow), p. 158. "Incandescent Street Lamps in Glasgow", Gas World, 10/11/1894.
 4. S.R.O., Selkirk Minute Book, op. cit., 19/11/1896.
 5. S.R.O., Galashiels Minute Book, op. cit., 7/11/1899.
 6. S.R.O., Cupar Minute Book, op. cit., 11/10/1900.
 7. W. Weekes (Sandwich), "Automatic Lighting", Mechanics Magazine 1839 (Vol. 31), p. 74.
J. Beck (Lambeth), "Mode of Lighting Gas Lamps by Electricity", Mechanics Magazine 1838-9 (Vol. 30), p. 407.
Strode's self lighting burners of 1849 used 'Dobereiner's Light' - coal gas on spongy platinum produced heat for ignition, vide Practical Mechanics Journal 1849-50, p. 97. Electric batteries and platinum wire were used in 1859 to ignite gaslights in Edinburgh University, vide J.G.L., 10/5/1859.
Original research by Johann Wolfgang Dobereiner (1780-1849) vide G. Lockman, The Story of Chemistry (1960), p. 212.

was first proposed in 1826, but in 1873 electric ignition was still on an experimental basis at several Scottish gasworks.¹ Success meant a great saving, both in lamplighters' wages, and in the gas which was wasted by the time taken to light and extinguish lamps. A reduction in the breakage of gas-mantles and glass chimneys and burners also became an important factor. Nairn in 1888 had one of the earliest Scottish systems using a 'pressure wave' along the mains to actuate electric ignition.

By the 1900s, two main systems were available, the clockwork² 'Unit System' which allowed a time to be set on each individual lamp for ignition and opening or closing the gas valve, and the 'Collective System'³ whereby a change of pressure on the gas mains caused all lamps to be lit at once. The unit system was best suited to hilly towns, or leaky gas mains, and did not interfere with 'district governors'.⁴ Nairn⁵ used this system after finding the other unreliable, as did Glasgow⁶ from fear of chaos which could result from a pressure wave. There, gas mantles lasted sixty seven days instead of forty five with hand lighting, and a lamplighter could clean 240 lamps instead of manually lighting and cleaning 120. Labour costs were halved.

1. By Malam at Dumfries, Foulis at Glasgow, and Smith at Ayr.

2. The Unit system included 'Gunfire', 'Horstman', 'Simplex', and 'Automation' designs.

3. The Collective System included 'A. & M.', 'Bamag' and 'Rostin' actuators, L. Gaster and J.S. Dow, Modern Illuminants and Illuminating Engineering 1915, p. 64.

4. Vide supra p. 340

5. G. Keillor, "Automatic Street Lighting and Extinguishing", N.B.A.G.M., 1912.

6. In 1907 Glasgow spent £480 on 'Horstman' controllers for 240 lights as an experiment. Lamplighters were being paid £68 a year to handle 118 lamps, and started work an hour before dark, thus wasting gas. Glasgow City Archives, Glasgow Reports, 1907-8, p. 706.

Broughty Ferry¹ public lighting in 1912 used three pressure waves of $45/10$ inch for two minutes compared to normal mains pressure of $30/10$ inch. The first wave lit all lamps, the second extinguished the evening lamps, and the third wave extinguished all-night lamps. For a total cost of £1775, the system gave a saving of £110 per year. Many small gasworks like Kelty and Cowdenbeath also used the pressure wave system, with a normal exhaustor to boost pressure. It was demonstrated at Glasgow gas exhibition in 1906, and several companies like Stonehaven took advantage of the benefits.

The total cost of street lighting made municipal authorities one of the largest consumers, and increased their interest in municipal control of gasworks.²

Table 6.54 Expansion of Public Lighting in Glasgow 1868-94

Date	Public Lamps		Common Stairs		Private Streets		Total Cost £
	Number	Gas (Million cu.ft.)	Lamps Number	Gas (Millions)	Number Lamps	Gas (Millions)	
1868			15,335				24,650
1884	*12,766	96.4	27,279	72.6			
1896	13,676	129.5	39,029	102.2	4,204	25.3	30,456

N.B. 10,657 public lamps by 1870. * Public and Private street lamps.

Sources:- J.G.L., 24/11/1885, p. 928. Vide infra pp.340, 1263

Third Statistical Account - Glasgow (1958) op. cit.,
p. 557.

1. At Broughty Ferry, 650 public lamps were fitted with Bray's horizontal inverted incandescent burners using $2\frac{1}{2}$ to 4 cu.ft. per hour, and A. & M.' actuators. An electric boosting pump was supplied by Messrs. Bryan Donkin & Co.

2. Glasgow Police Act (1866) made the police responsible for lighting common stairs and private as well as public streets, though in Edinburgh common stairs were lit privately up to 1891, and had only 7982 stair-jets in 1898 (replaced by incandescent burners in 1909). J.G.L., 24/11/1885, p. 928.

St. Cuthbert's Monthly Journal, April 1959. (Edinburgh Ref. Lib.)

Electric lighting appeared to seriously threaten gas in 1846, and thereafter provided a convenient excuse for high dividends in some gas companies because of the "risk" of obsolescence. J.B. Lindsay¹ (1799-1862) demonstrated electric lighting on a small scale in Dundee in 1835, filament lamps were developed in 1841 by de Moleyns and in 1845 by King, and T. Wright of London. When Green and Strait² installed electric light in 1846 at the National Gallery, Hungerford Bridge and Duke of York's column in London, shares in the London gas companies slumped.³ Thereafter, however, electricity was used only on a small scale, with a magneto current for lighting in France in 1857, and Faraday's electric light at Dungeness lighthouse in 1857.

A Stock Exchange⁴ panic amongst gas shareholders in 1878 heralded the return of the spectre, and although the Journal of Gas Lighting⁵ believed "the strangleholds of gas companies are shops and houses" as electricity was only suitable for large buildings, within a year far less objectionable electric glow-lamps had been devised by Swan in England and Edison in the United States. During 1878 G. Lowden (1825-1912) sold the first reliable dynamos in Dundee, Edinburgh and Glasgow, and the following year a proposed Greenlaw Gaslight Company⁶

1. A.H. Miller, James Bowman Lindsay and other Pioneers of Invention (1925, Dundee), pp. 21, 91. B. Lenman and K. Donaldson, "The Scottish Linen Area 1850-1921", Business History 1971, Vol. XIII, op. cit., p. 16.

2. G. Dodd, The Curiosities of Industry and Applied Sciences 1857, Chapter 6. L. Gaster and J.S. Dow, Modern Illuminants and Illuminating Engineering (1915), pp. 15, 75.

3. Liverpool gas company took trouble to evaluate electricity in 1848, but did not take the competition seriously until 1878, and found it severe in the 1890s. S.A. Harris, The Development of Gas Supply of North Merseyside (1956, Liverpool), op. cit., pp. 61, 83-5, 99.

4. Commercial History and Review of 1878 (Supplement to The Economist), Vol. 37, 8/3/1878, p. 38.

5. J.G.L., 3/9/1878, p. 341.

6. J.G.L., 4/2/1879.

was abandoned because of the electricity threat and the collapse of the City of Glasgow Bank. Montrose¹ town council in 1881, like several others,² revoked a decision to purchase the local gasworks, out of apprehension over electricity. Several private electrical installations were made in Scotland³ in 1878, and despite a number of failures⁴ during the 1880s, electricity was well established⁵ by the 1890s and municipal generating stations⁶ were under construction.

Electricity was first produced on a small scale, and the gas industry had about ten years in which to develop new markets. Feverish activity occurred in the early 1880s, but although showrooms, hire-purchase facilities, and discounts on gas used for heating could be introduced without excessive difficulty, survival based upon the increased use of gas cookers and gas engines was only possible because

1. J.G.L., 27/12/1881.

2. E.g. Helensburgh council in 1880 when Provost Stuart proposed acquisition. D. Macleod, A Nonagenarian's Reminiscences of Garlochside and Helensburgh (N.D.), p. 179. (Helensburgh Ref. Lib.).

3. E.g. December 1878, Rapieff electric light at Waverley Market, Edinburgh; electric lighting at Criterion Restaurant, Glasgow, and at a large Greenock sugar refinery. November 1878 Helensburgh council balked at the purchase of the local gasworks, from fear of the consequences of electric lighting. J.G.L., 5/11/1878, 10/12/1878, 17/12/1878.

4. And successes, e.g. 1883 Theatre Royal, Edinburgh, lit by the Electric Carbon Storage and Apparatus Manufacturing Company of Scotland; 1883 Messrs. Pullar of Perth used electricity at a new factory; 1884 Caledonian Railway Co. used electric light at Grangemouth Docks, and Central Station in Glasgow. J.G.L., 29/5/1883, 18/12/1883, 1/1/1884. Vide infra p. 1792

5. Journal of the Iron and Steel Institute 1902, Vol. II, pp. 220-63, applications of electricity; J.F. Rowan, "Applications of Electricity to Mining Operations", a historical survey, Mining Institute of Scotland 1886-7, Vol. 8, pp. 273-307. J.E. Shaw, Ayrshire 1745-1950, A Social and Industrial History (1953), p. 122.

6. Edinburgh corporation supplied electricity to principal streets in 1895. T. Adams, Edinburgh 1329-1929 (1929, Edinburgh), p. 175. H.A. Mavor, "On Public Lighting by Electricity", Proceedings of the Royal Philosophical Society of Glasgow (1889-90), Vol. XXI, p. 142.

innovators had already spent many decades of their own time and money in improving and developing these. Prepayment meters which opened new markets among the poorest classes, were not available until the 1890s, and the incandescent mantle which enabled gasworks to use much cheaper coals, was also not perfected until the 1890s. Both had great long term significance, but neither was available at the most critical stage of competition. The extent to which gasworks were able to continue expansion in the 1900s despite very rapid development of electricity, may be illustrated indirectly by local taxation receipts from these enterprises.

Table 6.55 Comparison of Growth in Gas and Electricity Industries 1890-1914

<u>Date</u>	<u>Scotland</u> (£ thousands)		<u>England</u>	
	<u>Gas Receipts</u>	<u>Electricity</u>	<u>Gas</u>	<u>Electricity</u>
1898-90	-	-	3867	-
1890-1	44	-	4227	-
1891-2	44	-	4297	8
1892-3	1151	0.5	4334	21
1893-4	1162	21	4511	44
1894-5	1238	25	4751	124
1895-6	1227	49	4719	195
1896-7	1273	66	4864	330
1897-8	1352	89	5091	427
1898-9	1481	112	5407	600
1899-1900	1611	155	6036	910
1900-1	1820	218	6856	1272
1901-2	1848	284	6966	1671
1902-3	1841	337	7169	1881
1903-4	1744	384	7386	2266
1904-5	1713	435	7093	2567
1905-6	1757	471	7073	2854
1906-7	1833	518	7150	3095
1907-8	2063	568	7649	3404
1908-9	1907	563	7488	3491
1909-10	1952	579	7484	3663
1910-11	1988	626	7805	4023
1911-12	2072	660	8029	4382
1912-13	2311	718	8591	4822
1913-14	2353	779	8716	5369

Note - Based upon Local Taxation Receipts; assumes equal tax charges on both.

Source:- W. Page, Commerce and Industry (1919), op. cit., pp. 65-6. See also B.R. Mitchell and P. Dean Abstract of British Historical Statistics (1962, Cambridge) pp. 414, 422

Expensive gas and very low daytime pressure¹ in gas mains prevented the early development of gas cookers or heaters.² By 1820 gas was used in parts of London for keeping meat warm and boiling water, for space heating, for heating copper-plates for printing, and by jewellers for soldering.³ All used luminous gas jets, but the aerated flame, or "Bunsen-burner" flame, provided a far greater intensity of heat and was first devised in 1825 precisely thirty years before Bunsen⁴ produced his successful, simplified design of 1855.

1. Annan first provided daytime pressure in the mains in 1866, following a petition by 66 consumers, but in 1884 St. Andrews allowed only 1 inch pressure by day compared to 1.8 inches at night; Port Glasgow did not raise day pressure from 0.9 to 1.4 inches until 1886, and Stranraer still refused reasonable daytime pressure in 1898. S.R.O., Annan Minute Book, op. cit., 25/5/1866, 31/5/1866. J.G.L., 22/6/1886, 28/9/1884.

2. Maiben of Perth in 1813 designed one of the first gas fires - (vide supra p. 74). S. Clegg's account of gas cooking, at a private gasworks near Liverpool in 1824 has been accepted as the earliest gas used for cooking, but the full quotation belies this and, because the information on Murdoch is incorrect, throws doubt on Clegg's memory:- "In 1792 Murdoch frequently cooked chops and steaks over gas jets, and, in 1824, I perfectly well remember men at Aetna Iron Works, near Liverpool, making a gas cooking apparatus, which consisted of a gun barrel turned backwards and forward and pierced with small holes". "Gun barrel" in this context could simply mean "gas pipe".

Vide

S. Clegg, "Gas Cooking Stoves", J.G.L., 10/4/1851, p. 68. S.A. Harris, Gas Supply of North Merseyside (1956, Liverpool), p. 73. D. Chandler, Rise of the Gas Industry (1949), p. 76.

3. F. Accum, Description of the Process (1819) 2nd. Edn., pp. 14-17. Ackerman, a London publisher, used gas for heating engraving plates, and Mr. Hicks of The Times in 1818 used it to boil water for tea making. Vide S. Everard, Gas, Light and Coke Company (1949), op. cit., pp. 137, 142.

4. Aerated burners were used in chemical laboratories long before the 'Bunsen' burner. Vide T. Graham, Elements of Chemistry, Including the Applications of Science in the Arts (1842), p. 425; E.A. Parnell, Applied Chemistry (1844), op. cit., Vol. I, pp. 115-7 (diag.). This fact has been overlooked by many historians of gas cookers, who claim Bunsen's innovation produced radical improvements in gas cookers. Robert Wilhelm Bunsen (1811-1899) worked at Heidelberg in the same laboratory which his pupil Carl von Welsbach later used. Vide Gas Journal Centenary 1849-1949 (1949), p. 17. J. Terrance Ed., Notebook for Gas Engineers (1948), op. cit., pp. 21, 57. G. Lockman, The Story of Chemistry (1960), p. 175. E. Thorpe, History of Chemistry (1924), Part II, p. 15.

The idea apparently occurred independently to two researchers in 1825, both of whom were inspired by the use of wire gauze on Sir Humphrey Davy's safety lamp which prevented ignition of gas passing from one side to the other. J. Deuchter¹ in Edinburgh used coal gas supplied under pressure from a portable vessel, and fitted gauze two inches above the gas nozzle. It was ignited above the gauze and produced an intense heat, which Deuchter hoped to develop as a blow-pipe for industrial processes. Also during 1825, James Sharp, the gas manager at Southampton² introduced "The Gauze Burner" on the same principle but using a normal gas supply. No patent was obtained, and a very similar design was described by 'J.R.' in the Mechanics Magazine of 1831.³ Sharp⁴ became the leading English exponent of gas cooking, and campaigned throughout the 1830s to encourage its adoption, but found opposition among domestic cooks whose occupations seemed threatened, and his main success was in hotels, as at Leamington, and Kettering.⁵

1. Deuchter was Lecturer on Chemistry and Experimental Philosophy in Edinburgh, and the portable gas supply was probably that developed by D. Gordon. J. Deuchter, "Account of Several Experiments performed with Compressed Gas Apparatus", Lecture, 19/3/1825 to Wernerian Natural History Society, Glasgow Mechanics Magazine (1825), Vol. III, p. 338.

2. J. Sharp, Observations on the Practical Advantages attending the Use of Coal Gas, with a Short Essay on Cooking by Gas (1850, Southampton), pp. 16, 18. D. Chandler, Rise of the Gas Industry (1949), op. cit., p. 76. King's Treatise (1882), op. cit., Vol. III, pp. 216-7. W.T. Sugg, The Domestic Uses of Coal Gas (1884), op. cit., p. 112; see also pp. 109-34.

3. 'J.R.', Mechanics Magazine 1831, Vol. 15, p. 344.

4. In 1837 Sharp toured southern England, but was soon frustrated by "the obstacles which habit, ignorance and prejudice" placed before gas cooking. From 1840 he retired to work as a gasworks manager, though Messrs. Sharp & Co. of Northampton continued to manufacture his cookers. John Barlow succeeded him in the south as the proponent of gas cooking, but also had little success. Vide June 1837 lecture to Mechanics Institute, Southampton, Mechanics Magazine 1840, Vol. 33, p. 27.

5. J. Sharp, Observations (1850), op. cit., fifteen testimonials cited.

Edinburgh and Derby¹ were the main centres for the development of aerated-burner cookers in the 1830s. Sir John Robison² of Edinburgh, inspired by the experiments at Derby, used "wire cloth" manufactured for safety lamps to produce kitchen cookers, and gas stoves for pharmaceutical classes. "A layer of coarse sand or powdered limestone" preserved the wire from heat deterioration, and his colleague Dr. D.B. Reid used blow pipes and bellows to achieve a heat suitable for industrial case-hardening, and used it for steel cutting tools. Robison's device, including the coarse sand, was manufactured and sold in the 1830s by Edinburgh ironmongers, Messrs. Steele Brothers,³ and a gas cooking exhibition⁴ held in Edinburgh in 1835.

Gas space-heaters⁵ were far more expensive than coal fires, and

1. William and Joseph Strutt of Derby strongly advocated the advantage of gas cooking with aerated burners to the working classes, using a similar wire-gauze arrangement as that of J. Sharp. Mechanics Magazine 1828, Vol. 9, p. 15. British Association (Newcastle) 1838, Part II, p. 159. J.C. Loudon, Cottage, Farm, and Villa Architecture and Furniture (London, c. 1833), pp. 726, 717, 1277. "Mallet's Apparatus" also had an aerated burner, ibid., p. 1023. The Schoolmaster and Edinburgh Weekly Magazine, Vol. III, 9/3/1833, p. 165.

2. Robison was an investor in the Edinburgh Oil Gas Co. (vide infra p. 419) and originally tried in 1828 to adopt the Derby stoves as a new source of revenue for that bankrupt company. A claim made in 1839, by his associate, that Robison was the inventor "of the advantages to be derived from the dilution of carburetted hydrogen [i.e. coal or oil] gas with atmospheric air", is therefore incorrect. Sir John Robison, "On the Best Means of Burning Gas for Supplying Heat", Mechanics Magazine 1839-40, Vol. 32, p. 291. Edinburgh Evening Courant, 25/1/1828, p. 62.

3. Ranges with up to 8 gas-burners were used in the city. Tubes of 4 inches diameter, surmounted by gauze, were suitable for kettles and stewpans, or 10 inches diameter for cooking fish or beef, or even heating a bath. J.C. Loudon, Cottage, Farm and Villa Architecture and Furniture (London, c. 1833), pp. 1023, 690, 714; Supplement, p. 1203. Loudon's article paraphrased in Mechanics Magazine (1833), Vol. 19, p. 307.

4. The Builder 1850, p. 418.

5. Rickett's stoves, among the best known in the mid 1830s in London, consumed up to 20 cu.ft. gas per hour. 'Evander's' stove used up to 15 cu.ft. an hour, and thus cost 10/6d for a 14 hour day. Mechanics Magazine 1836-7, Vol. 26, pp. 287, 288 (Evander), 391 ('C.H.'). Combustion of 15 cu.ft. gas an hour gave 1.25 pints water and 15 cu.ft. carbonic acid gas, producing condensation, pulmonary complaints and consumption.

normally required flue pipes which removed the combustion products, especially water vapour, but also caused a loss of heat. When Rickett, a well known gas-fire manufacturer in London, produced his first "diluted gas-stoves", with aerated burners, in 1838 it was noted that "from the great attention that has been paid to the subject of coal-gas in Scotland, the Scotch are far before us in a correct knowledge of its use and properties; and also in its useful application to many of the ordinary concerns of life".¹ Earlier, in 1837, the Paisley Advertiser described the construction of an aerated "Gas Cylinder" which could be fitted into a normal Carron coal-fire grate, for amateurs to convert this into a gas-fire at minimal expense. This was the first attempt at developing a mass-market for gas heating, and the national press soon parodied the idea.²

The "Gas Cylinder" was an iron stove pipe, three to eight inches in diameter, and covered at the top with wire gauze, upon which could be placed small balls from slaked lime, to make "a bright red colour, and give a more cheerful appearance". Greater heat could be produced, in a way very similar to the Bunsen "innovation", by placing a ten inch chimney above the gauze, whereby the ascending hot air drew more fresh air into the base of the Cylinder, and made the flame "burn more vividly [sic, fiercely?], on the same principle, no doubt, as steam-boat funnels or stalk-vents [chimneys] create a draught".³

1. W. Baddeley, "Improvements in Gas Stoves", Mechanics Magazine 1838, Vol. 29, p. 134. Rickett's stove desc. in Mechanics Magazine 1839-40, Vol. 32, p. 553.

2. "Heating Apartments with Gas", Mechanics Magazine 1837-8, p. 141.

3. A flexible pipe supplied gas to the Cylinder, inserted below the grate and then bent up through the grate bars. A 5 inch diameter cylinder was suggested for a room 15 ft. square. A 3½ inch cylinder consumed about 7 cu. ft. gas per hour, equal to about seven 4 inch flame 'jet' lighting burners but far less than the gas used by luminous flame stoves in England. With gas costing 8/6d in Paisley, such a heater cost ½ to ¾d per hour

A five inches diameter cylinder, using one cubic foot of gas, could also boil a quart of water in ten minutes, for cooking. Although dearer than a coal fire, and giving a "slight sulphery smell", gas was far easier to light and use and could provide a morning meal faster, or cook food in summer when a coal fire was not required for space-heating.¹

Dr. Andrew Fyfe² of Aberdeen made some of the earliest scientific measurements on the calorific value of gas in 1848, when gas heating was still a rarity, but concluded that gas used that way was wasteful and uneconomic. He challenged the view that an aerated burner used less gas, or gave more rapid heating, than a luminous flame burner with complete combustion, or even that it was more rapid than a coal fire.

Table 6.56 Experiments on Calorific Value of Gas using Various Burners, by Dr. A. Fyfe (1848)

<u>Burner</u>	<u>Time Duration to burn $\frac{1}{2}$ cu. ft. (Minutes)</u>	<u>Water Temperature after Heating ($^{\circ}$F)</u>	<u>Temperature Increase ($^{\circ}$F)</u>
Jet	30	140	95
Fishtail	13	146	101
Batswing	9	142	97
Argand 10 holes	12	142	97
Argand 24 holes	9	142	97
Argand 42 holes	7	144	99
Robison's Burner	15	151	106

Note - $\frac{1}{2}$ cu.ft. gas used in all-cases, to heat $\frac{1}{4}$ gallon water in special heat-retaining boiler. All burners had luminous flames, except Robison's aerated burner (3 inches diameter, 20 inches long).

Source:- Edinburgh New Philosophical Journal (1848), op.cit., p.214.

1. In 1839, when most gas cookers cost £4 to £7, the advantages of the Paisley system were obvious, and W. Weller of Battle produced another cut-price version at £1 10/- which he urged gasworks equipment manufacturers to sponsor since gas cooking would enable "any little compact village" to manufacture and sell gas profitably. Mechanics Magazine 1839-40, Vol. 32, pp. 400, 553, 720.

2. Vide supra pp. 27, 416, 460

3. The "boiler" holding water had external insulation, and a heat-exchange system to use both radiant heat, and the hot combustion products from the gas. Andrew Fyfe, "On the Comparative Illuminating and Heating Power of Different Kinds of Coal Gas Burners, and on the use of Coal Gas as a Source of Heat", Edinburgh New Philosophical Journal (1848), Vol. XXIX, pp. 214 et. seq.

Fyfe's experiments were more systematic than others which followed,¹ but disagreements over burner efficiency remained unresolved for at least another four decades. 'Lumen'² stated in 1872 that atmospheric burners gave "at least ten times" more heat for the same consumption as luminous flames, but in 1884 R.B. Main³ agreed with Fyfe that whilst 'Bunsen' flames gave the intense heat suitable for boiling rings, correctly adjusted luminous-flame burners gave equal quantities of heat, and being more easily regulated, were better suited to ovens, for operations like roasting. Fyfe's original results, however, showed that only the wealthy classes could afford gas cooking, as shown in Table 6.57.

Table 6.57 Cost Benefit Analysis of Gas Cooking by Dr. A. Fyfe
(1848)

(1) Cost of Heating One Gallon of Water -

Gas 1 cu. ft. 1.9d ; Coal 1.3 lbs. 0.25d

Edinburgh prices viz. gas 9/-, coal 12/- per ton.

(2) Speed of Cooking -

	Open Coal Fire	Gas Burner (3 cu.ft. per hour)
$\frac{1}{2}$ gallon water in open pot	5 to 7 minutes	15 minutes
Potatoes in $\frac{1}{4}$ gallon water	30 minutes	45 minutes

Source:- Edinburgh New Philosophical Journal (1848),
op. cit., p. 214.

Convenience⁴ and not economy was the only advantage of gas. Fyfe

1. E.g. In 1850 a London gas engineer stated that 1 cu.ft. gas from Newcastle coal gave 850 heat units, compared to 1162 from the same quantity of Scottish cannel gas. "Gas as a Source of Heat", J.G.L., 10/12/1850, p. 335.

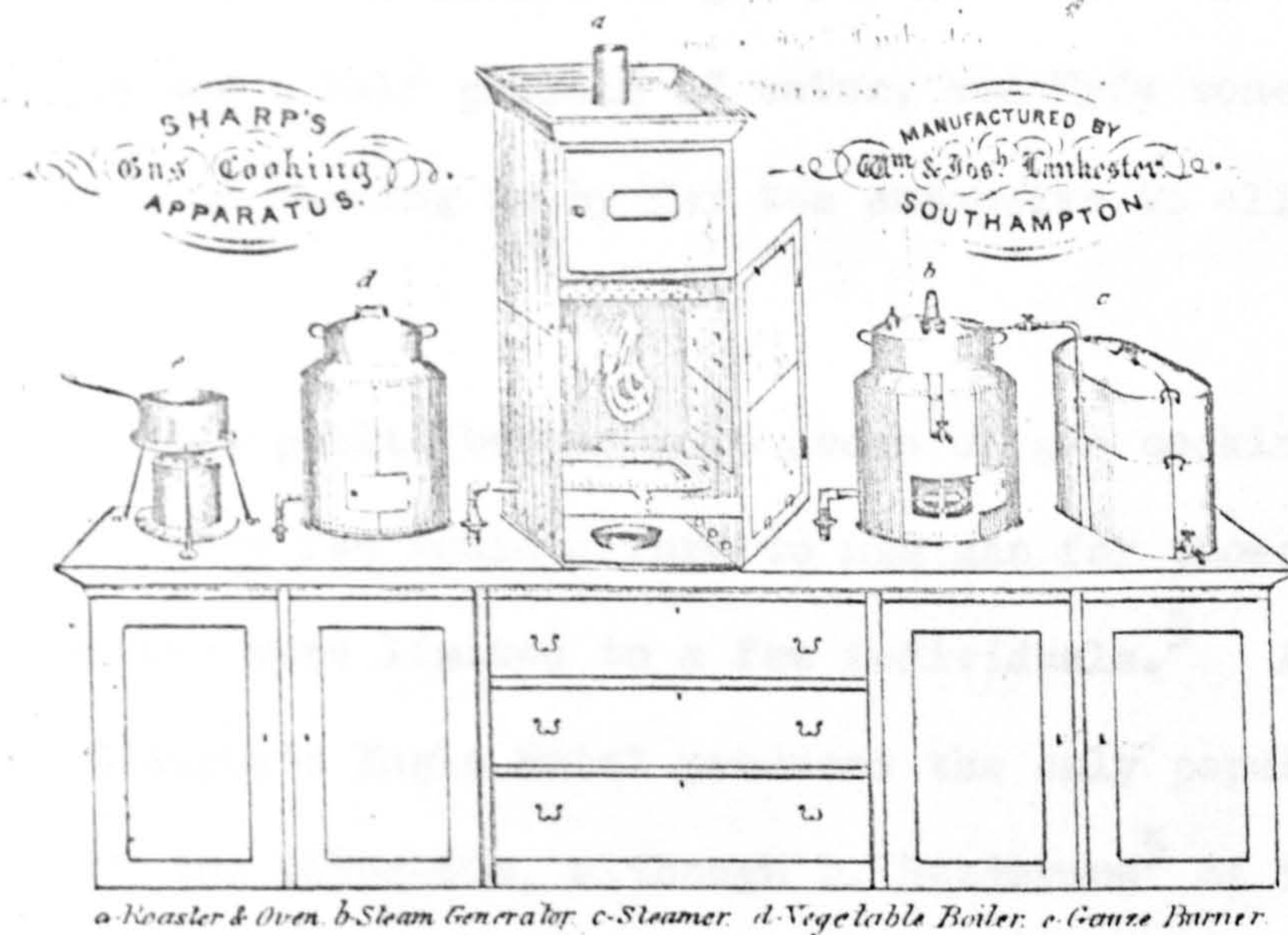
2. 'Lumen', Gas and All About It (1872), op. cit., p. 26.

3. R.B. Main, gas cooker manufacturer of Glasgow, J.G.L., 1883, p.338.

4. Dr. Fyfe devised one of the first gas-heated slipper baths, "a far superior method to the heating of baths by burning a small fire placed within the bath" which required a special chimney and often discharged smoke in the room. Six rose-jet burners with 16 holes each, beneath the bath, raised 24 gallons of water by 50° F, with 17 cu.ft. gas costing 2d. c.f. Bath by R. Hicks (1825) in King's Treatise (1882), op. cit., p. 215.

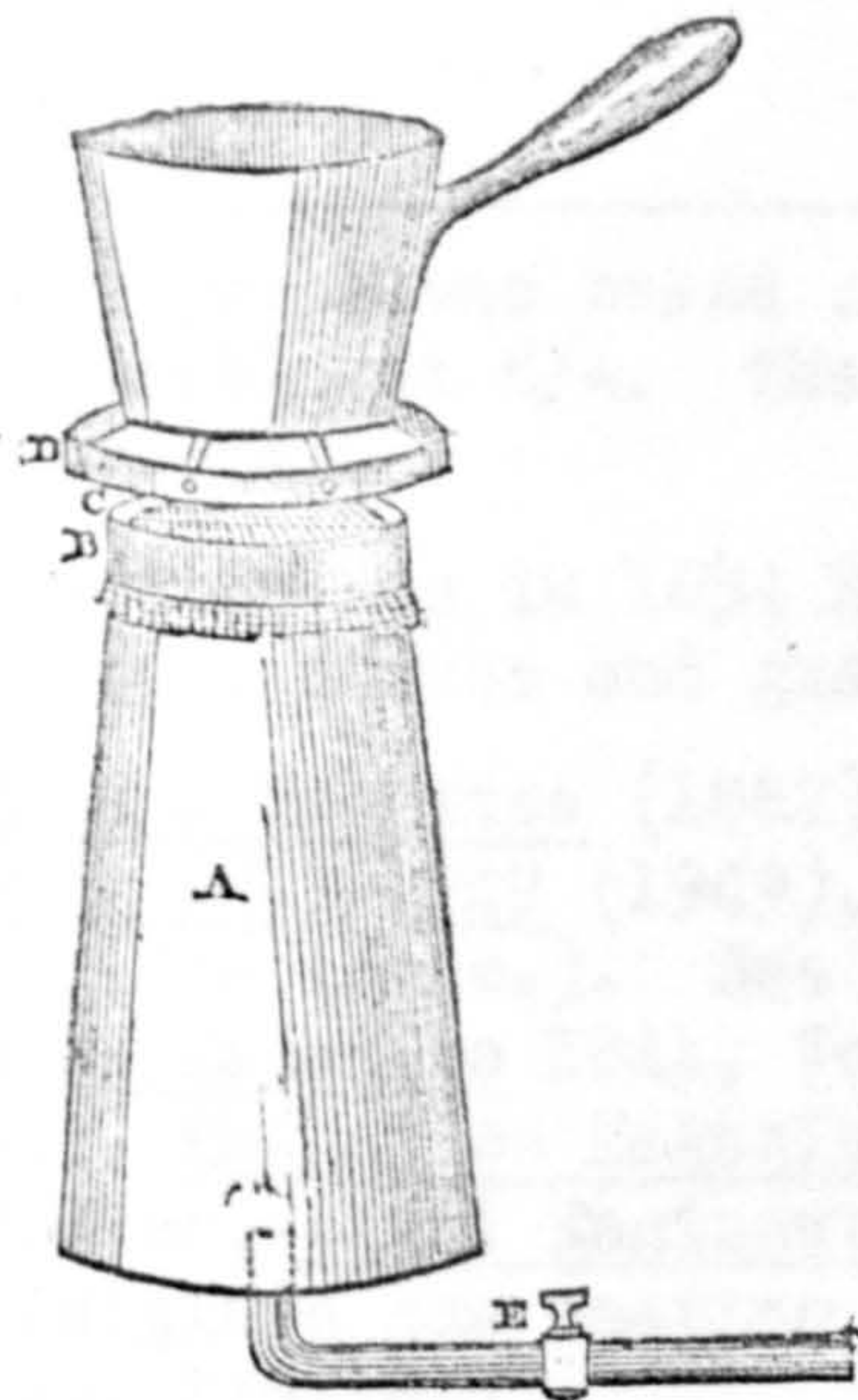
Fig. 6.58

Early Gas Cooker Designs



Gas Range by James Sharp of Southampton, 1851 - one of the most popular early designs.

Source - J Sharp Observations on the Practical Advantages Attending the Use of Coal Gas (1851 Southampton) 2nd Edn. Preface



Aerated burner used for cooking in 1831 by 'J.R.'

- A - conical tube of thin sheet-iron 12 inches high ; diameter 6" base, 3" top
- B - hoop
- C - gauze, retained by B
- D - bracket supporting pan over flame burning above gauze
- E - gas inlet projecting 3" inside cone

Source - Mechanics Magazine 1831 Vol.15 p.344

also examined the gas space-heaters sold in Scotland in the late 1840s. "Large apartments" in Edinburgh were usually heated to 60° F for twelve hours a day in winter, using half a hundredweight of coal¹ worth threepence. The amount of gas purchased for threepence could only boil one and a half gallons of water, and Fyfe concluded "that gas as a means of warming is by far too expensive to allow it to come into use".²

Although the public became more aware of gas cooking and heating from 1840-80, very few could afford to use gas for those purposes, and improvements were limited to a few individuals.³ Alexander Graham⁴ of Glasgow's Eagle Hotel produced the only popular Scottish gas-cooker of the 1850s-60s, although D. Henderson⁵ of that city sold gas-heaters and gas-heated baths, and two Edinburgh innovators, W.F. Rae in 1852, and C. Chalmers in 1860 introduced new gas stoves.⁶ 'Stoves' referred to both cookers and space-heaters at that time.

Table/

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1. This price was based on best coal at 10/- a ton, but coal was also available at 6/-. The apartments had contents of about 36,780 cu. ft.
 2. Nevertheless in 1854 Haldane and Rae of Edinburgh were selling gas cookers, stoves and gas heated baths. J.G.L., 10/2/1854, p.353.
 3. King's Treatise (1882), op. cit., pp. 215-55. Gas Journal Centenary 1849-1949 (1949), p. 117. The Builder 1850, p. 326; 1852, p. 246 (desc.). See also - "Heating Conservatories with Gas", Mechanics Magazine 1841, Vol. 34. 1852 Bogget's Patent Gas Baths and Kitchens, Mechanics Magazine 1852, Vol. 56, p. 41. 1848 Brockton's Room Heater, Civil Engineer and Architect's Journal, May 1848, p.143. 1857 Craigie's gas heating for Conservatories, Engineering and Mechanics Magazine, 1/5/1857.
 4. The Practical Mechanics Journal 1849-50, p. 280 (desc., diag.). J.G.L., 10/3/1851, 10/6/1851. Gas Journal Centenary 1849-1949 (1949), p. 116.
 5. The Builder 1851, p. 722.
 6. Engineering and Mechanics Magazine, 1/6/1860, p. 69. The Practical Mechanic and Engineers Magazine 1853-4, p. 139.

Table 6.59 Chronology of Gas Cooking Developments

- 1841 - gas cookers designed and sold by Alex Soyer, chef at Reform Club, London.
- 1845 - The Builder forecast that soon "every kitchen" would have a gas cooker.
- 1847 - A.A. Croll placed gas jets inside an iron-case as an oven.
- 1849 - cookers sold by C. Crickets, The Strand, London.
- 1849 - Henry Crossley's popular 'Ronald' stoves in London.
- 1850 - Delfries' gas-heated bath.
- 1850 - David O. Edwards' "Atmopyre", a widely used perforated hollow-clay burner.
- 1851 - Gas Heating and Cooking exhibition in Polytechnic Institution, London (because forbidden at the Great Exhibition).
- 1851 - London Illustrated News urged use of gas for boiling, stewing and baking.
- c.1850 - large 4-oven cookers designed by A. King, gas manager at Liverpool, and manufactured by W. Bennett.
- 1850s - Liverpool became main centre for gas-cooker manufacture.

Sources- D. Chandler, Rise of the Gas Industry in Britain (1949), p. 76; The Builder 1845, p. 577, 1850, p. 326; The London Illustrated News Supplement, 24/5/1851; S. Everard, Gas Light and Coke Company (1949), op. cit., pp. 388, 178; S.A. Harris, Gas Supply of North Merseyside (1956), op. cit., p. 73 (A. King possibly began cooking experiments in 1830s); G. Dodd, The Curiosities of Industry and the Applied Sciences (1857), Ch. 13, p. 23.

Numerous gas-fire patents in the late 1850s improved only the outward appearance, but not the efficiency of fires.¹ When J. Robb of Aberdeen introduced an improved, aerated flame heater in 1861, in which the gas-flame pre-heated the primary air supply and gave higher thermal efficiency, the Mechanics Magazine² recorded that "the stench arising from lighted gas stoves" elsewhere had caused them to be "in

1. Smith and Phillips' gas fire of 1853 used glass and metal ores to simulate burning coal; later pumice, asbestos, or carbon-scurf from gas-retorts was used to appear like coal fires. The Builder, 24/9/1859, p. 637.

2. "Robb's Gas Stoves", Mechanics Magazine 1861, New Series, Vol. VI, p. 22.

most cases abandoned". Again in the 1870s, J. Wallace¹ who campaigned in favour of gas fuel in industry, agreed that "the sickening smell from badly constructed burners is past all endurance", and accused gas companies of allowing "the manufacture of gas cooking and heating apparatus to fall into the hands of the most ignorant class of mechanics" who had brought it into "bad repute".

In Glasgow, Dr. Adams² in 1855 used burners for cooking which closely resembled Edwards' 'Atmopyre'. Each burner was "a group of hollow perforated tubes...of fireclay, supplied internally with a mixture of gas and air", and became "nearly white hot" as gas burned on the outside. Adams hoped to maximise radiant heat, instead of the convective heat of 'Bunsen' burners or ordinary gas burners, and like Robb he pre-heated the air supply. A heat-exchange system retained warmth in the room, and prevented the convective loss of heat up the chimney which normal bunsen-burner stoves experienced. By the late 1870s Adams advertized his stove for cooking, laundry work, conservatories, bakers' ovens, or wherever coal fires were used, but not until 1882 when the new era had dawned, did he promote a Gas Heating and Stove Company.³

1. Wallace promoted the use of aerated burners instead of coal fires for small steam boilers. J. Wallace, "The Combustion of Gas to Produce Heat", North of England Institute of Mining Engineers 1873-4, Vol. XXIII, p. 47 et seq.

2. In 1855, Adams' first stove was made by Mr. Harvie, ship-lamp manufacturer of Broomielaw, and demonstrated to Glasgow Medical Society. A normal, luminous flame gaslight gave 84% convective heat, and Bunsen's burner 94%. During the 1870s his convector stoves were manufactured by J. Wright of Birmingham. Dr. J. Adams, "On Improvements in Gas Stoves", Royal Philosophical Society of Glasgow 1879-80, Vol. XII, p. 190 et seq. Gas Journal Centenary 1849-1949 (1949), p. 120.

3. Adams Patent Gas Heating and Stove Company Limited, Glasgow. Using patents by J. Adams, M.D., 1879 (Pat. 1095), and 1880 (Pat. 601). Registered April 1882. Nominal Capital £5000. Dissolved 1884. - S.R.O., (BT2/1118). King's Treatise (1882), op. cit., Vol. III, p. 247 (diag.).

The gas cooking revolution swept through Scotland in the short period of 1881-5. Previously, rented accommodation contained coal-fired cooking ranges provided by landlords, and like private houses the inhabitants were quite unwilling to experiment with gas cooking when gas stoves had to be purchased outright. To reduce this problem, Salisbury¹ gas company in 1872 became the first to hire-out cookers, but most companies at that time provided such low gas pressure in the daylight hours, to reduce leakage from gas mains, that outside London it was "impracticable to employ gas for cooking, heating, and manufacturing purposes, especially in the summer months".² In 1881 the use of gas by William Denny,³ shipbuilder, for heating and cooking still appeared unusual.

During 1879 the first Scottish exhibitions of gas-apparatus were held in Glasgow, Paisley and Greenock.⁴ At the Watt Institution in Greenock a wide variety of equipment was shown, including Otto and Bisschop gas engines to power sewing and washing machines, and the very popular gas stoves by Argyle Ironmongery Company⁵ which were also used in "cooking depots established in Glasgow for the working classes".⁶

Table/

1. C. Mackenzie, The Vital Flame (1947), p. 21. In 1877 Gladstone spoke in favour of gas cooking. W.H.Y. Webber, Town Gas (1907), pp. 195-213. Historical survey of cookers. In the 1870s, companies saw gas cooking merely as a method of boosting sales in summer, the slack period.

2. 'Lumen', Gas and All about It (1872), op. cit., p. 9.

3. J.G.L.; 2/8/1881, p. 222, 27/12/1881, p. 1073. From 1864 J. Hislop, gas manager at Paisley, had also experimented with gas for heating water and rooms. J.G.L., 9/8/1881, p. 263.

4. J.G.L., 1879, p. 825.

5. Later renamed Messrs. Waddell & Main.

6. Founded in 1870s by T. Corbet.
W.H. Marwick Economic Developments in Victorian Scotland (1936) p. 221

Table 6.60 Exhibitors at Greenock Gas Exhibition, (1879)

Argyle Ironmongery Co., Glasgow	Messrs. Hassal and Singleton, Birmingham
J. Williamson, London	T. Nock, Birmingham
Messrs. Leoni & Co., London	Messrs. J. Wright & Co., Birmingham
Messrs. Billing & Co., London	Beverley & Wilde, Leeds
Wm. Sugg's Argand Burners, London	George Bray & Co. (burners), Leeds
C. Wilson, Leeds	D. Bruce Peebles & Co. (governors), Edinburgh
W. & B. Cowan (meters), Edinburgh	

Source:- J.G.L., 16/9/1879, p. 440.

The Paisley exhibition¹ was also dominated by English manufacturers, with the notable exception of the Argyle Company, and central heating apparatus by J. Boyd & Sons of Paisley. Glasgow Philosophical Society² organized another gas heating exhibition in 1880. A rise of ten per cent in gas consumption in Dumbarton³ that year was attributed to the popularity of gas heating and cooking especially in houses of "the wealthy". Glasgow⁴ Corporation hoped that gas cooking would boost consumption in the summer season, but other towns were slow to promote exhibitions, with two exceptions in 1881-2 at Aberdeen⁵ and Kilmarnock.⁶

During 1883, however, publicity in favour of gas cooking and heating was in full swing and the Glasgow firm of R. and A. Main⁷

1. J.G.L., 23/12/1879, p. 984. Smoothing irons heated on the bunsen-burner principle by air bellows or a gas engine, were also exhibited by the Air-Burning Co. Ltd. of Glasgow.

2. J.G.L., 28/9/1880, pp. 526, 605, 682, 736, 893.

3. J.G.L., 14/12/1880.

4. J.G.L., 8/11/1881.

5. J.G.L., 27/9/1881, 12/7/1881.

6. J.G.L., 27/6/1882. Kilmarnock exhibition organized by Waddell and Main.

7. Called Messrs. Waddell and Main in the early 1880s. Their most important products included - the 'Universal Domestic' cooker with double wrought-iron case; the 'Kilburn Range' for hotels and large institutions; Hislop's 'Metallic Gas Fire'; Hepworth's 'Patent Gas Fire'; the 'Edinburgh Patent Gas Fire'; Siemen's 'Gas and Coke Fire'; Foulis' 'Regenerative Patent Gas Fire'; Foulis' 'Patent Automatic Gas Hot-Water Circulating Apparatus'. Gas World 1887, Vol. II, pp. 615-7.

developed as the most important Scottish suppliers of equipment, after taking high awards in exhibitions at Glasgow in 1880, Aberdeen¹ in 1881, and in London. The company originated in the 1875 Argyle Ironmongery Company, run by Mathew Waddell (d. 1886), a restaurant owner who supported gas-cooking and gave demonstrations during the 1870s in Greenock, Paisley and Glasgow. In 1880 Waddell amalgamated with the stove business run by R.B. Main, a gas engineer and leading representative of R. Laidlaw and Son since 1864. Waddell² retired in 1884 and R.B. Main continued with the assistance of his brother Archibald. The Company³ took first prize at many gas exhibitions⁴ including the London Smoke Abatement (1881), Manchester Smoke Abatement (1882), Stockport (1882), London Crystal Palace (1884), Hawick (1885) and Edinburgh (1886) exhibitions.

Dundee was one of the first Scottish towns to offer special financial concessions to consumers in order to boost the use of gas for heating.⁵ In 1882 a showroom was opened in the town centre and leaflets were produced with testimonials from local residents who used gas, and a reminder not to use the thick boiling-pots which were necessary on coal fires. Stoves were hired out by the Gas Commissioners at an annual rent of ten per cent on their original cost, or sold at ten per cent discount on the normal price. Yet the gas manager still refused to raise daytime pressure from an unsatisfactory

1. The 2 week Aberdeen exhibition attracted 16,500 visitors. J.G.L., 23/10/1883.

2. Obituary, J.G.L., 5/10/1886.

3. 'Nutting' and ornamental fittings were sub-contracted to foundries in the Falkirk area until 1889 when the Company opened an iron foundry at their Argyle Works in Glasgow. J.G.L., 26/3/1889.

4. A. Main (Glasgow), "The History and Development of Cooking by Gas", Gas World, 26/8/1896.

5. "Heating" is used here and later to mean both cooking and space-heating, since gasworks were anxious to promote both, and gave similar concessions.

$\frac{8}{10}$ inch to $\frac{10}{10}$ ths. until sufficient cookers were in use to make it profitable.¹

By February 1883, Dundee² had hired out 268 stoves, all costing above one pound, which was chosen as the cheapest size suitable for hiring out, and had sold 163 stoves at prices between two shillings and six pounds. Arbroath³ followed in April with a shop in Market Street to exhibit cooking and heating stoves in operation, and by September had hired out seventy. Forres⁴ began hiring out in April, and by September had twenty two in use, with separate meters, which had already consumed 100,000 cubic feet of gas. Local residents who had no experience of gas cooking, were prepared to try only when they did not have to purchase the equipment first.

The new fashion was well under way by May 1883, when Waddell and Main organized a display of gas cookers at Wick Industrial Exhibition.⁵ That month Greenock⁶ began hiring out cooking and heating stoves with separate meters, followed by Dumfries.⁷ By January 1884, Airdrie⁸ and Ayr companies were selling gas stoves, Kilmarnock had arranged a

1. The Commissioners began their experiments specifically with electricity competition in mind, and in 1881 when summer consumption was only one sixth of that in winter, they obtained detailed information from Birmingham Corporation, and other gasworks in England which supplied gas apparatus on hire e.g. S. Metropolitan, Cirencester, Romford, Crystal Palace, and Hornsey. Dundee Gas Commissioners Reports 1880-3, 4/1/1882, 27/10/1881 (Nat. Lib. Scot.); J. McCrae (Dundee) "Gas Stoves", N.B.A.G.M., 1883.

2. By mid 1883 Dundee had hired out 304 stoves which consumed 3.8 million cu.ft. a year. Of these, the Waddell and Main stoves were most popular and 195 were 'Universal Domestic' cookers. 8 Bath heaters and 9 Water heaters were also hired out. J.G.L., 27/2/1883; N.B.A.G.M. 1883, op. cit.

3. J.G.L., 20/3/1883, 25/8/1883.

4. J.G.L., 25/8/1883.

5. J.G.L., 15/5/1883.

6. J.G.L., 8/5/1883.

7. J.G.L., 27/11/1883.

8. J.G.L., 11/1/1884.

showroom at the gasworks, and Dunoon had a town centre showroom for selling and hiring out appliances. Nairn¹ held an exhibition of stoves in February, but Dundee² remained the most successful centre of gas-heating, having sold 401 stoves and hired out 443, which were consuming 3.86 million cubic feet a year.

Two factors retarded the promotion of gas 'stoves'. Many companies and municipal gasworks still regarded "fittings" as the prerogative of private enterprise, leaving the choice to consumers and retailers, which was both less work for themselves and reduced their responsibility for any faults in the supply of gas. They were also unwilling to antagonize retailers in case of hostile publicity. It is also possible that electricity was adopted more slowly in Scotland than in England, and the pressure for new markets for gas was somewhat lower. Aberdeen³ commissioners began hiring out stoves in March 1884 only after a survey of local ironmongers showed that they either stocked no gas stoves, or very old-fashioned designs. A display of stoves in operation was also arranged in Bridge Street.⁴ Scottish hiring charges tended to be higher than those in England. In August 1884 the Journal of Gas Lighting⁵ noted that a stove costing two pounds fifteen shillings was hired out at one shilling and sixpence a year in England but five shillings and sixpence in Scotland, and one of seven pounds ten shillings for three shillings and fifteen shillings respectively.

1. J.G.L., 5/2/1884.

2. J.G.L., 11/3/1884.

3. J.G.L., 11/3/1884.

4. This included 3 by Waddell and Main, 2 by Messrs. John Wright & Co. of Birmingham, and one by Messrs. Arden Hill and Co., an indication of the relative popularity of makers. J.G.L., 10/6/1884.

5. J.G.L., 26/8/1884.

Cheap gas for heating and cooking compared to lighting, by a separate meter system, was first provided in Scotland at Helensburgh in 1884 when the discount was ten per cent. That gasworks had delayed setting up showrooms for two years out of fear¹ of antagonizing ironmongers, gasfitters and plumbers who were good consumers. Explanatory leaflets were often published, for example by Elgin² council which began to hire out stoves in May 1884. In return for distributing leaflets, Dumfries council³ was able to display stoves by a manufacturer for thirty three per cent below the advertized price, without having to make payment until the stoves were sold or hired out.

In southern Scotland, the first important gas exhibition was held for three days at Galashiels⁴ in October 1884. Cooking demonstrations⁵ were given by Miss Cameron of Liverpool, and other displays included a gas engine, "domestic washing and drying machines, gas baths, gas laundry stoves, a street lamp of 1000 candlepower", all in operation, as well as a model of a gasworks, a collection of

1. J.G.L., 26/8/1884.

2. J.G.L., 27/5/1884.

3. J.G.L., 18/3/1884.

4. In September 1883 Galashiels had opened stove showrooms in the High Street, advertized their benefits in newspapers, and published 500 pamphlets written by the Company secretary. From August 1883 to July 1884 Waddell and Main stoves worth £74 were sold. The 1884 exhibition, organized by John Wright & Co., sold £42 stoves and hired out another £34 in one month, with 10% discounts allowed on all sales at the exhibition. A further exhibition, organized by the manager in 1887, was advertized at Selkirk, Peebles, Hawick and Kelso and thus served a wide area. J.G.L., 21/10/1884. S.R.O., Galashiels Minute Book, op. cit., 4/9/1883, 2/10/1883, 1/7/1884, 5/8/1884, 30/9/1884, 28/10/1884, 2/9/1884, 3/5/1887, 2/8/1887.

5. Cookery lecturers were well trained. Mrs. W. Smith in the 1870s studied at the National Training School of Cookery in South Kensington, before lecturing at the new Edinburgh School of Cookery, and thence lecturing on gas cooking throughout Britain. Mrs. W. Smith, "Recollections of a Lecturer on Cooking", Gas World, 7/5/1898, p. 702.

tar by-products, and examples of gas burners. Hawick¹ followed with an exhibition in March 1885. Dunfermline² gas exhibition, organized by R. & A. Main, had as much variety as that at Galashiels, including bakers' hot-plates which they had developed. Hamilton³ followed in May when an exhibition was arranged by Messrs, John Wright & Co., who sold twenty five stoves to the gas department for a trial period of hiring out. Helensburgh⁴ held a two day exhibition in June 1885, and at the same time Pollokshaws⁵ company began to exhibit stoves at the company offices and to hire them out.

Special gas rates for stoves became a normal procedure for encouraging their use by the end of 1884. Buckie⁶ granted a special rate, and at Huntly⁷ in Aberdeenshire three rates were in use : seven shillings and sixpence for lighting, five shillings and tenpence for cooking and heating, or six shillings and eightpence for lighting, cooking and heating. Small companies like these, and medium companies, developed the gas stove market more readily than the largest undertakings at Glasgow and Edinburgh,⁸ which had less fear of rapidly losing their markets to electricity. Glasgow finally acted in the summer of 1885, after a council sub-committee and the gas manager, Mr. Foulis, had visited many English and Scottish

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1. J.G.L., 3/3/1885.
 2. J.G.L., 31/3/1885.
 3. J.G.L., 12/5/1885.
 4. J.G.L., 2/6/1885.
 5. J.G.L., 25/8/1885.
 6. J.G.L., 30/12/1884.
 7. J.G.L., 29/1/1884, 3/2/1885.
 8. J.G.L., 28/4/1883.

gasworks¹ for detailed information. Statistics showed that the private purchase of stoves could not alone be relied upon to boost the sale of gas.

Table 6.61 Quantity of Gas Stoves used in Various Towns (1885)

<u>Gasworks</u>	<u>Date commenced hiring-out stoves</u>	<u>Number Hired out (to March 1885)</u>	<u>Number of Private Stoves in use</u>
Gas, Light and Coke Co.	-	4000	1600
South Metropolitan	-	2500	-
Leicester	1881	2100	500
Hull	1883	2000	-
Dundee	1882	600	600
Inverness	1884	100	-
Aberdeen	1885	150	125
Dumfries	1884	30	30

Source:- J.G.L., 31/3/1885.

The Glasgow committee concluded that widespread use of gas stoves could only be achieved by hiring facilities, "the liberal issue of printed information, and the fitting up of convenient and attractive showrooms".² The lack of interest in promoting gas stoves in Edinburgh³ was at first caused by the high proportion of retired, upper class consumers. A display room arranged by Edinburgh gas company in July 1884 was at the top of a building and usually kept locked as

1. E.g. in London the Gas, Light and Coke Co., S. Metropolitan Gas Co., S. Leoni's General Gas Heating and Lighting Apparatus Co., and W. Sugg & Co.; the Birmingham Council showrooms, and J. Wright & Co. gas-stove works; Leicester Council showrooms; and in Glasgow, Messrs. R. & L. Main, and the Gas Fumes Neutralizer Co. The Patent Gas Fumes Neutralizer Co. Ltd. aimed to develop methods of absorbing combustion products made by J.F. Allan and W.B. Anderson, but was liquidated in 1890 because of excessive liabilities. Registered 1883. Nominal Capital £5000. S.R.O., (BT2/1303); J.G.L., 31/3/1885.

2. J.G.L., 31/3/1885.

3. J.G.L., 28/4/1883, 15/7/1884.

it was so rarely visited. By June 1885, Glasgow Council in contrast was hiring out or selling twenty to thirty five stoves each day.¹ Although gas exhibitions continued to be held, for example at Port Glasgow Town Hall² in April 1886, Greenock in 1892, and again at Aberdeen,³ the new market for heating gas had been firmly grasped by the mid 1880s and became increasingly important as electrical lighting⁴ expanded into the 1890s. Two new popular heaters, a "Regenerative Gas Fire",⁵ and an "Instantaneous Water Heater" were designed with technical knowledge by W. Foulis, the Glasgow gas manager. The "fire" used four tubes each supplying five cubic feet per hour, to heat an asbestos-covered fireclay slab, while waste heat warmed a water boiler for use in cooking or for a bath, before escaping to a chimney flue. This removed earlier objections to gas fires, and the entire assembly could be placed in an ordinary coal fireplace, for use only in summer if so desired. The water heater⁶ could be fitted to any existing hot-water pipes or tanks.

1. The most popular makes in Glasgow were by R. & A. Main, J. Wright & Co. (Birmingham) and T. Fletcher (Warrington). In June, Partick, Hillhead and Maryhill gas company was obliged to begin hiring and selling stoves in order to maintain its competition with Glasgow, J.G.L., 2/6/1885.

2. Stoves by Wright, Fletcher and Main dominated all exhibitions at this time, and Messrs. Main retained their popularity despite strong competition by the English firms. J.G.L., 18/4/1886; Greenock vide Gas World, 23/4/1892.

3. By 1886, Aberdeen had sold only 48 stoves, but hired out 252. J.G.L., 9/3/1886.

4. Competition between gas and electricity was so intense by the 1890s that kerosene sales for light and heat declined, and did not revive until 1900 when petroleum was required for vehicles. D.F. Dixon, "Petroleum Distribution in the United Kingdom 1900-1950", Business History 1963-4, Vol. 6, p. 2.

5. Gas and Water 1885, Vol. III, p. 569; "On Foulis' Regenerative Gas Fire", Proceedings of the Royal Philosophical Society of Glasgow 1886-7, Vol. XVIII, p. 365.

6. Foulis's Water Heater was manufactured by J. Wright & Co. (Birmingham). The first hot water 'Geyser' was devised by B.W. Maughan in 1868, Gas Journal Centenary 1849-1949 (1949), p. 121.

By the late 1880s, the middle classes preferred gas fires instead of coal, and made considerable savings by employing an occasional char and washing woman in place of a full-time servant.

Table 6.62 The Economy of Gas Fires Compared to Coal (1887)

(1) Comparison for a Large Glasgow Household

Coal (10 waggons at 14/- put into cellar)	£ 7	0	0
Firewood, chimney cleaning, &c.	1	10	0
Servant to light fires	30	0	0
			£38 10 0
Gas Fire	£ 7	0	0
Charwoman's Wages	10	10	0
			£17 10 0
			Total Saving £21 0 0

(2) Comparison for a Smaller Glasgow Household
without Servants

Gas Consumed (5 Nov. to 20 Nov.;			
15,400 cu.ft. at 3/-)	£2	6	3
Stove Hire (at 10/- per year)	0	4	0
Coal fires retained in parlour and bedrooms	0	19	6
			£3 9 9
Coal (7 tons at 13/- per ton)	£4	11	0
			£4 11 0
			Total Saving with gas £1 1 3

Source:- J.G.L., 4/1/1887.

When Cupar¹ organized a gas exhibition in 1884, Messrs. J. Wright & Co. provided the stoves, and allowed fifteen per cent discount on cash sales, when the company agreed to advertise them for sale and hire. Any stoves remaining unused after one year could be returned to the manufacturer. In 1894 Messrs. R. & A. Main refused to finance an exhibition and cooking lectures in Cupar, despite the offer of free

1. S.R.O., Cupar Minute Book, op. cit., 11/12/1884, 8/2/1884, 13/2/1909, 11/12/1904.

gas, because the Company refused to contract to hire out their stoves. New exhibitions were, however, held in Cupar jointly by J. Wright and R. & A. Main in 1902 and 1904. Dalkeith¹ gas company considered holding an exhibition in 1894 because nearby Musselburgh was selling 1.5 million cubic feet per year to seventy cookers, but the exhibition was delayed until 1899 when it was organized by R. & A. Main, and the company purchased fifteen of their cookers to start hiring out. A second exhibition, held in 1910, sold sixty cookers.

By 1890 'Darwin' gas fires were entering the market from Messrs. Darwin & Co.² at St. Andrews Works in Glasgow. Kirkcaldy³ gasworks organized a cooking and heating exhibition in 1887, a year after Rothesay,⁴ and the first exhibition at Campbeltown,⁵ in 1889, showed fittings by Messrs. Main, Messrs. Milne, and W. & B. Cowan. The Portobello⁶ cooking exhibition of 1890 was arranged by R. & B. Main, and Messrs. C. Wilson and Sons, but H. Darwin and Company were active in arranging the exhibition at Galston,⁷ near Kilmarnock, in 1891, and Messrs. Richmond and Company, gas-stove manufacturers, organized that at Stranraer⁸ in 1901.

Differential prices for cooking or heating gas and illuminating gas remained a standard practice. Barrhead⁹ charged three shillings

1. S.R.O., Dalkeith Minute Book, op. cit., 10/7/1894, 28/9/1894, 12/7/1899, 20/2/1899, 5/10/1910.

2. Gas World, 22/11/1890 (diag.).

3. Gas World, 25/4/1887.

4. J.G.L., 17/8/1886.

5. J.G.L., 26/3/1889.

6. J.G.L., 22/7/1890.

7. J.G.L., 19/5/1891.

8. S.R.O., Stranraer Minute Book, op. cit., 2/4/1901.

9. J.G.L., 16/7/1889.

and fivepence farthing for cooking and heating in 1889, seventeen and a half per cent less than for illumination. In 1890 Easter Buckie¹ charged three shillings and ninepence instead of seven shillings and one penny, and Stonehaven² three shillings and ninepence instead of four shillings and sevenpence, a reduction likely to have provided considerable stimulus for the move of consumers away from lighting to heating. In small northern towns like Banff, however, the overwhelming importance of gas for the purpose of illumination was still evident in the late 1890s.

Table 6.63 Analysis of Gas Consumption at Banff (May to November 1895)

<u>Use of Gas</u>	<u>Consumption (Thou. Cu.ft.)</u>	<u>Price</u>	<u>Value (£)</u>
Private Lighting	1,474.4	6s 3d	461
Cookers	128.2	5s 0d	32
Public Lights	200	=	58
Harbour and Private Outdoor Lamps	48	=	13
Used in the Gasworks	300	-	-

Source:- S.R.O., Banff Minute Book, op. cit., 6/3/1896.

Most gasworks plant was idle at mid-day while only illuminating gas was sold, and towns like Dumfries³ found this the main reason for promoting gas-cooking at mid-day. Reducing the single evening peak of consumption allowed a more efficient use of both manufacturing equipment and labour, and in towns like Alloa⁴ daytime consumption was raised almost to the level of nighttime consumption by the early 1900s.

Table/

1. J.G.L. 10/6/1890

2. J.G.L. 10/6/1890

3. J.G.L., 27/11/1883.

4. J.W. Napier (Alloa), "The Illuminating Power and Calorific Value of Coal Gas", N.B.A.G.M. 1904, p. 41.

Table 6.64 Changing Diurnal Pattern of Gas Consumption at Alloa
1893-1903

<u>Date</u>	<u>% Consumption</u>		<u>Date</u>	<u>% Consumption</u>	
	Daytime (6am to 6pm)	Nighttime (6pm to 6am)		Daytime (6am to 6pm)	Nighttime (6pm to 6am)
1893	9.58	90.42	1899	31.26	68.74
1894	15.84	84.16	1900	34.93	65.07
1895	19.56	80.44	1901	41.89	58.11
1896	21.86	78.14	1902	43.09	56.91
1897	26.48	73.52	1903	44.53	55.47
1898	28.95	71.05			

Source:- N.B.A.G.M. 1904, p. 41.

Meanwhile, the development of gas engines provided another new market for gas as a power source. The first successful gas-powered engine was produced by W. Cecil¹ in 1822, using hydrogen, and was adapted in 1823-6 by Samuel Brown² of London for propelling a carriage

1. Before 1817 Professor Farish at Cambridge tried a smaller engine powered by explosions of gunpowder. Cecil suggested coal-gas instead of hydrogen, but did not try it himself. From 1642 when E. Torricelli demonstrated the weight of the atmosphere, many attempts were made to use it as a power source, and R. Street in 1794 tried combustion of "spirits of tar" for a vacuum piston. The alternative, high-pressure internal combustion engine, proved far more difficult to develop. J. Barber in 1791 (Pat. 1833) distilled coal gas, and burned it with compressed air to drive a turbine, but had little success. Philippe Lebon in 1801 had some success with a double-acting gas engine, with the gas ignited under pressure in the cylinder. A.F. Evans, The History of the Oil Engine (c.1930, London); W. Young, "Notes on the Practical Development of the Oil Engine", Transactions of the Newcomen Society 1936-7, Vol. XVIII, p. 109; Rev. W. Cecil, "The Application of Hydrogen Gas to produce a Moving Power in Machinery, with a description of an Engine which is moved by the Pressure of the Atmosphere upon a Vacuum caused by Explosions of Hydrogen Gas and Atmospheric Air", Transactions of the Cambridge Philosophical Society, Vol. I, 1822, pp. 217-39 (diags.); Edinburgh Philosophical Journal 1822, Vol. VII, p. 364.

2. Brown's gas engines, the first to be used commercially e.g. pumping water on Croydon Canal, have been strangely neglected by historians. The first was built, as a model, in 1814. By the 1830s Brown hoped to use waste gases from charcoal or pyroligneous acid manufacture. Glasgow used 10,000 gallons of pyroligneous acid each week, the gas from which would have been sufficient to grind flour for the whole city. Mechanics Magazine (1826), Vol. 6, p. 79 desc.; (1828), Vol. 9, pp. 278-9; (1827), Vol. 7, p. 83; (1832), Vol. 17, pp. 273-7, 300, 326. King's Treatise (1882), op. cit., Vol. III, p. 189. Many others tried to produce water-gas engines e.g. Mr. Brunel sen., Mechanics Magazine 1833-4, Vol. 20, p. 313; 1825-6, Vol. 5, p. 409 (diags.). B. Cheverton of Bristol, Mechanics Magazine 1825-6, Vol. 5, pp. 411, 420; 1826, Vol. 6, pp. 7, 20. "Carbonic Acid Gas Engines" to power ships, The Practical Mechanics Journal 1849-50, p. 51.

and a boat, and pumping water using coal gas, and later water gas. Both of these engines operated by atmospheric pressure, like the Newcomen steam engine. Andrew Fyfe¹ was Brown's main supporter in Scotland, and in 1825 built a copy of his engine at the Edinburgh School of Arts. The Caledonian Mercury was sceptical, and claimed that with a one-horsepower engine, steam power would cost £30 but gas power £430. Although Edinburgh gas cost twelve shillings per 1000 cubic feet, Fyfe claimed that suitable private gas could be obtained for about three shillings, and by mixing one part of gas with seven of air, the gas engine would only cost twenty pounds to run.

Nevertheless, expensive town gas inhibited further innovation in Britain, and the internal combustion engine using gas or oil fuel was largely developed abroad.² Etienne Lenoir's gas engine³ was success-

1. No details are available on the use of Fyfe's gas engines in Scotland. He also suggested that "a box of two feet square" would hold sufficient gas to power locomotives between filling stations, and that ships using gas-power could have their own gasworks. Edinburgh Advertiser, 4/2/1825.

2. E. Eteve's 1885 oil fired engine, sold from 1887 by Priestman Bros., Hull, was the first such engine widely used in Britain where steam-power was dominant until a late date.

1857 electric ignition by Barsanti and Matteucci.

1858 cheap American petroleum after Col. Drake's well in Pennsylvania.

1858 J. Robson (North Shields) gas engine - gas and air drawn in till half-stroke, ignited for remainder of stroke, and exhausted on return stroke.

1860 Etienne Lenoir's horizontal, double acting gas engine (like Robson's but with electric ignition) - consumed 100 cu.ft. gas per hour.

1862 M. Hugon - water-spray cooling of cylinder in Lenoir's engine.

1862 Alphonse de Roches (1815-91) 4-stroke cycle gas engine.

D.C. Field, "Gas Engines" in C. Singer Ed., History of Technology 1850-1900 (1958, Oxford), Vol. V, p. 157. Gas Journal Centenary 1849-1949 (1949), p. 123. Boat powered by Lenoir's gas engine in 1861 vide Mechanics Magazine 1861, Vol. VI, p. 128. Internal combustion engines could use coal gas almost as easily as oil, and gas was used to power many vehicles in the 1914-18 World War. C.M. Walter, "The Application of Town's Gas for the Running of High Speed Internal-Combustion Engines", Transactions of the Mining Institute of Scotland 1932-3, Vol. LXXXV, p. 352.

3. The "Gas Engine Company" with a nominal £100,000 capital was promoted in 1865 to sell Lenoir engines in Britain and the Colonies. J.G.L., 26/12/1865, p. 912. Description of the engine vide J.G.L., 12/10/1862, 12/12/1865, p. 891.

fully developed for industrial use during the 1860s, but the best four stroke "Otto cycle" was not developed by N.A. Otto (1832-91) until 1877, just a few years before the threat from electricity. This horizontal engine used only twenty eight cubic feet of gas per hour, but was so successful that Messrs. Crossley Brothers of Manchester who held exclusive British rights to the Otto and Langen patent until 1890, prevented other British manufacturers from making gas engines.¹ By 1885 about 900 Otto engines had been built in Glasgow,² under licence from Messrs. Crossley, and 300 of those were used in the Glasgow region.³

Gas engines could provide a more convenient power source in many situations where steam engines had previously been used, but were particularly suitable for generating electricity, and refrigeration.⁴ Edinburgh and Leith⁵ Gas company in 1879 installed an early Otto engine of three and a half horse-power for £170 compared to a steam

1. All 2 and 6 cycle gas engines were less efficient e.g. D. Clark's 1879 2-cycle engine. Messrs. Otto and Langen sold 35,000 gas engines throughout the world within a few years of developing the system. List of firms using Otto and Crossley engines vide J.E. Dowson, "Gas Power", Cleveland Institute of Engineers 1898-9, p. 129. Messrs. Crossley's Factory described in Engineering 1884, Vol. XXXVII, p. 136. L. Bryant, "The Silent Otto", Technology and Culture 1966, Vol. VII, p. 184. J.H. Clapham, An Economic History of Modern Britain - Free Trade and Steel 1850-1886 (1932, Cambridge), p. 110.

2. Messrs. Watt and Son of Washington Works, Glasgow, produced Otto engines from 1879, J.G.L., 1879, p. 440; 2/6/1885.

3. Glasgow gas-manager W. Foulis devised a new, but less popular gas engine. King's Treatise (1882), op. cit., Vol. III, p. 209.

4. Bell-Coleman Refrigeration Company of Glasgow, which devised mechanical refrigeration on ships in 1879 and in the 1880s supplied refrigerators for vessels to Australia, India and America, in 1882 made the first successful refrigerator in which the piston (which expanded air for cooling) was driven directly from the piston-rod on an Otto gas engine. Iron - An Illustrated Weekly Journal of Science, Metals and Manufactures in Iron and Steel 1883, Vol. 21, p. 112.

5. F.T. Linton (Leith), "The Costs of Working a Gas Engine Compared to Steam", N.B.A.G.M. 1880.

engine of £110, but the maintenance cost was twenty seven pounds per year less, and savings were also made on labour and space, while the gas engine required no special buildings or smoky chimney. The engine was used to blow three smiths' fires and machinery including a circular saw, two lathes and two grindstones. An engine of the same size, installed by a sack-sewing firm in Dundee¹ in 1878 stimulated great interest in such engines there and used 2184 cubic feet (8/6d) gas per week. By 1880 several gas engines were used to operate hoists and other machinery at Aberdeen, Perth and Dundee. The only problem encountered was the need for higher pressure in the gas mains,² and separate service pipes to prevent nearby lights from flickering.

During 1879 a three and a half horse-power gas engine in a Dundee³ sack factory operated eighteen sewing machines, a cutter and a hoist. The printing works of T. Nelson and Sons in Edinburgh⁴ installed a sixteen horse-power engine in 1880, and one was also adopted by a Kilmarnock⁵ soda-water factory that year. A four horse-power engine for newspaper printing and folding machines in Dumfries⁶ was the largest in southern Scotland in 1882, but an eight horse-power engine was installed at Elphinstone⁷ that year to pump water 320 feet up a water-tower. Kirkintilloch⁸ purchased an eight horse-power engine

1. J.G.L., 10/12/1878.

2. Coupar Angus first allowed a daytime supply for gas engines and stoves in 1889, and even in Glasgow daytime pressure during foggy weather was inadequate for gas engines in 1891. J.G.L., 3/12/1889, 17/3/1891.

3. J.G.L., 4/2/1879.

4. J.G.L., 6/4/1880.

5. J.G.L., 2/4/1880.

6. J.G.L., 23/8/1881.

7. J.G.L., 11/7/1882.

8. J.G.L., 3/7/1888.

for pumping at the sewage works in 1888, Stirling¹ town had six gas engines by 1889, and at Glasgow² a large fifteen horse-power engine commenced at Tradeston gasworks in 1891.

When Glencadam Distillery installed a ten horse-power gas engine in 1883 Brechin boasted³ six such engines. The printing industry widely adopted gas engines in the 1880s. At Cupar⁴ J. Innes requested a twenty five per cent discount on the price of gas for his three and a half horse-power engine used in printing. The gas Directors refused only after inquiries at Perth, Dundee, Glasgow, Edinburgh and Leith showed that no special discounts were allowed. At Perth another printer, Mr. Young, used a three and a half horse-power engine and consumed three shillings and sixpence worth of gas per week at the standard rate of five shillings per 1000 cubic feet. In 1898 Messrs. G. & J. Innes installed a second gas engine for printing, but were still refused discounts. Bathgate⁵ gas company in 1887, however, supplied the gas engine of L. Gilbertson, printer, at three shillings and ninepence compared to the standard gas price of four shillings and twopence.

At Dalkeith the gas company in 1887 tried to encourage gas engines by allowing twenty five per cent discount on consumption by the engine used by the Burgh Water Committee to supply a water tower.⁶

1. J.G.L., 4/6/1889.

2. J.G.L., 11/8/1891.

3. Brechin falsely boasted more gas engines than any other British town. D.H. Edwards, Pocket History and Guide to Brechin (1884, Edinburgh), p. 170.

4. S.R.O., Cupar Minute Book, op. cit., 26/9/1882, 12/10/1882, 14/4/1898.

5. S.R.O., Bathgate Minute Book, op. cit., 20/6/1887.

6. Normal gas price was 4/2d, but the engine was expected to use 3000 cu.ft. per day. In practice the consumption was 2000 cu.ft. per day, and in 1891 the discount was reduced to 10%, the same as public lights. S.R.O., Dalkeith Minute Book, op. cit., 13/9/1887, 28/4/1891.

In 1888 the gas company provided a special mains pipe to the gas engine at J. Murray's engineering works, and in 1910 to the engine at Dalkeith Brewery, but in both cases refused a discount on consumption.¹ In many towns the lack of daytime pressure on gas-mains inhibited the use of engines. Stranraer² consumers were refused a daytime supply in 1878, and gas-engine users were also refused such a supply in 1898, although from 1901 the company tried to encourage their development with a five per cent discount for consumption by engines.

Although enthusiasts of gas-power were over-optimistic³ during the 1880s, with schemes to convert all town-engines to gas-power using supplies piped directly from large gasworks on the coalfields,⁴ Britain did adopt gas-engines on a very large scale. The imported Otto engine technology proved more popular in Britain than in Germany, as shown in Table 6.65.

Table/

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1. S.R.O., Dalkeith Minute Book, op. cit., 31/7/1888, 7/10/1910.
 2. S.R.O., Stranraer Minute Book, op. cit., 1/7/1878, 22/2/1898, 21/5/1901. c.f. Galashiels gas company in 1904 and 1907 adamantly refused any discounts for the gas engine used by Galashiels Co-operative Society. S.R.O., Galashiels Minute Book, op. cit., 5/1/1904, 6/8/1907.
 3. W. Kay, "On Coal Gas : and the Coal Question, in its bearing on the Illuminating power of Gas", Proc. Royal Philosophical Society of Glasgow 1886-7, Vol. XVIII, p. 87.
 4. R.T. Moore, "Recent Developments of the Hamilton Coal Field", Proc. Royal Philosophical Society of Glasgow 1892-3, Vol. XXIV, p.63.

Table 6.65 Adoption of Otto Gas Engines in Britain and Germany
(1877-97)

<u>Date</u>	<u>Number of Gas Engines</u>		<u>Total Brake Horse-Power</u>	
	<u>Great Britain/ Ireland</u>	<u>Germany</u>	<u>Great Britain/ Ireland</u>	<u>Germany</u>
1877	133	} 550	678	} 1,668
1878	145		2,270	
1879	590	424	3,009	1,366
1880	782	436	3,988	1,536
1881	942	522	5,605	2,118
1882	1,162	639	9,877	2,704
1883	1,172	693	9,962	2,922
1884	1,187	721	10,090	3,276
1885	1,205	717	11,267	3,280
1886	1,304	686	12,193	3,966
1887	1,365	944	13,923	4,494
1888	1,482	898	15,116	4,895
1889	1,615	943	17,846	6,090
1890	1,805	1,105	19,945	6,552
1891	1,933	1,052	23,003	6,219
1892	1,994	894	23,729	5,612
1893	2,043	886	25,180	6,034
1894	2,117	887	26,542	6,220
1895	2,364	891	29,639	6,462
1896	2,501	1,131	31,888	9,576
1897	2,832	1,174	37,312	11,676
Total	30,973	16,193	333,062	96,666
Total in Other Countries		14,204		78,297

Source:- J.E. Dowson, "Gas Power", Gas World, 2/7/1898.

No gas engines were used in Dunfermline¹ until 1892 when a severe depression of the linen industry led the Gas Commissioners to promote new uses for gas. Supplies were arranged at two shillings and elevenpence for motive power, compared to three shillings and sevenpence for lighting, and within five years twenty two gas engines, varying in size from one half to twelve horse-power had been adopted, and with a consumption of 1.7 million cubic feet per year they were a most important new market.

1. H. Poole (Dunfermline), "Ways and Means of Increasing Gas Consumption", Gas World, 31/7/1897.

Table 6.66 The Employment of Gas Engines in Dunfermline (1897)

<u>Consumer</u>	<u>Nominal H.P.</u>	<u>Annual Consump- tion. (Cu.ft.)</u>	<u>Consumer</u>	<u>Nominal H.P.</u>	<u>Annual Consump- tion. (Cu.ft.)</u>
Wholesale Grocer	$\frac{1}{2}$	3,100	Butcher	Under $\frac{1}{2}$	3,700
Cycle Repairer	$\frac{1}{2}$	7,800	Butcher	$\frac{1}{2}$	900
Car proprietor	2	12,600	Butcher	$\frac{1}{2}$	3,400
Co-op Society	2	900	Smith	$1\frac{1}{2}$	4,600
Linen Manufacturer	$3\frac{1}{2}$	159,200	Baker	$3\frac{1}{2}$	125,200
Ironmonger	$3\frac{1}{2}$	64,300	Joiner	4	41,200
Joiner	4	31,300	Joiner	4	105,500
Wholesale Grocer	4	19,100	Baker	3	117,400
Grain Merchant	6	73,900	Printer	$1\frac{1}{2}$)	382,500
Co-op Society	8	93,900	Printer	4)	
Co-op Society	12	462,200	Joiner	3	17,200
Printer	$\frac{1}{2}$	65,000	Plumber	3	20,000
Printer	4	290,000	Baker	6	60,000
Joiner	6	110,000	Icemaker	8	920,000
Joiner	10	53,000			

Source:- Gas World, 31/7/1897.

The largest concentration of gas engines was probably in the Glasgow municipal-supply district, where the number¹ rose from 632 in 1890 to 1584 with 7383 horse-power in 1900, 1690 with 19,003 horse-power in 1909, and 1409 with 20,454 horse-power consuming town-gas² in 1913.

Gas engines were praised for efficiency by the Coal Commission³ of 1905, and offered many advantages in the urban environment.

1. Glasgow City Archives, Miscellaneous Papers, Vol. 18 (1909), p. 118. 1 b.h.p. consumed 14 cu.ft. gas.

2. Greater Glasgow (1914, Glasgow), p. 95.

3. Digest of Evidence Given before the Royal Commission on Coal Supplies 1901-5 (1905).

Although many small factories still used steam engines in 1918, these gave only ten per cent efficiency from seven to twelve pounds fuel per horse-power, compared to twenty six per cent efficiency with gas engines which gave freedom from coal cartage and storage, required no boiler attendant, clinker or ash removal, could be used immediately without standby losses, and gave no liability for prosecution for smoke nuisance.¹

During the 1880s, gas engines which could power electricity generators² raised some hopes that gas power could compete with coal-fired power-stations. In 1882 gas-powered electricity was used in Sir W. Thomson's laboratory from a six horse-power Clark gas engine, in Anderson's College from Professor Blyth's eight horse-power engine, and at the Advertiser offices in Glasgow where an Otto engine was coupled to a "Brush" generator.³ Although small consumers soon found a central supply the best source of electricity, as late as 1907 private gas-powered electricity generators were fairly common in banks, large commercial offices, retail shops and public buildings, because municipal electricity undertakings refused to install plant to meet their short evening peak demands.⁴

In 1894 Glasgow Corporation⁵ sold electricity at sevenpence per

1. "Distribution of Motive Power in Towns", Gas World, 9/11/1889. W.H.Y. Webber, Town Gas and Its Use for the Production of Light, Heat and Motive Power (1907).

2. Dundee Gas Commissioners in 1879 experimented with electricity production using a $3\frac{1}{2}$ h.p. gas engine and Gramme machine. J.G.L., 11/2/1879.

3. Although the Brush Company of Scotland preferred to supply steam-engines to power their equipment, gas engines were initially almost as important as steam and certainly more important than hydro-power in Scotland. A. Jamieson, "On Electric Lighting", Mining Institute of Scotland 1882-3, pp. 330, 357. J.G.L., 11/1/1881, 15/2/1882.

4. W.H.Y. Webber, Town Gas (1907), op. cit.

5. "The Use of Gas Engines for Electric Lighting in Scotland", Gas World, 31/3/1894, p. 345.

Board of Trade Unit, which was equivalent to sixteen 16-candle incandescent gas lights burned for one hour. But even premises like Green's Billiard Rooms preferred to generate their own electricity by gas power. Messrs. Goodson, mantle manufacturers, used Crossley engines of four to nine horse-power for electricity in their Glasgow warehouse. The Otis Elevator Company which in 1894 supplied electric lifts at Maule's in Princes Street, Edinburgh, and at the Central Chambers in Glasgow, supplied Otto engines for power. The largest private electricity plant in Scotland, at Messrs. Stuart, Cranston & Co., tea and coffee merchants of Glasgow, used two fourteen horse-power Crossley engines which consumed only one penny to one and a halfpenny worth gas per Board of Trade Unit.

Messrs. Crossley had, by 1894, sold 1500 gas engines for generating electricity. Sixteen with a total 300 horse-power were in use at Glasgow, Edinburgh, Montrose, and at Hoddam Castle in Ecclefechan. Electricity generation did not become a substantial market for the sale of gas power,¹ despite the apparent advantages shown in Table 6.67. Small private electricity plants using gas engines were used throughout the 1890s and early 1900s, such as those owned by Mr. Steel at Selkirk² in 1894, Mr. Smith of Galashiels³ in 1902, and Mr. Cochrane also of Galashiels in 1904.

Table/

1. The steam-turbine by C. Parsons proved more successful for electricity generation. J.H. Clapham, An Economic History of Modern Britain - Machines and National Rivalries (1887-1914) (1938, Cambridge), p. 133.

2. S.R.O., Selkirk Minute Book, op. cit., 16/3/1894.

3. S.R.O., Galashiels Minute Book, op. cit., 7/10/1902, 14/10/1902, 7/6/1904.

Table 6.67 Advantages of Gas Engines over Mains Supply for Electricity (1907)

	£	s.	d.
(1) Three gas engines with generators combined, each capable of 60 Kilowatts, delivered and set up, on foundations provided by consumer	3312	0	0
Interest and depreciation on above			
at 10 per cent	£331	0	0
Renewals and oil at 10 per cent	100	0	0
Cost of gas at 30 cu.ft. per unit, at 2s 11d per 1000 cu.ft., for output 150,000 units per annum	656	0	0
Less 25 per cent discount as gas for power purposes	164	0	0
	<hr/>		
	492	0	0
Labour, mechanic and mate	182	3	9
	<hr/>		
Annual expenses for 150,000 units	1105	3	9
	<hr/>		
(2) Taking 150,000 units from the mains, on a lighting scale at 4d per unit	2500	0	0
	<hr/>		
Private gas engines therefore gave a saving of	1304	16	3

Source:- W.H.Y. Webber, Town Gas (1907), op. cit.

Gas companies were unwilling to supply cheap gas for private electricity plants, because the demand could only accentuate existing peak periods in the evenings and in winter, unlike the daylight requirements of cooking stoves and gas engines. For this reason, Bathgate company¹ in 1894 refused discounts for the gas engine required by a local merchant, H.S. Hissop, for generating electricity. Several gas companies did, however, consider becoming electricity companies. At Galashiels,² where Messrs. Sanderson & Son purchased electric lighting equipment for their factory in 1893, the gas company requested the town Council that year to refuse applications by electricity companies wishing to operate in the town. In return, "whenever any general desire was expressed for the introduction of

1. Bathgate Minute Book, op. cit., 8/5/1894.

2. Galashiels Minute Book, op. cit., 5/12/1893, 7/11/1893, 21/11/1893, 23/1/1894, 6/3/1894.

Electric light", the gas Directors would recommend a changeover to electricity manufacture, which the local company could achieve at minimal cost by avoiding competition. Later in 1893 the Caledonian Electric Supply Company did approach the Council, so the gas company financed detailed costing estimates by Messrs. Browning and Gardner, electrical engineers of Edinburgh. These showed such high expenditure, that the gas company refused to pursue the venture, yet the Town Council also refused permission to the Caledonian Company.

In 1899 an Edinburgh engineer, W.J. Purves, tried to persuade Dalkeith¹ gas company to manufacture electricity, but the Directors refused in the belief that demand would remain too small to be profitable. In general terms, electric lighting in Scotland had far less advantage over gaslight, than gaslight had in the early nineteenth century over oil and candles. Consequently electricity developed far more slowly² and provided an adequate period of time for gas companies to assess and respond to the challenge. At Montrose in 1897, four private electricity works were operating but the gas Company sustained a growth in output. Ayr³ was the only Scottish gas company in direct competition with a Municipal electricity works. Consequently the number of public gas lamps there fell from 585 to 443 by 1897, but their consumption had been maintained by fitting larger burners. Total gas consumption at Ayr rose seven per cent in 1896-7 and only eighty four consumers had by then adopted electricity. Of those, four ceased to use any gas, and consumption

1. Dalkeith Minute Book, op. cit., 9/11/1899.

2. Electricity development in Britain as a whole was slow in comparison to European countries like Norway and Switzerland. J.H. Clapham, Economic History of Modern Britain - Machines (1887-1914) (1938), op. cit., p. 132.

3. Gas World, 10/4/1897, p. 578.

by the others had fallen dramatically from three million to 800,000 cubic feet per year.

The incandescent mantle enabled the entire technological basis of the gas industry to change from the production of illuminating gas to calorific 'power' gas. The gas mantle produced illumination by its incandescence in a high temperature gas flame, unlike open-flame burners which relied entirely upon the incandescence of carbon particles produced during the combustion of the gas itself. It enabled the industry to concentrate entirely upon heating power instead of "candlepower", but, like gas cookers, the development of mantles had a long history¹ and, like the Otto gas engine, it was a technology in which Britain was subservient to German enterprise. Carl Aur Von Welsbach (1858-1929)² was the first to produce a cheap mantle using cotton thread which absorbed a solution of rare-earth salts. When

1. Berzelius discovered Cerium (1803) and thorium (1825), 'rare-earth' elements, and noticed the incandescence of thorium oxide when heated.

1826 Gurney's 'lime light' used incandescent lime in an oxy-hydrogen flame.

1835 Talbot made mantles of lime salts on blotting paper.

Later mantles were designed for use with water-gas (vide supra p. 463) which gave a non-luminous open flame e.g.-

1839 Cruikshank's platinum wire mantle, coated with lime or thoria oxide.

1848 Gillard's platinum wire mantles in France.

1878 Edison's platinum wire mantles coated with zirconium & cerium oxides.

1882 Clamond mantles of magnesia and magnesium acetate, which burned to magnesium oxide (Too fragile for normal use).

1883 Fahnehjeln of Stockholm made "combs" or rods of magnesia, widely used on European water-gas burners.

Mantles based on platinum all proved too expensive for normal use.

1884 Welsbach experimented with mantles made from cotton thread dipped in solutions of rare earth salts and then dried.

1885 Welsbach patented the use of oxides of lanthanum, yttrium, zirconium and magnesia.

E.F. Armstrong, "Important Dates in the Development of Gas Lighting", Terrance Ed., Notebook for Gas Engineers (1948), op. cit., p. 47.

Thorpe's Dictionary of Applied Chemistry (1941), 4th Edn., Vol. V, p. 481. Gas World, 21/2/1891, "Incandescent Gas Lighting".

2. G. Lockman, The Story of Chemistry (1960), p. 211.

heated over an aerated 'Bunsen' flame, the cotton was destroyed, but coherent threads of rare-earth oxides remained to produce light. In 1886 he introduced thorium salts, and in 1893 perfected the "Welsbach Mixture" of ninety nine per cent thoria and one per cent ceria for a stronger, more durable mantle.¹

The advantages of Welsbach's mantle were immediately apparent. The first Welsbach mantles in Glasgow were displayed in March 1887 by Messrs. Baird and Tattock, manufacturers of scientific equipment, both at their warehouse and in Anderson's College at a meeting of Glasgow Philosophical Society. St. Enoch's Station Hotel soon followed, and led the van of many commercial establishments which promoted this improved illumination. Dr. Wallace, the city gas examiner, stated that mantles produced "a gain of fully 100 per cent in illuminating power" compared to an equal quantity of gas in an open-flame burner.² At first they were an expensive novelty, with special burners costing one guinea, and mantles five shillings each.³ Only after 1891 did the scale of demand produce lower costs, and throughout the 1890s and 1900s the price of mantles was reduced by a number of innovations⁴ which made them suitable for most consumers.

1. Gas mantle manufacture vide S. Miall, A History of the British Chemical Industry (1931), p. 192; W.A. Tilden, Chemical Discovery and Invention in the Nineteenth Century (1936), pp. 272-9 (photos).

2. J.G.L., 22/3/1887.

3. S.A. Harris, Gas Supply of North Merseyside (1956), op.cit., p.99.

4. Thorium and Cerium sands from Brazil, Carolinas, and later Travancore (India) replaced expensive supplies from Scandinavia; 1898 Buhlmann used China-grass with long fibres, for stronger mantles; 1901 Plaissetty used "artificial silk" with continuous threads and little twist, for more durable mantles. Mantles became more efficient with Kent's inverted incandescent burner of 1891, the application of heat regenerative systems in 1903, and high-pressure lighting (120 inches pressure) by Keith and Blackman in 1907, which raised the illuminating power three to four times. J.S. Dow & L. Gaster, Modern Illuminants (1915), op. cit., pp. 34-47. D. Chandler, Outline of History of Lighting by Gas (1936), pp. 179-207. Thorpe's Dictionary of Applied Chemistry (1941), op. cit., p. 481.

Consequently in the late 1890s many Scottish gasworks reduced the candlepower of mains supplies,¹ and purchased cheaper types of coal which effected considerable financial savings.

Table 6.68 Reduction of Candlepower in Scottish Gasworks 1898-1903

<u>Candlepower</u>	<u>Number of Gasworks</u>		<u>Candlepower</u>	<u>Number of Gasworks</u>	
	<u>1898</u>	<u>1903</u>		<u>1898</u>	<u>1903</u>
32	5	3	24	19	37
30	10	11	23	6	21
29	8	5	22	3	17
28	41	17	21	3	9
27	38	23	20	0	5
26	48	25	18	0	1
25	48	56			

Source:- N.B.A.G.M. 1904.

As late as 1903, several Scottish towns had difficulty in persuading consumers to use gas-mantles despite the financial savings, but the gas-mantle was in widespread use. At Alloa that year, only thirty four per cent of gas used in lighting was consumed by incandescent burners, although the gas manager demonstrated how inefficient the older burners were. From random tests using five cubic feet of the twenty two candlepower mains gas, he found that fifty per cent of open-flame burners gave eighteen candlepower, fifteen per cent gave fourteen candlepower, and thirty five per cent gave only ten to twelve candlepower. One cubic foot of gas gave five candlepower in the average open-flame burner, but twenty candlepower in an incandescent burner, and thirty candlepower in a high-pressure incandescent burner.² Glasgow Herald³ in 1909 claimed that the flat-flame burners

1. J.W. Napier (Alloa), "The Illuminating Power and Calorific Value of Coal Gas", N.B.A.G.M. 1904, p. 41.

2. c.f. in London, one cu.ft. gave 3 candlepower in a flat-flame burner, 15 to 20 candlepower in a Welsbach mantle burner, and 30 candlepower in a high pressure incandescent burner. Digest of Evidence Given before the Royal Commission on Coal Supplies (1901-5), Vol. II, pp. 372-4. D. Terrance, "Modern Gas Lighting", Proc. Cleveland Inst. Engineers 1895, p. 305. D.R. Gardner, "On the Conversion of Ordinary Gas Shades into Regenerative Lamps", Proceedings of the Royal Philosophical Society of Glasgow 1889-90, Vol. XXI, p. 92.

3. Glasgow Herald, 21/9/1909. Glasgow City Archives, Miscellaneous Papers 1909, Vol. 18, p. 118.

once "almost universally used" gave only three candlepower from a mains supply of twenty candlepower, whereas the same gas gave fifteen to twenty candlepower with ^MElsbach burners, twenty to twenty five candlepower with inverted burners and mantles, and fifty to sixty candlepower in high-pressure street lamps.

Hamilton retained many flat-flame burners in 1904, and although the gasworks supplied free burners, consumers still purchased inferior types at sixpence to one shilling, while local ironmongers and plumbers refused to co-operate in supplying or maintaining incandescent burners. The incandescent mantle enabled gaslight to compete with electric lighting,¹ but adoption was evidently a slow process² extending well into the 1900s.

Scottish 'town gas' was not widely used for heat in large-scale industrial processes during the nineteenth century.³ On a small scale, gas blowpipes, soldering-iron heaters, crucible heaters and annealing furnaces were widely used⁴ by 1850. In addition to these, even a town like Edinburgh⁵ with only light industry, in 1911 used gas for branding, linotype bronzing and laundry machines, kilns, coffee-roasters, tailors', upholsterers' and laundry irons,⁶ enamelling

1. e.g. Dalkeith gas company in 1900 placed incandescent mantles at the railway stations of Dalkeith and Eskbank, and supplied free gas-burners to consumers, in a campaign to show the advantages of gas over electricity. Dalkeith Minute Book, op. cit., 20/11/1900.

2. Even in 1918, gas engineers urged the retention of self-luminous gas flames, which did not depend on importing foreign materials which could be halted by war. In railway tunnels, theatre exits and similar situations where a permanent light was required, open-flames were still more reliable than incandescent mantles. W.H.Y. Webber, Town Gas (1918), op. cit., p. 77.

3. Private installations for water-gas and producer-gas, however, were common. Vide supra pp. 459 et seq.

4. Detailed examples vide W.H. Webber, Town Gas (1907), op. cit., pp. 188-93.

5. F. Popplewell, Journal of the Royal Statistical Society 1910-11, op. cit.

6. c.f. irons heated by gas were used by Nicolson's Abbotsford Laundry, Galashiels, in 1897. S.R.O., Galashiels Minute Book, op. cit., 7/9/1897.

and drying stoves and gas-hammers. "Gassing" textiles¹ like cotton, with a gas flame instead of oil lamps to burn off the "fluff" surrounding threads, was devised in 1817 and still widely used in textile mills in the 1860s.

In 1829 Charles Macintosh² used coal-gas instead of charcoal to control the carbon content of steel, and produced steel in under eighteen hours compared to eight or fourteen days in the conventional crucible process. However it did not become a commercial success. Not until the 1880s did cheaper gas lead the large bakeries around Glasgow to employ gas fired ovens, "the first use of gas in industry on any scale".³ Elsewhere gas was employed on a workshop rather than factory scale.⁴ Many developments originated in the Glasgow firm of Messrs. Waddell and Main who in 1881 produced a gas-oven to speed up the "hot press" stage in newspaper printing,⁵ when wet papier-mache had to be dried around type on a stereotyper, to produce a mould for the molten metal which made the stereotype plate

1. Process devised by Mr. Hall of Nottingham in 1817. In the 1840s G.F. Urling and Co. made machines for gas singeing silk thread. J. Cooke of Belfast improved cotton singeing in 1859, and by 1860 bobbins moved the thread at 3500 revolutions per minute past the flame. A. Ure, The Cotton Manufacture of Great Britain (1861), pp. 172-8. The Builder, 1847, Vol. V, p. 17. Engineering and Mechanics Magazine, 1/4/1859, p. 1.

2. G. Macintosh, Biographical Memoir of Charles Macintosh, F.R.S. (1848, Glasgow).

3. C. Mackenzie, The Vital Flame (1949), p. 38.

4. Using a gas-engine to force gas to 100 inches water-pressure, enabled it to be used in the 1890s to fuse metals like platinum, to temper steel e.g. axles, to "shrink-on" wheel tyres, and for case-hardening. T. Fletcher, "Coal Gas as a Labour Saving agent in Mechanical Trades", and "Gas for Light and Work in the Workshop", Iron - An Illustrated Weekly Journal, op. cit., 1884, Vol. 23, p. 158; 1885, Vol. 25, p. 137. W.H. Webber, Town Gas (1907), op. cit., p.193.

5. Commissioned by the Glasgow Herald, and so successful that a second oven was installed for the evening paper in 1883. J.G.L., 31/7/1883.

for printing. In 1883 they devised a gas-heated stove to keep tailors' irons¹ at constant temperature, which superseded coal fires in many large Edinburgh tailoring firms since gas reduced insurance premiums and gave better working conditions.

Prepayment meters were the last important nineteenth century innovation to expand the market for gas sales.² Some of the earliest examples, made by W. & B. Cowan, were exhibited in 1888 by McGilchrist to the North British Association of Gas Managers, and apparently first used in Scotland by him at Dumbarton.³ In 1893 the Nairn gas manager campaigned for their greater use, and they were introduced in Glasgow that year. Development was slow, however, because they involved very heavy capital outlay for small returns.⁴

1. J.G.L., 15/5/1883. See also R. & A. Main's "Non-firing-back Burners for Gas Stoves", Gas World, 25/8/1894, p. 222.

2. Money meters devised by Hero of Alexandria, c.50 B.C., described in Pneumatics. Prepayment gas meter patented in 1887 by R.W. Brownhill of Walsall (Pat. 7412).

1888 tried experimentally by S. Metropolitan Gas Co.

1889 slot meters by J. Haynes, T. Thorpe and T.G. Marsh used experimentally by Liverpool Gas Co. in artisans' dwellings.

1889 improved slot-meter by W.E. Price used at Ramsgate (1889), S. Metropolitan Co. (1892) and Liverpool Gas Co. (1892) where 8000 ordered.

1889 improved slot-meter by W. Cowan.

S. Metropolitan Co. gave bonus to workmen to canvass for prepayment meters, and the number used rose from 439 in 1892 to 6166 in 1893, 25,516 in 1894 and 80,115 in 1898.

From 1888 Brownhill's meter manufactured under licence by Messrs. W. Parkinson and Messrs. T. Glover & Co. Gas World, 16/6/1888, pp.373-5 desc. Brownhill meter.

T. Wilson (Coatbridge), "Prepayment Meters", Gas World 1897.

E.W.T. Richmond, "Slot Cookers and All About Them", Gas World, 3/12/1898, p. 758, 19/11/1898, p. 758, 10/12/1898, p. 884. C. Mackenzie, The Vital Flame (1947), p. 21. - S.A. Harris, Development of the Gas Supply of North Merseyside (1956), op. cit., p. 91.

3. At Dumbarton their use may have predated the experiments made in 1890 by the corporations of Birmingham, Bolton and Blackburn to test the accuracy of such meters. W. & B. Cowan were soon manufacturing these meters in Edinburgh.

4. W.H.Y. Webber, Gas and Gas Making - Growth, Methods, and Prospects of the Gas Industry (1918), p. 70.

Diag. of prepayment meter vide W.H.Y. Webber, Town Gas (1907), p.154.

At Montrose, shilling slot-meters were installed in 1898 for small shops like pie-vendors and ice-cream vendors where the gas manager was unwilling to allow credit. The success of these led to penny slot-meters being provided to poor houses, where consumption rose very rapidly to 22,200 cubic feet in six months. Payment before consumption was very popular among the working classes, and the slot-meters produced "a veritable revolution in the domestic arrangements of that large section of town dwellers who cannot run quarterly bills".

Galashiels¹ company experimented with a dozen 'slot-meters' in 1897, as did Stranraer² in 1899, with great success in both cases. Consumers who were frequently in arrears were often refused any supply except by prepayment meters, as at Stranraer³ from 1903, and they became increasingly important for reducing such bad debts. Perth⁴ began in 1896 by installing six prepayment meters in a poor part of the town, and within fourteen months had supplied 800, of which 700 were completely new consumers. In 1888 McGilchrist⁵ had shown managers that instead of the heavy labour costs at Nairn, where gas-rents were collected weekly from low income groups for their own benefit, prepayment meters were ideal since many poor families burned oil "not because they consider it cheaper or better than gas, but simply because they...cannot lay sufficient past to pay a three months'".

1. Prepayment meters were expensive. James Milne (Edinburgh) charged £2 6/- each in 1898. Galashiels bought 61 (£140) from Milne in 1898, and 66 in 1899 (£152), but by 1900 also purchased them from D. Bruce Peebles (Edinburgh), T. Glover & Co. (Glasgow), and Sawyer & Purves (Manchester). S.R.O., Galashiels Minute Book, op. cit., 7/9/1897, 7/6/1898, 4/6/1899, 5/6/1900.

2. S.R.O., Stranraer Minute Book, op. cit., 18/7/1899, 1/9/1899.

3. Ibid., 19/2/1903. Gas arrears amounted to £203 when the decision was made for their compulsory use.

4. Gas World, 7/8/1897, p. 215.

5. J. McGilchrist (Dumbarton), "Selling Gas", Gas World, 4/8/1888.

bill", which companies normally charged.

Although small consumers had been well treated in Scotland, the prepayment meter still tapped a large part of the poorest urban population,¹ and replaced dangerous petroleum oil-lamps. The initiative, however, rested upon the gas undertaking itself. Up to 1905, when Glasgow² issued 10,000 slot-meters to encourage "a large number of potential consumers among the poorer citizens", only 721 were in use there. After 1907 the total number of ordinary meters in Glasgow declined in favour of prepayment meters, which were in great demand despite the higher charge made for gas³ to cover high maintenance costs on such meters, as shown in Table 6.69.

Table 6.69 Market for Prepayment Meters, Gas Cookers and Heaters in Glasgow (1901-14)

(Number of Appliances)

Date	Prepayment Meters	Ordinary Meters	Cookers	Heaters	
				Hired Out	Hire Purchase
1901	328	206,236	21,053	-	-
1902	434	209,323	22,065	-	-
1903	515	215,608	23,851	-	-
1904	660	221,351	25,657	-	-
1905	721	227,902	28,044	-	-
1906	11,100	231,184	31,185	-	-
1907	27,177	229,062	42,435	-	-

1. This was especially true in England where workmen in the 1880s preferred to burn oil-lights and cook with coal, instead of paying quarterly bills, and making a humiliating journey, with loss of wages, to sign on with a gas undertaking and pay a deposit for good faith. Few weekly tenants, small householders, or tenants of two or three rooms therefore used gas. W.J. Liberty, "The Century of Gas Lighting and its Historical Development", The Illuminating Engineer 1913, Vol. VI, p. 200.

2. The Gas Supply of Glasgow (1935, Glasgow Corporation Gas Dept.), op. cit., p. 59.

3. In 1907, the average English surcharge for slot-meters was 10d per 1000 cu.ft., and a typical small household had one prepayment meter, two or three lights, and a gas cooker. 1d provided up to 30 cubic feet gas, sufficient for a 60 candlepower incandescent light to last seven hours, or to cook a dinner of a joint, two vegetables, and pudding, sufficient for six persons. W.H.Y. Webber, Town Gas 1907, op. cit., pp. 155-6.

Table 6.69 (contd.)

Date	Prepayment Meters	Ordinary Meters	Cookers	Heaters	
				Hired Out	Hire Purchase
1908	35,466	227,503	49,469	-	-
1909	43,900	225,422	58,928	-	-
1910	49,957	223,889	67,802	-	-
1911	57,068	221,613	78,997	-	1,815
1912	65,018	217,523	100,693	-	4,599
1913	76,778	210,105	145,141	12,589	6,391
1914	88,008	202,303	172,152	26,787	4,119

Note - all cookers hired-out up to 1907, then loaned and hired; from 1912 loaned out.

Sources:- The Gas Supply of Glasgow (1935), op. cit., p.59.
Glasgow City Archives, Glasgow Reports 1912-13,
p. 876; 1913-14.

Gas fires, and free loan facilities in place of hire-charges for fittings, provided the final extension of markets. Incandescent, radiant heaters were developed during the 1880s with flat, vertical surfaces of clay which held tufts of asbestos fibre, heated red by gas jets. The 'Incandescent Gas Heating Stove' by John Wright¹ in 1890, with cast metal filigree work backed by clay which was heated to red incandescence, provided complete combustion and eliminated malodours.² It remained popular into the 1920s, and this type of space heater was adopted in Scotland during the 1890s. By 1896, Dunfermline had forty four gas fires hired out. At that time only sixty seven of the 246 Scottish gas undertakings supplied free meters,³ though the number increased during the late 1890s-1900s for the benefit of poor consumers.

1. Similar incandescent arrangements were developed for twentieth century gas fires. Gas Journal Centenary 1849-1949 (1949) p. 120.

2. Even in 1907, however, luminous-flame heaters without chimneys were still widely used in retail shops, warerooms, lodging houses and churches, and some factories and warehouses relied entirely upon gas-lights for heating in winter. W.H.Y. Webber, Town Gas (1907) pp. 171-94.

3. Viz. 27 municipal gasworks and 40 private companies. Gas World, 31/7/1897.

Meter rents had previously discriminated against small consumers, and were used to conceal the true price of gas.¹ In the mid 1870s one gas manager who received only £106 rent from 1300 meters, had complaints about expensive gas prices, whereas nearby, comparable companies which supplied slightly cheaper gas, obtained £350 to £500 in rent from the same number of meters. At Haddington, where most consumers in 1879 used only 100 cubic feet of gas during the three summer months, they paid eightpence for gas and two shillings meter rent for that Quarter. For small consumers, "cheap gas" often cost more than "dear gas" because of meter rent.

Table 6.70 Meter Rents Discrimination Against Small Consumers
(1879)

	'Dear Gas' at 5/-			'Cheap Gas' at 4/-		
	£	s.	d.	£	s.	d.
4000 cu. ft. annual consumption) by small consumer)	1	0	0	0	16	6
Annual Meter Rent	0	1	6	0	6	0
Total Annual Cost	1	1	6	1	2	6

Source:- J.G.L., 1879, p. 254.

During the 1900s, loan facilities² increased greatly, and by 1911 not only meters but hotplates, grills, incandescent burners and

1. Meter hire charges varied considerably. Paisley in 1879 charged 1/6d per year for a three light meter, approximately equal to the repair costs, but Dumbarton charged only 1/-, and Coatbridge received £340 per year from a meter rent of 3/-, or 10% on larger meters. D.B. Esplin (Forfar), "Some Reasons for Gas Companies and Corporations Letting Out Meters to Consumers Free of Charge", N.B.A.G.M. 1879. J.G.L., 1879, p. 254.

2. C.W. Hastings, Gas and Water Works Statistics (1911) (Nat.Lib. Scot.). In 1911 Elie and Earlsferry supplied free cookers; Largo and Loanhead free grills; Kinross/Milnathort free cookers; Perth free cookers and heaters; and Renton free cookers and grills.

cookers were supplied free of charge in many Scottish towns, and consumption was maintained despite competition from electricity.

Table 6.71 Examples of Gas Appliances on Free Loan in 1911

<u>Company or Town</u>	<u>Fittings</u>
Ayr	Hot plates, grills, rings
Bothwell and Uddingston	Hot plates, grills, incandescent burners with slot-meters
Dundee	Cookers and heaters
St. Andrews	Cookers, grills, fires
Coupar Angus and Carnoustie	Boiling rings

Source:- C.W. Hastings, Gas and Water Works Statistics (1911).

The development of incandescent burners enabled Scottish gas undertakings not only to overcome the growing scarcity of best-quality coals without raising the long term price of gas, but also to compete successfully with electricity for lighting, and to foster a rapidly expanding market for domestic cooking and space heating. The new technology and vertical retorts,¹ previously described, produced a great increase in gas output of low candlepower but high calorific value from smaller quantities of cheaper coals which, unlike the high-candlepower cannel coals, also produced good quality coke for sale. Significantly, the great encouragement given to gas cooking in the mid 1880s coincided with a major slump in by-product sales.² The reduction of this market finally persuaded gas undertakings to take vigorous and successful action to protect their position against the encroachments of electricity.

1. Vide supra p. 395

2. Vide supra p. 575

CONCLUSION

Gas-lighting developed in Britain as a cheaper and safer alternative to traditional oil-lamps and candles for illuminating large industrial premises, especially textile mills. Capital investment by the owners of industrial and commercial premises encouraged Boulton and Watt to investigate the possibilities of marketing gas apparatus, and William Murdoch's installation of large-scale plant demonstrated the economics and safety of gas-lighting. To assist Murdoch, several Soho employees like Samuel Clegg senior, Hutton, and Henry Creighton were trained as gas engineers. In the absence of patent restrictions, these engineers later sold their skills elsewhere, and assisted both the rapid adoption of private gasworks for industrial premises and the successful development of joint-stock gas companies. Gas companies obtained the economic advantages of large-scale production by piping gas to commercial and domestic premises, and usually gained municipal support and way-leave¹ by selling gas for municipal street-lighting at or below the prime cost.

Private gasworks remained important throughout the nineteenth century, but especially so in the period before 1840, when an earlier geographical dispersion of factories to water-power sites made the combined output of private gasworks probably of greater importance than that of joint-stock gas companies outside the principal commercial cities like Glasgow, Edinburgh, Dundee and Paisley.

1. In the late nineteenth century, way-leave charges for opening the streets became more common; in 1890 Lochgelly paid £20 per year to the Road Trustees, and Dunfermline company £20 to the Town Council. J.G.L. 29/7/1890, 23/9/1890.

Factories sometimes supplied gas to the village housing their employees, and the Bairds of Gartsherrie,¹ for example, provided cheap gas and water for employees in the 1880s. Estate owners also built small gasworks for their tenants, like James Farquharson who opened Auchinblae² gasworks in 1840.

The first joint-stock gas companies in Scotland, from 1817-28 marked a resumption of mercantile prosperity in the nation after the close of the Napoleonic Wars. Only eighteen companies representing perhaps £305,581 initial nominal capital stock³ were formed at that time and were largely confined to the principal commercial towns, Ellon (1827) being an important exception. Sixteen new companies in 1829-30 represented a very rapid increase. This was a time of surplus brick capacity⁴ and cheap labour,⁵ following the boom of 1825; and also moderate bank rates.⁶ Insufficient data are available to judge the role of interest rates in Scotland at this time, but it is possible that new banks created after 1825 encouraged both a greater availability of funds for commerce and industry,⁷

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1. F. Groome, Ordnance Gazetteer of Scotland (1882, Edinburgh) Vol III p. 80.
 2. J. Watt, The Argus and Mearns Directory for 1846 (1845, Edinburgh) p. 9.
 3. i.e. original stock invested to test viability of companies e.g. £20,000 at Edinburgh in 1817 before the Act. Vide infra p.154
 4. Economic History Review 1956-7 Vol. IX. Vide supra pp.733, 739
 5. B.P.P. 1836 (40) XXXIV, p. 99 (571) Vide supra p.735
 6. Minimum bank rate each calender year was constant from 1820-35, except for a high level in 1824-7; but the rate was far higher than that after 1842. B.R. Mitchell and P. Dean, Abstract of British Historical Statistics (1962, Cambridge). Vide supra p.732
 7. A wave of new Banking companies, like the Ayrshire and the Glasgow Union, actually commenced from 1830. R.H. Campbell, Scotland Since 1707 (1965) pp. 140-2; H. Hamilton, The Industrial Revolution in Scotland (1932, Oxford) pp. 273-9.

and by competition reduced interest charges.

The slow start in Scotland was not necessarily evidence of insufficient or poor quality entrepreneurship, or a shortage of willing investors or capital, but possibly an effect of population distribution. Rural factories organised their own gas supplies, while small towns and villages without factories and occupied by artisans, retail traders and handloom weavers were too conservative to support the 'new light'. Though not too small to organize a joint-stock company, they lacked adequate motivation. Gas light was known to be much cheaper than oil or candles, but until such inhabitants had first-hand experience of it at neighbouring factories or towns, they were reluctant to embark upon the necessary organization and heavy capital outlay. Thus the 1820s were a period in which the diffusion of technology occurred slowly from a relatively small number of operational works. Willing joint-stock investors were at first concentrated mainly in the larger towns, but entrepreneurs actively proposed companies even in small towns, where capital in the form of savings was available though slower to be mobilized.

Nevertheless, from the late 1820s a proliferation of gas companies throughout the populous regions of Scotland provided the first opportunity for very large numbers of persons to invest in joint-stock enterprise. Some still feared the hazard of investment but promoters were increasingly confident that a major catastrophe was unlikely, and the convenience of using gas-light appeared to many an adequate compensation even if dividends were not immediately obtainable. Many promoters were civic dignitaries and parochial pride, as reflected in the New Statistical Account, became an additional stimulus in the 1830s.

Factory as well as shop and domestic consumption was a prime target for the promoters¹, as at Hawick where the original mains pipes were only laid along the High Street, and up the Crescent to Peter Wilson

1. The first duty of Selkirk directors was to consider laying "pipes to the Machinery Houses about to be erected on Dunsdalehaugh", which had obviously stimulated interest in the promotion of a gas company.
S.R.O. (G.B.1/72/1) Selkirk Contract of Copartnery 4/2/1836 article 15.

and Company at Whiskey-house Mill.¹ Mains pipes were, however, such a large item of capital expenditure that manufacturers were often expected to sign long-term contracts² for consumption before the installation was made. Discounts to large consumers, like the fifteen per cent on 9s gas allowed by Dalry company in 1843 to the Glasgow, Paisley, Kilmarnock and Ayr Railway,³ were designed to encourage consumption by these firms. Dalry⁴ in 1880 provided a discount to Messrs Kyle and Aitken's new mill on the River Rye in 1880 after applying the "method of comparisons" by obtaining statistics from the Paisley, Kilmarnock, Johnstone, Irvine and Beith gas companies. Comparisons like this were used by the directors of all companies to plan any aspect of management from gas prices and wage levels to new capital equipment. This was the basis for regional and national levels of conceptual management, whereby new methods were communicated straight to directors rather than through the gasworks managers as intermediaries.

Despite the industrial applications of gas-lighting, manufacturers were not numerically or financially the leading promoters of most joint-stock gas companies, with some notable exceptions like Glasgow, the Vale of Leven, and Coatbridge companies.⁵ Subscription

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1. Transactions of Hawick Archaeological Society 1969 op. cit.
 2. e.g. . . . , Biggart's Mill at Bridgend, Dalry, in 1834 signed a ten-year contract for 50,000 cu ft per year at 12s with 2s discount, but agreed to pay four per cent interest on the cash difference between any lower consumption and the interest on the £28 cost of pipes. (Biggart ceased to use the gas in 1838). S.R.O. Dalry Minute Book op. cit., 2/8/1834, 11/8/1838
 3. The Railway signed a 10-year contract, and paid the entire cost of mains pipes extensions from which the Gas company retained a right to join service pipes. S.R.O. Dalry Minute Book op. cit. 11/7/1843.
 4. By 1887, Messrs. Kyle, Aitken and Gardiner were the principal consumers of gas at Dalry. Ibid., 20/9/1880, 15/8/1889
 5. Because gasworks provided a market for a wide range of small cast-iron implements which could be made locally, they did have the active support of foundry owners like J.Caldow of Dumfries; vide infra p.1368; also pp. 709,828. Publicans also gave support for extra business; vide supra p. 913

committees and early Boards of Directors held a large number of retail traders, who were important consumers and supporters, but there is a strong probability that men in professional occupations,¹ especially bankers, writers and advocates like Mark Sprott of Garnkirk, exercised a leading role in company promotion. They were the unpaid "consultants" whose wide experience of other towns, of the nuances of Scots Law, and of financial management, permitted the development of joint-stock gas company organisation. Taking Parliamentary regulations for chartered gas companies as their model, they recreated on a small but more comprehensive scale, contracts of co-partnery² which anticipated a wide spectrum of business risks and instituted inexpensive summary methods which remained within the law of the land. Only rarely did they overplay their hand - advocates were leading supporters of the 1824 Edinburgh Oil Gas Company,³ and the collapse of that venture probably remained a vivid memory for over a decade in the Scottish legal profession. It was a mistaken attempt to revive the Scottish whale fisheries, and high raw material costs could not be overcome by the lower consumption necessary with high quality gas. Nevertheless, the venture financed scientific experiments in which Edinburgh chemists acquired a national reputation for their significant advance in photometric analysis.⁴

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1. Professional groups in which established channels of communication, especially oral, encouraged rapid extension of knowledge, e.g. doctors, clergy.
 2. The laxity with which contracts were finalised was in great contrast to the intricacy of their details. Lesmahagow company commenced in 1846 and had made a full call on shares besides taking a £100 loan, and payed dividends, before the General Meeting of 1848 "agreed that the Contract of Co-partnership should be legally drawn out and subscribed by the several shareholders". S.R.O. Lesmahagow Minute Book op. cit., 19/5/1848
 3. The company has been frequently misquoted. Vide, A. and N.L. Clow The Chemical Revolution (1952) p. 436; D. Chandler Outline History of Lighting by Gas (1936) p. 18.
 4. Vide infra Appendix XI p.1629 et seq.

By preceding railway developments in most Scottish regions, gas companies provided the first means of mobilising the savings of the middle classes, and even of the working classes in the north. They were the first opportunity for such people to participate in, and observe joint-stock company organization. This capital-intensive industry provided the earliest large-scale outlet, with the exception of water supply, whereby savings enhanced the prosperity and living standards of the inhabitants.

The 1830s-40s experienced a rapid growth in new branch-bank facilities¹ in Scotland, one aspect of the quickening tempo of development especially in western central Scotland as a result of Neilson's 1828 Hot-Blast iron process. Those two decades, however, like the 1820s still represent an important gap in knowledge. Gas company minute books, Municipal records and Parliamentary committees investigating the affairs of large gas companies, provide some light on broad economic themes affecting the industry, but there is inadequate information on, for example, cast-iron prices,² to estimate how significant these were in the pattern of investment in new gas companies during that period. Although Consumers' Companies in the early 1840s claimed that labour and cast-iron were particularly cheap then, no comparable statistics are available in the interval 1829-40, or before 1829.

Population statistics are not available for many early nineteenth century urban centres; the Census often continued to provide

1. Vide J.M. Reid, The History of the Clydesdale Bank 1838-1938 (1938) pp. 82, 89, 93, 124, 154.

2. J. Butt "The Scottish Iron and Steel Industry before the Hot Blast" Journal of the West of Scotland Iron and Steel Institute 1965-6 Vol. 73

parish figures whilst ignoring the existence of a growing village, with a gasworks, inside the parish. In many cases, gasworks or companies commenced in a village so early that no date of origin has survived. These factors prevent a comprehensive chronology of fixed-capital investment in the Scottish gas industry, as does the variability between recorded capital and population. This latter was caused by variations in the degree of industrial gas consumption. The cause of such anomalies, and an improved classification of mid-nineteenth century statistics for projection backwards into the 1830s, must await detailed research upon urban population, and a historical classification of occupational geography. A short classification of occupations, and the percentage of working population in each arranged by town/village, and also as a regional pattern, at decade intervals, would be of considerable assistance in relating investment and output statistics from the gas industry to other variations in the national economy. Given such a classification format, for which statistics could be collated regionally in a similar way to the Land Utilization Survey of Britain, L.D. Stamp Ed. (1946),^{*} it would be possible to determine which areas, and how many people, were affected by nineteenth century economic trends already recognised. Only when such information is available can realistic appraisals be made of the significance of available early nineteenth century statistics on the gas industry.

In several cases, merchants and industrialists who later played an important role in railway developments, like James Lumsden,¹ gained their early experience at company promotion and organisation

1. Vide supra 'Consumer Companies' p.1130

* Vide explanatory leaflet The Organization of the Survey p.2 (no date, c.1947) London School of Economics (Croydon Ref.Lib. q.333.7)

in the gas industry. John Orr Ewing (1809-78)¹ similarly obtained joint-stock management experience in the Vale of Leven gas company.

A national review of the personalities involved in company management before 1850 could be deduced from trade directories which are available at irregular intervals on a regional format, e.g. the Edinburgh Almanac or Universal Scots and Imperial Register for 1836 (1836); J. Watt - The Angus and Mearns Directory for 1846 (1845, Edinburgh). Existing studies have concentrated upon an examination of individuals involved in particular sectors like banking and railway promotion, but the information has not been correlated into an alphabetical form suitable for easy reference. Progress in developing a suitable dictionary form of these individuals, and those shown in directories, could provide an insight into the diffusion of commercial and technical knowledge, and the fundamental mechanism of joint-stock company promotion. Similarly, engineers and company managers can be identified by name in the directories, and also in the Inventory Deeds of the Court of Council and Session (S.R.O.). These records would be suitable, given sufficient time, to derive a far more comprehensive review of engineering skills and of the origins of engineers, than has yet been possible. The gas industry provided

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1. Began as a calanderer's office clerk in 1828 to learn the type of goods used in the India trade; in 1831 joined his employer in partnership in the yarn trade, before opening Turkey-red dye-works in the Vale of Leven in 1835. He was soon involved in organising the Vale of Leven gas company of 1835, and became a director and prominent member of the Edinburgh to Glasgow Railway Company (1842), and an original promoter and director of the Caledonian and Dunbartonshire railway. Later Chairman of Young's Paraffin Oil Co.

Memoirs and Portraits of One Hundred Glasgow Men (1886, Glasgow) Vol. I, p. 127.

W.H. Marwick, Economic Developments in Victorian Scotland (1936) p. 61.

blacksmiths, artizans and shopkeepers, with technological problems which required improved standards of technical skill - they trained on the job, with the assistance of consultant engineers. This rule-of-thumb technology enabled the industry to expand without more than a small minority of technologists who planned and supervised only the major alterations to equipment.

Specialist engineering firms provided additional assistance, having commenced as general engineers like the predecessors of Hyde Park railway locomotive works. Through their large size, these firms by the late nineteenth century were able to provide advanced technical training and a wide range of skills to men who subsequently became gasworks managers. Among the most important, Messrs Laidlaw¹ retained a structural-ironwork department in addition to gas apparatus production, and by 1901 had a nominal capital of £110,000. Two of the largest gas-fittings manufacturers attained similar size: James Milne and Son Ltd.² by 1899 had a nominal capital of £200,000, and Bruce Peebles and Company Ltd.³ in 1903 had a nominal capital of

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1. R. Laidlaw and Son Ltd. took limited liability on 24/5/1901. Owned Alliance Foundry, Broomhill Ironworks and Lambhill Foundry in Glasgow, and works in Simon Square, Edinburgh. 5,500 Pref. Shares (5 per cent) of £10; 5,000 ordinary shares of £10. Directors Robert Laidlaw, David Laidlaw, Thomas Kennedy Laidlaw, William Kennedy Laidlaw. S.R.O. (B.T.2/4856).
 2. Registered 3/5/1899. Purchased old company for £100,000 cash and £100,000 new shares. 10,000 Pref. shares (5 per cent) of £10; 10,000 ordinary shares of £10. Directors - James Milne of Edinburgh; John L. Milne of Peebles; Thomas T.M. Lumsden of Edinburgh; Daniel Macfie of Edinburgh; Adam Macpherson gas manager of Kirkcaldy; James M. Oliver of Edinburgh. S.R.O. (B.T.2/4239).
 3. Registered 24/6/1903. 20,000 ordinary shares of £5; 20,000 Pref. shares of £5. Directors - Wm. Carmichael Peebles of Edinburgh; Arthur C. Peebles of Edinburgh; R.S. Portheim, engineer of London; M.T. Pickstone, engineer of Edinburgh; H. Mungall, coal-master of Edinburgh. S.R.O. (B.T.2/5383).

£200,000.

Innovations in technology, and a reduction of capital costs, were achieved at various times by gasworks managers (chief engineers), and by manufacturers who were stimulated by the universal practice of gas companies taking sealed tenders and accepting the lowest reliable estimates. Improved pipes by Messrs. Russell, and cheaper gasmeters for consumers,¹ both devised by manufacturers, produced a considerable reduction in capital costs; the principal early nineteenth century innovation pioneered by Scottish equipment manufacturers was that of clay retorts. Fraser's Inverkeithing retorts produced a very considerable saving in working costs, through longer duration at higher temperatures, which also raised gas-output per ton of coal and proved highly suitable for Scottish cannel coals. Competition from Garnkirk, and from Joseph Cowan,² kept these valuable retorts available at vastly lower price than their cast-iron rivals. Improved retort-ovens, purifiers, washers and governors were devised largely by gas managers like Reid and Whimpster, on the basis of experience gained as consultant engineers, handling practical problems at a large number of companies.

Price competition between coalmasters and the advent of rail transport enabled companies to reduce expenditure on coal by a judicious blend of various coals of different quality. "The close

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1. Working costs also fell, because large quantities of gas had previously been used without payment. In 1836 Dunfermline company employed a tailor to "perambulate the town" twice a week to catch these miscreants. Dunfermline Press 9/11/1929, p. 5
 2. Testamonal to Joseph Cowan, Tyneside retort maker. J.G.L. 14/6/1864, p. 453.

dependence between the price of coal ... and the amount of gas sold and used"¹ remained of great importance into the 1920s. The cost of coal formed such a large proportion of working costs, than an increase in price had to be passed on directly to the consumer by most Scottish gasworks to avoid an immediate and heavy deficit; this was true of municipal undertakings as much as companies. To offset this cost, by-products were developed as an auxiliary market of considerable importance, reaching twenty to thirty per cent of the original coal costs. Although Scottish gas undertakings sometimes expanded vertically to undertake tar-chemicals and ammonium sulphate manufacture, there is no evidence of attempts to control collieries. Some managers like H. Bartholomew, and directors like J. Russel at Falkirk, were partners in colliery companies, but gas companies obtained their supplies usually on an annual basis on the open market.

The Scottish shale-oil industry had close links with the gas industry, because its technology was in many respects similar. Besides providing technical training for many future gas managers, the oil industry exchanged knowledge with that of gasworks, especially through William Young who occupied a pivotal position between these industries and, through his associate Henry Aitken, the iron furnace by-produce industry. With gas managers like McGilchrist, Young pioneered inter-industry investment whereby a small group of technologists purchased existing gas companies to obtain profit by the direct application of their engineering skills. He also adapted

1. Evidence of Dr E.W. Smith, Chairman of the Society of British Gas Industries, quoted by A.M. Neuman, Economic Organisation of the British Coal Industry (1934) p. 96

the oil-gas enrichment which was being developed in the United States,¹ and devised the popular Peebles Process whereby mineral-oil gas was used in Scotland to raise the candlepower of coal gas from cheap, low quality coals. Concurrently he produced the advanced designs of vertical shale-oil retorts which became the basis for Glover-West Vertical gas-retorts.

Mineral oil gas proved far more successful than coal gas for high-pressure storage and use in railway carriages,² vehicles and navigation buoys. The Pintsch Company held a monopoly over this system and built several large Scottish installations. In 1892, enlargements to the Pintsch works,³ at St. Enoch station cost £1,781; at nearby Bellahouston a plant of £2,315 in 1895 also supplied that station; and at Ayr⁴ on the Glasgow and South Western Railway a Pintsch plant of £4,037 was built in 1907. Piped distribution of mineral oil gas superseded coal gas at several small gasworks after the mid-1880s, like the installations at Lochgilphead⁵ in 1887 and Cowdenbeath⁶ in 1888 by the Patent Paraffin Gas Lighting Company of Glasgow. From the 1890s, acetylene gas also provided an important

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1. A progression from Lowe's process using oil from 1872 to carburett water-gas, as marketed after 1882 by the United Gas Improvement Co. of Philadelphia. Development encouraged by new oil-fields in Ohio and Pennsylvania, and high coal cost in California which used Australian coal until 1884. G. Wehrle, American Gasworks Practice (1919, New York) pp. 23, 61.
 2. In 1907, Railway companies in the United Kingdom privately manufactured gas worth £286,000 per year. Census of Production 1907 (1910) op. cit. Category 52.
 3. Unclassified records recently received by S.R.O.; courtesy of Mr Johnstone. Large scale plans dated 16/6/1892, 5/6/1895.
 4. Sixteen iron retorts to make 30,000 cu ft per day; gasholder twenty ft diameter, ten ft deep. S.R.O. Ibid. documents dated 12/4/1907.
 5. S.R.O. (R.H.P./10398)
 6. J.G.L. 11/9/1888.

low cost supply in many small villages in place of uneconomical coal-gas works. Like water-gas and other special gases, these were direct rivals to coal gas and yet only proved effective competitors on a relatively limited scale.

Initial organisation in unincorporated gas companies frequently used a proportional voting system, limited the number of shares an individual could hold,¹ and established residential qualifications in order to minimise the voting power of wealthy individuals. Many of the original ideals, including low denomination shares and maximum involvement of consumers, were exactly the same as those of later Consumer Companies. Heavy responsibility was devolved upon company directors, who usually acted gratuitously and took full control of the financial affairs. Treasurers were appointed, but in most companies they were supervised by the directors, who at least until the 1860s undertook all the auditing without the assistance of external professional accountants.

In the absence of direct competition, other than from candles, dangerous naphtha lamps,² and from paraffin lamps (after 1857 but especially during the 1870s), the principal motivation for gas-price reductions before 1878 was the desire to extend markets. Infrequent threats of competition by consumer organisations did enforce rapid, localised reductions in price, but in the long term were not as significant as the promise of higher profits and dividends which could

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1. e.g. Brechin originally allowed no partner to hold above twenty shares of £5. Journal of Artificial Light 18/10/1879.
 2. Improved oil lamps and candles vide J. Butt "Technical Change and the Growth of the British Oil Shale Industry 1680-1870" Economic History Review 1964-5 II Series, Vol. XVII.

be earned by companies selling larger quantities at lower prices. Fluctuations in coal price, and especially the psychological impact of coal crises like 1871-3 combined with the fear of an exhaustion of cannel supplies, provided the most significant additional stimulus to improved management and technology before 1878; possibly more immediately effective because crises highlighted the problems of the industry.

Because of elastic demand, the effects of regional and national trade slumps could be partially offset by reducing the price of gas. Consequently, these external factors were a third major stimulus to better management. The initial loss of trade often led directors to take active steps to obtain information on new technology and market policy from other companies, which produced long-term improvements. The domestic lighting market became especially important in off-setting short-term variations in demand by local manufacturing industries. Thus the Vale of Leven company in a local trade slump of 1845 reduced gas from 11s to 10s and offset a fall of 21,200 cu ft in factory consumption by a rise of 133,000 cu ft in domestic gas. Total consumption fell only 78,000 cu ft in 1846, because the factory reduction of 190,300 cu ft was largely absorbed by a domestic increase of 111,500 cu ft. Because light was a necessity of life, the cheapest supplies were sought perhaps even more actively during a slump. In 1847 private consumers at 953,150 cu ft exceeded the importance of factories at 816,850 cu ft, and an increase of 24,200 cu ft in sales was made "notwithstanding the depressed state of trade". Not until 1848, a year of "manufactur-

ing depression almost unexampled in severity"¹ did both markets decline, and even then the domestic fall of 173,750 cu ft was less than factories at 229,250 cu ft. The reverse tended to be true at a time of high coal prices, which raised domestic heating bills and often indicated strong industrial activity. A slump in consumption² at the Vale of Leven in 1855 was caused by 51,000 cu ft reduction in factory consumption, and 282,000 cu ft less by private consumers.

The financial position of early companies appeared precarious. They were undercapitalized and relied heavily on loans, frequently in the form of expensive bills of relatively short duration, which sometimes amounted to more than the entire capital stock. This was mainly the combined result of an inadequate number of original investors, and a very rapid expansion in consumption which required immediate capital extensions. Although many works commenced with quite modest apparatus,³ like the 8,000 cu ft gasholder at Broughty Ferry⁴ in 1847, partners had to accept the burden of loan debts. Credit was readily available, and although heavy reinvestment of profits was also resorted to, prosperous companies found loans cheaper than share-capital to finance especially large extensions.

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1. c.f. in 1850 by reducing gas to 8s 9d, the company achieved an increase in sales of 199,000 cu ft. S.R.O. Vale of Leven Minute Book op. cit. 2/6/1845, 1/6/1846, 14/6/1847, 10/6/1850
 2. Prosperity returned in 1856 with a rise of 487,000 cu ft in sales. Ibid., 5/9/1856.
 3. When the original Glasgow Townhead gasworks was sold at public auction in 1876, two of the early small gasholders fetched only £38 and £40; and three telescopic holders £310.
J.G.L. 12/9/1876
 4. J.G.L. 31/7/1877

Reserve or contingency funds were rarely sufficient to finance large-scale extensions, especially retort-benches or gas-holders. For these, it was normal to obtain considerable loans which were repaid by profits generated by that new equipment. Revaluation of nominal shares was a discontinuous process, with the result that great variations occurred throughout the century between nominal capital stock and gas output, or population in the market-zone. This largely inhibits the development of an accurate method of calculating capital-stock for companies where no figures are extant. Moreover, the practice of charging large items of capital expenditure against annual profits created sharp variations in annual expenditure records which make these an unreliable guide to company prosperity. Estimating turnover or trading capital by comparing annual expenditure to nominal fixed capital investment can exaggerate the errors, though it remains a useful long-term guide to prosperity. Annual fluctuations in wages compared to total annual expenditure cannot be used with accuracy because of the same problem. The extent of reinvestment of surplus profits in a prosperous company was nevertheless such that over a period of three or more decades this became the main source of fixed capital by financing both replacements for outworn plant, and also extensions of equipment costing more than the original share-capital which had been invested.

Incorporated gas companies acted in a similar manner, used extensive loans and reinvested large quantities of surplus profits in capital equipment, by evading Parliamentary regulations. Characteristically they supplied a large number of small consumers,¹ and

1. e.g. Aberdeen in 1871 had 17,558 consumers, of whom 16,217 used under 45,000 cu ft per year. J.G.L. 23/5/1871

argued that loan capital and re-invested profits gave a positive benefit to consumers who, in some measure, became co-participants in the venture. Companies initially projected an image of benevolence towards public welfare. The Consumers' Movement reviewed shareholders and directors as monopoly capitalists exploiting their commercial position. Although this movement coincided with periods of low interest rates, the promoters and their supporters in most cases, and certainly in the successful cases, had a genuine desire to use the cheap wages and iron then available to operate a low-cost works and supply cheap gas; only in a few cases were ironmasters stimulating these companies to enliven the market for iron.

The Reformed Parliament proved far more sympathetic to consumer companies in the 1840s than Members had been to earlier complaints of monopoly, like those against the Dundee company in 1829 when they were closely lobbied by wealthy supporters of the old company. However, this was not a simple laissez faire attitude; concurrently the regulations placed upon chartered companies were increasingly detailed, albeit frequently evaded.

Consumer companies, with their ideal of "socialism from above", soon faced the same problems as earlier gas companies when ideals were replaced by dividends. Moreover, consumers suffered under competition since the reduced scale of output by both competitors raised working costs and hence prices to a level in excess of that required for 'excessive' profits under monopoly conditions. Professor Alfred Marshall¹ in 1890 used this argument to redefine

1. J.G.L. 14/10/1890

gas and water supply, like electricity and railways, as an 'indivisible industry'. He favoured a monopoly for such industries, with private ownership subjected to public control,¹ in contrast to the government bureaucracy then being advocated by German and United States economists: "A private company which stands to gain something by vigorous and efficient management, by promptness in inventing, as well as in adopting and perfecting improvements in processes and organisation, will do much more for progress than a public department."² A municipal body would have less ability to discover which "employees have originating and constructive ability", and according to Marshall was "more liable to have the efficiency of its management interfered with for the purpose of enabling other persons to gain the votes of their constituents on questions in which it has no direct concern; and as a corollary from this, it tends to promote the growth of political immorality, and it suffers from that growth."

This was a premature post-mortem on the municipal enterprise which assumed ownership of many Scottish gas companies, especially in large towns, after 1868. The Journal of Gas Lighting² correctly estimated that "fresh outlets for trade are due in the main to individuals" initiative, yet this does not verify Marshall's view that "in great matters the freedom of experimenting lies only with those who undertake the [private] responsibility of the business." Individual managers expressed their personality in the efficiency and innovations of their gasworks, whether these were company works like

1. Although Babbage had earlier favoured free-competition, he too proposed public control (maximum dividends, public auditing and published accounts) over the voluntary monopolies produced by gas companies making "districting" agreements.
C. Babbage On the Economy of Machines and Manufactures (1832) p.259

2. J.G.L. 14/10/1890

Perth under Whimpster, or municipal works like Greenock under A. Ritchie, or Glasgow under W. Foulis. There is no evidence that municipalities chose less capable managers than did companies, and they undoubtedly experimented with some bold schemes including the first regenerative retorts in Scotland at Glasgow, the Insch Green works at Greenock, and the vast new Granton gasworks in Edinburgh. They were not necessarily more efficient than equivalent company gasworks, as illustrated by the rise of Partick, Hillhead and Maryhill company in competition with Glasgow in the 1870s, but in reducing the price of gas they were at least equally efficient.

Municipal works solved the problem of public accountability without the higher operating costs of duplicate facilities and leakage in competing companies. However, the use of loan capital carried the same burden of interest payments as when used by monopoly companies, and municipal gasworks practised heavy reinvestment of surplus profits both in the purchase of capital equipment out of revenue, and the repayment of loans. They made excessive depreciation allowances in the same manner as companies had previously done, thereby reducing the book capital to well below the market value of capital equipment exactly as it appeared in companies which practised reploughing. By this means, cheap gas was produced and high profits in comparison to book capital; but it is by no means clear whether a Chartered company in the same position could not have achieved similar results.

Geographical "depressed regions" are clearly defined by gas industry statistics and await more detailed analysis than has been possible here. In 1863, for example,¹ Aberlour in Banffshire charged

1. Black's Morayshire Directory (1863) op. cit., pp. 81,131.

16s per 1,000 cu ft and the company at Garmouth/Kingston at the mouth of the Spey charged 15s, well above the prices in most towns. Small companies paid higher overheads than large concerns, and even on the coalfields consumers in smaller towns paid more than those in large commercial centres. The convergence of population into central Scotland¹ enabled a whole range of companies, not least in the gas industry, to benefit from a large local market, an integrated commercial infrastructure, and good transportation especially of coal supplies. These advantages reduced prime manufacturing costs, and thereby allowed sale prices to be reduced. Where long-distance transport was impractical, as in the case of gas, or where it raised the market price of manufactured or semi-manufactured goods, the benefits were confined to the immediate locality and encouraged a further concentration of population wishing to take advantage of them.

Away from the coalfields county Directories and C.W. Hastings' periodical Gas and Water Works Statistics illustrate the twin handicaps of expensive coal and small markets. Consumers paid more, investors received lower dividends, and in comparison with industrial towns, these were "depressed regions". Even small towns had a gas supply, but high prices resulted in fewer consumers, lower output, and greater competition from alternative lighting like paraffin lamps. Lower profits reduced reinvestment in technical improvements, and the cycle repeated itself.²

1. A Slaven, The Development of the West of Scotland: 1750-1960 (1975) p. 136.

2. i.e. lower efficiency meant higher coal costs and a higher ratio of turnover exported from the town; lower profits meant a slower recycling of money in the local economy which, repeated in many industries, was a disincentive to further progress.

The pace of technological change increased rapidly in the 1880s and was maintained into the 1910s. This was the result of four factors, only two of which were totally independent variables. Very high prices for by-products especially ammonium sulphate, up to 1884 resulted in considerable investment in improved gas-purification equipment, and despite the price slump caused by by-product recovery from blast-furnaces, the Ammonia-Soda process provided a growing market which continued to absorb growing quantities of gas-works 'liquor'. Competition from electricity, whether real or threatened, was nevertheless the major stimulus to technological change from 1878; and in some measure it stimulated the great interest in by-product revenue. Regenerative retort-benches, using a system of heat-conservation developed more than a decade earlier for metallurgical industries, were introduced rapidly and successfully in the 1880s to produce cheaper gas.

Large price reductions were offered, and exhibitions organised to encourage gas consumption in heating and cooking 'stoves'. Candlepower was gradually reduced, to enable cheaper, poorer coals to provide the additional output. Gas engines provided a further market,¹ though not for generating electricity² since peak-load demand coincided with that of domestic consumers and would have required heavy additions to fixed capital equipment.

Gas output rose rapidly in 1880-1914 and gas became increasingly valued for calorific rather than illuminating power as incan-

1. Especially for printers, like Messrs. Nelson of Edinburgh. M. Plant, The English Book Trade (1965) p. 288.

2. c.f. Gas engines provided the first electricity supply in Belfast. R.H. Parsons, A History of the Institution of Mechanical Engineers 1847-1947 (1947) p. 228 (diag.)

descent mantles were adopted. The important technological innovations, mantles and regenerative retorts, were imported from continental Europe, and imply a serious gap in entrepreneurial progress between 1850, when British engineers were constructing European gasworks, and the 1900s when vertical retorts were a British innovation. The quality of management in many small and medium-sized Scottish gasworks improved little between the 1840s and 1860s, when an Association of Gas Managers provided a great improvement in the diffusion of knowledge. In larger works, managers were educated under the excellent part-time South Kensington scheme from the 1880s; previously the best managers had to seek external engineering practice in oil-shale or general engineering works.

As a consequence of dull national trade after the 1871-3 boom, stokers wages fell after 1878 to a level which probably more than offset the reduction in commodity prices, caused by cheap imports. A genuine wage grievance was thus the basis for labour agitation throughout the 1880s, and especially during the disturbances of 1889-90. Rising labour costs provoked a rapid development of mechanization in the 1890s, and ultimately the highly automated vertical retorts of the 1910s. The precise correlation between labour costs, labour agitation, and mechanization after 1890 requires further detailed study. As output rose rapidly, many old gasworks moved to new locations adjoining railway lines, to take advantage of gravity-feed and constructional arrangements which reduced labour costs on a growing input of coal, and output of coke. Coke production increased considerably in value in the early 1900s as different types of coal were used for calorific gas.

Electricity installations had a considerable impact on small

companies, like Cupar¹ in 1903; but through increased advertising, gas cooking and incandescent lights increased in popularity, pre-payment meters captured the poor section of the market from oil lamps, and the gas industry remained in a highly competitive position at the outbreak of the First World War. Liquid by-products were again remunerative, and the great increase in gas consumption which continued into the 1920s was largely a result of a rising market for calorific gas² by many sectors of manufacturing industry.

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1. In 1894, Cupar arranged to supply the Fife and Kinross Lunatic Asylum, which soon consumed over one million cu ft per year (£254), but changed to electric lighting in 1903.
S.R.O. Cupar Minute Book op. cit., 7/9/1894, 16/1/1896, 14/5/1903.
 2. A.M. Neuman, Economic Organization of the British Coal Industry (1934) p. 101.