

### **3. SLOW DAWN OF THE ELECTRIC LIGHT, 1881-1904**

The introduction of electricity to Sydney fell roughly into three phases. The first, from 1881 to 1887, was one of demonstration by entrepreneurs, growing public interest, and an increasing number of single-building applications of electric lighting. The years 1888 to 1894 saw the first municipal installations of electric lighting, raising questions about the ultimate ownership and direction of what was obviously, by then, an important and potentially profitable enterprise. Concurrently, there was intense competition for the legislative right to supply Sydney with electric light. By 1894 the Sydney Municipal Council (SMC) remained the only contender, although the enabling legislation was not formally passed until 1896. The final phase to 1904 saw the introduction of electric traction, and the resolution of a number of mainly technical issues leading up to the construction of Sydney's first two large power stations.

#### **3.1 THE INTRODUCTION OF ELECTRICITY**

Electricity first achieved commercial importance in the 1840s in the transmission of information over the telegraph wire. Thereafter, a separate branch of electro-technology emerged, directed towards assembling the elements of an economic system of lighting. Many different approaches to the problem were explored, but all of them contained some means of generating power from a primary energy source, of distributing it and of utilising it to provide energy services, related as shown schematically in Fig. 3.1. Innovations in electro-technology reached Australia very soon after their introduction in Britain, the USA and Europe: so soon, in fact, that the processes of rapid technological competition, adaptation and succession documented by Hughes (1983) were repeated in miniature in Sydney.

##### **Developments in Electrotechnology**

The history of electrical engineering is perhaps better documented than that of any other major technology. Its formative years coincided with enormous growth in technical publications and in formal technical education. Most workers in the field were acutely aware of the commercial possibilities of their inventions, and careful to document them for patent purposes. Among the many histories of the field, those of the Oxford History of Technology (Singer et al 1958), Dunsheath (1962) Brittain (1976) and Hughes (1983) give a useful overview.

The small amounts of electrical energy required in telegraphy from the 1840s were supplied by non-reversible chemical reactions in what were known as 'primary batteries'. Batteries had been used by Davy and others as early as 1808 to demonstrate the carbon arc, the basis of the

earliest electric lamps (Dunsheath 1962,123) but they were too expensive to sustain a commercial system of lighting. Further development was stalled until the introduction of reliable mechanical generators working on the principle of relative movement of a magnetic field and a system of coils. Small hand-driven generators were manufactured in quantity in the 1840s, mainly for the then fashionable 'therapeutic' uses of electricity (Singer et al 1958 V, 180).

Larger scale generators coupled to engines began to appear in western Europe from 1850. From about 1857 generators connected to single arc lamps were used in lighthouses (ibid,182,209).[1] The early generators used permanent magnets, a design which subsequently came to be called 'magneto-electric'. By 1870, smaller and more efficient machines incorporating electro-magnets and the principle of 'self-excitation' had been introduced: such designs came to be called 'dynamo-electric' or, more briefly, 'dynamos' (ibid, 186). Progress was rapid. A typical dynamo of 1873 cost half as much as a magneto of 1858, weighed less than a quarter, yet produced nearly three times the power (ibid, 192).

For the first time electricity could be produced cheaply and reliably enough for general lighting purposes. However, the intensity of the electric arc-light restricted its application to outdoors or to large spaces such as factories, where it was used from 1875. Thereafter one of the major problems of electrical engineering was "the subdivision of the electric light" (Dunsheath,128). To tap the market for indoor lighting then dominated by gas, it was necessary to reduce the size of individual lights and to allow them to operate independently of the others connected to the same generator. The circuit problem was solved by the connection of lamps in parallel rather than in series, but the real breakthrough was the incandescent filament lamp, developed independently (following unsuccessful experiments by others) by Swan in England and Edison in the USA, and introduced commercially in 1881 (Singer et al 1958, V,196).[2]

By 1881 all the necessary elements for urban-scale electric lighting from a central power station were commercially available: generators suitable for coupling to steam engines or water-turbines, cables and control gear for power distribution, arc lights for outdoors and incandescent lamps for indoors. The first electric power station erected to supply private consumers as well as street lighting was that of the English Electric Light Company at Holborn Viaduct in London, which commenced operation in April 1882 (Hughes, 55).[3] The Edison Electric Illuminating Company's station at Pearl Street, New York, commenced operation in September of the same year (ibid,42).

Electric lighting was now in a position to compete with gas in terms of quality of light, convenience and cost. The first two points were generally conceded in favour of electricity, but

the last was hard fought by the supporters of gas. Initial cost comparisons were complicated by the fact that the smallest available electric arc provided about ten times the illuminating power of the largest gas lamp. The proponents of electricity therefore invariably compared costs on the basis of equivalent candle power, while the opposition compared costs per lamp, contending that the extra illumination was unnecessary and unwelcome.

The costs of electric lighting fell as generators and lamps became cheaper, more efficient and more reliable, and load growth led to economies of scale. As the mains extended the loss of power through voltage drop became an increasing problem, more so in the low voltage direct current (DC) systems introduced by Edison than with alternating current (AC) systems of his chief rivals. The costs of distribution rose prohibitively for distances beyond a mile (Hughes, 83). The possible remedial measures involved various configurations of power stations, distribution equipment and combinations of DC and AC, all of which attracted some support during the 1880s and 1890s.[4] The critical choice was between DC and AC working:

"During the closing years of the eighties, technical journals and even the popular press kept readers informed of "the battle of the currents," or "the battle of the systems""(Hughes, 106).[5]

The battle was complicated by the fact that certain types of arc-light could work only on AC (Singer et al 1958 V,210). Incandescent lamps could take either current, but were susceptible to flickering and shortened lamp life due to the imperfect synchronisation of multiple AC generators. A further important consideration was that DC electric motors became commercially available in 1873 (ibid, 231). Even after the AC induction motor was invented by Tesla in 1888, DC remained the only system capable of operating the heavy-duty traction motors which by 1900 were becoming increasingly common in electrified railways and tramways (ibid,233). DC was also the only economical way of working the storage batteries installed in some early systems to provide extra power at peak times (ibid,200). These, then, were the technical, commercial and economic factors underlying the development of electro-technology in the 1880s and 1890s. They were all to prove significant in the establishment of electric lighting in Sydney.

## **Electricity Comes to Sydney**

The first public exhibition of electric lighting in Australia took place in Sydney on 11 June 1863, as part of the illuminated displays marking the marriage of the Prince of Wales. The Electric Telegraph Office mounted an arc light on the Observatory tower and five gas-charged luminescent tubes at the Telegraph office itself, all operated by batteries (SMH 12.6.1863,4).[6] The first practical installation of electric arc-lighting in Australia was said to be in Melbourne, where a Gramme DC generator was installed at the Apollo Stearine Candle

Company factory for night work in 1877 (Cannon 1975 III,108). Electric lighting was first used in Sydney in 1879, for night work on the construction of the Garden Palace building on Macquarie Street for the International Exhibition of 1879-80 (ISN 25.1.1879).

Public interest in electric lighting increased markedly from 1880, stimulated partly by the displays of the latest electrical apparatus at the Exhibition (eg TCJ 21.2.1880). In March 1880 it was reported that the new Macquarie lighthouse was to be electric (TCJ 6.3.1880), the first such use of electric light in the southern hemisphere (ISN 17.2.1883). During 1881 demonstrations of, and lectures about, the electric light became regular events.[7] In addition, extensive exhibitions of electric lighting equipment were held in Sydney and in regional centres including Bathurst (ISN 11.1881).

The first public places in Sydney to be permanently lit by electricity were the major transport interchanges. The Redfern railway terminal was arc-lit from 15 June 1882 (Paddison 1956,110). Circular Quay was also arc-lit at about the same time, enabling the loading and unloading of ships to go on into the night (ISN 17.2.1883).[8] Several incandescent lighting installations followed. One of the first, inaugurated on 3 November 1882 was in the composing-room of the Sydney Morning Herald. The light compared favourably in brilliance and steadiness with gas, which however was retained in the rest of the building (SMH 10.6.1880). Sydney's first electric lighting entrepreneur, H.H.Kingsbury, demonstrated Edison's system for working both arc-lights and incandescents from the one generator at the Sydney Exchange on 7 December 1882. He used the system to illuminate the official celebrations at the completion of the NSW-Victoria rail link at Albury on 14 June 1883 (ABCN 30.11.1889, Paddison 1956,110).

NSW government instrumentalities were among the first major users of electric light. In October 1883 the Legislative Council chamber was lit with 500 incandescent lights (ABCN 30.11.1889). By the end of 1886 several railway workshops and wharves were lit (Paddison 1956,110), and portable arc lighting had been used for night work at several major construction projects, including the Prospect Dam for the Sydney water supply (ibid). The private market for electric lighting also grew rapidly. By 1890 several hotels, theatres, emporia and newspaper offices were electrically lit (DT 10.6.1890).[9]

In a paper read before the Electrical Club of NSW in September 1893, Kingsbury noted that "Since 1883 some 87 private installations have been erected in the colony, aggregating 27,508 incandescent and 545 arc lamps" (ABCN 30.9.1893). His own firm had been responsible for perhaps a third of these and almost all of the largest ones, but was by no means the only important electrical contractor in Sydney. Some merchants advertised as "general electricians"

selling everything from 'medical' apparatus to electric bells and lighting equipment.[10] Other contractors came to specialise in large installations, using exclusively the equipment of whichever overseas manufacturer they represented. This sometimes led to local skirmishes in overseas patent battles.[11] By the 1890s the competition among contractors was keen.[12]

The popular press took great interest in matters electrical from the very beginning. The general rubric 'electrical' subsumed a wide range of novel, 'therapeutic' or bizarre applications of electricity as well as lighting and telegraphy, and early coverage dwelt on the former rather than the latter.[13] Press coverage took on a different tone as the rapid development of electric lighting overseas became apparent, and its local adoption came to be seen as a symbol of progress. As early as January 1882 the SMH commented:

"Sydney is somewhat dilatory in availing itself of the recent developments in electric lighting, and for some reason even those attempts that have been made to introduce it here have not been as fortunate as elsewhere...The mistakes made in the colonies hitherto in connection with electric lighting have usually been in the direction of using apparatus which, in the course of rapid improvements, has already been discarded in Europe" (SMH 16.1.1882).

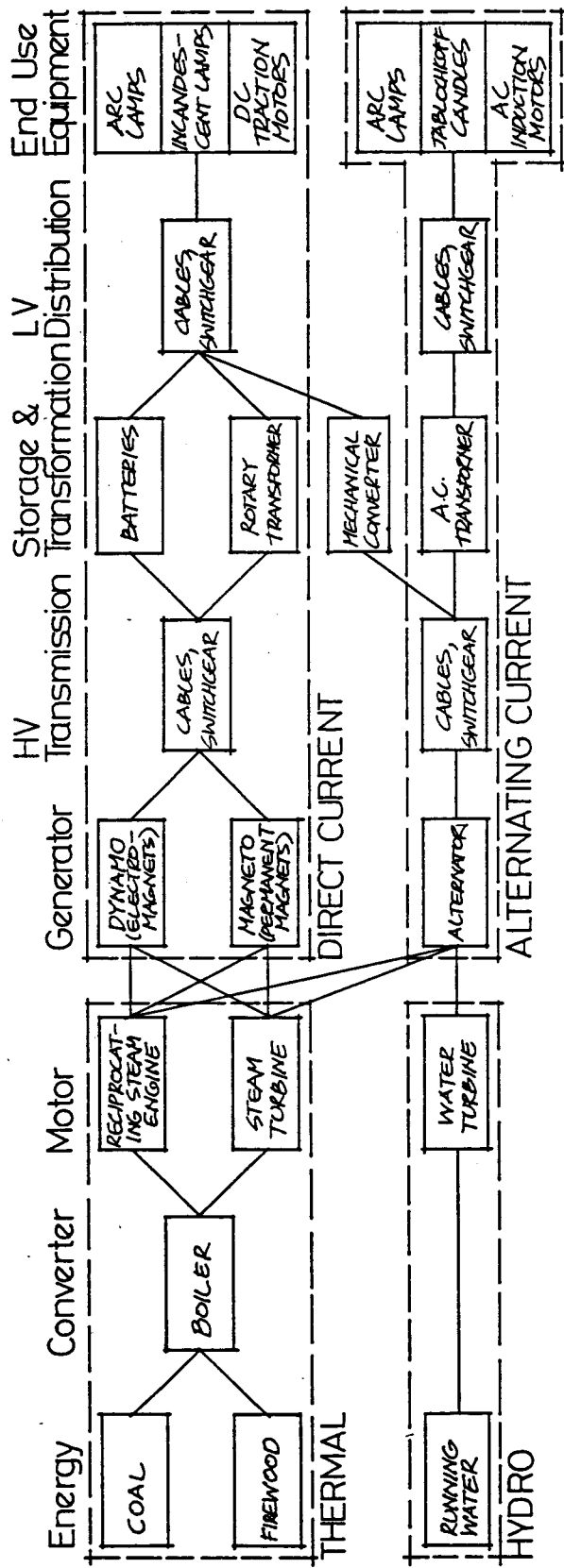
Overseas and local developments in electro-technology were reported in great detail even in the daily press. To some extent this reflected the commercial interest of the newspaper owners. The Daily Telegraph Company offices were lit solely by electricity from mid 1889. By mid 1891 the company was selling power to a half dozen other consumers, and its manager was a director of one of the companies seeking the power to supply electricity for public lighting in Sydney (NSWPP/LA 1891,761). The proprietor of the Evening News, for whom Kingsbury had installed a lighting plant in 1890, was by 1894 making L500 profit per year supplying nearby buildings, including Tattersall's Hotel (Cannon 1975 III,109). These and other private installations formed the nuclei for a number of private electric lighting companies in the 1890s.

The coverage of electrical developments extended in the 1880s to the picture magazines such as the *Illustrated Sydney News (ISN)* and the *Town and Country Journal(TCJ)*, and even to the newly emerging women's magazines such as *The Australasian Woman's Magazine and Domestic Journal* (qv July 1882) and *Cosmos* (qv 30.9.1895). As urban-scale electric lighting became imminent, the press dwelt at length on the questions of municipal versus private ownership. Again, the reporting was not always disinterested. The Fairfax family, owners of the *Sydney Morning Herald*, were large shareholders in AGL, another of the contenders to supply the City with electric light.

By 1890 Sydney had a thriving electrical industry. Competition was keen, and public interest was high. The level of expertise was growing, and a significant proportion of electrical equipment apart from high technology items like dynamos and incandescent lamps was locally

made (ABCN 30.11.1889). Some of the streets were brightly lit by the competing arc lamps of neighbouring merchants. King Street was "...if anything, excessively illuminated, there being no less than ten large arc lamps in a length of about a hundred yards..." (Tournay Hinde 1892,131). This inevitably gave the citizens "...some idea of the superiority of arc lamps for city street lighting in comparison with gas lamps" (ibid). Two NSW country towns had already installed electric street lighting. Yet the streets of Sydney remained lit with gas. Reporting in 1890 that Hong Kong was to be lit with electricity, the ABCN noted: "In some respects Australian cities will shortly be far behind the Pagan human aggregations of the Flowery Land." (ABCN 28.6.1890).

**FIGURE 3.1**  
**ELEMENTS IN SYSTEMS FOR THE PRODUCTION AND**  
**DISTRIBUTION OF ELECTRIC LIGHTING**



## **3.2 THE MUNICIPALISATION OF STREET LIGHTING**

The first users of electricity were large commercial enterprises and government departments with sufficient lighting demand to justify the expense of a generating installation. Some of these made supply available to nearby users under semi-formal arrangements. Further extension relied on access to the street lighting market to provide a revenue base and a reticulation grid from which dispersed consumers, too small to justify their own plant, could be supplied. Street lighting was the means by which gas had originally spread, and if the promoters of electricity were to be successful in their turn, they had to displace gas from the streets. The competition for the general lighting market therefore hinged on the control of public lighting, and the control of public lighting was one of the powers most keenly sought and jealously guarded by the newly emerging municipalities.

### **Municipal Powers and Public Lighting**

The Municipalities Act 1858 had allowed councils to make regulations for street lighting and to levy a special lighting rate for that purpose.[14] In 1858 AGL had prudently obtained an amendment to its own legislation to allow it to extend supply beyond the City boundaries and to make lighting contracts with the new suburban municipalities. Municipalities did not at that time have the power to establish or purchase gasworks, although legislation such as the Dubbo Gas Company's Incorporation Act of 1884 contained clauses to permit subsequent council purchases, in anticipation of such powers in the future (Larcombe 1973 II,200).

The relations between councils and their local gas companies seemed to have been as uneasy as those between the City of Sydney and AGL, and for similar reasons: price, the inconvenience of road openings, and the refusal of the companies to service areas with unprofitably low load densities. In 1884 a deputation of municipal mayors prevailed on the government to introduce legislation enabling them to establish their own works (ibid,199). The Municipal Gas Act 1884 and its 1886 amendments allowed councils, acting jointly or severally, to construct, purchase and operate gasworks to supply gas for public lighting and for private purposes.[15]

Had these powers been extended to include electric lighting, much subsequent parliamentary debate and legislation could have been avoided. Several of the Municipal Gas Act's supporters pointed out that it would be opportune to extend its provisions to electricity or any future illuminating agent. The Colonial Secretary, who had introduced the bill, replied:

"There is no very pressing necessity for any provision with regard to the use of electricity as a means of lighting. This matter forms a special subject in the Local



Government Bill, which I hope to have the pleasure of introducing at an early date, if not during the present session" (NSWPD 24.7.1884,4527).

The provisions of the Municipal Gas Act were not extended to electric lighting until the Municipalities Electric Lighting Act of 1904, necessitating two decades of special legislation.[16]

After the enactment of the Municipal Gas Act, gas manufacture in smaller towns became a largely municipal enterprise by default. Private companies showed little interest in establishing new gasworks outside the major population centres, where gas reticulation was most profitable and where there were already thriving companies. These were too large and powerful for the local municipalities to compete with or acquire, especially since the piecemeal development of local government legislation had left a legacy of small, sometimes barely viable suburban councils. No Sydney suburban municipalities ever established gasworks, though they held discussions on joint action from time to time.[17]

The main immediate effect of the Act was to enable smaller communities, where gas demand was not high enough to attract private capital, to supply themselves with gas. Only in Bathurst did the Municipal Gas Act have the intended effect of lowering the price of gas by forcing competition on a private gas company.[18] It is difficult to determine whether municipal gas prices were any lower than if the same works had been run by private companies, since all gas prices generally moved downwards during this period, as sales and production volumes increased.

Nevertheless municipal involvement in gas manufacture set precedents for municipal control over the means of street lighting, and for energy sales to private consumers. It served to identify local government, rather than any other unit of administration, with the public supply of energy. It also meant that those municipalities which acquired gasworks in the 1880s and 1890s were financially committed to paying them off, and were thus effectively removed from the market for electric street lighting. However there were still dozens of municipalities disaffected with their local gas companies, or not served by gas, and new municipalities were constantly being formed beyond the reach of the urban gas companies. These formed a pool of natural customers for electric street lighting.

### **The First Electric Street Lighting**

The earliest electric street lighting installations took place under less than ideal conditions. They were in low density country towns where lamps were dispersed and installation costs high. Long cable runs increased voltage losses and reduced the illumination from the outlying

lamps, especially where DC equipment was used. On the other hand the gas alternative was also expensive. Because of distance from the coalfields, gas, if available at all, was priced to recover the high coal haulage costs, whereas wood for steam raising for electricity generation was cheap and readily available.[19]

The first electric street lighting installation in Australia commenced operation at Tamworth on 9 November 1888 (DT 7.6.1890). The streets of the town had been lit since 1883 by the local gas company, but at the end of 1887 the council decided that the price was too high. After unsuccessful negotiations for the purchase of the gas company, the council contracted with the Sydney firm of Harrison and Whiffen for the supply of an electric lighting installation (ibid). The technical details of this and all other municipal electric lighting installations in NSW from 1888 to 1902 are summarised in Table 3.1.[20]

Harrison and Whiffen operated the Tamworth plant for one year, after which it was purchased by the council. Opinions about the success of the installation in terms of quality of light and its cost relative to gas differed sharply. The Sydney Daily Telegraph correspondent "JL" estimated that the annual cost per lamp, taking into account running costs, depreciation and loan interest, was more than 30% above the contract price per lamp previously paid to the gas company (DT 7.6.1890). In reply the mayor of Tamworth took minor issue with some of the costs used, but based his defence of the installation on the fact that "...we have extended our wires nearly three miles beyond the gas mains and are giving seven times the light at an additional cost of about L 200 per annum..." (DT 24.6.1890).[21]

The municipal electric lighting installation which commenced operation at Young in April 1889 was the first in Australia to supply private as well as street lighting. In late 1887 the council had been on the point of signing a L 5,000 contract for the construction of a gasworks (ABCN 26.11.1887). A year later, however, it contracted with Kingsbury and Co. for an electric lighting installation which eventually cost it over L 7,500. The capacity of the installation was some 1500 lamps, or three times that of Tamworth. At the end of the first year there were 116 street lamps, all incandescent, and about 450 "private" lights in public buildings, hotels, shops and a few residences (DT 30.7.1890).[22] Public lighting installations at Moss Vale (which commenced March 1890) and Enfield, a newly-incorporated outer suburb of Sydney (April 1890), were operated by contractors. The municipalities had options to purchase during and after the 12 year contracts.[23]

Municipal electric lighting was not at first a financial success. Revenue barely covered running expenses, and if depreciation and interest charges were included, the installations ran at a deficit. The supporters of the gas companies seized on these figures, but other commentators

were more measured. The *Daily Telegraph* (which was then selling electricity to the neighbouring businesses) published a lead article on the subject, noting the success of the electric light in Sydney and rightly observing that the economics of municipal installations depended on density, and that the running costs at Young in particular could have been reduced:

"The two hotels which in this city run the most electric lights shut them off about midnight and rely for the balance of the night upon other means of lighting, and if this can be done in Sydney it should be sufficient for Young." (DT 10.6.1890).

The engineering and construction press reported on the schemes with obvious approval, since they involved work for their readers, and took the opportunity to bemoan the slow pace of electrical progress in Sydney:

"Several of the country towns of New South Wales have adopted the electric light with marked success; yet such is the arm-folding apathy of the Sydney Council in the matter that the Borough of Ashfield recently called a conference of municipal delegates to consider forming a syndicate of neighbouring municipalities to undertake the co-operative lighting of them all by electricity, while another conference of four suburban boroughs stands adjourned, whose object is to obtain offers for electric lighting from some well-established English or American company. Truly, a heavy bill of indictment could be drawn up by the ratepayers against the Sydney City Council" (ABCN,13.12.1890).

As far as the municipalities themselves were concerned comparative cost was only one of the considerations in adopting the electric light. The others, though not measurable, were more powerful in that they compensated for any cost disadvantage. An electric lighting installation marked a municipality as progressive even more than the possession of its own gasworks. The council's prestige was further enhanced if it provided private services as well. In the case of Tamworth the installation gave the council the independence from the local gas company which many municipalities sought. The next step was not just independence, but direct competition.

### **The First Skirmish with Gas**

Municipal electric lighting schemes were slow to proliferate. Some councils showed an interest only to strengthen their hand in negotiating with gas companies, while others were unable to raise the finance.[24] Between 1891 and 1902 only five municipal electric lighting installations were built, considerably fewer than the number of municipal gasworks (see Table 3.1). All were in suburban Sydney or Newcastle rather than in rural boroughs: the latter may have been deterred by the financial experiences of Young and Tamworth. The electric lighting installations at Lambton (1890) Penrith (1892) and Canterbury (1898) were of only local importance. The one at Newcastle (1891) was highly significant in that it represented the first major challenge to a well-established urban gas company, while the one at Redfern (1892) brought municipal electricity supply near the heart of Sydney.

Tamworth's substitution of council-generated electricity for privately-supplied gas was largely an extension of the municipal prerogative over street lighting conceded by the NSW parliament in 1884 and 1886. At Newcastle, however, the municipality sought clear sanction to enter the private energy market in direct competition with a private gas company, and in 1890 parliament was presented, for the first but by no means the last time, with a clear choice between municipal and private electricity systems. The Borough of Newcastle Electric-Lighting Bill and the City of Newcastle Gas and Coke Company's Electric and Other Light Bill made their way in parallel through the parliamentary process. Each was referred to a select committee, and several witnesses gave evidence in turn, in support of the one bill and in opposition to the other. The select committee reports and the parliamentary debates on the bills give an insight into the development of the arguments for and against public ownership, which were to be repeated on so many occasions thereafter.[25]

The City of Newcastle Gas and Coke Company was established under a private Act of 1866 and had, in due course, contracted with the Borough of Newcastle for street lighting.[26] In January 1890 the gas company wrote to Newcastle and the surrounding municipalities forwarding copies of a bill "...proposed to be submitted to Parliament next session, for the purpose of extending the powers of this Company, so as to enable it to supply electric or other light as well as gas." (V&P/LA 1890,95). The bill also provided for an extension of the company's area of operations to a radius of 10 miles from Newcastle. The 12 municipalities within the 10 mile radius, led by Newcastle, resolved unanimously to oppose the gas company's bill (ibid,44). In April 1890 the Newcastle council called tenders for a municipal electric lighting installation. It was only after the contract was signed in May 1890 that the council applied for its own bill to enable it to supply private consumers.[28]

The arguments presented to the parliamentary select committees hearing evidence on the bills in mid 1890, and later debated in parliament, hinged on the previous behaviour of the gas company towards the municipalities, the question of monopoly, the appropriateness of municipal competition with private enterprise, and the projected cost of the electric light. The Newcastle gas company had the infrastructure and the access to capital to readily establish an electric lighting system, if it could obtain the power to do so. The company did not seek exclusive rights to supply electricity, as the supporters of its bill took every opportunity to point out, but it was obvious to opponents that its market power could eventually give it a natural monopoly (V&P/LA 1890,98).[29]

Another central issue was that by supplying electricity for private lighting the municipality would be using ratepayers' money on a risky venture that was properly the province of private

enterprise. Its supporters argued that the council had every right to supply private consumers if it lowered the cost of street lighting, and that "...the spirit of the age favours the supply of gas and water - commodities in daily use - being placed in the hands of the people themselves" (NSWPD 2.10.1890,3379). The gas company had to tread a fine line in pursuing the argument of the risky and experimental nature of electric lighting, while trying at the same time to obtain powers for its own shareholders to invest in it. Arguments were advanced that the costs of the venture would be lower, and hence its success more likely, if it were professionally managed by a private company, even if that company had to make a profit which the municipality did not. The municipal supporters answered that the electricity could be supplied "at cost" without overheads for profit or management expenses.

One of the arguments repeatedly raised in favour of municipal control of electric lighting (at the time when underground cables were still contemplated) was that this would minimise the inconvenience caused to the ratepayers by street openings, because the council could better co-ordinate cable-laying and street paving (V&P/LA 1890,97). Alternatively, even if the inconvenience were the same it would be more willingly borne if the organisation were publicly owned rather than privately. While some of these arguments now have a specious ring, there is little doubt they represented general municipal opinion at the time, possibly because of the previously cavalier attitudes of the gas companies to pavement repair.

The council's supporters did not attempt to substantiate their assertion that the cost of electric street lighting would be cheaper from a municipal plant than a private one, but they did try to make a case that it would be cheaper than the existing gas lighting. The evidence presented by the council itself fails to support this: if anything, it demonstrates how rudimentary was the grasp of costings by both the council and the select committee.[30] The issue of access to service was also raised. Parliamentary opponents of the gas company's bill pointed out that there was no intention to let any obligation to supply get in the way of profits, and that "some people will be favoured, and others will not." (NSWPD 2.10.1890,3388). The gas company's bill was introduced in the Legislative Assembly on 21 May 1890, and debated on 2 September 1890. The Assembly was clearly sympathetic to municipal ownership, and the bill was resoundingly defeated.[31] The Borough's bill was eventually passed in 1892, by which time the installation had already commenced operating.

The Borough of Newcastle Electric Lighting Act set an important precedent by granting the municipality exclusive powers to own and operate an electric lighting installation, and the right to sell electricity to private consumers. The arguments for "private enterprise" on the one hand, or "ownership by the people" on the other may have been exacerbated by the fact that in this case the private enterprise concerned was a gas company which had not been reluctant to exploit

its monopoly position. Since all the major centres had gas companies and municipal disaffection with them, justified or not, was widespread, so was the sentiment favouring municipal control of electric lighting. The Newcastle outcome may have been different if a private company not associated with gas had sought the franchise in co-operation, rather than in competition with the municipality. The feeling against private ownership seems to have been less in small municipalities without gas companies: Enfield and Moss Vale made arrangements with private contractors.

The assertions that municipal ownership would lead to lower costs were essentially unsubstantiated, incomplete, and, as it turned out, incorrect. Newcastle council's optimism about operating costs was rapidly dispelled. A later manager of the undertaking, G.Allbut, noted:

"As was the case with some of these early concerns, misfortune and financial losses provide most of the early history. Until 1911 the concern was not financial..." (Allbut 1958,28).

The assumptions about the balance between public and private electricity consumption also turned out to be incorrect. Private electricity sales by municipalities had been justified on the grounds that they would defray the costs of public lighting. There is no evidence that parliament or the council considered the possibility that private consumption could exceed street lighting demand, as eventually occurred, or whether a municipal monopoly would then be appropriate. The only parliamentary amendment to the Borough of Newcastle Electric Lighting Bill was the separation of the lighting from the municipal account.[32] This was another precedent of major consequence, removing the incentive for the council to manage the undertaking in a way which paid a return to the ratepayers.

All in all, the Newcastle case highlighted the polarisation of opinion between supporters of private gas companies and of municipal enterprise. It also demonstrated the strength of pro-municipal and anti-business sentiment in the New South Wales House of Assembly (soon to be reinforced by the formation of the Labor Party) and demonstrated for the first time the limitations of parliament and its select committees in dealing with the technical and economic aspects of electricity.

TABLE 3.1  
MUNICIPAL ELECTRIC LIGHTING INSTALLATIONS  
NSW  
1888-1896

| LOCATION<br>AND DATE     | CONTRACTOR             | ENGINES<br>(a) | GENER-<br>ATORS<br>(b) | PUBLIC<br>LAMPS<br>(c) | PRIVATE<br>LAMPS<br>(c) | COSTS<br>(d)  | RATE<br>(e) | SOURCE      |
|--------------------------|------------------------|----------------|------------------------|------------------------|-------------------------|---------------|-------------|-------------|
| TAMWORTH<br>Nov 1888     | Harrison<br>& Whiffen  | 2x12           | 2x250<br>DC            | 4 arc<br>210x20        | -                       | 3047<br>+591  | 5           | (f)         |
| YOUNG<br>Apr 1889        | Kingsbury              | 2x25           | 3x500<br>AC            | 216x20                 | 350                     | 7567<br>+1100 | 4           | (f)         |
| MOSS VALE<br>Mar 1890    | Wood fros.<br>(12 yrs) | na             | 2x150<br>DC(g)         | 29x16                  | 100x8                   | na            | 3           | (f)         |
| ENFIELD<br>Apr 1890      | (12 yrs)               | na             | DC(g)                  | 50                     | -                       | na            | na          | (f)         |
| LAMBTON<br>1890          | Kingsbury              | na             | for<br>1200            | na                     | -                       | 7000          | na          | (h),<br>(i) |
| NEWCASTLE<br>1891        | Kirkland<br>& Co       | na             | na                     | 400x25                 | 700x25                  | 8930<br>+1150 | 3           | (h)         |
| REDFERN<br>Late 1892     | Williamson             | 2x150          | 4x100<br>kW            | 406x25                 | 1000x16                 | na            | na          | (j)         |
| PENRITH<br>Late 1892     | na                     | na             | na                     | na                     | na                      | na            | na          | (k)         |
| CANTERBURY<br>After 1896 | na                     | na             | na                     | na                     | na                      | na            | na          | (k)         |

(a) Number of units by power in hp.

(b) Number of units by capacity in lamps, or other units if indicated.

(c) Number of lamps by rating in cp.

(d) Purchase price plus annual running cost, in pounds.

(e) Annual lighting rate, pence in the pound.

(f) Letters of "JL", DT 7.6.1890.

(g) Later changed to AC.

(h) V&P/LA 1890,105.

(i) Allbut 1958.

(j) BEJ 20.8.1892

(k) Statistical Registers.

TABLE 3.2  
GAS WORKS ESTABLISHED IN NSW  
1837-1913

| PERIOD          | Metropolitan  | Regional & Country |           | Total |
|-----------------|---------------|--------------------|-----------|-------|
|                 | (All private) | Private            | Municipal |       |
| Before 1871 (a) | 2             | 2                  | -         | 4     |
| 1871-80         | 3             | 4                  | 2         | 9     |
| 1881-90         | 3             | 8                  | 10        | 21    |
| 1891-1900       | -             | -                  | 6         | 6     |
| After 1900 (b)  | -             | 2                  | 7         | 9     |
| TOTAL           | 8             | 16                 | 25        | 49    |

Sources: Wilson (1967,97-112), Larcombe (1973,II 201), debate on Municipal Gas Bill 1884 (NSWPD 6.8.1884,4714).

- a. First gasworks were AGL's at Kent Street, commencing operation in 1837. AGL's other works are separately enumerated.
- b. Last gasworks to be built were at Cowra, 1913.



### 3.3 GOVERNMENT AND POWER: THE SYDNEY ELECTRICITY FRANCHISE

Innovations in energy technology, and attempts to commercially exploit them, demanded considerable attention from the NSW legislature in the 1880s and 1890s. The competition between municipal and private enterprise which had marked the introduction of electric lighting to Newcastle was repeated for Sydney, but on a much larger scale. Between 1887 and 1896 parliament dealt with no fewer than six separate bills for the electric lighting of the City of Sydney, some of them introduced more than once. There were also several bills related to regional electricity developments, gas companies, hydraulic power companies, and new forms of energy for traction. The fate of each proposal depended less on its intrinsic merits than on the influence of its sponsors, and on shifts and balances in the broader political and legislative framework.

#### Parliament and the Labor Party

The erratic nature of the legislative process and the formation of a parliamentary Labor Party had direct consequences for the subsequent development of the Sydney energy system.[33] During the 1880s and the 1890s the system of government in NSW changed, from majorities organised around parliamentary factions to a more formal party structure. Fixed triennial terms for the elected Legislative Assembly were introduced in 1874, but parliaments often failed to serve their full terms and the progress of legislation was disrupted by short sessions and unexpected prorogations.[34] The legislative programme was also a particularly heavy one, and not always<sup>as</sup> subject to formal government control~~as~~ today.[35] The enactment rate for bills was only about 40% (Hawker 1971,70).

There were three major categories of bills: private bills, public bills introduced by ministers to further the government's programme, and public bills introduced by individual members. Private bills were "...for the particular interest or benefit of any person or persons" and were seldom controversial" while public bills "dealt with those measures of public policy in which the whole community was interested..."(ibid,71). Some 13% of the bills originating in the Legislative Assembly were private compared with about 19% in the Legislative Council, illustrating the tendency of the latter to be more identified with private interests. The progress of over 50 bills related to gas, electricity and other forms of energy distribution in NSW introduced in the period 1881 - 1900 is illustrated in Figure 3.2 (the many other bills dealing with collieries, railway and tramway extensions are not included). A large proportion of the measures introduced in the 1880s were relatively routine and generally successful private bills

to establish or extend the powers of gas companies in Sydney and elsewhere. Another group, concentrated in the period 1888 to 1896, dealt with electric lighting. These were unusually controversial for private bills, and had a high attrition rate.

The government took on sponsorship of energy bills only when the matters touched on issues by then firmly within the public sphere, such as local government powers (eg the Municipal Gas Act 1884) railways (eg the Electric Traction Act 1896) or the regulation of weights and measures (eg the Sydney Coal Delivery Act 1901). The Sydney Municipal Council Electric Lighting Bill, which eventually prevailed over competing private measures, was a public bill sponsored not by the government but by members who were also SMC aldermen.

The political environment was as fluid as the legislative.[37] Most of the bills dealing with the electric lighting of Sydney were brought in during life of the Dibbs government (October 1891 to August 1894), the first period during which the newly formed Labor Party held the balance of power in the Assembly.[38] The Labor presence strengthened the Legislative Assembly's support for municipal rather than private electric lighting, already evident from the fate of the Newcastle bills in September 1890.

One of the 16 points in the platform adopted by the Labor Electoral Leagues in 1891 was "(11) Local Government and decentralisation; an extension of the principle of the Government acting as employer, through the medium of local self-governing bodies..."(Black 1926 I,40). At a conference of the Leagues in January 1895 six new planks were added, including

"1. Ownership by the State or Local Government bodies of such works as railways, tramways, water-supply, public lighting, or other works for the good of the community" (Coghlan 1928,2187).

Labor also reinforced the feeling of the Assembly against monopolies. A "pledge of solidarity" drawn up by the Labor Electoral Leagues in November 1893 included the clause

"That a parliamentary Labour Party to be of any weight must give a solid vote in the House upon all questions affecting the Labour platform, the fate of the ministry, or calculated to establish a monopoly or confer further privileges on the already privileged classes..." (ibid,1870).[39]

Three private bills for the electric lighting of Sydney, the Australasian Rights Purchase Bill, the Australian Gas Light Company's Electric Lighting Bill and the Sydney Electric Lighting Bill, were laid aside during the Dibbs ministry. A Labor member of the time noted with approval the Party's role in their defeat:

"Each of the electric-lighting bills had proposed to hand over to private companies the sole right to provide Sydney with electric light and power. The Labor Party believed in the supply of light by municipal authorities only, and, in addition, was opposed to the creation of monopolies. (Black 1926 III,37).

## Government and Utilities

Given the apparent strength of Labor support for government as well as municipal enterprise, why was the question of direct government involvement in electric lighting not seriously raised? There was no lack of government willingness to undertake public works. On the contrary: after 1881, in common with the other colonies, New South Wales "entered upon a career of extravagant governmental expenditures" (Coghlan 1918,1409). By the 1880s the NSW government was involved in varying degree with all the major utilities of the state: the railway and the telegraph (as builder and owner) metropolitan water supply (as builder and co-ordinator) and gas supply (as regulator). The NSW railways became in 1856 the first in the world to be government owned, albeit through circumstances rather than policy: the private companies which began to build them were on the verge of bankruptcy even before the first line was completed (Paddison 1956,29).

Sydney's water supply had been a government responsibility until the city's incorporation in 1842, when it became the responsibility of the SMC. In the late 1870s it became necessary to construct a major water supply project outside the city. The government decided in 1880 that the constructing authority for the project, called the Upper Nepean scheme, should be the Department of Public Works, and that a new style of organisation representing the SMC, suburban and government interests should take control of Sydney's water supply on its completion. The Metropolitan Board of Water Supply and Sewerage began operation in 1888 (Aird 1961,214). It was the forerunner of a number of special purpose authorities made necessary by the fragmentation of Sydney's municipal government, the main weakness of which, according to Larcombe, was the exclusion of the SMC from the general structure of the 1857 Local Government Act (Larcombe 1973 I,167). There was no reason in principle why another special purpose authority could not have been established for electricity supply.

As it was, the one aspect of electric lighting which did concern government from 1887 to 1896 was the possibility that it could become a local monopoly like gas supply, and if so, whether it should be publicly owned. Electricity did not appear to have those features of the railways, ports or water supply which had justified government involvement. The poor financial performance of the early street lighting installations did little enough to enhance their attraction for other municipalities - except as means of revenge against the gas companies - and certainly held no attraction for a government already burdened with a loss on the railways.[40] If municipalities wanted to insist on taking the financial risk of supplying electricity, they had their own rate-making powers to fall back on, and so would not need financial rescue like the first, private railway companies.

Perhaps the most important factor was the rudimentary state of electro-technology at the time when these decisions were made. Electricity reticulation was more spatially constrained than water supply, and the administrative problems of exceeding municipal boundaries and powers were not foreseen. Furthermore, electricity in NSW was still closely identified with the energy service of lighting. The full electrification of the entire energy system was not foreseen by those in government until the late 1890s. If it had been, the wisdom of leaving electricity supply in municipal rather than private or government hands may have been questioned.

Ironically, at the very time the right to supply electricity was awarded to the SMC, the government embarked on tramway electrification, so associating electricity with a utility in which direct government control was firmly established. Four days before the passage of the SMC's bill in November 1896 the premier stated his belief that the government would not be building any new power stations, and that the existing Rushcutter's Bay cable power house would be adequate for tramway electrification. Within months the decision was taken to build Ultimo Power House, and had the SMC bill still been before parliament the outcome may well have been different.

The rapid construction of Ultimo power station and the SMC's delays in completing its own power station kept open for a while longer the possibility of the state assuming control of Sydney's electricity system. In June 1899, with the completion of Ultimo some months off and the SMC still to settle on a final power station site, the Chief Electrical Engineer to the Railway Commissioners, P.B.Elwell, proposed that the SMC should "effect a very great saving" by taking surplus power from the tramways rather than building their own power house (BEJ 8.7.1899). The Minister for Public Works, E.W.O'Sullivan, also contemplated a direct role for the government:

"I hold very strongly that electricity is only in its infancy, and that it is merely a question of time when we will have to go in for a much larger scheme of electricity than we are working at the present time. Large as our machinery at the power house at Ultimo is, it would not suffice to supply this city and suburbs with electrical power, and I think it will become very soon the duty of the Public Works Department to take possession of the water power of the Grose River and other streams in the mountains for the purpose of carrying out the supply of electrical power in a comprehensive and satisfactory way for all time" (NSWPD 26.6.1900,377).

These events illustrate a recurrent theme in the electrification of the Sydney energy system. Accidents of timing, shifting political alignments and the dynamics of technological development shaped events far more than any parliamentary or government comprehension of the nature of the process. The very real opportunities for central control missed in the 1890s effectively set the electricity agenda for the next 90 years.

## The Competition to Supply Sydney

The main features of the six bills related to Sydney's electricity supply introduced into the NSW parliament between 1887 and 1893 are summarised in Table 3.3. The first two were opportunistic attempts by promoters to gain rights to the most lucrative markets in NSW even before the technology for urban scale electricity supply was demonstrated.[41] They failed through a combination of parliamentary uneasiness with the safety of electricity, a glimmering awareness of the value of what they sought, and the disruption of the legislative process by prorogations of parliament.

Three later bills represented more credible attempts to establish a Sydney electricity supply system by competing interests: AGL, the SMC and the Sydney Electric Lighting Company, a consortium established for the purpose. The sixth bill was an attempt to secure the development rights to the nearest hydro-electric resources to Sydney, and to sell energy in bulk to whichever organisation emerged with the Sydney distribution franchise. These later bills all reached parliament after the formation of the Labor Party, and so had to contend with a growing feeling against private monopolies. Even so, it was the disjointed and random nature of the legislative process and the instability of governments which largely decided the outcome, by delaying all competing measures until the SMC clarified its intentions.

From 1882 the SMC had on occasions expressed an interest in the electric lighting of Sydney, possibly by a third party, but had not yet resolved to undertake the work itself. The field appeared to lay open to the enterprising. The Sydney and Suburban Electric Lighting Bill, introduced in the Legislative Assembly in late 1887, sought exclusive rights to supply electricity for both street lighting and private consumption in Sydney, at a time when the municipality of Tamworth was only just beginning to consider it. The promoters modelled their bill on the British Electric Lighting Act 1882, but omitted the clauses safeguarding the rights of the municipalities and empowering them to purchase the works.[42] The bill was referred to a select committee which seemed unaware of, or unconcerned with, its opportunism and its lack of any firm technical basis.[43] Parliament was petitioned against the bill by seven electrical engineers protesting against the setting-up of a monopoly prejudicial to the public's interest (Larcombe 1975 II,62). The bill was stopped by prorogation of parliament on three occasions, the last of them in October 1889, after which it was not re-presented.

The New South Wales Electric Light and Power Company's bill was introduced in the Legislative Council in March 1888 and referred almost immediately to a select committee.[44] The committee showed, not for the last time, the tendency of members of parliament to make

arbitrary decisions on technical matters such as voltage, preferring the testimony of one expert witness over another while having no source of independent technical advice. As it was, the system proposed was based on the Edison model, and given the technical expertise at the disposal of its backers it may have stood a chance of success, at least in the City of Sydney itself where there was a high density of demand. No judgement can be made of their financial resources, however, and their political support seems to have been meagre: the bill was stopped by prorogation in July 1988 and not re-introduced.

Of all the SMC's competitors, the Sydney Electric Lighting Company was best placed to succeed. Its proposal was based on proven technology, its backers were well-connected local businessmen untainted by association with any gas company, and it was sponsored in the Assembly by G.R.Dibbs, who became premier during the life of the bill. It was ultimately defeated due to growing parliamentary sentiment against granting private control of what had come, by then, to be generally recognised as an inevitable natural monopoly, legally enshrined or not. Timing was also a factor: the first Labor members were elected just before the bill was introduced, and during its progress the City Council finally took firm action to secure electric lighting powers, after a decade of prevarication.[45]

The promoters took the British Electric Lighting Act regulations as their model, as those before them had done, but took care to meet every one of the objections previously raised. Their bill sought powers only in the City of Sydney and not in the suburbs or other towns. They nominated a "compulsory area" within the City, in which they bound themselves to supply light within a period of 3 years to any consumer requesting it - though they had naturally picked the area with the highest density of demand.

However soundly conceived the proposal, and however influential its government support, it could not move the SMC. The Council saw the decision as its own prerogative, not that of parliament, and had no intention of being pressed on the matter. The Lord Mayor of Sydney, W.P.Manning, told the select committee that while the SMC considered its options it was opposing all of the various private electric lighting bills then before parliament. Asked by Dibbs whether the SMC would itself introduce electric lighting, Manning replied

"Perhaps...but they have not decided that it should not be entrusted to private enterprise. They have devoted themselves up to the present time wholly to the consideration of the advisability of introducing the system. They have not decided the question whether it should be by private enterprise or whether the council should take it up" (V&P/LA 1891,763).

Manning stated categorically that if the council decided to light the streets, it would also have to sell to private consumers to make the installation pay, and that to do so would not be beyond the object of municipal government.[46]

As it turned out, the SMC's assessment of the balance between municipal and parliamentary prerogative proved correct, on this matter at least. The bill was opposed by the Labor Party and by SMC aldermen members on the grounds that the monopoly supply of electricity should be in the hands of a public body. Some supporters of the bill argued that it would at last break AGL's lighting monopoly, while opponents replied it would create a second monopoly just as bad.[47] Another sudden change of government delayed further debate on the bill for nearly 18 months, by which time the SMC's own bill had been introduced, and the Sydney Electric Lighting Company Bill was then rejected.[48]

Unlike the other measures, the Australasian Rights Purchase Bill did not seek powers to retail electricity within the City of Sydney, but to:

"...authorise the Australasian Rights Purchase Association, Limited, a company registered in Melbourne, in the colony of Victoria, under the Companies Act, or their licensees or assigns, to take and divert water for mechanical power from the Colo River and the Grose River by means of channels returning to the stream again; and also to construct and work the plant requisite for generating electricity and transmitting it to the city of Sydney and to any other places along the main cable line" (NSWPD 9.2.1893,4054).

The company intended to sell electricity in bulk to large consumers taking at least 40 kW, such as factories and electricity retailers, taking a role which was to be ultimately carried out, on a vastly larger scale, by the Electricity Commission of NSW some 60 years later. The company expressed confidence that Sydney and other municipalities would buy electricity from it (V&P/LA 1892,317). The bill did indeed receive relatively favourable treatment in the Assembly by the City aldermen.[49]

Supporters of the bill pointed to the special attraction of hydro-electricity in terms of creating value from a previously unexploited resource (NSWPD 6.4.1893,5799).[50] Labor Party members were not united in opposition to it, despite the fact that it was introduced in the Assembly as "...an important experiment by men of capital who are willing to invest their money in this speculative manner" (NSWPD 9.2.1893,4047). [51] City aldermen serving on the select committee were also, if anything, supportive.[52] In June 1893 the bill came close to enactment. The Legislative Assembly actually passed the third reading on the eve of yet another prorogation, and the Legislative Council's objection to the lack of time given it to consider the bill in the few hours remaining in the session proved the only remaining barrier.

Opposition to the bill firmed in the following months. Members in both Houses recognised that successful exploitation of low cost water power could give the company an effective monopoly of bulk electricity sales. The feeling that such potentially high profits should not go to a group

of speculators, particularly Victorians, finally outweighed the Labor Party's desire for new jobs in an increasingly depressed economic climate, and the SMC's desire for cheap bulk electricity.[53] In February 1894 the bill was lost due to a combination of anti-monopoly and anti-Victorian sentiment and procedural circumstance which had little to do with its intrinsic merits.[54]

The history of the Australasian Rights Purchase Bill illustrates how little unanimity there was on the control of electric power (especially when distinct in the minds of the legislators from electric lighting) outside a recognisably municipal context. The proposal did not conflict directly with municipal rights, and could even have assisted the SMC in providing cheap bulk power - provided of course that its backers had proved themselves financially willing and technically able to carry it out, and the government had proved equal to the task of regulation which had been reserved for it in the bill. Ultimately, the proposal was stalled by the lack of legislative framework and precedent. As one member put it "The Government are not supposed to trouble themselves about a measure of this kind, which is certainly not a matter of public policy" (NSWPD 20.2.1894,846). Within two years, the Electric Traction Act of 1896 firmly placed electric power within the within the scope of public policy.

The Australian Gas Light Company (AGL) was another of the later applicants for powers to supply electricity to all public and private consumers in Sydney. The AGL bill had the support of the Legislative Council where AGL directors and shareholders were well represented. It may conceivably have succeeded had it been introduced a few years earlier, before the growth of municipal influence in parliament, the election of Labor members and the introduction of rival bills. As it was it had no real chance of success, given the hostility of the Assembly towards the company, which had by then alienated the City Council and came to embody the evil of monopoly for the newly elected Labor members.[55]

AGL's reaction to electric lighting in the decade preceding the bill, as recorded in the minutes of its directors (ML MSS 2921/3x-17x) typifies the reaction of the gas companies to the new competitor - exhibiting in turn curiosity, complacency, resistance and then a desire for commercial control.[56] It attempted to head off municipal interest in the electric light by changing the price structure for public lamps in 1884 and 1888 (Broomham 1987,75). In 1890 the company made sure that the financial difficulties of the first municipal installations at Tamworth and Young were well publicised.[57] What AGL could not counter was the fact that municipalities found electric lighting attractive not because of any cost advantage, but because it gave them independence from the gas companies. The board minutes record that AGL was belatedly panicked into action in February 1892, as recorded in the board minutes:



"Secretary states that Borough of Redfern have signed a Contract for an Installation of the Electric Light for their Public Lighting...Secretary also reports that Paddington, Woollahra, Waverley and Randwick are moving in the same direction...Allen and Allen to prepare a Bill in time for next session of Parliament for permission to supply the Electric Light" (AGL/DM 2.2.1891).

The directors became aware of municipal opposition to their bill even before it was introduced (AGL/DM 23.3.1891). AGL's declarations that it was not seeking exclusive rights seemed particularly transparent since few other companies better understood how to build and protect a natural monopoly.[58] The bill made no firm technical proposals, beyond reserving powers to run wires underground in the main streets of the City and above ground in other areas, and to use high voltage (V&P/LC 1891,1012). In fact the company did not think it necessary to engage any electrical engineers at all, unless the select committee required expert evidence (AGL/DM 10.8.1891).

On the other hand, the bill gave evidence of more commercial and financial consideration than any of its competitors.[59] The AGL secretary expressed the company's thoroughly commercial approach:

"We should like to be in a position to give our customers a supply of electricity or gas, whichever they require. We should not make an installation at once, unless the desire were pretty general, and the supply of light were payable. What I mean is, we would not supply at a loss" (V&P/LC 1891, 1010).

Such sentiments would have pleased shareholders, but only confirmed the suspicions of those members of parliament who considered electric lighting a public service to be made available to all citizens, without discrimination or delay. The views of AGL's many opponents prevailed, and Sydney lost an opportunity to have an integrated energy utility similar to those which developed in many American cities.

### **Victory by Attrition: The Sydney Municipal Council**

The SMC's initial interest in electricity in 1882 may have been partly motivated by the desire to exert pressure on AGL, since at about the same time the Council also expressed concern that the Municipal Gas Bill should be enacted without delay (SMC 17.7.1883, 10.9.1883).[60] Its success in obtaining control over Sydney's electric lighting was due largely to fortuitous timing. Parliamentary support for municipal government was growing, as was opposition to monopolies, general hostility towards AGL, and an economic nationalism which excluded Melbourne interests. The early 1890s also saw a peak in the Council's enthusiasm for electric lighting, which had varied from 1882 to 1898 with the press of other business and the personal interests of individual aldermen.[60]

Following recent British precedent, many of the post-1884 bills proposing to establish private gas, hydraulic power and transport utilities contained provisions for municipal acquisition after a nominated period. Private promoters began to send copies of their bills to the SMC for comment as a matter of form. Frustrated with how little notice the government gave to its opinions, the Council made attempts to exert more political and physical control over urban services. It is probable that it initially saw its role in terms of regulation rather than ownership, with regulatory control given effective weight by the right to acquire, but the idea of directly providing major services such as electric lighting gradually took hold.[62]

The issues of tramways and garbage destruction dominated the agenda in 1888, but in January 1889 the Council again turned its attention to electric lighting. The Council still seemed inclined to subcontract the lighting of Sydney rather than to undertake the work itself. In the meantime it dealt case by case with electricity promoters wanting to use public streets for electricity distribution, or offering to carry out lighting schemes for the Council. The new town hall gave the Council its first direct experience with an electric lighting installation. Like the construction of the building itself, the project was clumsily administered by subcommittees chaired by the Mayor, and marked by false starts and delays.[63]

The Council made no active moves towards lighting the entire city until December 1890, when a new subcommittee to consider both public and private lighting was established (SMC/FC 18.12.1890). It was chaired by alderman Manning, who in 1893 as Mayor and a member of the Legislative Assembly eventually helped steer the Council's bill through parliament. Its deliberations were given some urgency by the introduction of the competing Sydney Electric Lighting Company and AGL bills in July and August 1891. The subcommittee was firm on the economic need for sales to private consumers, but ambivalent on Council ownership:

"...whether carried out by the Council itself or under concession from the Council, it is desirable to combine the public lighting and the supply for private lighting" (SMC/ELC, 1891).

In October 1891 the Electric Lighting Committee presented its report and tabled a draft bill for Council consideration and adoption (SMC/FC 1.10.1891, 20.10.1891).[66] The Municipal Council of Sydney Electric Lighting Bill was first introduced into the Legislative Assembly in November 1891, and on five other occasions thereafter, before finally receiving assent in October 1896.[67] The major opponents of the bill were, ironically, the same Labor members who had disposed of its competitors. They objected to the clauses which gave the Council the right to contract with private tenderers, fearing that the Council would give away the same monopoly rights which the Labor party had fought to deny AGL, the Sydney Electric Lighting Company and the Australasian Rights Purchase Association.[68]

By the time the bill was passed the SMC's sense of urgency had dissipated. Its enthusiasm for gas was rekindled in 1896, when AGL fitted new high efficiency mantles to the street lamps free of charge and reduced the rates.[69] The Council's reaction was so favourable that the town clerk stated, immediately following his report of the passage of the electric lighting bill:

"Meanwhile the street lamps are being supplied with an incandescent gas burner, which so much improves the brilliancy of illumination, that the urgency of the question of the use of electric light has been considerably minimised" (SMC/TC 1896,4).

Interest revived with the re-establishment of the Electric Lighting Committee in December 1898, this time with a brief to consider the commercial as well as the technical basis of the venture (Anderson 1955,17).[70] In 1899 the SMC engaged the British electrical engineers Preece and Cardew to draw up a design and specifications suitable for tender.[71] Cardew's proposals differed crucially in emphasis from the scheme which the SMC's previous consultants, Cracknell and Threllfall, had proposed in 1891. The earlier scheme was essentially for street lighting supported by private sales, whereas Cardew's approach in his 1900 report to the Electric Lighting Committee was aggressively commercial:

"It is...essential to the early success of the undertaking that it should be pushed and extended as rapidly as possible. The conditions in Sydney are not such that the business of electric supply will take care of itself. You will do no good with a small supply at a high price. You have to meet powerful competition from the Gas Company, Hydraulic Power Company, existing electric supply companies and private installations. Success will be secured by encouraging demand by every legitimate means, taking care that your arrangements for supply are kept ahead of the growth of the demand" (SMC 1900,264).

The committee and the Council shared this view. Some members expressed concern at the possibility of competition from the small private firms, but were assured that only the Council had the power to take supply across public streets (ibid,270).[72]

Construction of the SMC's power station would have commenced in 1900 but for the intervention of plague. On public health grounds, the government resumed all of the Darling Harbour waterfrontage, including the Council's power station site, so putting further strain on the already deteriorating relations between the SMC and the government.[73] In 1902 the Council purchased a new site in Pyrmont, and began construction of a power station to a modified design by Cardew. The small power station serving the town hall was converted to a substation, and three others were built to serve a high voltage DC distribution system (Anderson 1955,25). The street lighting of part of the city was ceremonially inaugurated by the Lady Mayoress on the evening of 8 July 1904 (SMH 9.7.1904,11).

When the SMC had obtained the powers to light Sydney with electricity, its parliamentary influence in street lighting matters had matched that of the government. Its ability to call on pro-municipal sympathies, especially from Labor members, had been at its height. Its influence and credibility then declined rapidly. Had the Council applied for the same powers at the time it was finally ready to take action, it is questionable whether it could have obtained them, particularly since the government itself had in the meantime built a large power station for tramway purposes. The delay in commencing had other notable consequences. The technology of supply advanced rapidly in the late 1890s, while the commercial prospects for electricity increased enormously. In addition to the street lighting powers which parliament had thought to grant it as a municipal right, the SMC found itself with monopoly rights to a commercial enterprise with enormous prospects for growth.

**FIGURE 3.2**  
**PROGRESS OF ENERGY-RELATED BILLS IN THE NSW PARLIAMENT**  
**1881-1904**

**Gas Related Bills (Private) -**

Wagga Wagga Gas Act  
 Australian Gas Light Co's Act  
 Dubbo Gas Co's Incorporation Act  
 Singleton Gas Bill  
 Tamworth Gas & Coke Co's Bill  
 Albury Gas Co's Act  
 Wollongong Gas Light Co's Act  
 Armidale Gas Co's Incorporation Act  
 Grafton Lighting Co's Act  
 Manly Gas Light & Coke Co's Act  
 Windsor Gas Light Co's Act  
 Wallsend & Plattsburg Gas Light Co's Bill  
 Hay Gas Act  
 Mudgee Gas Light & Coke Co Act  
 City of Goulburn Gas & Coke Co's Amdt Act  
 Broken Hill & Suburban Gas Co's Act  
 Windsor Gas Co Amendment Act  
 Katoomba Lighting Act  
 Maitland Gas Co Amendment Act

|   |   |   |   |   |
|---|---|---|---|---|
| • |   |   |   |   |
| x | • |   |   |   |
| x | x | • |   |   |
| x |   |   |   |   |
| x | • |   |   |   |
| x | • |   |   |   |
|   | • |   |   |   |
|   | • |   |   |   |
|   | • |   |   |   |
|   | • |   |   |   |
|   | x |   |   |   |
|   |   | • |   |   |
|   |   | • |   |   |
|   |   |   | • |   |
|   |   |   | • |   |
|   |   |   | x | • |
|   |   |   | x |   |

**Gas and Other Energy (Public)**

Sale & Supply of Gas Bill  
 Municipal Gas Act  
 Municipal Gas Act Amendment Act  
 Fuel Delivery Bill  
 Tramways Declaratory Act

|   |   |   |   |   |
|---|---|---|---|---|
| x |   |   |   |   |
|   | • |   |   |   |
|   |   | • |   |   |
|   |   |   | x | x |
| • |   |   |   |   |

**Hydraulic and Electric Power (Private)**

NSW Electric Light and Power Bill  
 Sydney & Suburban Electric Lighting Bill  
 Sydney & Suburban Hydraulic Power Co's Bill  
 Sydney Hyraulic Power Co's Act  
 Borough of Newcastle Electric Lighting Bill (No 1)  
 Borough of Newcastle Electric Lighting Act  
 City of Newcastle Gas & Coke Co's Electric Light Bill  
 Australian Gas Light Co's Electric Lighting Bill  
 Sydney Electric Lighting Bill  
 Hillgrove & Armidale Water Power Electricity Act  
 Parramatta Loan & Electrical Bill  
 Borough of Redfern Electric Lighting Bill  
 Australasian Rights Purchase Bill  
 Municipal District of Broken Hill Electric Lighting Bill  
 Saywell's Tramway & Electric Lighting Bill

|  |   |   |   |   |
|--|---|---|---|---|
|  | x |   |   |   |
|  | x | x |   |   |
|  | x |   |   |   |
|  | • |   |   |   |
|  |   | x |   |   |
|  |   |   | • |   |
|  |   | x |   |   |
|  |   |   | x | x |
|  |   |   | x | x |
|  |   |   | • |   |
|  |   |   |   | x |
|  |   |   | • |   |
|  |   |   | x | x |
|  |   |   |   | x |
|  |   |   |   | x |

**Electric Power & Traction (Public)**

Sydney Municipal Council Electric Lighting Act  
 Electric Traction Act  
 George St & Harris St Electric Tramway Act  
 Electric Tramway (Belmore Pk to Fort Macquarie) Act

|  |  |  |   |   |   |   |
|--|--|--|---|---|---|---|
|  |  |  | x | x | • |   |
|  |  |  |   |   | • |   |
|  |  |  |   |   | • |   |
|  |  |  |   |   |   | • |

1885 YE 90 DEC 95 1900

• Enacted during the year    x Unsuccessful during the year

TABLE 3.3  
ELECTRIC LIGHTING BILLS  
SYDNEY  
1887 - 96

| BILL  | PROMOTER   | POWERS<br>SOUGHT   | TECHNOLOGY  | PARLIAMENTARY<br>PROGRESS<br>(a)   |
|---|--|--|---|--|
| SYDNEY &<br>SUBURBAN<br>ELECTRIC<br>LIGHTING<br>(b) | E.H.Taylor<br>(Accountant)<br>G.K.Kirkland<br>(Elect Eng)  | Exclusive rights<br>Street & private<br>City & suburbs                               | DC,LV<br>Dispersed<br>power stns<br>in suburbs    | Init LA Dec 87,<br>Oct 88, May 89<br>SBP Jul 88,<br>Jan 89, Oct 89           |
| NSW<br>ELECTRIC<br>LIGHT &<br>POWER CO.             | Agents for<br>American Elec.<br>J.C.Bogue<br>(Elect Eng)   | NSW rights;<br>separate companies<br>in Sydney, Bathurst<br>Newcastle etc            | DC,HV<br>Remote<br>Accumulators<br>(Edison model) | Init LC Mar 88<br>SBP Jul 88   |
| SYDNEY<br>ELECTRIC<br>LIGHTING<br>COMPANY           | W.Wynne (mgr,<br>Daily Tele)<br>A.H.Whiffen<br>(Elect Eng) | City of Sydney<br>only; "compulsory<br>supply" area                                  | DC,LV   | Init LA Jul 91,<br>Sep 92<br>SBP Apr 92<br>Laid aside Mar 93                 |
| AUSTRAL<br>-ASIAN<br>RIGHTS<br>PURCHASE<br>(c)      | A'sian Rights<br>Purchase<br>Association<br>(inc in Vic)   | Hydro-power rights<br>on Colo and Grose<br>rivers; trans. to<br>Sydney; bulk sales   | AC,HV   | Init LC Feb 93,<br>Nov 93, Jan 94<br>SBP Jun 93, Dec 93<br>Laid aside Feb 84 |
| AGL'S<br>ELECTRIC<br>LIGHTING<br>(d)                | Australian<br>Gas Light<br>Company                         | Non-exclusive<br>rights<br>Street & private<br>City & suburbs                        | HV  | Init LC Aug 91,<br>Aug 92.<br>Not returned by<br>LA; lapsed                  |
| SYDNEY<br>MUNICIPAL<br>COUNCIL<br>ELECTRIC L.       | Sydney<br>Municipal<br>Council                             | Street & private<br>City (exclusive) &<br>suburbs (negot);<br>Power to assign<br>(e) | AC,HV<br>DC,HV<br>3 power<br>stations             | Init LA 6 times<br>Nov 91 to May 96<br>SBP 4 times (f)<br>Passed Oct 96      |

(a) LA Legislative Assembly

LC Legislative Council

SBP Stopped by prorogation of Parliament (end of session)

(b) Company claimed to have acquired a site on Kent St and to be prepared to invest L 100,000.

(c) Authorised capital of L 500,000.

(d) AGL authorised capital to be increased by L 1,150,000.

(e) Power to assign rights to private contractor removed by amendment before bill passed.

(f) Also ruled out of order on one occasion.

### 3.4 THE SYDNEY ENERGY SYSTEM AT THE TURN OF THE CENTURY

The political framework for Sydney's electrification was established against a background of rapid suburbanisation. At the 1881 census 55% of the Sydney population lived in the suburbs of the capital. By the 1901 census the proportion had risen to 76% and population growth in the City itself had almost stopped.[74] Sydney's development was disrupted by the financial crisis of 1893, which "shook Australian trade and industry and even the social life of the country to their very foundations" (Coghlan 1918,1231). For three to four years there was a contraction in manufacturing activity, a cessation of construction, a scarcity of employment, and a fall in wages and prices (ibid 2013). However, the effect on New South Wales energy demand was relatively minor. Annual NSW per capita coal consumption doubled between 1881 and 1901, and the rate of increase was checked only briefly by the depression (see Table 2.2). All sectors of the urban economy were becoming more energy intensive, especially industry and transportation. Steam and gas were still the dominant energy technologies, but there were experiments with energy reticulation by cable and hydraulic power, and the first signs of electrification were appearing.

#### From Horses to Electric Traction

Between 1879 and 1899 Sydney's tramways progressed from horse to steam to cable to electric traction, a transition which required both technical and legislative innovation.[75] Steam tramcars were introduced on the main routes shortly after the opening of the Hunter Street line in 1879, and minor routes continued to be worked by horse. The extension of the tramway to suburbs too hilly to be served by steam propulsion was achieved by the cable system, which was by then well established in the United States. The first cable service was a one mile long line from Milson's Point to St. Leonard's park. It was opened in May 1886 and extended to Crow's Nest in 1893 (Paddison 1956,180). Although the first full scale electric railway had been built by Siemens and Halske in Germany in 1881 (Singer et al 1958 V,233) electric traction was still thought to be in the experimental phase.[76]

In the event, cable proved to be a short lived interregnum between steam and electricity. In 1889 the Railway Commissioners reported experiments with both accumulator and overhead wire systems of electric traction:

"which, if satisfactory, will...lead to the tramways being far more successful than can possibly be the case under the present mode of working with steam motors"(RC 1888/9,7).[77]

When the Parliamentary Standing Committee on Public Works reported on the George Street tramway in May 1896, it had no doubt that the motive power should be electric, and that the overhead wire system was preferable (V&P/LA 1896,490).[78] The Secretary for Public Works introduced the George Street and Harris Street Electric Tramway Bill in August 1896, saying

"...this line will, perhaps, tend more to the convenience of the people than almost any other public work we can construct in the city" (NSWPD, 27.8.1896,2711).[79]

The bill had general support because members believed that the lower operating costs of electric traction would lead to a reduction in fares, and that tramway construction would give employment in a time of economic recession.[80] It was passed in September 1896.[81]

The Premier assured the Legislative Assembly that there would be no additional expense for buildings, since the Railway Commissioners had informed him that the cable engine house at Rushcutters' Bay, "which cost an enormous amount of money", was large enough to supply all of the electric power needs of the metropolitan tramway system (NSWPD 1.10.1896,3723). Within a year, however, construction had begun of an entirely new power house at Ultimo.[82] The George Street tramway, powered from the Ultimo Power House, opened to the public in December 1899 (Paddison 1956,110).[83]

In 1881, the year after the Tramways Extension Act was passed, there were 9.5 miles of tram line in Sydney, all operated by steam. By 1904 the interconnected City and suburban network had increased to over 73 miles, all electrified.[84] Table 3.4 shows the number of passenger journeys on the Sydney rail and tramway networks, by energy type, from 1889 to 1904. The cable tram was useful on lines with steep grades, but its carrying capacity was limited. Even at its peak cable carried only a seventh of total tram traffic. By contrast the growth in electric tram traffic was phenomenal. Within two years electric trams were carrying the majority of the traffic, and over 80% by the end of 1904. Public transport thus became the first sector of the Sydney energy system to be electrified.

The steam powered railway remained an important component of the transport system. Between 1889 and 1904 the number of annual suburban rail journeys more than doubled and the proportion of all NSW rail passengers making suburban trips grew from 80% to 90%.[85] The increase in suburban rail and tram traffic reflected the growth in Sydney's population, its dispersal to the suburbs, and the decline in horse operated public omnibuses. In the 15 years to 1904 Sydney's population increased by about 42%, but suburban rail and tram journeys combined increased by over 130%. The government consistently guarded its monopoly of cable and electric traction. Several proposals were made for private electric tramways,



including those for Balmain in 1889 (ABCN 27.7.1889) and between Newtown and Cook's River in 1890 (ABCN 5.7.1890), but none were successful.[86]

Other transport services relied on modes which could not be electrified. Urban freight and private passenger movement still depended on the horse. The coach building, harness and other industries associated with horse transport still thrived, and feed was a significant part of the rail freight tonnage arriving in Sydney. By 1904 the motor car had made its appearance. An experimental three wheeled car using an imported Daimler engine was built in Sydney as early as 1894 (Petroleum Information Bureau 1960,27). By 1901 there was sufficient demand for the Colonial Oil Company to order its first shipment of motor spirit (*ibid*,30), so introducing a new fuel to the Sydney energy system. At the end of 1902 there were 42 motor cars in Sydney (Dixon 1972,39).

### **Energy Demand in the Factory and the Home**

Between 1881 and 1902 the number of workers in factory employment and the steam power available in NSW factories more than doubled.[87] The average engine power per Sydney factory employee increased from 0.32 to 0.46 hp between 1886 and 1896, as Table 3.5 illustrates, but then stabilised for the next six years. By contrast the average power per employee in the rest of NSW rose steadily, from 0.86 hp in 1886 to 1.57 in 1902. This is consistent with the differentiation in industrial energy demand which had begun in the 1870s. By the end of the century the most energy intensive industries had left Sydney, and metropolitan manufacturing was based more on the secondary processing of food and metals, most of which required the controlled application of smaller amounts of energy in complex production processes.[88]

Sydney industry provided a ready market for small, clean engines to replace the cumbersome shaft and pulley systems which distributed the power from central steam engines. Gas was the first to exploit this market: gas engines had been used in printing, textiles and other high value added Sydney industries since the 1860s. By 1902 electricity generated on site was also being used in factories, though probably as much for lighting as for power. Nevertheless, there were signs of electrification in production. Nearly 5% of the engine power installed in Sydney factories in 1902 was provided by electric motors (and 13% by gas engines) compared with 2% and 1% respectively in the rest of NSW (SR 1902,659).

The most significant feature of domestic energy use was the increasing penetration of gas. The number of AGL's domestic consumers increased at more than twice the rate of population growth in the period 1881 to 1901. By 1901 nearly half of all dwellings in the 32

municipalities south of the Harbour were connected to the company's reticulation system.[89] The predominant use for gas was still lighting, and its popularity increased with the introduction of the Welsbach incandescent mantle and steadily declining price.[90] The main source of lighting in the half of all Sydney dwellings not yet connected to gas, and in the vast majority of rural dwellings, remained kerosene and candles.[91]

Household electric lighting was still a rarity at the turn of the century. It was restricted to the few dwellings with access to public electricity supply in towns like Young and Newcastle. In the metropolis it could be seen only in the houses connected to the Redfern municipal system, or those in the City commercial districts supplied by private lighting companies. There was also a handful of private installations in the suburbs and in the country, in the houses of the wealthy and of some particularly enthusiastic engineers.[92]

In response to the threat from electricity, AGL began to actively promote gas cooking (Broomham 1987,88). Gas cookers could be obtained from several importers and local manufacturers, and AGL had rented or sold them to about a fifth of its customers by the end of 1899.[93] Gas space and water heaters were also available, but installed only in more expensive dwellings. Most households in Sydney, as in the rest of NSW, still used firewood or coal fuel, albeit in cast iron cookers instead of open hearths.

Rising prosperity led to further increases in the range of household furniture and hand-operated mechanical equipment. While this increased the demand for the traditional residential energy services of cooking, cleaning and laundry, those tasks remained largely unmechanised, and if anything even more labour-intensive. Domestic service continued to be one of the largest categories of employment in NSW, and by far the largest employer of women outside the home. Table 3.6 shows that the proportion of the workforce employed in domestic service declined from the 1840s to the 1880s, with the modernisation of the convict-based economy. By 1901 it was actually increasing again, despite the growth of factory employment.

### **The Emerging Energy Grids**

By 1904 the conditions in Sydney were ideal for the development of energy reticulation grids, and it was these grids which most distinguished the urban energy system from the rest of NSW. There was a spatial concentration of overlapping domestic, commercial and industrial energy markets, in each of which relatively modest amounts of energy were providing high value energy services, using increasingly standardised equipment. The rising cost of labour and of urban land made the maintenance of separate energy systems expensive for consumers,

and rising urban density made the separate combustion of fuel by each consumer troublesome for all.[94]

The degree to which energy production in Sydney became centralised in the period 1881 to 1902 is indicated by Table 3.7. In 1881 the power of all machinery used in reticulated energy production (mainly gas) was equivalent to less than 6% of the power installed in factories. By 1902 the power used in gas production, small electric installations and hydraulic power (but excluding electric traction) was equivalent to no less than 30% of the power installed in factories. The development of energy grids in the rest of NSW was much slower: the proportion of power capacity centralised was still less than 6% in 1902.

Each of Sydney's energy grids relied, ultimately, on coal brought to the city by sea and rail. The ready availability of coal-derived energy in ever cheaper and more convenient forms further accelerated the departure of firewood, kerosene and tallow from the urban energy system. No single form of coal-derived energy could conveniently supply all energy services in all sectors of demand. The fuels and technologies of lighting, heating/cooking, lifting/hoisting, large motive power, small controlled power and traction had all developed independently and had yet to converge.

The oldest, best developed and still the most important grid was the gas system. Gas technology was well developed for lighting, thermal and small power applications, and AGL's system expanded steadily in extent and in sales.[95] The urban area north of the harbour continued to be served by the North Shore Gas Company, and after 1883 by the Manly Gas Light and Coke Company. The gas industry was still dominated by AGL, which sold the great majority of the gas consumed in Sydney, and indeed in the whole of NSW (see Table 3.8).[96]

The steady growth in gas sales was brought about mainly by the connection of new consumers: the annual consumption per private consumer remained remarkably constant between 1881 and 1904, at about 30 thousand cubic feet. The quantity of gas sold annually for public lighting more than tripled in the period 1881 to 1897, as the mains extended to more municipalities and new street lighting contracts were made. The year 1897 marked the high point of AGL's public lighting sales, both in quantity and in the proportion of total production (nearly 14%). Public lighting sales slowly fell away after that year, due partly to the fitting of more efficient Welsbach mantles, and partly to the impact of electricity. The rate of decline was gradual, and punctuated by peaks in the late 1900s and after World War I, when the rate of electrification faltered.

Energy distribution by means of water under high pressure was introduced in several British cities in the 1880s and 1890s, and a bill to enable the laying of high pressure mains in Melbourne was passed by the Victorian parliament in 1887 (Dickinson 1894,39). In 1888 the competing Sydney and Suburban Hydraulic Power Company and Sydney Hydraulic Power Company bills were introduced into the NSW parliament. The object of the latter was to:

"...facilitate the supply of motive power on the high-pressure hydraulic system for use on wharves, in warehouses, and other buildings, for electric lighting, and for other purposes, in the City of Sydney and its suburbs" (NSWPD 1.5.1888).[97]

The Sydney Hydraulic Power Company's bill succeeded, and it built a high pressure accumulator in Pier Street which commenced supply to 8 machines in May 1891. Three years later the company's grid was supplying power to 200 machines. Some of these had previously been connected to single-building hydraulic systems powered by gas engines (Dickinson 1894,45). Such small scale installations were cumbersome, inefficient, and readily displaced by reticulated hydraulic power, despite AGL's attempts to retain the market (Broomham 1987,88). Otherwise, hydraulic power was no threat to gas, and strictly limited in application: in 1894 it delivered little more than a thousandth of the energy supplied by Sydney's gas system.[98] It managed to fill its limited and specialised niche until as late as 1976, considerably longer than the cable traction system, which was completely superseded by electricity in 1904.

Although the preamble of the Sydney Hydraulic Power Company's Act specifically mentioned electric lighting as one of its purposes, there is no record that electricity was ever generated by hydraulic power in Sydney.[99] In the 1890s, electrification still waited on the development of an urban electricity distribution grid. The potential for a universal urban electricity grid capable of supplying any stationary energy service at any point does not appear to have been widely grasped in Sydney at the time, despite the rapid development of several small independent electricity grids in and near the City. Electricity was still mainly perceived as a technology with special advantages in illumination, power and traction, rather than as an energy distribution medium, as evidenced by the proposals to generate electric lighting from reticulated gas and hydraulic power.

It was well after the turn of the century before the conditions of both supply and demand were favourable for the development of an electricity grid in Sydney. The expansion and merger of smaller installations, as had taken place in Melbourne in the 1890s, was prevented by political forces.[100] By 1904, the issue of political control had been settled for the time being, with clearly delineated functions assigned to the SMC and to the Railway and Tramway Commissioners. Each organisation had its own large power station, and access to capital at favourable rates to assist expansion. The demand for all forms energy was growing as

traditional processes were mechanised and new processes introduced. The increasing density of the city placed a premium on clean, compact energy converters and was favourable to the economics of electricity reticulation.

Metropolitan electrification had, in fact, already advanced appreciably. Table 3.7 shows that the total power of electric installations in Sydney (excluding traction) was equivalent to about 25% of the power installed in factories by 1902, compared with less than 5% in the rest of NSW. The loads served by these installations could be readily transferred to an electricity grid. There was a pool of engineers and contractors, with up to 25 years' experience with electro-technology, in a position to make the appropriate economic and technical decisions and to carry them out. In this environment, the growth of Sydney's electricity grid was not only a natural development, it was well overdue.

TABLE 3.4  
SUBURBAN RAIL AND TRAM TRIPS BY ENERGY TYPE  
SYDNEY  
1889 - 1914

Millions of passenger-journeys

| YEAR | RAIL              | TRAM                    |                   |       | TOTAL                  |           |
|------|-------------------|-------------------------|-------------------|-------|------------------------|-----------|
|      | SUBURBAN<br>Steam | INNER SUBURBAN<br>Steam | SUBURBAN<br>Elect | Cable | OUTER SUBURB.<br>Steam | Elect (a) |
| 1889 | 13.3(b)           | 52.8                    | -                 | 2.0   | -                      | 68.1      |
| 1894 | 16.3(c)           | 58.8                    | -                 | 4.1   | 0.3                    | 79.5      |
| 1899 | 20.6(d)           | 41.0                    | 1.5               | 6.2   | 0.2                    | 68.0      |
| 1904 | 30.4(e)           | 11.7                    | 105.6             | 9.8   | 1.5                    | 53.4      |
| 1909 | 46.0(f)           | -                       | 173.3             | -     | 2.5                    | 48.5      |
| 1914 | 77.4(g)           | -                       | 282.7             | -     | -                      | 7.9       |

Sources: RD annual reports

- (a) Includes both mobile steam traction and steam-powered cable.
- (b) In addition to 2.8 m country rail trips.
- (c) Estimated suburban component of 19.3 m NSW total.
- (d) Estimated suburban component of 24.7 m NSW total.
- (e) In addition to 3.4 m country rail trips.
- (f) Estimated suburban component of 52.1 m NSW total.
- (g) In addition to 8.9 m country rail trips.

**TABLE 3.5**  
**EMPLOYMENT AND ENGINE POWER IN FACTORIES**  
**SYDNEY AND REST OF NSW**  
**1886 -1902**

| SYDNEY  | 1886   | 1896    | 1902    |
|---|--------|---------|---------|
| <b>MANUFACTURING (Excluding heat, light &amp; power works)</b>  |        |         |         |
| Number of works   | 1449   | 1168    | 1446    |
| Number of employees   | 25690  | 27810   | 42690   |
| Power of machinery (hp)   | 8330   | 12910   | 19340   |
| hp per employee   | 0.32   | 0.46    | 0.45    |
| <b>HEAT, LIGHT FUEL AND POWER (Excluding traction)</b>          |        |         |         |
| Number of works   | 14     | 23      | 43      |
| Number of employees   | 672(b) | 534     | 891     |
| Power of machinery (hp)   | 496(b) | 1726    | 9760(a) |
| <b>ELECTRIC LIGHT &amp; POWER STATIONS (Excluding traction)</b> |        |         |         |
| Power of machinery (hp)   | 90     | 1100(b) | 8000(b) |
| <b>PERCENTAGE OF POWER CENTRALISED(c)</b>                       |        |         |         |
| In Heat, Light Fuel & Power works                               | 5.6    | 11.8    | 33.5    |
| In Electric Light & Power Stns                                  | 1.0    | 7.5     | 27.5    |
| <b>REST OF NSW</b>  |        |         |         |
| <b>MANUFACTURING (Excluding heat, light &amp; power works)</b>  |        |         |         |
| Number of works   | 2245   | 1938    | 1948    |
| Number of employees   | 18620  | 20380   | 22040   |
| Power of machinery (hp)   | 15940  | 27250   | 34670   |
| hp per employee   | 0.86   | 1.34    | 1.57    |
| <b>HEAT, LIGHT FUEL AND POWER (Excluding traction)</b>          |        |         |         |
| Number of works   | 24     | 51      | 76      |
| Number of employees   | 800(b) | 325     | 654     |
| Power of machinery (hp)   | 400(b) | 1033    | 2059    |
| <b>ELECTRIC LIGHT &amp; POWER STATIONS (Excluding traction)</b> |        |         |         |
| Power of machinery (hp)   | -      | 920(b)  | 1580(b) |
| <b>PERCENTAGE OF POWER CENTRALISED(c)</b>                       |        |         |         |
| In Heat, Light Fuel & Power works                               | 2.4    | 3.6     | 5.6     |
| In Electric Light & Power Stns                                  | -      | 3.3     | 4.6     |
| <b>PERCENTAGE OF NSW MACHINERY LOCATED IN SYDNEY</b>            |        |         |         |
| Manufacturing (Excl H,L F & P)                                  | 34     | 32      | 27      |
| Heat, Light, Fuel and Power                                     | 55     | 63      | 83      |
| Electric (Excl traction)  | 100    | 57      | 84      |

(Source: NSW Statistical Registers: Manufactories and Works)

- (a) Estimated additional 11100 hp at Ultimo and 500 hp at Rushcutter's Bay used solely for traction (PWD & RD reports)
- (b) Estimates
- (c) Machinery in power works as a percentage of total machinery (including that in power works).

TABLE 3.6  
DOMESTIC SERVANTS IN THE WORKFORCE  
NSW  
1841 - 1901

|                                       | 1841        | 1861  | 1871  | 1881  | 1891   | 1901   |
|---------------------------------------|-------------|-------|-------|-------|--------|--------|
| <hr/>                                 |             |       |       |       |        |        |
| NUMBER ('000) ENGAGED IN:             |             |       |       |       |        |        |
| Supply of board<br>& lodging          | na          | na    | na    | na    | 17.9   | 23.9   |
| Paid domestic service<br>& attendance | na          | na    | na    | na    | 38.0   | 48.9   |
| TOTAL DOMESTICS                       | 9.8         | 20.1  | 25.2  | 37.7  | 55.9   | 72.8   |
| TOTAL IN EMPLOYMENT<br>(a)            | 65.1<br>(b) | 161.3 | 207.9 | 317.8 | 480.2  | 559.2  |
| TOTAL POPULATION                      | 128.7       | 350.9 | 504.0 | 751.5 | 1132.2 | 1351.9 |
| <hr/>                                 |             |       |       |       |        |        |
| PERCENTAGES                           |             |       |       |       |        |        |
| Total Domestics/<br>total employed    | 15.1        | 12.5  | 12.1  | 11.9  | 11.6   | 13.0   |
| Total Domestics/<br>female employed   | na          | 48.3  | 45.4  | 45.5  | 42.7   | 46.5   |
| Total Domestics/<br>total population  | 7.6         | 5.7   | 5.0   | 5.0   | 4.9    | 5.4    |
| Paid domestic<br>servants/population  | na          | na    | na    | na    | 3.4    | 3.6    |
| <hr/>                                 |             |       |       |       |        |        |

(Sources: NSW Statistical Registers, Mansfield 1841).

(a) Total population less Dependants and Not Stated).

(b) 1841 total in employment calculated as all workforce categories plus 8655 convicts in government employment (see Mansfield 1941,27).



**TABLE 3.7**  
**HEAT, LIGHT, FUEL AND POWER WORKS**  
**NSW**  
**1881 - 1902**

| TYPE OF WORKS  | 1881 | 1886 | 1896 | 1902  |
|--|------|------|------|-------|
| <b>GAS</b>   |      |      |      |       |
| Number   | 15   | 28   | 42   | 48    |
| Employees  | 541  | 1084 | 621  | 723   |
| Machinery power (hp)                                     | na   | 479  | 625  | 1113  |
| <b>ELECTRICITY</b>                                       |      |      |      |       |
| Number   | -    | 5    | 27   | 58    |
| Employees  | -    | 13   | 134  | 413   |
| Machinery power (hp)                                     | -    | 90   | 2021 | 21175 |
| <b>COKE</b>  |      |      |      |       |
| Number   | -    | -    | 4    | 10    |
| Employees  | -    | -    | 70   | 283   |
| Machinery power (hp)                                     | -    | -    | 93   | 326   |
| <b>KEROSENE</b>  |      |      |      |       |
| Number   | 2    | 4    | 1    | (a)   |
| Employees  | 44   | 375  | 34   | (a)   |
| Machinery power (hp)                                     | na   | 327  | 20   | (a)   |
| <b>HYDRAULIC POWER</b>                                   |      |      |      |       |
| Number   | -    | -    | (b)  | 1     |
| Employees  | -    | -    | (b)  | 10    |
| Machinery power (hp)                                     | -    | -    | (b)  | 800   |
| <b>ALL RETICULATED ENERGY</b>                            |      |      |      |       |
| Number   | 15   | 33   | 69   | 103   |
| Employees  | 541  | 1097 | 755  | 1146  |
| Machinery power (hp)                                     | na   | 569  | 2646 | 23088 |
| <b>ALL RETICULATED ENERGY AS PERCENTAGE OF NSW TOTAL</b> |      |      |      |       |
| Number   | 0.5  | 0.9  | 2.2  | 3.0   |
| Employees  | 1.8  | 2.4  | 1.5  | 1.7   |
| Machinery power (hp)                                     | na   | 2.3  | 6.2  | 36.5  |

(Source: NSW Statistical Registers; machinery power is "full capacity" rather than "actually used")

(a) Included with Gas Works.

(b) Known to be in operation in that year, but not enumerated in statistics.

TABLE 3.8  
GAS PRODUCTION AND SALES  
AGL  
1884-1934

| YEAR | VOLUME<br>MADE<br>(a) | SOLD<br>BY<br>METER | PUBLIC<br>LIGHTS | TOTAL<br>ENERGY<br>(PJ) | %<br>LIGHTS | %<br>NSW<br>TOTAL |
|------|-----------------------|---------------------|------------------|-------------------------|-------------|-------------------|
| 1884 | 699.6                 | 525.4               | 74.6             | 0.30(b)                 | 12.4        | na                |
| 1889 | 1199.5                | 921.0               | 127.4            | 0.52                    | 12.2        | 86.3              |
| 1894 | 1431.6                | 1088.2              | 167.6            | 0.63                    | 13.4        | 80.7              |
| 1899 | 1493.4                | 1234.0              | 144.6            | 0.69                    | 10.5        | 79.3              |
| 1904 | 2016.8                | 1705.6              | 149.1            | 0.93                    | 8.0         | 77.6              |
| 1909 | 2598.8                | 2229.3              | 172.8            | 1.20                    | 7.2         | na                |
| 1914 | 4283.1                | 3655.8              | 122.9            | 1.89                    | 3.3         | na                |
| 1919 | 5472.0                | 4283.9              | 154.9            | 2.22                    | 3.5         | na                |
| 1924 | 7060.3                | 6354.3              | na(c)            | 3.34                    | na          | na                |
| 1929 | 8084.2                | 7275.8(d)           | na               | 3.82                    | na          | na                |
| 1934 | 7218.4                | 6496.6(e)           | na               | 3.57                    | na          | na                |

(Source: AGL manuscript records, Mitchell Library)

(a) millions of cubic feet: volume made = sold by meter + public lights + unaccounted for gas + own use.

(b) Assumed that gas is produced at the lowest energy content permitted by the prevailing legislation: 500 BTU/cu ft until 1919, then 525 until 1929, then 550.

(c) In 1922, the last year in which public light sales were separately recorded, they accounted for 87.1 m cu ft, or 1.6% of total sales.

(d) Industrial sales 436.6 m cu ft, or 6.0% of total.

(e) Industrial sales 700.0 m cu ft, or 10.8% of total.

## **4. THE MOMENTUM OF GROWTH, 1904 - 1932**

The rapid suburbanisation of Sydney in the early decades of this century stimulated the demand for electric traction, and the extension of supply to the new suburbs tapped a huge market for lighting and small appliances. Smaller and cheaper motors spearheaded the substitution of electricity for steam power in manufacturing. These trends were reinforced by the development of a local electric equipment industry and by the promotional policies of the electricity suppliers. The Sydney Municipal Council in particular built up a momentum of growth and expansion which accelerated Sydney's electrification. Nevertheless, electricity supply remained organisationally and geographically fragmented. Greater co-ordination was advocated by various politicians, engineers and commissions of inquiry. None of their suggestions were taken up, because technical issues were inextricable from questions of control and institutional autonomy, and because steady growth masked the economic costs of fragmentation. This first phase of electrification was interrupted by the depression, but the momentum of supply expansion and the strength of latent demand ensured that the interruption would be brief.

### **4.1 THE ELECTRICITY UNDERTAKING OUTGROWS THE COUNCIL**

The Sydney electricity market was supplied by three major generating organisations for most of this period. The smallest was the privately owned Electric Light and Power Supply Corporation (ELPSC), established in 1908. By 1911 it had secured the franchise for the municipalities surrounding its power station at Balmain, and attained its maximum geographical extent. The Railway and Tramways Department (RD) built its first major power station at Ultimo in 1899 exclusively to supply the electric tramway system, and commenced a second power station at White Bay in 1912, in anticipation of suburban railway electrification. The RD supplied electricity in bulk to outlying municipalities in the south west from 1923. The third generating body was the Sydney Municipal Council (SMC), which opened its power station at Pymont in 1904. All three systems expanded their production steadily and independently, except for limited energy exchanges between the RD and SMC in the 1920s. The traction load was reserved for the RD, and the general load was divided by the boundaries of franchise areas. The SMC was the least constrained and best placed to grow.

The Council (or rather, its largely autonomous Electric Lighting Department) rapidly acquired the small private power companies in the City. It then expanded its energy sales and consumer numbers by means of the pricing structure, promotion, and the incorporation of new service areas. This strategy meshed in with the addition of generating plant, in which technological development and ever-increasing economies of scale led to reductions in supply cost. At the

same time some very large investment decisions were made more on the basis of retaining or enhancing the independence of the Council than from consideration of the true costs to electricity consumers.

## **The Development of Policy**

Electricity supply was the only one of the SMC's functions which extended, in due course, over most of the metropolitan area. Its growth was so rapid that by 1929 two thirds of Council staff were employed by the Electric Lighting Department (ELD), generally known as the "electricity undertaking" (SMC/CC 1929,67). The degree of direct Council involvement in electricity supply matters varied with the composition of its Electric Lighting Committee, which changed from year to year.[1] By contrast, the ELD and its successor, the Sydney County Council, remained under the direction of the same general manager, H.R.Forbes Mackay, from 1908 to 1939 (Anderson 1955,41,163). At first the Electric Lighting Committee was involved in almost every aspect of the management of the ELD.[2] On technical matters it acted on the recommendation of the City Electrical Engineer, and on financial and pricing matters called for supplementary reports from the Town Clerk, who was responsible for all ELD accounts, stores and staffing.

This cumbersome structure invited friction. After the resignation of the first City Electrical Engineer in 1908 over the interference of aldermen in staffing matters (SMC/TC 1908,170), the ELD's need for greater independence was progressively recognised.[3] An investigating accountant advised the Council in 1913 "...to commercialize this undertaking in the fullest possible manner" (SMC 1913,580). The question of "commercialization" touched on an issue central to the management of publicly owned enterprises. Trading organisations, public or private, may be managed with the intention of obtaining a real return on the capital invested in them, to be paid as dividends to private shareholders, or as payments to a central fund in the case of public ownership. Alternatively, organisations may not be required to make a return on capital, but only to avoid a trading loss and to raise internally some prescribed proportion of their investment capital: a mode of operation characteristic of public utilities.

The ELD was often described as a "business" or a "commercial operation" by its management, by aldermen, and by the press, and on that basis all parties argued for greater autonomy for it. If the ELD was indeed a business, the Council did not set any clear criteria for its performance, and seemed satisfied with an average annual return on capital of 2.8% during the 1910s, declining to 0.8% during the 1920s.

The Council's initial intention that the profits of electricity supply should offset the general rate gradually gave way to a conscious public utility policy. In fact, the management of the undertaking took the decision to run it as a utility about a decade before that policy was ratified by the Council.[4] In 1922 the SMC endorsed Forbes Mackay's policy by resolving:

"That the policy of the Council's Electricity Supply Undertaking be laid down as follows: (a) To produce electric light and power at the lowest possible rate; (b) To produce sufficient to cover working expenses, interest, sinking fund, depreciation, and allocation of a maximum of one percent (1%) towards the relief of rates" (Smith & Johnson 1922,95).

Opinion varied on the issue of contribution to revenue. In the 1920s the Labor Party and the conservative Civic Reform movement contested the control of an increasingly politicised Council (Curnow 1957). The owners of most City businesses had by then migrated to the suburbs, yet their rates maintained Council services to the remaining residents, most of whom were tenants and Labor Party voters. The Civic Reform Association represented the interests of non-resident ratepayers, and its aldermen occasionally succeeded in appropriating small amounts from ELD surpluses for the relief of rates.[5] The opposing Labor policy was clearly expressed by an alderman and member of parliament:

"We do not believe in distributing the profits made by a business undertaking of that sort to relieve ratepayers of their burden. We say that when a profit is shown in a business of that kind it is an indication of bad management, and that if any surplus is being shown the price of current to consumers should be reduced" (NSWPD 16.11.27,329).

In the event, neither political faction exercised any effective financial control over the ELD: it was not until 1928 that it first presented forward estimates of income and expenditure to the Council (SMC/CC 1928,79).[6] The one point of policy on which both Labor and Civic Reform agreed was that the Council's electricity system should remain independent of government control.

## **The Expansion of Supply**

The original generators installed at Pyrmont in 1904 were driven by vertical reciprocating steam engines. All new plant installed by the SMC from 1907 was steam turbine driven, as was the trend in large thermal power stations throughout the world. Turbines required constant loading to function efficiently. They were, in effect, "supply in search of demand" (Hughes 1983,364). Their installation prompted the ELD management to promote load growth, which in turn allowed newer, larger and more efficient units and dropped production costs still further, albeit adding to capital charges. The SMC's total installed capacity at the end of each year to 1935 and the size of the largest unit are shown in Fig 4.2. The increase in scale was rapid: the maximum size of plant more than doubled at each increment.[7]

Total capacity increased steadily until 1915. The world war then made it impossible to obtain new equipment, and it was apparent to the ELD that the Council would be unable for a time to meet the anticipated growth in electricity demand.[8] Informal arrangements were made to supplement the output of Pymont power station by purchases from the Railway Department at peak times. Forbes Mackay recommended to the Council in 1917 that this arrangement should be formalised, to defer the large capital expenditures required to extend Pymont. His recommendation was rejected by the Council in 1918, in favour of the extension of Pymont Power House (Pearce 1924,17).

Partial reliance on the RD system continued to smooth the SMC's capacity increments throughout the 1920s. The value of the arrangement was apparent to the consulting engineer S.L.Pearce, who recommended to Council in 1924 that the two systems should be fully integrated, and that the next power station should be built by the Railways (Pearce 1924,22).[9] In March 1923 the Council made a formal agreement with the Railway Commissioners for the interchange of power for an indefinite period from March 1925, subject to termination at five years' notice by either party (Anderson 1955,88).

Economic considerations were overtaken by political events. In 1925 the Minister for Works and Railways in the Fuller coalition government appointed a commission to examine the issue of the state's electric power resources (SMH 7.1.25). The reaction of the Lord Mayor and Labor MLA for Goulburn, P.V.Stokes, as expressed to a special meeting of Council in January 1925, precluded any long term co-operation:

"Newspaper reports and unchallenged accounts of official statements by accredited Ministers of the Government indicate that a preconceived scheme to filch from the Council the undertaking established by the citizens, with their own money, is shortly to become operative...the contract [with the Railway Commissioners] is against the best interests of the people of the Metropolis and the Citizens of the City, and the object of the contract is only too apparent, namely, to form a nucleus of an Electricity Commission for the State of New South Wales" (SMC 1925,831)

On Stokes' recommendation the Council gave five years' notice of termination to the Railway Commissioners in March 1925, very shortly after the arrangement took effect. At elections one month later the Fuller government was succeeded by the Lang Labor government, and the commission appointed by Fuller lapsed. By that time, however, the Council was committed to having a new power station operational by March 1930.

The decision had far reaching consequences. The construction of Bunnerong power station between 1926 and 1929 led indirectly to drastic government intervention in the SMC's affairs. There were allegations of corruption on the part of senior ELD officers, and certain Labor

aldermen, over the award of contracts for the boiler plant - allegations used by the conservative Bavin government elected in October 1927 as excuses to suspend the City Council for two years and appoint Commissioners in its place (Spearritt 1978,177).[10] The ELD emerged from the period of the Commission with more autonomy than before. In July 1930 the Civic Reform group gained control of the Council in the first post-Commission elections. It took steps to implement its policy that the ELD should be governed by an independent board and that it should return a small percentage annually for the relief of City rates (Anderson 1955,130).[11]

The most serious consequence of the SMC's termination of the interchange agreement was a costly and technically unnecessary delay in the integration of the Sydney electricity supply system. If the interchange had been maintained, normal load growth could have been satisfied without the Bunnerong power station for at least another five years.[12] The effect of the depression on energy demand made the station even more premature. The excess capacity made necessary a promotional pricing structure to stimulate the penetration of electricity into thermal energy markets formerly dominated by gas.

### **The Growth of Demand**

The Council's electricity sales grew at an average annual rate of 21% in the 1910s and 16% in the 1920s, before declining by 4% in 1930 and 1931 due to the depression (SCC 1935,18). This growth rate reflected the acquisition of the remaining private electricity companies, the connection of new consumers in the City, the development of new loads, and the extension of supply to the suburbs. The tardiness in setting up Sydney's first large non-traction power station also contributed to rapid initial growth. In his 1909 review of the ELD, Cardew remarked:

"This very rapid rate of increase I partly attribute to the delay which occurred in starting the enterprise, Sydney having lagged behind other cities of its importance in this matter..."(SMC 1909,607).

The SMC purchased the five small remaining private electricity companies and the Redfern municipal undertaking at the earliest opportunity, as summarised in Table 4.1, and by 1913 had succeeded in eliminating all competition in the City.[13] Purchased business contributed about half of the total growth in sales over the three years ending 1910 (see Table 4.2). The load acquired was nearly 74% lighting, whereas the rest of the SMC's sales were nearly 60% power. The immediate effect on the system load factor was negative: it declined from over 34% to less than 28% during the period of acquisitions, after which it increased steadily (SCC 1935,34). Another element in the growth of demand was the stimulation of commercial and industrial electricity sales through the hiring of equipment, which overcame the resistance of consumers to investing in a capital intensive and unfamiliar form of energy.[14]

The SMC sought to stimulate residential demand as well. In areas such as Annandale there were long cable runs between street lamps without any consumers at all, because householders did not want to spend money on wiring (SMC/TC 1911,201). The Council discussed a "free wiring" scheme as offered in British cities, whereby the consumer could repay the cost of wiring through a surcharge on the normal tariff. The City Solicitor was of the opinion that charging differential tariffs would contravene the Act. This narrow interpretation, reinforced on later occasions, had important consequences. Firstly it led the undertaking away from its initial impetus toward the provision of complete electrical energy services, where overall costs could be minimised through optimal pricing of each component, and towards the more limited role of selling electricity. Secondly, it reduced the scope for the selective recovery, through differential pricing of the costs imposed by specific consumers. It therefore contributed to the development of cross-subsidisation, a major feature of the Sydney electricity system ever since.

From the beginning of central station electricity supply in the 1880s, it was well understood that tariffs should ideally reflect the costs of supplying various classes of loads and consumers, and in particular their contribution to the peak load on the system (Neufeld 1987,695). The SMC peak load was originally dominated by night time lighting, and so day time loads were encouraged. All consumers were wired with separate light and power circuits, and had the option of maximum demand or flat rate tariffs on each. The price for power and thermal energy was substantially lower (in 1907 it averaged 1.88 d/kWh compared with 3.05 d/kWh for light) yet it was still estimated that power consumption subsidised lighting (SMC/TC 1908,144).

Constant load growth, steady improvement in the load factor and the regular installation of more efficient plant reduced the need for tariffs to reflect true costs. As electrification progressed, end uses soon multiplied outside the familiar categories of night time lighting or day time motor load.[15] Only the energy and maximum demand on the light and power circuits were measured, and the metering technology of the time was too crude to allow accurate time of use registration. The tariff structure became more arbitrary in its allocation of total operating cost to various consumer groups.

Tariffs first rose in 1920, when the SMC partially applied increases awarded by a tribunal established under the Municipal Council of Sydney Electric Lighting Amendment Act of that year. In 1922 the ELD made a substantial operating profit, and in 1923 the then Labor-controlled Council voluntarily reduced prices. Operating profits still continued to be made until a restructuring of tariffs in 1925 led to a decrease in average price.[16]



The tariff structure adopted in 1925 marked the transition of the Sydney electricity system from an aggregate of discrete energy service demands to a unified system of supply. Consumption was categorised not by end use but by 'Level 1' end user.[17] The 1925 structure has persisted, with modifications, up to the present time. It was intended to stimulate consumption as much as to recover costs. Forbes Mackay wrote in his annual report for 1925:

"It is hoped that the new method of charging will bring about a greatly increased demand for electricity supplied by the Department; from users in "commercial" premises chiefly in the greater use of electricity in refrigerating apparatus, display windows and illuminated advertisements, and from users in residential premises in the greater use of electricity in cooking and other domestic appliances" (Anderson 1955,102).

Almost from the commencement of supply in 1904, the SMC employed publicity to gain new consumers and to promote electricity use.[18] Promotion was a constant feature of the ELD's operations, except in the years from the end of the war to the mid 1920s, when the generating reserve margin was small and new suburbs were being connected. Forbes Mackay then thought it prudent to suspend active promotion for a time (Smith and Johnson 1922,100). In the early years of the 20th century domestic lighting promotion took preference. When in early 1909 the Council asked its long-standing consultant P.Cardew for his views on promoting the use of electricity for heating and cooking, he replied

"I do not believe that the use of electricity for heating and cooking purposes can be popularised: it is too wasteful. At any rate you do not want it on now when you are not meeting demands for light and power, which are far more legitimate uses" (SMC 1909,623).

The installation of turbines, however, soon made the development of a day time load both possible and necessary to improve the load factor. By 1911 the ELD's generating capacity had more than doubled, and the Publicity Branch was actively promoting cooking and heating equipment (SMC/TC 1911,197).

Cooking and heating revenue was also necessary to justify the costs of the expansion of the system into suburban residential areas. In 1928 the Civic Commissioners reported that "the domestic supply is not profitable to the Council", which therefore

"...needs to spread amongst domestic users of electricity the knowledge of the great convenience and economy of electric domestic appliances, which will consume current during the day as well as at night" (SMC/CC 1929,55).

The circular argument that increased demand was necessary to recover the losses incurred through uneconomic expansion was used more than once to justify the promotional efforts of the ELD.[19] It was also the rationale for the SMC's entry into the business of retailing electrical appliances.[20]

## Strategic Expansion to the Suburbs

Then SMC expanded its supply area at a leisurely pace at first, and by 1910 only 5 municipalities outside the City were supplied.[21] (The area supplied by the SMC in 1905, and at 5 yearly intervals to 1935, are shown in Figure 4.1). The pace increased sharply in the years immediately preceding the war, in response actual competition from the Electric Light and Power Supply Corporation and the threat of competition from other quarters.[22] By 1915 the SMC supplied a total of 23 municipalities including some on the strategically important North Shore.[23] Expansion continued after the war despite a shortage of generating capacity, and by the early 1920s the area in which the City Council retailed electricity direct to consumers was close to its maximum. Almost all of the sales agreements made by the Council after 1921 were for supply in bulk to municipalities which then retailed the electricity themselves.

Increases in sales helped the ELD towards its two main objectives: to lower the average cost of production and to extend supply to as many consumers as possible. Supply technology developed so rapidly that each increment of plant was more efficient, and so lowered the system average costs of production, all else being equal. The two objectives conflicted where the demand pattern of a new consumer lowered the system load factor, as was the case with small residential consumers. They also conflicted as the supply was extended further from the power station, and the distribution costs per consumer increased. It is unlikely that the SMC ever balanced these considerations to determine an optimum strategy for growth when it embarked on its programme of suburban expansion.

In the first comprehensive analysis of the economic costs of expansion, in 1922, the accountants Smith and Johnson expressed surprise that neither the Council nor the ELD appeared concerned with the immediate cost implications:

"Apparently the policy of extending into the suburbs has been followed by the Council without counting the cost. Indeed, until we prepared - with difficulty - an analysis of the capital cost of the undertaking as between the City and Suburbs, we are not aware that anything of the sort had previously been attempted, while no attempt has been made since 1916 to analyse the revenue earned in various districts. How then can the Council - being in ignorance of the capital cost of each area, and knowing nothing of the proportion of revenue earned in each - frame a satisfactory policy of expansion ?" (Smith and Johnson 1922,15).

Smith and Johnson found that the suburbs giving the highest return on capital invested were to the east, a compact area with a high density of predominantly residential consumers, and the south, which was principally industrial. The mixed western zone gave a consistently negative return, as did the newly connected northern zone, which was almost entirely low density residential (see Table 4.4).

By 1921 over half of the undertaking's capital was invested in the suburbs, which were returning well below half the gross revenue.[24] They were moving towards profitability, but for the time being the cost burden on City consumers, who were supposedly the main beneficiaries of the SMC's activities, appear not to have been considered. Forbes Mackay's defence of the strategy of expansion hints at the SMC's aspirations to electrical hegemony over the entire metropolitan area:

"A condition, in the case of Sydney, which has helped to make the capital cost heavy, is the great area over which supply is given. It may be argued, and Messrs. Smith and Johnson take that view, that such a wide area should not have been taken in. The suburban areas were taken in for a very simple reason. If Sydney Council had not provided a supply in the areas, someone else would. It may be asked "What harm would that do to Sydney Council?" It would not do the Council much harm, but in a few years' time, when something must be done to consolidate the control of the Metropolitan area, the ownership of a number of separate bodies of a lot of trifling little separate electric systems would have caused endless trouble and expense. The Council was certainly right in extending its system to the suburbs. if I had not recommended it to do so, I would have been culpably lacking in foresight" (cited in Smith and Johnson 1922, 97).

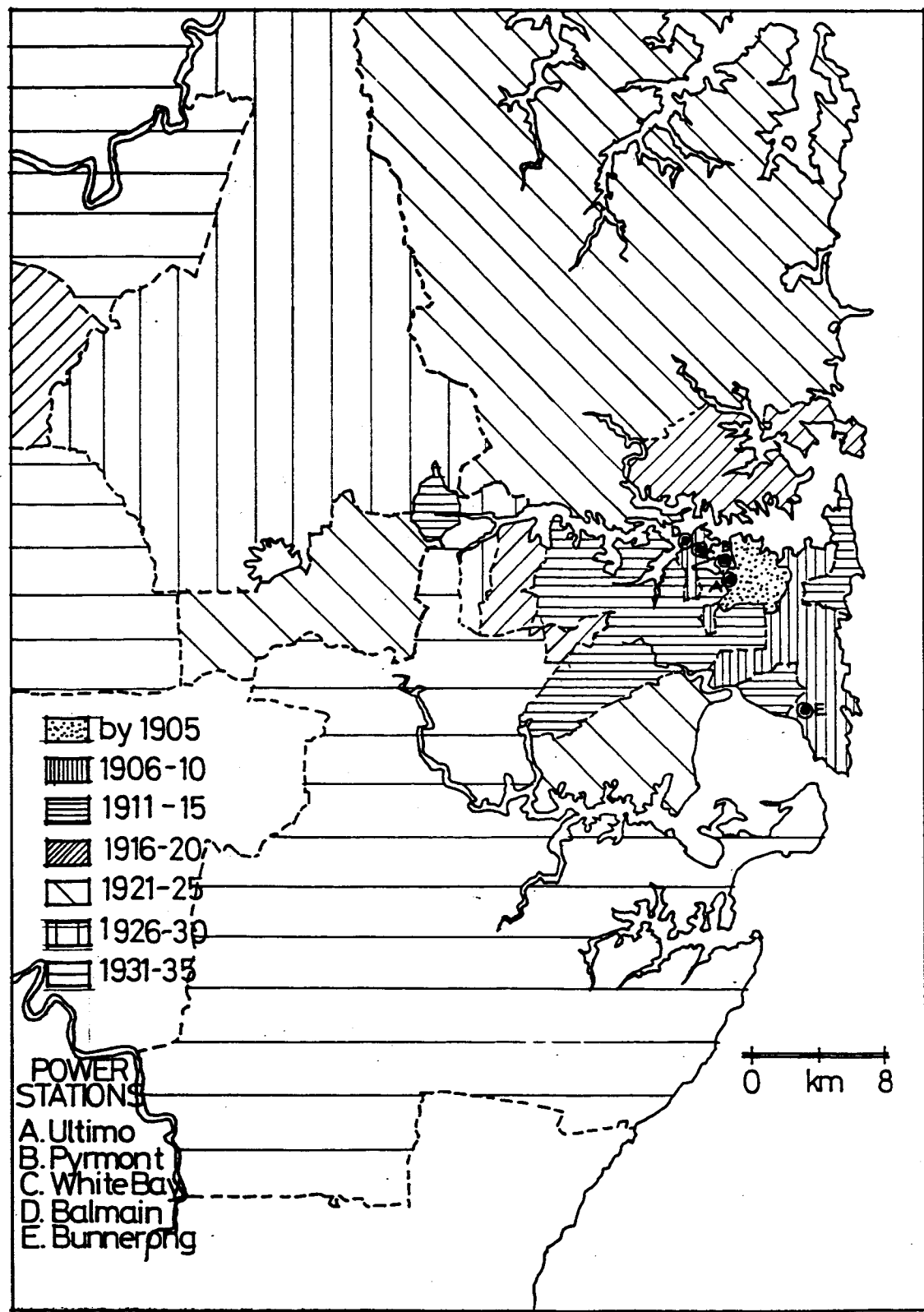
On consideration of the Smith and Johnson report, and of Forbes Mackay's response to it, the Electricity Committee endorsed, as usual, the management's expansionist policies(ibid,173).

Immediately after the war the SMC informed suburban councils that no extensions could be made until late 1920 at the earliest, because of the difficulty in obtaining equipment. Several municipalities stated their intention to establish their own power stations. The SMC decided reluctantly, under pressure from the Minister for Local Government, to consider applications for bulk supply by municipalities more than 9 miles from the Town Hall (Anderson 1955,75). The SMC made bulk supply agreements with 11 outer suburban councils in the period to 1932, by which time it again had excess capacity.

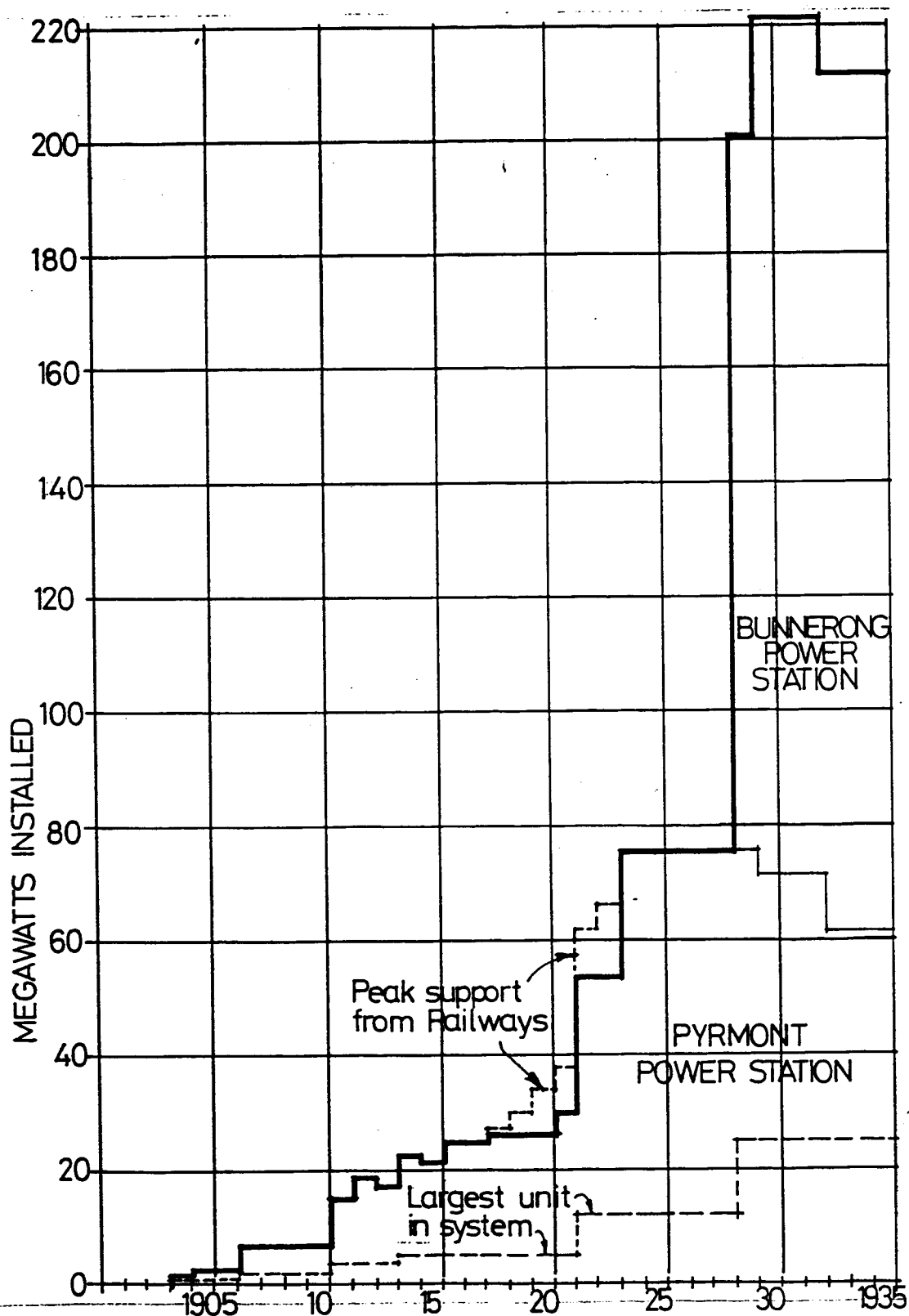
In one sense the pace of expansion was forced on the Council. If it had declined to supply municipalities when requested, the ELPSC and the Railways would have been all too eager to fill the breach.[25] In 1922 the Railways obtained the power to supply bulk electricity to municipal councils. In 1923 the first electricity supply county council, St. George, became the first to take advantage of the RD supply.

This showed suburban councils an alternative to absorption into the SMC's reticulation system. The apparent autonomy in matters of policy and tariffs of the St. George municipalities contrasted with the dependence of those within the SMC's reticulation area. The consequent pressure for suburban participation in the SMC's electricity supply policies was one of the factors leading to the establishment of the Sydney County Council.

**FIGURE 4.1**  
**SYDNEY LOCAL GOVERNMENT AREAS WITH ELECTRICITY SUPPLY**  
**1905-35**



**FIGURE 4.2**  
**TOTAL ELECTRICITY GENERATING CAPACITY**  
**SMC 1904-35**



**TABLE 4.1**  
**ELECTRICITY UNDERTAKINGS ACQUIRED BY**  
**THE SYDNEY MUNICIPAL COUNCIL**  
**1907 - 1913**

| UNDERTAKING       | YEAR OF PURCHASE | COST (L) | LOAD (kW) | SALES (MWh) |
|-------------------|------------------|----------|-----------|-------------|
| Empire            | 1907             | 31,000   | 500       | 800         |
| Strand            | 1908             | 45,000   | 800       | 1235        |
| Oxford Street     | 1908             | 13,500   | 320       | 350         |
| Imperial Arcade   | 1908             | 20,875   | na        | 500         |
| Palace            | 1913             | 10,000   | na        | 500         |
| Redfern Municipal | 1913             | 20,000   | na        | 260         |

(Sources: SMC reports, Anderson 1955,36,49).

**TABLE 4.2**  
**CONTRIBUTION OF ACQUIRED BUSINESS TO ENERGY SALES**  
**SYDNEY MUNICIPAL COUNCIL**  
**1907 - 1910**

| SALES                   | 1907  |      | 1908  |      | 1909(a) |      | 1910     |      |
|-------------------------|-------|------|-------|------|---------|------|----------|------|
|                         | (MWh) | %    | (MWh) | %    | (MWh)   | %    | (MWh)    | %    |
| TO PUBLIC               |       |      |       |      |         |      |          |      |
| Light                   | 1945  | 31.9 | 2540  | 29.3 | 3172    | 26.6 | 3631     | 25.2 |
| Power                   | 2387  | 39.2 | 3098  | 35.7 | 4375    | 36.7 | 5368     | 37.3 |
| VIA PURCHASED COMPANIES |       |      |       |      |         |      |          |      |
| Light                   | 121   | 2.0  | 883   | 10.2 | 1918    | 16.1 | 2636     | 18.3 |
| Power                   | 65    | 1.1  | 482   | 5.6  | 729     | 6.1  | 938      | 6.5  |
| SMC OWN USE             |       |      |       |      |         |      |          |      |
| Light                   | 197   | 3.2  | 216   | 2.5  | 209     | 1.8  | 201      | 1.4  |
| Power                   | 47    | 0.8  | 43    | 0.5  | 38      | 0.3  | 40       | 0.3  |
| TOTAL LIGHT             | 2263  | 37.1 | 3639  | 41.9 | 5299    | 44.5 | 6468     | 44.9 |
| TOTAL POWER             | 2499  | 41.0 | 3622  | 41.8 | 5142    | 43.1 | 6346     | 44.1 |
| STREET LIGHT            | 1333  | 21.9 | 1413  | 16.3 | 1474    | 12.4 | 1585     | 11.0 |
| TOTAL SALES             | 6095  |      | 8674  |      | 11915   |      | 14399(b) |      |

(Sources: SMC reports)

- a. 569 of 654 customers acquired from Strand, Oxford Street and Imperial Arcade Companies connected in 1909.
- b. Increase in sales (other than street lighting) 1907-10 was 8241 MWh, of which 3388 MWh (41%) was contributed by purchased business.

**TABLE 4.3**  
**AVERAGE PRICES, OPERATING PROFITS AND RETURN ON CAPITAL**  
**SYDNEY MUNICIPAL COUNCIL**  
**1910 - 1932**

| YEAR | AVERAGE<br>PRICE<br>(d/kWh) (a) | PROFIT<br>(L'000) (b) | CAPITAL<br>(L m) (c) | RETURN ON<br>CAPITAL<br>(%) (d) |       |
|------|---------------------------------|-----------------------|----------------------|---------------------------------|-------|
| 1910 | 2.12                            | 24.7                  | 0.71                 | 3.5                             |       |
| 1911 | 2.00                            | 28.4                  | 0.94                 | 3.1                             |       |
| 1912 | 2.05                            | 37.1                  | 1.24                 | 5.7                             |       |
| 1913 | 1.93                            | 53.3                  | 1.56                 | 3.5                             | 1910s |
| 1914 | 1.88                            | 59.9                  | 1.84                 | 3.3                             | av.   |
| 1915 | 1.88                            | 64.8                  | 2.30                 | 5.5                             | 2.8   |
| 1916 | 1.96                            | 30.7                  | 2.66                 | 1.2                             |       |
| 1917 | 1.72                            | -19.9                 | 2.85                 | -0.7                            |       |
| 1918 | 1.73                            | 73.9f                 | 3.00                 | 2.5                             |       |
| 1919 | 1.70                            | 19.1                  | 3.20                 | 0.8                             |       |
| 1920 | 1.75                            | 2.1                   | 3.80                 | 0.5                             |       |
| 1921 | 1.95e                           | -25.6                 | 4.64                 | -0.5                            |       |
| 1922 | 2.11                            | 141.4g                | 5.23                 | 2.7                             |       |
| 1923 | 1.93                            | 93.8h                 | 6.12                 | 1.5                             | 1920s |
| 1924 | 1.95                            | 207.3                 | 6.86                 | 3.0                             | av.   |
| 1925 | 1.92e                           | 53.6                  | 7.60                 | 0.7                             | 0.8   |
| 1926 | 1.80                            | -38.4                 | 8.92                 | -0.4                            |       |
| 1927 | 1.76                            | -22.0                 | 10.91                | -0.2                            |       |
| 1928 | 1.72                            | -33.7                 | 13.39                | -0.2                            |       |
| 1929 | 1.69                            | 227.6                 | 15.83                | 1.2                             |       |
| 1930 | 1.73                            |                       | 17.34                | 0.1                             |       |
| 1931 | 1.69                            |                       | 17.83                | -1.0                            |       |
| 1932 | 1.65                            |                       | 17.94                | 0.2                             |       |

(Sources:

a. SCC 1935,25

b. SMC/CC 1928,80

c. SCC 1935,31

d. SCC 1935,24)

e. Tariffs increased 18 July 1921, reduced 1 April 1925 (to new single meter structure).

f. L 22,000 contribution to rates.

g. L 33,000

"

"

"

h. L 30,592

"

"

"

**TABLE 4.4**  
**ESTIMATED RETURN ON CAPITAL INVESTED BY SUPPLY AREAS**  
**SYDNEY MUNICIPAL COUNCIL**  
**1913 - 1921**

| YEAR | CITY  | SUBURBAN |          |         |          | ALL<br>AREAS |
|------|-------|----------|----------|---------|----------|--------------|
|      |       | EAST(a)  | SOUTH(b) | WEST(c) | NORTH(d) |              |
| 1913 | 5.86  | 1.29     | 1.49     | -2.64   | -        | 3.5          |
| 1914 | 5.60  | -0.16    | -0.24    | -2.44   | -        | 3.3          |
| 1915 | 5.85  | 1.05     | 1.34     | -2.59   | -        | 5.5          |
| 1916 | 3.92  | 1.65     | -0.03    | -3.65   | -6.54    | 1.2          |
| 1920 | 0.96  | 0.72     | 0.56     | -1.08   | -2.67    | -0.5         |
| 1921 | -0.01 | 0.62     | -0.12    | -1.63   | -1.79    | -0.6         |

(Source: Smith & Johnson 1922, Figs 7-11; Table 5.3).

- a. Paddington, Randwick, Woollahra, Vaucluse, Waverley:  
"practically wholly a residential area".
- b. Alexandria, Botany, Darlington, Erskineville, Marrickville,  
Redfern, St Peters, Waterloo: "principally an industrial  
area".
- c. Annandale, Canterbury, Concord, Drummoyne, Glebe, Homebush,  
Strathfield, Burwood, Enfield, Lidcombe, Prospect and Sherwood  
(ie Holroyd): "...partly industrial".
- d. Kuring-gai, Lane Cove, North Sydney, Mosman, Ryde, Willoughby,  
Hunter's Hill, Manly: "...almost wholly residential".



## **4.2 A FRAMEWORK FOR ELECTRIFICATION**

Municipalities and shires wanted to use their enabling powers to obtain local supply as soon as possible, under arrangements which would enhance their civic stature and independence. For the metropolitan municipalities, this meant looking for alternatives to incorporation into the SMC's supply area. The inner western municipalities found their alternative in the form of the Electric Light and Power Supply Corporation, so giving private capital a niche in the Sydney electricity system. The southwestern municipalities took advantage of the willingness of the Railways Department to sell electricity, and so pioneered the electricity county council.

As electrification proceeded, electricity affected the interests of more individuals and groups in the community. Those who made a livelihood out of supplying some aspect of electrical energy services - engineers, power station workers, appliance manufacturers - coalesced into associations and unions and came to see themselves as part of an "electrical industry". As the electricity system expanded its geographical, economic and social boundaries, the public interest required state governments to regulate more of its operations. Between 1904 and 1932 the state became increasingly involved in matters of public safety, emergency rationing, pricing, system organisation and in some cases the development of generation and the actual supply of electricity.

### **The Emergence of the County Council**

The Local Government Act 1919 enabled councils to form county districts to more efficiently undertake tasks which they were individually empowered to do (Larcombe 1978 III, 250-66). The idea sprang from the successful combination of a group of councils in northern NSW for the purpose of controlling the water hyacinth weed, and was soon taken up for electricity supply. Since much less capital was necessary to establish a retail system than a power station, the financial obstacles and risks confronting prospective electricity county councils were reduced if a bulk supplier of electricity were available. The first fortuitous combination of prospective county council and willing bulk supplier occurred in the south west of Sydney in the early 1920s.

The bulk supplier was the Railways Department, which had commenced the electrification of the city's tramways from Ultimo power house in 1899. White Bay power station was commenced in 1912, in anticipation of the electrification of the suburban railways (RNSW 1955,113). The RD system had originally been designed for low voltage DC supply for traction, but as it expanded its technology incorporated high voltage AC, for economic

transmission throughout an expanding area of operations. This enabled the RD to supply electricity for general purposes at any point along the extensive tramway and railway systems.

The RD generated on a large scale - in fact it generated more electricity than the SMC in each year to 1930. Most was used by trams and by the city and suburban railways, which were progressively electrified from 1926. The RD also supplied its own general purpose electricity for railway stations, offices and workshops. Its plant capacity had to be adequate to meet the traction peak load which occurred during the day or evening, and to provide station lighting at night. During much of the day and night there was excess capacity which could supply energy at marginal cost. This excess capacity had been put to good use in supplying energy to the SMC under informal arrangements after 1918, and the Chief Railway Electrical Engineer of the 1920s, W.H.Myers, strongly advocated the policy of supplying in bulk the suburban municipalities along the southern rail lines, at prices which returned a small profit (Paddison 1956,118). However, the Railway Commissioners had no legal powers to enter into formal supply arrangements with outside bodies until the Government Railways (Supply of Electricity) Act 1922.[26]. Armed with the Act, the Commissioners formalised the arrangements under which they had been supplying Parramatta council since 1921, and commenced supply to the St. George County Council (SGCC) in 1923 and the Sutherland Shire in 1925. By 1928 they were supplying the entire south-western region of the metropolitan area (TED 1929,160).

The St. George was the first county district constituted for electricity supply. Although it covered only four suburban municipalities, and in 1932 supplied less than 4% of the electricity sold in Sydney, it was the prototype of the form of organisation which characterises electricity supply in NSW to the present time. In 1920 the four adjoining municipalities of Bexley, Hurstville, Kogarah and Rockdale constituted themselves into a county district and negotiated a bulk supply agreement with the Railway Commissioners.[27] The Minister for Local Government acknowledged the historical significance of the county council's formation when he opened its first formal meeting in December 1920:

"I cannot too strongly impress upon this Council the importance of the responsibilities they are charged with, for you are the body that is charged with setting a lead to the rest of the State in matters under the Local Government Act ..."  
(SGCC 1932a,21).[28]

The SGCC commenced supply in March 1923 (ibid,29). Its primarily residential load was dominated by lighting until domestic power use increased, following active promotion by the council. Even so, the system load factor barely reached 30% by the early 1930s, compared with over 40% for the SMC. The SGCC's attempts to promote commercial and industrial sales stalled during the depression.

The absence of specified financial targets, already a feature of the SMC's electricity undertaking, became an essential and a permanent feature of local government electricity reticulation. The SGCC was unequivocally a public utility. It had no obligation to earn profits and in fact had no power to return any to its constituent municipalities. In the first ten years of trading it realised a small net surplus for reinvestment, amounting to about 3% return on the total capital (ibid,64,70).[29] The SGCC's creation identified electricity distribution with local municipal interests in a way not possible for those councils absorbed within the SMC reticulation area. Like the SMC, the SGCC tenaciously defended its territory against all perceived threats. Summarising the achievements of the county council in its first decade, the county clerk added:

"It is well for the people of this district to keep the above facts in mind when proposals are submitted for the absorption of this Undertaking in Greater Sydney, Electricity Commissions and other such schemes which are continually being resurrected by successive Governments. For many years Greater Sydney proposals have been in the air, and in the year 1931, the Government brought down a Bill under which it was proposed to abolish the St. George County Council and to rob the people of their Undertaking, without compensation of any kind. The council was forced into the position of fighting for its very existence and was gratified to find that it was supported by the people" (ibid,39).

The SGCC also pioneered the organisational separation of electricity generation and reticulation. The SMC embodied both functions, and could therefore balance them in the interests of orderly load development: for example, by refraining from promotional activities in years of stretched capacity. County councils on the other hand had no control over or direct interest in generating costs, beyond the price they paid to the bulk supplier. The SGCC was fortunate to purchase from an organisation generating mainly for traction, and whose price structure for bulk sales did not fully reflect all capital costs. In its first decade it paid about 14% less per unit than those municipalities taking bulk supply from the SMC.[30]

The county council structure encouraged the development of other institutional goals in lieu of the financial targets which a true business may have set itself, or the constraints which may have been imposed on the retail arm of an integrated generating organisation. The SGCC's primary objectives were to lower prices and expand sales. Increasing sales meant greater efficiencies of scale and so lowered the council's average distribution cost per unit sold. If they were daytime sales, they compensated for the night-time peaks and led to better load factors and lower average bulk purchase costs. There was every incentive for the council to promote electric cooking, space and water heating, and to press the bulk supplier to reduce the purchase price to achieve still greater volumes. The SGCC was successful in this respect: in 1932 it claimed to supply "the cheapest current in Australia" (ibid,3).

## **A Niche for Private Capital: The Electric Light and Power Supply Corporation**

The events leading up to the creation of the Electric Light and Power Supply Corporation (ELPSC) originated with a Department of Public Health direction to the Balmain Council to find an alternative to dumping garbage in open tips. In 1903 the council invited tenders for a combined garbage destructor and power station "so that the waste heat could be used to advantage" (NSWPD, 23.8.1906, 1337). The Borough of Balmain Electric Lighting Bill was introduced into the Legislative Assembly by the member for Rozelle in July 1906. Modelled on the Sydney Municipal Council Electric Lighting Bill of 1896, it empowered the council to contract with a private supplier, a feature which had held up the enactment of the earlier bill for several years until its removal. Parliament was more kindly disposed towards private capital than before, and the Balmain Act was passed without amendment within two months.[31]

The Balmain council contracted for supply with the ELPSC, a private company established in 1908 with capital of £50,000. The company's power station at Iron Cove commenced operation in September 1909, and within 2 years franchise agreements had been made with the adjoining municipalities of Leichhardt, Ashfield, Newtown and Petersham. This remained the ELPSC's area of supply until its absorption into the ECNSW in the early 1950s. The company steadily expanded its sales, and increased its generating capacity.[32] It had the advantage of a dense and compact area of supply with a high industrial load (SMH 29.6.27, 17), and it was a successful business. It paid a regular dividend of 10% on shareholders' funds after providing for depreciation, income taxes and rates.[33]

The ELPSC provides the best opportunity to test the assertions made in the 1880s that municipal ownership would lead to cheaper electricity. Table 4.5 compares the main operating and financial characteristics of the ELPSC and the SMC in the year 1926, before the construction of Bunnerong power station had made any major financial impact on the SMC's accounts. The SMC had the theoretical advantage of scale: its total sales were more than eleven times those of the ELPSC, and its average sales to each consumer were far greater. Yet the capital investment per unit sold was almost identical for the two systems, perhaps because of the large reticulation area which the SMC had developed as a result of its expansion policies, and its lower density of consumers.

Differences in tariff structures make direct price comparisons difficult. The average revenue per unit sold (including metering charges) was over 25% higher for the ELPSC than for the SMC, but dividends, rates and income tax, which the SMC did not pay, accounted for nearly 40% of the ELPSC's price. The net costs common to both systems, such as fuel, operations,

administration and capital charges, were 25% lower per unit sold for the ELPSC than the SMC, despite the enormous scale advantages theoretically available to the latter. The return on capital for the ELPSC was nearly 15%, whereas for the SMC it was negative in 1926 and averaged only 0.8% through the 1920s. This suggests that the SMC's lower prices masked inefficiencies in operation, and contradicts the price arguments in favour of public ownership.

The competence of the ELPSC was widely recognised: so much so that in 1950, under a Labor government, its two chief executives became the first chairman and the first chief engineer of the ECNSW. Nevertheless it was destined to occupy a limited niche in the Sydney energy system. Attempts to establish another private company on the North Shore were blocked by the McGowen Labor government, which came to power in late 1910. By 1915 the ELPSC was geographically surrounded by the SMC, and unable to expand.[34]

### **Electricity and the Public Interest: Safety, Rationing, Pricing and Access**

The public dangers of the high voltage distribution systems proposed in the 1880s and 1890s had been of great concern to parliament. Once electricity supply actually commenced, standards of design and workmanship were left under the direct control of the supply authorities until the rising accident rate again attracted parliamentary attention.[35] In August 1910 an Electricity Bill was introduced into the Legislative Council. Its objectives were

"...to regulate the use of electricity for power or for illumination; the examination and testing of the material and apparatus used therefor, and of the quality thereof; the inspection of electric plants during erection, on completion, and when in use, and the examination and licensing of persons employed in electrical construction work" (NSWPD 4.8.10,1404).[36]

It was narrowly defeated without debate, for no apparent reason other than the usual end of session crowding (ibid,1406). Despite frequent fires and electrical fatalities, and apparently compelling public safety arguments, licensing for electricians was not established until well after plumbers, gasfitters, drainers, dentists, medical and veterinary practitioners.[37] The Electrical Contractors Licensing Act 1924 was framed primarily to license electrical contractors rather than their employees, causing some MLAs to suspect that its effect would be more to increase contractors' power over their customers and their employees than to enhance public safety.[38] For these reasons it was resisted by the Labor Party, but nevertheless passed, making it an offence for any unlicensed individual to perform electrical work in NSW.[39]

From the 1870s on, occasional strikes had caused disruptions in the supply of coal and gas, the most industrially organised elements of the Sydney energy system. The degree of government intervention during strikes increased in the 1910s.[40] By 1916 electricity and gas supply so clearly constituted an essential service that the government felt justified in intervention during

emergencies. Intervention was at first unusual enough to be a matter for separate legislation by parliament, but events during the war established rationing as almost routine.

The first emergency regulation of electricity supply came as a consequence of the national coal strike of 1916, and at the request of the SMC, the government introduced the Electric Lighting and Gas Emergency Act in November 1916, to release the electricity and gas companies from their contractual obligations to consumers and to constitute an emergency board of control to administer rationing.[41] The act was passed within two days, and emergency rationing proclaimed (SMH 18.11.16).[42] Although the restrictions were lifted, the Act remained in force until repealed by proclamation in May 1917 (NSWPD 16.8.17,586).[43] In August 1917, in response to another coal strike, the government on its own initiative brought in a new Emergency Act, though it was content to leave the administration of rationing to the SMC, as before (NSWPD 16.8.17,584).[44]

The NSW electricity bills of the 1880s and 1890s had incorporated maximum selling prices borrowed from British legislation of the 1880s. Technological development and system growth were so rapid that the SMC's tariffs were well below the maxima even at the commencement of supply in 1904, and declined steadily until the 1920s.[45] Unlike electricity prices, AGL's prices or dividends had not been subject to external limit or control at any time since its establishment by special legislation in 1837. It paid a regular annual dividend of 15%, was continually accused of using its monopoly position to exploit the public, and so was a natural target for price control. In August 1912 the first Labor government introduced a bill to control the prices, dividends and gas quality of private gas companies.[46] The central pricing feature of the bill was a "sliding scale" under which gas companies could increase their dividend, to a 10% ceiling, in return for lowering the price of gas below a "standard" rate determined by the government.

The government eventually succeeded in enacting the bill, though its provisions were watered down considerably in the Legislative Council, to preserve the premium value which AGL shares had acquired on the strength of their dividend record. The shareholders' cause was championed by the conservative press, which saw the bill as "an attack on capital" (SMH 10.10.12,8). The bill also drew criticism at first from the Gas Employees' Union, whose secretary contended that price controls would reduce the chances of workers negotiating higher wages with the company:

"The consumer may be described as a middle class person, seeing that the working class uses comparatively little gas. The Government is, however, looking after the interests of the middle-class man while the workers do not appear to have been thought of" (SMH 15.8.12).[47]

Government control of electricity pricing followed the precedents laid down for gas. In 1920 the SMC realised that the electricity undertaking was headed for a loss, and applied to the government for the power to increase prices (SMC/CC 1928,80). The government was in political sympathy with the Council, both at the time being under Labor control, but could not allow it to increase charges without some independent justification (Curnow 1957,87). To do otherwise would have invited unfavourable comparisons with the gas companies, whose price increases were subject to judicial inquiry. In December 1920 the government inserted similar provisions into the SMC Electric Lighting Act, and then, in response to parliamentary calls for even-handedness, into the Balmain Electric Lighting Act (NSWPD 21.12.20,3913).[48]

The 1912 Gas Act demonstrated how difficult it was for the government to pursue the interests of energy consumers in the face of opposition from organised and vocal interests, such as the shareholders and the unions. The provision to pass on increases in wages and other costs set a precedent in energy pricing practice which was extended in due course to electricity suppliers. The provisions for independent arbitration, inserted into both gas and electricity legislation in the 1920s, distanced the government from the price setting mechanism. This was politically useful in diverting responsibility for unpopular increases, but by providing a forum in which suppliers could argue largely on their own terms and without informed challenge, it established a mechanism favouring the granting of increases and reducing the incentive for suppliers to contain costs and raise efficiency.

The government's next step after regulating electricity suppliers in the public interest was to assist in taking electricity to areas not served. Towards the end of the war government instrumentalities generating electricity for their own needs were permitted to sell to the public. The Railways Department established a power station for traction purposes at Zarra Street, Newcastle in 1915, and commenced supply to the Newcastle City Council in 1917 (Allbut 1958,30). The Public Works Department (PWD) built a power station for the harbour works at Port Kembla in 1915, and in 1921 commenced bulk supply to Wollongong (RPT 1937,76). The first government projects intended exclusively for general supply were the Burrinjuck and Nymboida hydro-electric schemes authorised by the Holman Nationalist government's Hydro-Electric Development (Construction) Act of 1919. The government considered hydro-electric generation in association with regional development particularly attractive, and saw the schemes as fore-runners of projects extending in due course to the Snowy, Shoalhaven and Tumut rivers (NSWPD 5.11.19,2413).[49] The Fuller coalition government foreshadowed further hydro-electric development in 1924 (NSWPD 15.12.24), but none eventuated before the second world war.

The RD constructed its first power station exclusively for general supply, as distinct from traction, at Lithgow in 1928, and by 1936 it was supplying power to seven local government areas. Table 4.6 illustrates the government's direct contribution to electricity supply in NSW in 1936, when load growth had resumed after the hiatus of the depression. The government, through the Railways and Public Works Departments, was the largest generating organisation in NSW and produced about 41% of the state's and Sydney's electricity. Most of this was for traction, but the government still supplied more than a quarter of the state's general electricity demand, and its electricity infrastructure constituted a ready-made framework for a state-wide electricity system.

## **Foundations of an Electrical Industry**

As electrification progressed the industry forming around it grew in influence and importance. A central and distinctive technology gave the industry a measure of cohesion, in much the same way as the railways and the coal industries before it. As electricity systems multiplied, the industry associations recognised the common advantages of standardisation in equipment, training and work practices. The individuals and groups associated with the industry, and united by a mutual interest in its growth, gained considerable leverage in academic, professional, commercial, union and political circles. Electrification acquired an internal organisational momentum in addition to the external momentum created by the demand for electrical energy.

In 1891 those members of the Engineering Association of NSW with particular interest in electrical engineering joined the more technically inclined of Sydney's commercial "electricians" to form the Electrical Club of NSW.[50] The Club was reconstituted in 1896 as the Electrical Association of NSW, (EANSW 1919,201) and in 1919 the Electrical Association became one of the foundations of the Institution of Engineers Australia.[51]. Formal opportunities for discussion and teaching also became available: a course in electrical engineering commenced at Sydney University in 1900 (Branagan & Holland 1985,111).

The workers in the Sydney electrical trade were almost as quick to organise as the engineers. In 1900 tradesmen employed at the Ultimo Power House formed a short-lived union, which was succeeded in 1902 by the more durable Electrical Trades Union (ETU) (Pola 1982,17). After years of negotiations the ETU joined its interstate counterparts in a federal union in 1914 (ibid,75).[52] The increasing militancy of their unionised employees was one of the factors which prompted the major utilities, including the SMC and the ELPSC, to form the Electricity Supply Association of Australia (ESAA) in 1918 (Allbut 1958,89). It also spurred private



contractors to organise. The *Australasian Electrical Times*, the journal of the Electrical Federation of Victoria, said

"...if electrical trade unionists have the gumption to bind themselves into a Federal organisation, while their employers continue to fight each other tooth and claw, we shall have, sooner or later, the unpleasant spectacle of the electrical tail wagging the disgusted electrical dog" (AET 27.4.22).

In 1924 the NSW electrical contractors' and manufacturers' associations combined to form the Electricity Development Association (EDA) the primary objective of which was

"To promote and increase the use by the public of electric current for all useful purposes as an end in itself and as a means for increasing the demand for apparatus and supplies..." (AET 28.4.24,271).

The SMC, the ELPSC, the Railway Commissioners and several "leading electrical houses" also contributed (ibid).[53] They were no doubt mindful of their mutual interest, as expressed by the *Australasian Electrical Times*:

"The supply station can sell its power, the engineering firm its generating and distributing plant, the manufacturer and trader his accessories, and the contractor his services, to the best advantage only when the whole of the people are educated to the uses, conveniences and comforts of the electrical home" (AET 27.6.22).

The "comforts of the electrical home" depended on appliances as well as electricity supply. Before the depression the increasing demand for electrically powered devices and generating equipment was met by imports, mainly from Britain and the USA.[54] The development of local manufacturing in the 1930s was assisted by the imposition of protectionist tariffs and the devaluation of the Australian L (Boehm 1971,142-4). Local manufacturers quickly took over the market for small appliances such as irons and toasters, and began to make other products. Because of protectionism, however, the growth of local manufacturing did not lead immediately to a decrease in prices, and larger appliances such as washing machines and refrigerators remained beyond the reach of average wage earners (A.Spearritt 1983, 36).[55] The situation did not change until the late 1930s, when foreign firms established facilities to manufacture or assemble appliances locally, free of tariff, and production volumes gradually increased.

By the mid 1930s, electricity generation and the manufacture of electrical and wireless apparatus employed about 3.7% of the Australian factory workforce. Half the workers were in NSW, where these sectors together made up 4.7% of factory employment, the sixth largest of the 16 listed industrial categories (AYB 1937,780). Many more people were employed in selling, repairing and transporting electrical equipment and in the electricity distribution industry. The industry had acquired considerable economic significance through its sheer size, apart from the value of the energy services it supplied.

**TABLE 4.5**  
**SYDNEY MUNICIPAL COUNCIL AND**  
**ELECTRIC LIGHT AND POWER SUPPLY CORPORATION**  
**COMPARATIVE STATISTICS**  
**1926**

|                                       | SMC    | ELPSC(a) |
|---------------------------------------|--------|----------|
| Installed capacity (MW)               | 65.5   | 14.6     |
| Electricity sales (GWh)               | 234.6  | 20.5     |
| Station Load Factor (%)               | 43     | 40       |
| Capital invested (L '000)             | 8920   | 750      |
| Investment/sales (L/GWh)              | 38     | 37       |
| Shareholders' Equity (% of capital)   | 9(b)   | 85       |
| Revenue (L '000)                      | 1877   | 208      |
| Revenue/sales (d/kWh)                 | 1.92   | 2.43     |
| Profit (d/kWh)                        | -0.04  | 0.72     |
| Income tax and rates (d/kWh)          | -      | 0.23     |
| Operating & Capital costs (d/kWh) (c) | 1.96   | 1.48     |
| Profit (L '000)                       | -38.4  | 109.5    |
| Return on capital (%)                 | -0.4   | 14.6     |
| Consumers connected                   | 147504 | 21267    |
| Service area (sq miles) (d)           | 156    | 12       |
| Population in service area (e)        | 825750 | 167000   |
| Consumers/sq mile                     | 946    | 1772     |
| Consumers/population                  | 0.18   | 0.13     |
| Sales/consumer (kWh)                  | 1590   | 960      |
| Sales/capita population               | 280    | 123      |

(Sources: SCC 1935, SMH 4.6.1927, 29.6.1927, TED 1929).

a. ELPSC figures to YE April 1927.

b. As if total profits to 1926 not paid as contribution to rates were reinvested.

c. Includes depreciation.

d. Reticulation area only: SMC bulk supply excluded.

e. 1927 for SMC, 1928 for ELPSC.

**TABLE 4.6**  
**MAIN ELECTRICITY SUPPLY SYSTEMS**  
**NSW 1936**

| SYSTEM                | POWER STATION | DATE    | CAP.<br>MW | GEN.<br>GWh | SALES<br>GWh | TRACT<br>GWh | FREQ.<br>Hz | DIST-<br>mls | AREA<br>sq ml | POP<br>'000 |
|-----------------------|---------------|---------|------------|-------------|--------------|--------------|-------------|--------------|---------------|-------------|
| <b>SYDNEY</b>         |               |         |            |             |              |              |             |              |               |             |
| SCC                   | Bunnerong     | 1929    | 150        | ) 560       | 560          |              | 50          | 1020         | 900           | 1000        |
|                       | Pymont        | 1904    | 49         | )           |              |              |             |              |               |             |
| ELPSC                 | Balmain       | 1909    | 42         | 51          | 51           |              | 50          |              | 12            | 180         |
| RD                    | White Bay     | 1913    | 150        | ) 428       | 103          | 325          | 50,25       | 617          | 240           |             |
|                       | Ultimo        | 1899    | 50         | )           |              |              | 25          |              |               |             |
| <b>NEWCASTLE</b>      |               |         |            |             |              |              |             |              |               |             |
| Council               | Sydney St     | 1894    | 2.5        | 3           | 3            |              | 50          | 215)         | 794           | 168         |
| RD                    | Zarra St      | 1915    | 35         | 109         | 104          | 5            | 50,25       | 260)         |               |             |
| <b>PORT KEMBLA</b>    |               |         |            |             |              |              |             |              |               |             |
| PWD                   | Pt Kembla     | 1915    | 7.5        | 21          | 21           |              | 50          | 195          | 325           | 38          |
| <b>BURRINJUCK</b>     |               |         |            |             |              |              |             |              |               |             |
| PWD                   | Burrinjuck    | 1928(a) | 10         | 27          | 27           |              | 50          | 606          | 820           | 65          |
| <b>LITHGOW</b>        |               |         |            |             |              |              |             |              |               |             |
| RD                    | Lithgow       | 1928    | 7.5        | 15          | 15           |              | 50          | 180          | 120           | 55          |
| <b>CLARENCE RIVER</b> |               |         |            |             |              |              |             |              |               |             |
| Clarence              | Nymboida      | 1924(a) | 3.2        | ) 14        | 14           |              | 50          | 440          | 405           | 48          |
| River CC              | Lismore       | 1933(b) | 1.5        | )           |              |              |             |              |               |             |
| <b>TAMWORTH</b>       |               |         |            |             |              |              |             |              |               |             |
| Council               | Tamworth      | 1888    | 2.3        | 6           | 6            |              | 50          | 72           | 200           | 20.         |
| <b>YANCO</b>          |               |         |            |             |              |              |             |              |               |             |
| WCIC(c)               | Yanco         | 1913    | 4.3        | 6           | 6            |              | 50          | 42           | 280           | 23          |
| <b>OTHERS</b>         |               |         | 21         | 29          | 29           |              |             |              |               | 277         |
| <b>PRIVATE(d)</b>     |               |         | 95         | 191         | 191          |              |             |              |               |             |
| <b>NSW TOTAL</b>      |               |         | 631        | 1461        | 1132         | 328          |             |              | 309400        | 2094        |
| <b>ALL GOVERNMENT</b> |               |         | 260        | 600         | 271          | 328          |             |              |               |             |
| <b>(% TOTAL)</b>      |               |         | (41.2)     | (41.1)      | (24.0)       | (100.0)      |             |              |               |             |
| <b>ALL SYNEY</b>      |               |         | 440        | 1084        | 714          | 325          |             |              | 1152          | 1400        |
| <b>(% TOTAL)</b>      |               |         | (69.7)     | (71.1)      | (63.0)       | (98.9)       |             |              |               |             |

(Source: Rendel, Palmer and Tritton 1937,7, RD 1936, TED 1939/40).

a. Hydro b. Oil (internal combustion). All others steam.

c. Water Conservation and Irrigation Commission (Murrumbidgee)

d. For own use (but included with Sales for percentage analyses).

Including: BHP, Newcastle 10 MW  
Australian Iron & Steel, Pt Kembla 13 MW  
Western NSW EPP, Broken Hill 12 MW  
Caledonian Collieries, Newcastle 10 MW  
Southern Portland Cement Co, Berrima 4 MW

### 4.3 THE SYDNEY ENERGY SYSTEM IN THE 1930S

The electrification of the Sydney energy system proceeded steadily except for brief pauses during the first world war and the depression. Supply was extended throughout most of the metropolitan area and total electricity consumption increased. By the mid 1930s electricity dominated the energy markets for lighting and power, but was slow to penetrate the thermal energy market, where gas was still firmly entrenched. The increasing demand for public transport created by Sydney's suburban growth was met by the expanding electric tramway system and suburban railways, progressively electrified after 1926. By the 1930s petroleum powered transportation, both public and private, was also significant. The residential sector remained the least electrified, and became the main focus of intensifying competition between the SMC and AGL. While gas continued to hold a large share of the energy market in Sydney and the rest of NSW, the trends in sales, capital investment and energy prices all favoured electricity and foreshadowed accelerating electrification after the depression.

#### The Heyday of Electric Transport

During the 1930s electrically powered forms of transport carried their greatest ever proportion of Sydney's passenger traffic. Usage peaked in 1929 and 1930, when the electric tramway system reached its maximum extent and the electrification of the suburban rail network was completed. All public transport modes were then affected by the depression, but the electric modes recovered strongly. Table 4.7 indicates that electric tramways and railways carried 85% of Sydney's public transport passenger journeys in 1935/6. Bus patronage was badly affected by the depression and by new licensing arrangements in 1932 which reduced the number of buses on public routes: passenger numbers fell away from 1930, when buses had accounted for 18% of all public mode trips, to 10% in 1935/6 (NSWYB 1930-36).

The use of private vehicles increased. The annual report of the Railway Commissioners for 1929/30 said

"Attention has been drawn by the Commissioners in their Annual reports for some years past to the effect of motor competition on the earning powers of this State's railway system.

The use of private motor cars for excursions, for long distance travel, and even for daily suburban travel, has greatly increased during the last five or six years. In addition to the driver, there is often a full load of friends and relatives, and there is evidence in more recent times that private motor cars are frequently carrying strangers free or for a fee, so that today the private car is the railway's most serious competitor for passenger traffic, although the bus and motor coach are important factors in the situation" (RD 1929-30,4).[56]

Despite the Railway Commissioners' misgivings, the internal combustion engine had far more immediate consequences for the horse, which had dominated private passenger and freight transport at the turn of the century. The first motor cabs were introduced in Sydney in the late 1900s, and outnumbered their horse-powered counterparts after 1924, as did motor vans (Hovenden 1981,31). A handful of horse vehicles remained on the register until the eve of the second world war, after which horses ceased to be a part of the Sydney energy system.[57]

## The Transformation of Industry

By 1936 the mechanisation of NSW industry was virtually complete: 95% of factories used some form of machinery compared with 70% in 1911, and over the same period the average power of machinery used in each factory tripled from 42 to 126 hp (NSWYB 1935/6, 456). Most of this increase was directly attributable to electrification. Table 4.8 gives the aggregate horsepower of machinery in use in all NSW factories from 1901 to 1936, together with the power installed in electricity generation and other centralised energy plant. In 1901 steam power was almost universal. By 1921 it was overtaken by electricity, which by 1936 provided over three quarters of all industrial power. These trends follow closely the rate of electrification in the USA, where 4% of the power used in manufacturing was electric in 1899, 21% in 1909, 50% in 1919 and 75% in 1929 (Woolf 1984,177).[58]

Several economic historians have discussed the changes in the productivity of labour and capital brought about by industrial electrification in the advanced economies during this period. According to Woolf (1984) and Devine (1983) electric power was adopted in US industry not only because it lowered the cost of industrial power but because it transformed industrial processes:

"Electricity had a value in production by virtue of its form...that exceeded savings in direct costs.

The form value of electricity was due to the precision in space, in time and in scale with which energy in this particular form could be transferred. Motors could convert electrical energy to mechanical energy precisely where conversion was needed - the drive shaft of a machine... because of this flexibility, manufacturers could turn their attention away from problems of power production and distribution and toward improving the overall efficiency of their operations" (Devine 1983,371).

The value of fuel consumed in NSW industry in 1935/6 is summarised in table 4.9.[59] Purchased electricity accounted for almost 49% of the value of all fuels, other than coke. The next most valuable category, accounting for 29%, was coal, some of which was used to generate electricity on site. High value-added industries located predominantly in Sydney were particularly electricity-intensive. Purchased electricity made up over 70% of the fuel value for

textile manufacture and in paper and printing. These indicators confirm that industry in NSW, and in Sydney in particular, was highly electrified by the mid 1930s.

While electricity was rapidly adopted for industrial power it was not a natural choice for industrial heat. It was used in special applications such as steel melting as early as 1916 in Sydney (Anderson 1955,118) but it was slow to penetrate the general thermal energy market where there was competition from gas and, increasingly, oil products.[60]

### **The Residential Sector: Plugged In, But Not Switched On**

By 1933 nearly 80% of Sydney households were connected to the electricity grid.[61] Until well into the 1920s, connected households used electricity for lighting and for little else. Householders were slow to purchase the wide range of electrical appliances available in the shops.[62] They showed more interest in the radio, introduced in 1923, which was found in about 20% of Australian homes by 1930 (AYB 1937,806). The actual penetration of household electrical appliances in Sydney before the second world war is difficult to determine. A trade journal of the time commented:

"...no one knows, owing to the unfortunate lack of organisation in the electrical trade, in how many [connected households] electricity is used for anything else but lighting; but it is safe to say that the vast majority are using current for lighting purposes only" (AET 27.3.22,115).

Contemporary surveys suggest that apart from lamps, the only common household electric appliance in the 1920s was the iron, which was not a large energy consumer.[63]

Just as the mass connection of dwellings had driven down average gas consumption per consumer in the 1870s, it drove down average electricity consumption after 1908. The resulting under-utilisation of vast capital resources became a pressing concern of the supply organisations. In 1922 Forbes Mackay, addressing the Electrical Employers' Association of NSW, complained of "thousands upon thousands" of lighting consumers, whose annual consumption amounted only to 70-140 kWh (AET 27.6.22,322).[64] He noted that the SMC was legally compelled to supply these consumers, yet the revenue received was barely enough to cover generating costs, let alone capital charges. It was his opinion that the best way of meeting the situation was to organise a campaign to introduce more electrical devices into the home (ibid).[65]

The SMC embarked on the direct promotion and sale of electrical appliances in the late 1920s as part of its strategy to increase domestic sales. Another part of the strategy was the tariff structure adopted in mid 1925, under which typical domestic accounts were halved, and the

marginal cost of electricity reduced by up to 75%.[66] Figure 4.3 illustrates the extent of the tariff reduction, and Figure 4.4 shows the effect: an immediate reversal of the declining trend in average consumption.

There was a corresponding fall in average gas consumption (see Figure 4.4). The incandescent mantle had maintained the popularity of gas for home lighting through the 1900s and 1910s, but gradually gave way to electric lighting from the early 1920s. Gas was more firmly entrenched in the thermal appliance market, where competitors found that it had "the advantage of an early market and continuing popularity" (Batson 1927,27). Gas cookers and water heaters had been locally manufactured since the 1880s, were cheap to purchase and run, and often installed free of charge by the gas companies. By the mid 1920s AGL had a considerable promotional programme with showrooms in the City, Parramatta, Burwood, Waverley and Rose Bay, gas cooking demonstrations and tri-weekly radio broadcasts (AGL 1924/5,6).

The cooking market was the first major area of direct competition where electricity did not enjoy a natural advantage, as it did for lighting and power. The electricity suppliers competed fiercely. The relative cost of appliances was for the present beyond their control, but they directly copied AGL's promotional methods.[67] Even more effective was the erosion of the energy price differential which had favoured gas. The price of domestic gas reached an all time low in 1913 following the introduction of price control under the Gas Act 1912, and then rose until the depression (see Figure 4.3). The SMC marginal power tariff, which was effectively the cooking tariff, declined steadily after 1923.[68]

This phase of electrification did not lead to a significant displacement of human labour from household work. Major tasks such as cleaning and laundry still remained unmechanised, and the burden of carrying them out was shifting from paid servants to members of the household. The ratio of paid female domestics to females classified as "dependant" (who may be assumed to have carried out household tasks unpaid) fell from 1:10 in 1901 to 1:15 by 1933.[69] The fact that women's time became more valuable, both in terms of the wages paid to domestics and the increasing opportunities for women to work in manufacturing and commerce, contributed to the impetus towards the rationalisation and electrification of household tasks after the depression.

## **The Reticulated Energy System**

During the first third of this century electro-technology unified the previously disparate elements of the energy system. Electricity was the first universal energy form, capable of conveniently meeting the demand for every urban energy service at the point of end use. As the electricity system crossed the boundaries of energy markets it blurred the distinctions between consumer types, between municipalities, between private enterprise and public utility, and between supply organisations. Full unification of the supply system, however, was frustrated by an institutional structure fragmented by accidents of parliamentary timing, shifting political alliances and sporadic conflicts between the government and the Sydney Municipal Council. This process had led to the creation of the ELPSC in the 1900s and, just as arbitrarily, prevented the creation of similar companies in the 1910s. On the strength of precedent, the Railway Commissioners remained responsible for traction, and other government instrumentalities continued to generate their own needs.

By the mid 1930s Sydney had the first, second and third largest electricity systems in NSW. Each had developed separately to meet various sectors of energy demand originally separated by function or location. These divisions were no longer valid: the systems were now spatially superimposed, and all supplied electricity for the entire range of uses apart from traction, which remained the preserve of the Railways Department. Yet they remained organisationally and operationally separate, apart from the occasional and limited exchange of energy between the two largest.

Three separate distribution systems radiated from five power stations, the largest in the state and one of them the largest in the Commonwealth, all located within a few miles of each other in the inner suburbs. Together they supplied an area of about 3000 sq km, less than 0.4% of NSW, with over 70% of the state's total electricity, and over 85% of the public electricity (ie excluding generation by private industrial plant - see Table 4.6). There was obvious scope for integration of the metropolitan electricity system, not only to make it more efficient but to give technological, financial and organisational impetus to the electrification of the rest of the state.

An estimated breakdown of electricity demand in Sydney in 1936 is given in Table 4.10. The industrial sector, which had rapidly adopted electric power, accounted for a third of total demand. Electric traction, the dominant mode of public transportation, accounted for a further third. The commercial and institutional sector, which was also highly electrified, accounted for 10% of the demand. The residential sector, where consumers were many but average consumption low, used only 19%. Street lighting, the cornerstone of the arguments for



municipal control which had shaped the legislative structure of the system in the 1890s, used less than 3%.

The organisation of the Sydney gas system remained unchanged except for AGL's acquisition of the Liverpool municipal gas works in 1928 (Broomham 1987,123). In 1933 AGL produced 85% of the gas made in Sydney, and 77% of the NSW total (CGE 1934,3). The North Shore and the Manly Gas Companies produced 12% and 3% respectively of the Sydney total (ibid). AGL gas production increased at an average of 7% annually during the 1910s and 4% annually during the 1920s to peak in 1929/30 before slipping back 14% during the depression; by 1936 it was increasing again, but did not recover to its 1929/30 level until the second world war. The underlying growth trend was less robust than for electricity, which increased at 13% per annum during the 1920s and was interrupted for only one year during the depression.

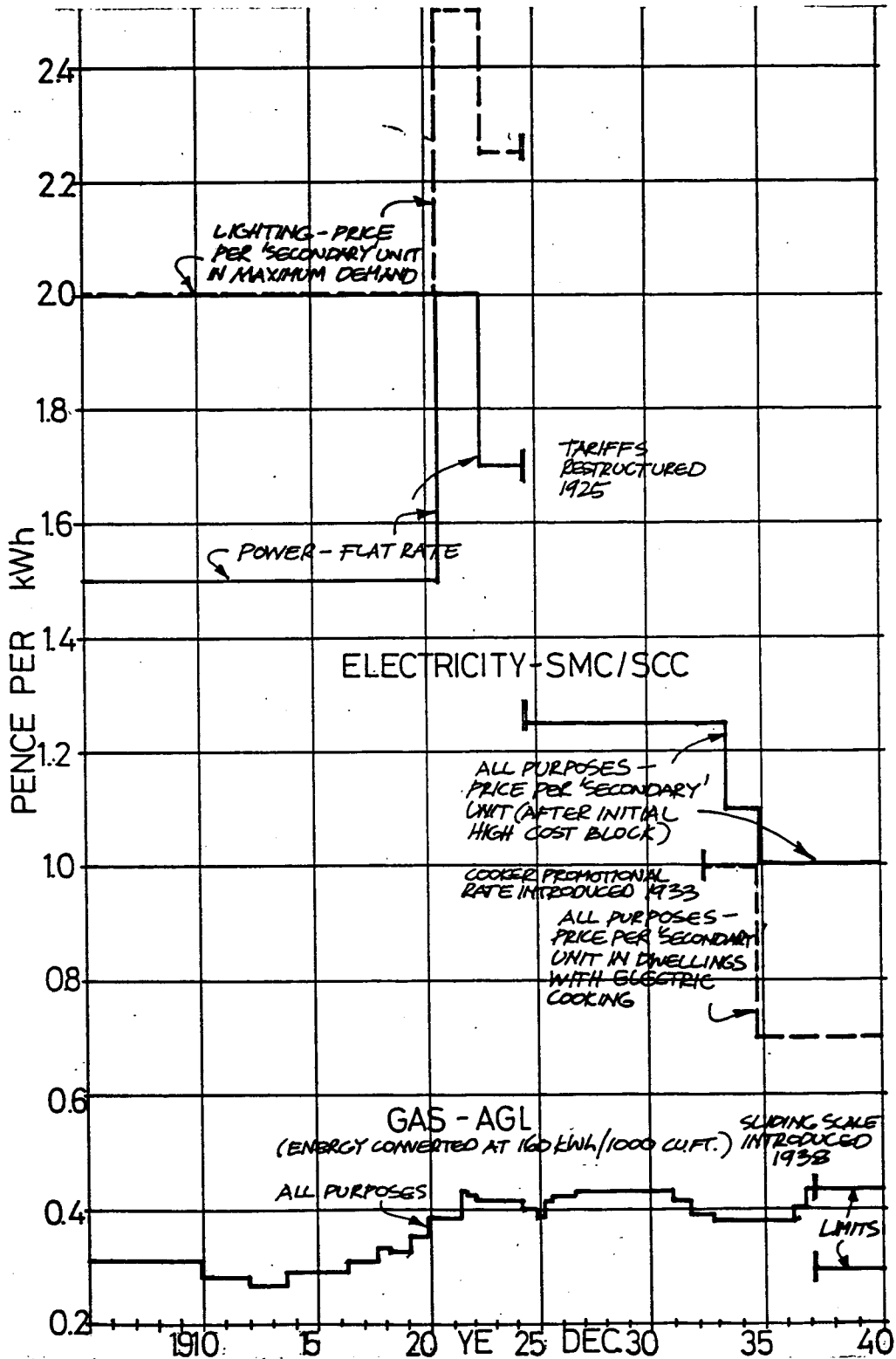
AGL gas sales for street lighting surged briefly after the first world war, when the SMC was unable to meet requests for expansion to the suburbs, but then fell away to negligible levels by the mid 1920s.[70] With the loss of the lighting load, the pattern of gas demand came to be dominated by the evening domestic cooking load. In order to make use of excess daytime capacity AGL began for the first time to develop its industrial load, and in 1924 implemented a scale of discount charges (Broomham 1987,120). Industrial sales grew from less than 3% of the total in 1925 to more than 10% in 1933 but the gas load was still predominantly residential, in contrast to the electricity load which was dominated by traction and industrial power.[71]

By the 1930s the electrification of the Sydney energy system was well advanced in all sectors but the residential. Electricity was increasing its share of an expanding market for energy.[72]. Table 4.11 shows per capita production of gas and electricity in Sydney, the rest of NSW and Australia in 1933. Reticulated energy production in Sydney, where the gas and electricity systems were the most highly developed, was nearly five times that in the rest of NSW, where energy forms such as coal and timber were still widely used.

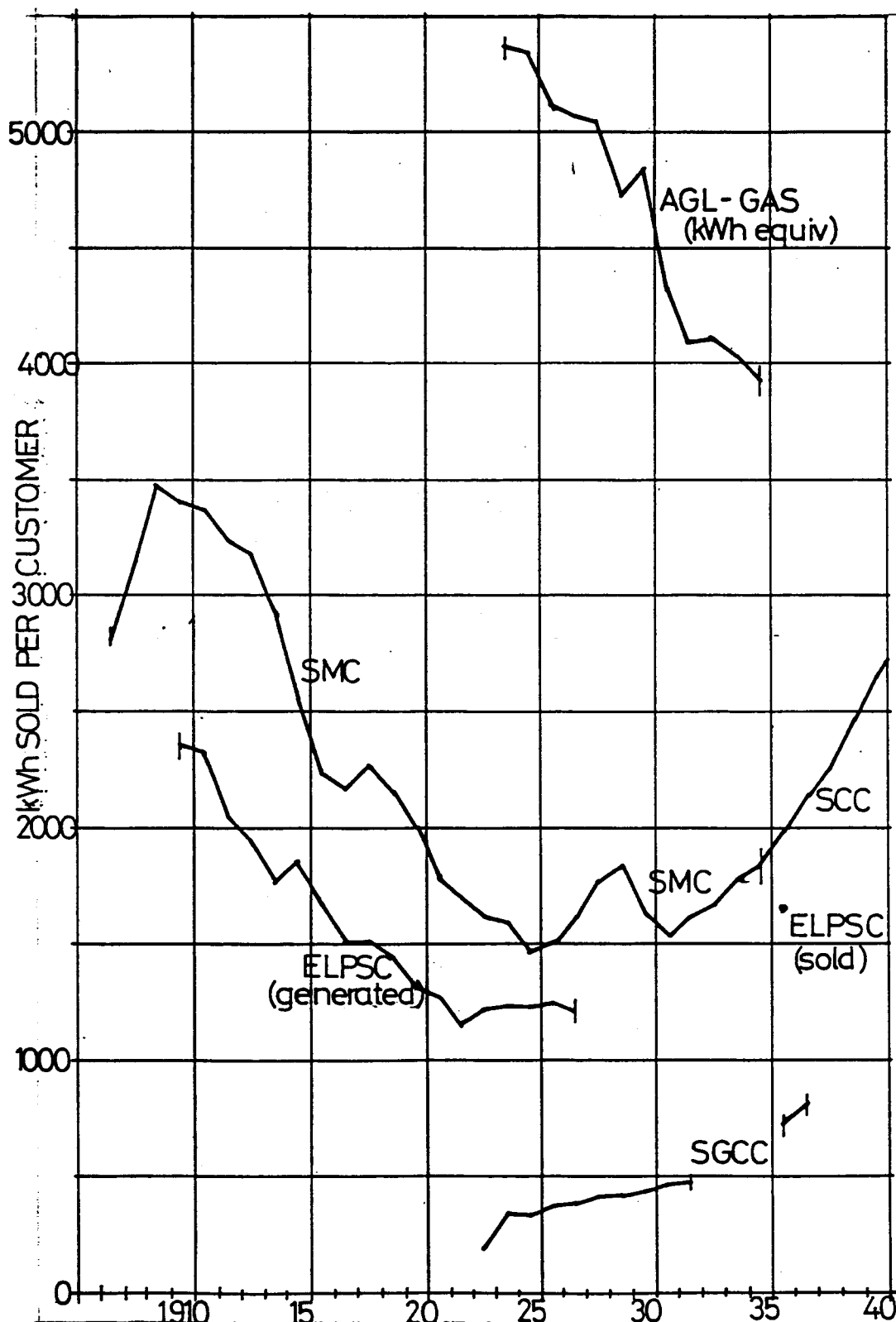
However greatly electricity had penetrated the highest value energy markets, gas still supplied about 55% of Sydney's reticulated energy. Indeed, the Sydney energy system was distinguished from the rest of NSW more by its gas than its electricity use. Metropolitan gas production per capita was ten times that for the rest of the state, while for electricity it was three times.[73] At the same time the scale and density of the Sydney electricity market made it qualitatively distinct from the rest of the state and the rest of the country, and made possible unprecedented economies in generation and in distribution.

This phase of electrification gave Sydney benefits which were not as yet available elsewhere in the state. Through its domination of the Sydney industrial power market electricity had come to be identified with industrial development. Through the marketing efforts of suppliers, rather than actual market penetration, it was also identified with domestic comfort, modernity and convenience. As the state emerged from the depression the desire for cheap, reliable and unlimited electricity supply throughout NSW was firmly on the political agenda.

**FIGURE 4.3**  
**DOMESTIC ENERGY TARIFFS**  
**SMC AND AGL**  
**1904-35**



**FIGURE 4.4**  
**AVERAGE ENERGY SALES PER CONSUMER**  
**SMC, AGL, ELPSC AND SGCC**  
**1904-35**



**TABLE 4.7**  
**PUBLIC TRANSPORT TRIPS BY ENERGY TYPE**  
**SYDNEY**  
**1935/36**

| MODE                | PASSENGER-JOURNEYS (million) |       |           | MODE<br>TOTAL |
|---------------------|------------------------------|-------|-----------|---------------|
|                     | ELECTRIC                     | STEAM | PETROLEUM |               |
| RAIL Suburban (a)   | 161.1                        |       |           | 161.1         |
| TRAM Central system | 265.6                        |       |           |               |
| Suburban lines      | 15.1                         | 2.5   |           | 283.2         |
| BUS Private         |                              |       | 27.5      |               |
| Government (b)      |                              |       | 23.8      | 51.3          |
| FERRY               |                              | 23.6  | 1.0       | 24.6          |
| ALL MODES           | 441.8                        | 26.1  | 52.3      | 520.2         |
| (%)                 | (84.9)                       | (5.0) | (10.1)    | (100)         |

(Sources: NSWYB 1929-36, RD annual reports)

a. Suburban trips comprised over 94% of all NSW rail trips.

b. Includes a small proportion of trips in the Newcastle district.

**TABLE 4.8**  
**POWER OF MACHINERY USED IN CENTRAL ENERGY SYSTEMS**  
**AND IN MANUFACTURING, BY ENERGY TYPE**  
**NSW**  
**1901 - 36**

| YEAR        | AVERAGE HORSE-POWER OF MACHINERY IN USE (%) |                 |                   |                  |                  |                 | (e)              |
|-------------|---|-----------------|-------------------|------------------|------------------|-----------------|------------------|
|             | Heat, Light<br>& Power (a)                  | Steam           | Gas               | Electric         | Oil              | Total (b)       | hp/emp<br>(elec) |
| 1901        | 8369  | 34297<br>(94.7) | 1533<br>(4.2)     | 298<br>(0.8)     | 36<br>(0.1)      | 32226<br>(100)  | 0.83<br>*        |
| 1906<br>(c) | 30505                                       | 41354<br>(68.1) | 4901<br>(8.1)     | 10072<br>(16.6)  | 429<br>(0.7)     | 60759<br>(100)  | 0.72<br>(0.12)   |
| 1911        | 56948                                       | 57828<br>(64.2) | 10713<br>(11.9)   | 20418<br>(22.70) | 1079<br>(1.2)    | 90106<br>(100)  | 0.85<br>(0.19)   |
| 1916        | 109648                                      | 67514<br>(48.7) | 11700(d)<br>(8.4) | 58075<br>(41.9)  | 1200(d)<br>(0.9) | 138500<br>(100) | 1.23<br>(0.52)   |
| 1921        | 120482                                      | 84628<br>(44.1) | 10291<br>(5.4)    | 95575<br>(49.8)  | 1309<br>(0.7)    | 191827<br>(100) | 1.37<br>(0.68)   |
| 1926        | 243234                                      | 85774<br>(32.9) | 9224<br>(3.5)     | 162874<br>(62.5) | 2686<br>(1.0)    | 260705<br>(100) | 1.54<br>(0.96)   |
| 1931        | 461635                                      | 63041<br>(21.9) | 4908<br>(1.7)     | 210911<br>(73.4) | 8464<br>(2.9)    | 287381<br>(100) | 2.31<br>(1.70)   |
| 1936        | 586929                                      | 85726<br>(19.9) | 3706<br>(0.9)     | 329604<br>(76.5) | 11478<br>(2.7)   | 430574<br>(100) | 2.27<br>(1.74)   |

(Sources: NSWYB 1935/6, 456-7; Figures for 1906 and 1916 estimated from NSWYBs and AYBs, assuming that all electricity generation is steam).

a. Mostly electricity generation; includes small component for Gas & Coke and Hydraulic Power.

b. Includes very small water power component.

c. Factory power figures are for 1907; 1906 not available.

d. Estimated, by assigning 2200 hp of gas engines and 500 hp of oil engines to Heat, Light and Power.

e. Factory employment taken to be a subset of "Industrial", excluding building trades, construction etc, and excluding Heat, Light and Power.

\* negligible

**TABLE 4.9**  
**VALUE OF FUEL CONSUMED BY SELECTED INDUSTRIES**  
**NSW**  
**1935/6**

| INDUSTRY  | ('000 pounds) |             |                  |             |            | ELEC        | TOTAL       |
|---|---------------|-------------|------------------|-------------|------------|-------------|-------------|
|   | COAL          | COKE        | FIRE-<br>WOOD(a) | OIL&<br>TAR | GAS        |             |             |
| Treatment of non-metalliferous mine & quarry products | 74            | 12          | 7                | 3           | 14         | 106         | 216         |
| Bricks, pottery & glass                               | 237           | 3           | 23               | 30          | 11         | 53          | 357         |
| Chemicals, paint, oil & grease                        | 64            | 8           | 6                | 21          | 6          | 64          | 168         |
| Industrial metals, machines, conveyances(b)           | 304           | 924         | 7                | 129         | 278        | 714         | 2357        |
| Textiles & textile goods                              | 35            | 2           | -                | 7           | 2          | 113         | 159         |
| Food, drink & tobacco                                 | 189           | 32          | 73               | 54          | 34         | 287         | 69          |
| Paper & printing                                      | 15            | *           | 1                | 3           | 14         | 88          | 120         |
| <b>TOTAL INDUSTRY</b>                                 | <b>978</b>    | <b>985</b>  | <b>121</b>       | <b>266</b>  | <b>376</b> | <b>1660</b> | <b>4385</b> |
| <b>HEAT, LIGHT &amp; POWER</b>                        | <b>841</b>    | <b>150</b>  | <b>7</b>         | <b>159</b>  | <b>47</b>  | <b>256</b>  | <b>1460</b> |
| <b>TOTAL NSW</b>                                      | <b>1818</b>   | <b>1135</b> | <b>128</b>       | <b>425</b>  | <b>424</b> | <b>1916</b> | <b>5845</b> |

(Source NSWYB 1935/6,457).

a. Includes charcoal.

b. A signifacnt proportion of coal consumption used for on-site generation at major steelworks (see RPT 1937,83).

**TABLE 4.10**  
**ESTIMATED END USE OF ELECTRICITY BY CONSUMER CLASS**  
**SYDNEY**  
**1936**

| (GWh)              | RESIDENT | COMMERC<br>&INSTIT | INDUST | STREET<br>LIGHT | TRACT | TOTAL | %    |
|--------------------|----------|--------------------|--------|-----------------|-------|-------|------|
| SMC RETAIL<br>(a)  | 108.7    | 72.7               | 218.1  | 14.2            |       | 413.7 | 47.9 |
| RD: OWN USE<br>(b) |          |                    | 39.1   |                 | 293.1 | 332.2 | 38.5 |
| BULK SUPPLY<br>(c) | 47.2     | 7.6                | 15.2   | 6.1             |       | 76.1  | 8.8  |
| ELPSC (d)          | 8.2      | 5.8                | 24.7   | 2.5             |       | 41.2  | 4.8  |
| TOTAL              | 164.1    | 86.1               | 297.1  | 22.8            | 293.1 | 863.2 |      |
| %                  | 19.0     | 10.0               | 34.4   | 2.6             | 34.0  | 100.0 |      |

a. From SCC 1951,28.

b. From RD 1935/6, 1936/7. It is estimated that losses account for 10% of electricity production. All "Departmental Use" assigned to industrial.

c. Bulk sales: SMC 30.6 + RD 54.0 = 84.6. Assuming 10% losses, 76.1 GWh is sold to consumers; assumed sector breakdown based on SGCC 1945,45,:

|                               |     |                   |              |     |
|-------------------------------|-----|-------------------|--------------|-----|
| Private lighting              | 27% | - equivalent to - | Residential  | 62% |
| Domestic power                | 47% |                   | Commercial   | 10% |
| Industrial power              | 18% |                   | Industrial   | 20% |
| Street Light<br>& council use | 8%  |                   | Street light | 8%  |

d. From ELPSC 1937 (sales YE April), estimated sector breakdown assuming area was heavily industrial and low-income residential:

|              |     |
|--------------|-----|
| Residential  | 20% |
| Commercial   | 14% |
| Industrial   | 60% |
| Street light | 6%  |

**TABLE 4.11**  
**ESTIMATED GAS AND ELECTRICITY PRODUCTION PER CAPITA**  
**SYDNEY, NSW AND AUSTRALIA**  
**1933**

|                      | SYDNEY | REST NSW | TOT NSW | TOT AUST | %(a) |
|----------------------|--------|----------|---------|----------|------|
| POPULATION ('000)    | 1235   | 1365     | 2601    | 6630     | 39   |
| GAS MADE (m cu ft)   | 8416   | 910      | 9326    | 17900    | 52   |
| GAS/CAP ('000 cu ft) | 6.8    | 0.7      | 3.6     | 2.7      | 133  |
| (kWh equiv)          | 1090   | 107      | 574     | 432      |      |
| ELEC GEN (GWh)       | 873    | 317      | 1190    | 2813     | 43   |
| ELEC/CAP (kWh)       | 707    | 232      | 458     | 424      | 108  |

(Sources: NSW Commissioner for Gas & Electricity, 1934  
 AYB 1937,848,financial years averaged).

a. NSW total as a percentage of Aust total.