The History of Electricity Supply in Leicestershire and Rutland up to Nationalisation in 1947

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This paper seeks to place the development of public electricity supply in Leicestershire and Rutland into the national context. A brief introduction to the technology of electricity generation is followed by a review of the legislation enacted to oversee the standardisation of supply and distribution of power, which culminated in Nationalisation in 1947. Generation of public supplies for electric lighting and traction began in the final two decades of the 19th century and expanded at a rapid rate throughout the first forty years of the 20th, such was the demand for traction, industrial processes, electric motors and heating. The availability of electricity released the industrial and domestic consumer from the restrictions of gas supplies and the dependence of industry upon the gas and steam engine. The development of the Leicester and Loughborough municipal undertakings is dealt with in some detail and sundry other generating plants are described within the constraints of the sources available.

Introduction

The phenomenon of the creation of static electricity, using friction to produce an electric charge, has been known for many centuries. These charges could be multiplied and stored in Leyden jars or condensers and machines, such as the Wimshurst, which were often used as playthings, produced spectacular arcs between electrodes. It was the creation of a continuous electric current, as distinct to static charges, which paved the way for the widespread practical application of electricity. Volta's invention of the pile or battery in 1800 produced a continuous current by chemical means and, if several were connected in series, higher voltages could be achieved and these were sufficient for use in telegraphy. Several other types of battery or cell followed, including the Leclanché cell of 1868 which forms the basis of most modern dry cell batteries. Later, secondary batteries or accumulators, which could be re-charged from an electricity supply, of which the Fauré lead-acid battery of 1881, familiar in motor cars, became the most common.

Michael Faraday's discovery of electromagnetic induction in 1831 led to the invention of the magneto, by which means an electric current was generated mechanically using a permanent magnet. Further development by Wheatstone led to the dynamo in 1867, in which current was generated directly by rotary motion without the need for a permanent magnet. By the reverse principle, using a current to produce a magnetic field in an electric motor could result in rotary motion. These discoveries were to lead to the development of ever larger generators for electricity supply and motors for traction and machine drive purposes. Electric motors were eventually to replace water-wheels and steam, gas and oil engines for driving machines. For further information on electrical technology and the

legislative regulation and development of the supply industry various works may be consulted.[1] These provide a background against which specific developments in Leicestershire and Rutland are discussed below.

Electric lighting

The first practical uses of electricity were for lighting private and public locations where it was seen as a more efficient and cleaner source of power than coal gas. Humphry Davy had demonstrated the production of light by the passage of electricity between two carbon electrodes, and arc lamps were used in early demonstrations of public lighting and also in lighthouses. Early applications of arc lighting were at the Gaiety Theatre in London and at Stanton Ironworks near Derby, both in 1878. The arc lamp was fairly complicated, requiring a mechanism to maintain the tips of the carbon rod electrodes at the correct distance and also the rods themselves had to be replaced at frequent intervals. Of more practical use was the carbon filament lamp, invented independently and simultaneously by Thomas Edison and Joseph Swan around 1880. The filament was contained in a glass bulb, evacuated of air and the lamp provided a simple, compact and long-lasting source of light. The filament lamp was first used at Cragside in Northumberland, and at the House of Commons, Savoy Theatre, Mansion House, British Museum and Royal Academy in London. The filament lamp continues in widespread use today, albeit with a metallic tungsten filament rather than carbon.

In the new generating plants waterwheels, steam engines, oil- or gas-fuelled internal combustion engines were used to turn direct current (DC) generators, which powered arc or filament lamps. Public lighting systems initially used arc lamps and private houses and factory buildings used filament lamps. In some domestic and factory applications, a battery of accumulators could also be kept charged up to provide stand-by current for lighting when the generator was out of service.

The development of public electricity supply

Companies such as Siemens (Germany), Brush (America) and Crompton (Britain) marketed arc-lighting sets and influenced by these early installations and exhibitions in Paris and London, individuals, industrial undertakings and municipalities soon realised the potential of this new form of lighting. By the late 1870s there was considerable promotional activity to provide both public and private mains supplies. Many private Bills were introduced into Parliament by local authorities and companies to generate and transmit supplies and eventually a Parliamentary Select Committee was set up in 1879 to consider the legislative procedures for their regulation. A legal precedent for other public utilities had of course already been established for gas and water supply undertakings and street tramways, with sanctions to excavate public streets to lay pipes and cables and erect posts for cables.

The Committee reported within three months in June 1879 and the resulting Electric Lighting Act, 1882 governed the procedures for the establishment of the electricity

[1] Ballin, H.H., *The organisation of electricity supply in Great Britain*, London: Electrical Press, 1946. Cardwell, D., *The Fontana history of Technology*, London: Fontana, 1994. Hannah, L., *Electricity before Nationalisation: a study of the development of the electricity industry in Britain to 1948*, London: Macmillan, 1979. McNeil, I., ed., *An Encyclopaedia of the History of Technology*, London: Routledge, 1990. Self, H. & Watson, E.M., *Electricity Supply in Great Britain: its development and organisation*, London: Allen & Unwin, 1952.

generating and supply industry. The Board of Trade was empowered to grant either a Licence for seven years, with the consent of the local authority, or a Provisional Order (even without consent of local authority) which was subject to confirmation by Parliament. The Act allowed for both public authorities and private companies to lay underground cables and erect overhead cables, subject to local authority consent. As a safeguard to public interests, the local authority had the option to purchase private undertakings after 21 years of operation, and then at seven year intervals thereafter, at an agreed value. Of 69 Provisional Orders granted in 1883, 55 were granted to companies, but none were actually taken up; four were granted in 1884, one in 1886 then no further orders until 1888. It was felt that the 21-year purchase option period was not sufficient to provide a satisfactory return to investors and the purchase provision was increased to 42 years under the Electric Lighting Act, 1888. The economic climate subsequently improved and technical improvements in both electricity generation and transmission meant that in 1890, 74 Provisional Orders were granted and by 1900 there were 354 Provisional Orders held by local authorities and 164 by companies.

The earliest schemes had been established before the 1882 Act, such as that to light streets and provide a consumer supply at Godalming in Surrey. A water-powered generator commenced supply in 1881, but demand was to prove inadequate and in 1884 the town reverted to gas lighting. A company financed by Thomas Edison erected a steam-powered generator station at Holborn Viaduct in London in 1882, with many more potential customers; however, this closed in 1884, having proved uncompetitive compared with gas. A lighting scheme established in Brighton in 1882 was more successful and by 1887 was powering 1,500 filament lamps and 34 arc lamps supplied by some 15 miles of bare overhead copper wires. Following the Act, the first municipal schemes to start operating were at Bradford (1889), St Pancras in London (1891) and Portsmouth, Hampstead and Ealing (1894). Bradford also converted its horse-drawn tramways to electric traction in 1892; the London Underground and several provincial suburban railway systems were using electric traction by 1910.

A major problem with any generating station for lighting was one of economy of operation, since there were obviously limited hours at which peak demand occurred for lighting. Economies could only be achieved with more continuous demand by the addition of power loads for heating, cooking and industrial uses. This additional demand was encouraged through the hire of domestic appliances and lower price tariffs for power users. One disadvantage of the continuous or direct current (DC) systems was the cost of distribution over a wide area and the power losses involved in transmission. The development of alternating current (AC) generators and motors and the use of transformers to convert to higher (or lower) voltages, together with improved transmission systems, enabled wider areas to be supplied; by 1927 distances of 200 to 300 miles were possible. The use of AC current was destined to become the standard supply system, with conversion to DC where more precise control of motor speeds was necessary for traction purposes. The original DC plant of many early generating stations was first augmented and then replaced by new AC plant, after which DC demand was met by rectifier or converter equipment. The economic production of AC required higher generator drive speeds than the reciprocating steam engine could provide and this was achieved through the development of the steam turbine developed by Charles Parsons. A small production model went into service in Newcastle in 1888, a second larger version in Cambridge in 1892 and a third, still larger at Portsmouth in 1894. By 1912, over one third of the generators in service were powered by turbines and nearly all new plant being installed was of this type.

During the decade from 1910 several committees considered the electricity industry and new legislation was introduced to try and regulate their many proposals for supply. The controversial Electricity (Supply) Bill of 1919 included the appointment of a body of Electricity Commissioners to direct electricity policy and the establishment of voluntary Joint Electricity Authorities. Many of the original proposals for the control of generation and distribution were not included in this Bill because of political pressures to reduce its proposed powers of control. A subsequent Act of 1922 was needed to give financial powers to these new Authorities. However, the generating industry was still not rationalised; for example, in 1924 there were 17 different AC frequencies in use in Britain and a compulsory standard of 50 cycles per second was settled upon. A further committee, the Weir Committee, was set up in 1925 and its findings incorporated in the Electricity (Supply) Act of 1926.[2] This established a new Central Electricity Board to construct a power transmission system, connecting together selected larger generating stations which would be compelled to supply power to the 'grid' which was then resold to local distribution companies. Construction of the National Grid commenced, a standard supply of 3-phase 50-cycle, at 132,000 volts for primary transmission and secondary transmission at 66,000 and 33,000 volts was adopted. This connection began locally with the construction of overhead lines in Leicestershire, linking Nottingham to Loughborough, Loughborough to Leicester and Leicester to Coventry.[3] By the end of 1946, there were 3,675 miles of primary transmission lines and 1,486 miles of secondary transmission lines on the mainland. The Board could also authorise the construction of new generating stations. At that date, there were 572 separate authorised undertakings, each with a monopoly of supply in its area, but of these, 438 generating stations supplied only one tenth of the national output. The Commissioners were given powers to close down inefficient generating stations as soon as an equivalent supply was available from the grid at lower cost but rarely made use of them. Some nine regional areas were planned with schemes for their inter-connection; these were reduced to six in 1943.

The large-scale production of electricity using water power was fostered in 1922 by the Hydro-Electric Development Company and certain Scottish resources were exploited. This reached fruition in 1943 when the North of Scotland Hydro-Electric Board was authorised. Otherwise, new plant construction during the period 1939–45 was almost at a standstill, but the existence of the grid had ensured that continued supplies were available through the war. In the post-war changes, nationalisation of the generation, transmission and distribution systems was seen as the way forward for the industry and the Electricity Bill was enacted on 13 August 1947. At that date, there were still 562 authorised suppliers in Britain and in addition a number of privately owned plants, to which the Act did not apply.

Leicester – first initiatives

The first public proposals concerning electricity supply came from those who were responsible for its main competitor, gas. The Leicester Corporation Gas Act, 1879 contained provision for an expenditure not exceeding £20,000 over a five year period to experiment with electric street lighting. This was not acted upon. It was during the 1883 session when the first application by the Corporation was made to the Board of Trade

[2] Coates, W.A. & Marshall, C.W, *The National Grid* (Manchester: Metropolitan-Vickers n.d.).
[3] LLRRO, QS 76/31, Central England Electricity Scheme, 1928. Plans and amended plans, September 1929 and July 1930.

for a Provisional Order for Leicester Electric Lighting. The proposed areas of supply were in the Borough of Leicester; Belgrave Local Board, Aylestone Park and Aylestone in Blaby Union; Clarendon Park, Knighton village, South Knighton, Stoneygate and Oadby in Blaby Union; Humberstone village and New Humberstone in Billesdon Union; and Birstall in Barrow-upon-Soar Union. This was an ambitious proposal which included rights to lay cables along the Leicester Navigation and the Union Canal, but its implementation was delayed.[4] Further proposals in 1889 included a letter of intent to the County Council on behalf of The Leicester Electric Light and Power Company notifying its intention to apply to the Board of Trade for an order to supply electricity. Then The Midland House to House Electricity Company Ltd also sought a provisional order in 1889 for supply in the Borough of Leicester,[5] and a further order was sought on behalf of the Corporation for extending the Leicester (Corporation) Electric Lighting area of supply to the whole County Borough in the same month.[6] It would seem that nothing came of these additional proposals but they must have influenced the Corporation to take action.

The Corporation's Provisional Order was not confirmed by an Act until 1890, and the first progress towards lighting the central area began. Distributing mains were to be laid in the central area bounded by Belvoir Street, Pocklington's Walk, Grey Friars, Loseby Lane, High Street, Eastgates, Gallowtree Gate and part of Granby Street. Tenders were invited for plant in July 1892; seventeen were received, of which two were submitted to Professor A.B.W. Kennedy for consideration, those from Brush and Ferranti.[7] Orders were placed with the Brush Company of London in December 1893 for three 200 kilowatt (kW) alternators (£26,966) and with Hick Hargreaves of Bolton for three compound steam engines (£4,695) and for six Babcock & Wilcox boilers. The plant was to be housed in new buildings at the Aylestone Road gas works (SK 57850253) and was placed under the control of Alfred Colson, the gas engineer. There were to be 25 miles of mains cables and 33 substations. The undertaking was described and illustrated in the technical press.[8] A supply of current for domestic and factory lighting commenced on 19 December 1894,[9] and the station met the lighting demand on its own until 1903. The output figures shown in Table 1,[10] indicate the growing use of electricity from 1899 onwards when sales of power for other than lighting purposes began. These increased supplies were made possible by the installation of new mains and generating plant in 1898, an extension for two new 1,000kW Brush alternators driven by Hick Hargreaves horizontal engines in 1900/1, so that by 1903 the station capacity was 3,400kW.[11] When lighting supplies began in 1894, consumers were charged 6d per unit, this was later reduced to 5d in 1897 and in 1899 a lower tariff of 2d per unit was introduced for larger users of power. This dual tariff continued until 1903. Maximum demand on the station rose from 360kW in 1896 to 2036kW in 1903.

[4] LLRRO, Quarter Sessions Deposits QS 76/1, 17 November 1882.
[5] LLRRO, Quarter Sessions Deposits QS 76/3, 21 November 1889.
[6] LLRRO, Quarter Sessions Deposits QS 76/4, 14 November 1889.
[7] LLRRO, Pamphlet Collection Vol. 73. Report from Professor A.B.W. Kennedy to the Gas Committee, dated 12 April 1893.
[8] *The Engineer*, 21 June & 19 July 1895.
[9] Storey, John, *Historical sketch of some of the principal works and undertakings of the council of the Borough of Leicester since the passing of the Municipal Corporation Reform Act*, Leicester. W.H. Lead, 1895, 102. For plant description see *The Engineer*, 21 June 1895 and 19 July 1895; *The Electrical Engineer's Directory*, 1897.
[10] LLRRO, 25D73/717, Leicester Corporation Lighting Department accounts, 1894–1910.
[11] *Ibid.* and Leicester Council Minutes: Gas.

Table 1: Electricity output at Aylestone gas works

Year	million units
1894	0.005
1895	0.078
1896	0.169
1897	0.262
1898	0.386
1899	0.567
1900	0.813
1901	1.042
1902	1.426
1903	1.719

Note 1 unit = 1 Board of Trade Unit
= 1 watt per hour
1000 units = 1 kilowatt (kW) per hour

Leicester – electricity for trams and a unified undertaking

A private company was granted an order to construct a horse-drawn tramway system in Leicester in 1873, having paid the Corporation £500 for the concession. Services commenced in December 1874 and further extensions were added up to 1884. The Corporation resolved not to exercise their powers of purchase of the undertaking after 21 years in 1893 but did do so in 1901, for a consideration of £134,410.[12] The council immediately made plans to electrify the tramway system and to build a separate 500 volt DC electricity generating station for their supply to be managed by the Tramways Committee. This was to be on a central location adjacent to the canal basin at the Belgrave Road wharf (SK 59050557). The site, previously known as the 'Lero' field, had been undeveloped except for a lime, plaster and cement works with several kilns which had been erected by 1888. However, by 1904 a refuse destructor had been built adjacent to them. The site was cleared to build the new station.[13] Electric trams started services in May 1904, some 99 double-deck cars originally being purchased and services were gradually extended to use the 19.25 miles of track; by 1905, there were 140 cars in service and the fleet eventually reached 170 vehicles. At the Lero generating station, three Yates and Thom inverted cross-compound steam engines, six Lancashire boilers and two economisers and three DC generators were supplied by Dick Kerr & Co. Ltd., of London and Preston (for £28,417) and by the end of 1906 the generating plant was working to full capacity: three 500kW and one 1,000kW DC generators were in service. There was an overhead coal conveyor system from the nearby canal wharf. In 1908, it was decided that up to 20% of the station output could be sold, and a supply of DC to commercial consumers commenced. In 1910, the engine house was lengthened by 53ft 6in and a Willans & Robinson turbine and Siemens 1000kW DC generator were commissioned.[14] In order to meet a demand for AC, a 750kW alternator driven by a DC motor was installed.[15]

[12] Storey, note 9, 170. LLRRO, 25D 73/82, Leicester Corporation Tramway Accounts, 1904–1911. QS 74/13, Leicester Corporation Tramway Act, dated 29 November 1901.
[13] LLRRO, Ordnance Survey 25 inch to 1 mile map, sheet XXXI.10, 1888 and 1904.
[14] *Ibid.* LLRRO, 25D 73/82. Leicester Council Minutes: Tramways.
[15] LLRRO, 25D 73/783, Leicester Corporation Tramways Department Accounts, 1912–1923. Leicester Council Minutes: Tramways

Expansion of the Leicester undertakings was by then only possible at the Lero station, and the first steps were taken to link it with the AC power supply system from Aylestone. New trunk mains were laid to Rutland Street, East Park Road and to Sarah Street. The first full year of the two generating stations being fully coupled together was 1914 and the Corporation undertakings were then placed under the unified control of the Tramways and Electricity Committee which continued to function until 1920.[16] In 1914 another rotary converter was installed at the Lero station to increase AC production for resale and also a further rotary converter at East Park Road (SK 60910477) to supply local factories in 1917. A new turbo-alternator installed at the Lero station in 1918 met the ever increasing AC demand and new underground cables had been laid from it to transformer sub-stations in the new areas of supply.

The respective outputs of the two generating stations are shown in Table 2.[17] It will be seen that production of power at the Lero station increased at a rapid rate, and by 1919 was nearly four times that of Aylestone Road, where the maximum supply demand only rose from 2,219kW in 1904 to 4,111kW in 1919. It was intended to eliminate the actual generation of DC and produce the tramway DC supply by means of rotary converters. By 1919 both stations were operating at full capacity in their confined locations and further expansion was not possible. The consumer tariff continued at 4d per unit for lighting and 2d for power until 1909 when a three stage tariff of 4d, 2d and $^{3}/_{4}$d was introduced with a quarterly charge of 15 shillings per horse power of electric motor connected to the mains; this charge was reduced to 11 shillings in 1911.

Table 2: Electricity output from two Leicester generating stations

	Aylestone Rd Gas Works	Belgrave Rd Lero Works		combined output
Year	Lighting/power million units	Tramways/power million units	Lighting/power Resale units	units
1904	1.895	1.598	-	3.493
1905	2.015	4.976	-	6.991
1906	2.083	5.746	-	7.829
1907	2.191	5.816	-	8.007
1908	2.056	6.125	0.063	8.181
1909	1.952	6.616	0.434	8.568
1910	2.030	8.188	1.516	10.218
1911	2.368	9.248	2.000	11.616
1912	2.719	10.783	2.631	13.502
1913	5.039	11.208	3.984	16.247
1914	5.538	11.951	5.041	17.489
1915	5.214	15.371	7.380	20.585
1916	5.252	18.170	9.412	23.422
1917	5.401	20.453	11.114	25.854
1918	5.210	20.406	11.531	25.616
1919	5.220	20.718	11.060	25.938

[16] Howe, C., *Leicester, its civic, industrial and social life*, Leicester: Midland Services Agency, 1927.

[17] LLRRO, 25D 73/717, Leicester Corporation Electric Lighting Department Accounts, 1894–1910 and 25D 73/718 for 1911–1923; 25D 73/782, Leicester Corporation Tramways Department Accounts, 1904–1911 and 25D/783 for 1912–1923.

From Table 2 it will be seen that the power generated at both existing Leicester stations had reached a plateau by 1917, even allowing for the effects of the war. Plans had to be laid for future development and in 1917, the Corporation had requested a report on their plants from Mr C.H. Wordingham.[18] He reported as follows:

> *Aylestone station.* Three horizontal compound engines, coupled to 250kW single phase AC generators working at 2,000 volts, part of the original 1898 plant. Three horizontal Corliss engines each driving 1000kW alternators. Steam plant, six water tube boilers (practically worn out) and ten Lancashire boilers with mechanical stokers. Overall, the site is very restricted and not recommended for increased generation capacity.
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> *Lero station.* A quantity of exceedingly fine plant. Vertical compound engines driving three 500kW and one 1000kW DC generators working at 500/550 volts. One mixed pressure 750kW turbo-alternator. Two 3-phase 3000kW turbo-alternators of most modern type working at 6,000/6,600 volts. Eight Lancashire boilers and four Woodeson water tube boilers, all with mechanical stokers and coal conveying gear. The Lero station has problems for any future extension, the coal storage facilities are inadequate and railway, as well as canal connection, would be essential – this is not practical. Condensing water would also be a problem, the canal basin water is already at a high enough temperature. Ash is presently removed by cart, a system of great nuisance value in a built-up area.

Wordingham commented that demand had been growing at the rate of 1,000kW per year for the last six years. The present demand of 10,000kW would be 30,000kW in 20 years time without any extension of the supply area. Any plans should allow for a demand of 50,000kW within 20 years. He proposed that a new station be built on a large area of land at Aylestone, to generate power at 6,600 volts, 50 cycles AC and using a four wire distribution system at 415 volts. The tramway network was to be fed by 3-phase current to rotary converter stations as had already happened in some parts of the area. The present Aylestone plant should be written off and the Lero plant reduced to the two 3000kW turbo-alternators.

Leicester – new power station at Freemen's Meadows

The Corporation acted upon their consultant's recommendations and sought to purchase land at Freemen's Meadows on Aylestone Road, bounded by the River Soar, St Mary's Road and the Midland Railway Burton branch line.[19] Development and control of the new station, with road, rail and canal/river access, was placed under a separate Electricity Committee which assumed control of the three separate generating stations. In order to meet demand, some changes were made at the Aylestone Road gas works station in 1920; boilers were replaced and the foundations laid in 1908 for a further 1000kW alternator set were rebuilt for a new 5000kW English Electric turbo-alternator. A new substation in Newarke Street (SK 58680412) was completed and contained two 1000kW rotary alternators to convert AC to DC, as well as high voltage transformers to provide current for street lighting.[20] During 1921, oil fuel had to be used due to a shortage of coal.

Mention has been made above of the formation of regions under the 1919 Act. The East Midlands Electricity District was provisionally determined by the Electricity

[18] LLRRO, DE 2667/9, 'Report on the Electrical Undertakings of the Leicester Corporation' by C.H. Wordingham, dated 17 May 1917.
[19] LLRRO, Quarter Sessions Deposits QS 76/13, 29 November 1917; QS 76/14, 29 March 1918.

Commissioners and was to comprise parts of Derbyshire, Leicestershire, Nottinghamshire and Staffordshire. In Leicestershire, the area included the County Borough of Leicester, Municipal Borough of Loughborough; the Urban Districts of Ashby-de-la-Zouch, Ashby Woulds, Coalville, Melton Mowbray, Oadby, Quorndon, Shepshed, Thurmaston and Wigston Magna; the Rural Districts of Ashby-de-la-Zouch, Barrow-upon-Soar, Belvoir, Billesdon, Blaby, Castle Donington, Loughborough, Market Bosworth and Melton Mowbray.[21] Other areas of Leicestershire were not included, for example, the Hinckley, Market Harborough, Lutterworth and Hallaton areas were in a different District. The Joint Electricity Authority was set up with twelve members, two were appointed from Leicester and one from Loughborough. It was first proposed that one large main station should supply the whole District, however, this was abandoned. It was then proposed that the new generating stations already sanctioned at Leicester and Nottingham, with those existing at Derby and Burton-on-Trent, would be able to meet the demand, together with a possible new station at Newark-on-Trent. The total generating of the existing or sanctioned sites if each were fully developed was 500,000kW. Existing stations at Loughborough, Mansfield, Long Eaton and Ilkeston were to continue in operation until it became practicable to replace them with a bulk supply from one of the above main stations.

The construction of the new Leicester generating station at Freemen's Meadows (SK 582029) has been well documented in the technical press following its opening in December 1922.[22] Its original plant consisted of two English Electric turbo-alternators of 10,000kW and 12,500kW capacity, generating power at 6,600 volts and supplied with steam from four Babcock & Wilcox horizontal marine type water tube boilers and four Vickers Spearing cross type boilers, all with chain grate stokers. River/canal water was used for cooling and two cooling towers were erected. A third turbo-alternator of 18,750kW capacity of Oerlikon (Swiss) manufacture was commissioned in 1927. By 1928, the City undertaking's new central power station had a capacity of 41,750kW, Aylestone gas works station 5,000kW and the Lero station 9,250kW. The City pledged to connect the new works to the National Grid by October 1930 and planned to have closed both the Lero and Aylestone Road gas works generating stations by 31 March 1930. To achieve these objectives, a new rotary converter for AC to DC was installed in Sanvey Gate in 1929, which enabled the Lero station to close on 30 June 1930, although the premises were retained until 1938 when they were transferred to the Education Department.[23] The Aylestone gas works station did not close until 1931 and was subsequently demolished in 1981/2.[24] Subsequently further extensions and additions at Freemen's Meadows were made in 1930,[25] when a 25,000kW English Electric alternator was added, along with three new International Combustion boilers. These were innovative and burnt pulverised coal using the Lopulco system.[26] Three further cooling towers were erected, and the station then had a 68,250kW capacity.

[20] LLRRO, 25D73/717, Annual Report y/e 31 December 1920.
[21] LLRRO, Quarter Sessions Deposits QS 76/16, 20 October 1920.
[22] *English Electric Journal*, II/3, 1923, 109–129.
[23] Leicester Council Minutes: Electricity, 22 February 1938.
[24] LLRRO, DE 2667/4, Annual Reports y/e 31 March 1929, 1930 and 1931. Information in The Gas Museum, Aylestone Road, Leicester.
[25] *City of Leicester Central Generating Station Opening, 19 February 1930*, souvenir booklet.
[26] LLRRO, DE 2667/4, Annual Report y/e 31 March 1930.

Table 3: Combined outputs of city of Leicester electricity department

Year	Output million units	Tramways million units	Factory Power and Lighting million units
1920	30.476	7.794	
1921	31.432	7.219	
1922	30.714	7.954	
1923	35.950	8.270	
1924	48.005		
1925	53.213		
1927	75.301*		
1928	68.088	8.611	28.920
1929	75.623	8.002	32.305
1930	80.262	7.848	34.918
1931	86.561	7.994	36.399
1932	97.169	8.144	38.575
1933	107.800	7.837	40.551
1934	120.783	7.685	45.037
1935	153.898	7.626	47.378
	130.334 sold		
1936	150.237	7.414	51.523
	140.859 sold		
1937	238.029	7.499	56.396
	174.590 sold		
1938	218.574	7.946	57.217
	180.911 sold		
1939	188.887	7.873	57.933
	189.135 sold		
1940	249.956	7.066	66.217
	205.482 sold		
1941	288.585	6.540	71.535
	223.603 sold		
1942	320.122	6.440	82.211
	227.104 sold		
1943	342.916	6.009	84.297
	241.539 sold		
1944	358.661	6.009	87.843
	258.458 sold		
1945	376.687	5.521	
	265.644 sold		
1946	305.835	5.604	74.114
	267.900 sold		
1947	338.159	6.127	75.958
	312.951 sold		
1948	338.794	5.523	76.583
	299.175 sold		

*for 15 months

The outputs of the combined stations are shown in Table 3 for the period up to Nationalisation. The gradual fall in power used on the tramway system can be attributed to the introduction of diesel-powered buses.[27] The maximum local demand on the undertaking increased more than seven-fold from 12,275kW in 1920 to 86,160kW in 1946. From 1935 onwards, following the commencement of the operation of the Central England Electricity Scheme on 1 April 1934, the Leicester undertaking sold power to the Central Electricity Board at an agreed price; only in the year ending 31 March 1939 was Leicester a nett importer from the grid. The output units in the first column of Table 3 have therefore been corrected to show the nett units sold or supplied for traction each year. Freemen's Meadows station output to the grid ranged up to nearly 30% of its output, the highest outputs being 1937 (26.6%), 1942 (29.0%), 1943(29.6%), 1944 (27.9%) and 1945 (29.5%). It will be seen that the total Leicester undertaking outputs increased more than tenfold over the 28-year period. Within the annual reports there are other statistics of interest. Indications of the promotion of electricity for domestic use are the 17,793 cookers on hire, 3,633 circulating water heaters and 17,498 assisted wiring schemes recorded in 1937. Further items recorded each year from 1931 onwards are expenditure on steam mains and income from sales of steam, presumably for factory process or heating use: these sales rose from £6,959 per annum in 1931 to £26,002 in 1948. An arrangement had been made with the Dunlop Rubber Co. to supply steam to their St. Mary's Mills nearby.[28]

At Nationalisation in 1948, Leicester was included among the twelve local authority-owned undertakings vested in the East Midlands Electricity Board. This area embraced the whole of the counties of Leicester, Northampton and Rutland, the greater part of Lincolnshire, large parts of Derbyshire, Nottinghamshire and Warwickshire, as well as small parts of Bedfordshire, Buckinghamshire, the Soke of Peterborough and Staffordshire. This was an area of 6,274 square miles, with a population of around 3.5 million, and 88% was classified as rural in character. For administration purposes the area was divided into nine sub-areas, two of them being the Leicester and the Leicestershire & Warwickshire Sub-Areas. At Nationalisation, the Leicester undertaking had a 89,250kW generating capacity with a proposed 60,000kW capacity extension; 91,718 consumers were connected, taking around 249 million units per annum.[29] John Mould, who had been General Manager and Engineer of the Electricity Undertaking in Leicester for 20 years, became Deputy Chairman of the new Board. During the next phase of expansion, two further cooling towers were erected on the former Leicestershire County Cricket ground on Aylestone Road. By 1966, Freemen's Meadows had a station capacity of 138,250kW, reduced to 93,000kW by 1970, and by then using both pulverized coal and oil fuel. By 1976/7 the station had two 58,000kW alternators coupled to gas turbines using oil fuel, which operated on a stand-by basis.

[27] LLRRO, 25D73/717 & 718; 25D73/783 and DE 2667/3, /4 & /5, Annual Reports of City of Leicester Electricity Department, 1920–1948.
[28] Leicester Council Minutes: Electricity Committee, 24 December 1929.
[29] Ministry of Fuel & Power, Electricity Supply, 1947–48.

Electricity consumption for lighting and factory power in Leicester

Little information is known of private electricity generation plants in Leicester which preceded the public supply. Corahs the hosiery manufacturers had an installation at their St Margaret's Works in 1883.[30] The Midland Railway in 1895 had an installation near London Road station, probably on Samuel Street (SK 59530460 approx.); this comprised a gas producer plant driving six Crossley gas engines connected to DC generators powering 50 arc lamps in the goods yard, station lighting and other uses.[31] The Great Central Railway had four steam-powered generators producing 220 volts DC in their own power station erected in 1899 on Western Boulevard (SK 58090382) which also included a stand-by accumulator system. This supplied power for lighting in the goods yard and warehouse.[32] The Pearson and Bennion works in Belgrave Road (SK 593061), begun in the late 1890s, became the Union Works of the The British United Shoe Machinery Co. Ltd. In 1911, the factory contained a power house with three vertical Hick Hargreaves 150hp steam engines direct-coupled to 220 volt, 100kW dynamos; a larger steam engine of 500hp was then on order. The works were still generating electricity in 1928.[33]

Examination of the 1892 series of Goad's Fire Insurance Plans which show power sources in buildings indicate many steam plants and gas engines, but none mention electricity. By 1901 Faire Brothers in Morledge Street and Freeman Hardy and Willis at Humberstone Road both had electricity systems, with dynamos powered by gas engines and stand-by accumulators. By 1923, in boot and shoe, hosiery and engineering firms, small electric motors were in use, powered from the mains in the lately-developed areas of North Evington and East Park Road.[34]

Information concerning the sales of electricity from the Leicester undertakings shown in Table 4 is far from comprehensive, due to the inconsistency of the record keeping.[35] For the Lero works from 1908 to 1919, the total horsepower connected to their mains rose from 120 to over 13,000, and the average power per customer rose from 8.6 to 36.6hp. For the combined undertaking the total horsepower rose from 22,139 in 1921 to 49,310 in 1934 but no corresponding numbers of customers are available. From the factory power consumed shown in Table 3, comparing the 45,037,520 units consumed in 1934, with the 76,583,101 units in 1948, the amount of horsepower connected to the mains must have altered by a similar factor to around 80,000hp.

Table 4 also serves to illustrate the continued predominance of gas for street lighting in Leicester. Before 1928 there were fewer than 1000 electric street lamps in the city although 500 had been erected in this year alone.

[30] Corah plant – *Leicester Chronicle*, 6 January 1883.
[31] *The Engineer*, 19 April 1895.
[32] *Fielden's Magazine*, 1, 1899, 478/9.
[33] *The Boot and Shoe Trades Journal*, 30 June 1911; *Serving the Shoemaker for 100 years*, by Iain Howie, Leicester: British United Shoe Machinery Co, 1999.
[34] LLRRO, Goad's Fire Insurance Plans, Sheets 77, 78 & 79, 1923.
[35] LLRRO, 25D 73/717 & 718; 25D 53/781 & 782; DE 2667/3, /4, /5.

Table 4: Sales of electricity for lighting and power purposes

	Aylestone	Lero Works			Combined works	
Year	Motor h.p.	Total Motor h.p.	No.of Customers	Each hp	Motor h.p. connected	Street Lamps
1908		120	14	8.6		
1909	240	710	36	19.7		
1910	330	1880	69	27.2		
1911	572	2670	90	29.7		
1912		3900	130	30.0		
1913		5615	179	31.4		
1914		7018	214	32.8		
1915		9100	260	35.0		
1916		11,100	292	38.0		
1917		11,900	299	39.8		
1918		12,180	348	35.0		
1919		13,174	360	36.6		16
1920						16
1921					22,139	
1922						
1923						
1924						176
1925						350
1927						746*
1928						1257
1929					36,672	1602
1930					39,382	
1931					40,779	2061
1932					42,289	2303
1933					46,850	2719
1934					49,310	2995
1935						3370
1936						3830
1937						4517
1938						5346
1939						6178
1940						6873
1941						7306
1942						7347
1943						7435
1944						7450
1945						7083
1946						7105

*15 mths

Electricity supply in Loughborough

The Loughborough Board of Health first considered the question of electric lighting in November 1878, when a report prepared by Messrs Hodson (Town Surveyor), Price and Hodson was presented on the subject.[36] In May 1891, a Loughborough engineer, Walter Claypoole, was appointed agent for Messrs. Bailey of Salford makers of 'engines for lighting gentlemen's mansions' and by October Claypoole had a demonstration set at his John Street Works.[37] At the end of 1895, the Sanitary and Sewage Disposal Committee of the Borough council sanctioned the purchase of a small lighting plant from the Brush Company for their works.[38] In 1898, the Borough considered the purchase of the private gas undertaking in the town under their option and in the necessary legislation to do so resolved to incorporate the provision of an electricity supply.[39] With this in view the Town Council lodged a memorial against the proposed Leicestershire and Warwickshire Electricity Bill in February 1899. A Provisional Order was obtained in 1899 for electricity supply by the Borough. The Gas Company had initially objected to the proposed purchase by the Borough of their works, but after negotiation their works were purchased and handed over on 30 June 1900. The new council Gas Committee, as in Leicester, were charged with planning for the new generating station. A report had already been commissioned by the Town Council in 1898 from C.H. Gadsby and a second Consulting Engineer, T.L. Miller of Liverpool, reported in November 1901.[40] The estimated cost was around £28,000, if no provision was made for light railways (tramways); alternative schemes for gas- and steam-powered plants were outlined and alternative sites discussed. In view of the cost, coupled with that for the purchase of the gas works, the council were slow in making a decision, as even in November 1903 the matter was still being discussed.[41] In February 1904, a letter was received from the Board of Trade enquiring what steps the Corporation had taken to carry out their obligations under the Provisional Order in the Loughborough Corporation Act.[42] However, progress was being made for on 30 March 1904, various tenders for plant had been received. The Brush Electrical Engineering Co. Ltd., by then operating in Loughborough, won orders for steam turbines, dynamos and condensing plant; whilst Danks & Co won the order for the steam boilers. Wm. Moss & Sons of Loughborough were to build the chimney stack but tenders for the buildings themselves were still not due until 17 April.[43] The new works, off Bridge Street close to the Canal Basin (SK 534198), opened in December 1904, with two Brush 250kW capacity 440/460 volt DC dynamos coupled to Parsons steam turbines (made under licence by Brush).[44] A storage battery was added in 1907.[45]

In the November 1903 report it was mentioned that the temporary Brush generating supply for the new works of Messrs Herbert Morris and Bastert had been operational by

[36] *The Loughborough Advertiser*, 14 November 1878.
[37] *The Loughborough Advertiser*, 14 May 1891, 5; *The Loughborough Herald*, 29 October 1891, 5.
[38] Borough of Loughborough, Sanitary and Sewage Disposal Committee minutes 11 November and 9 December 1895, 13 January 1896.
[39] Borough of Loughborough, Report of Gas and Electricity Committee, 3 October 1898.
[40] C.H. Gadsby Report, 7 November 1898. T.L. Miller Report, 27 November 1901, presented to Town Council on 2 December 1901.
[41] Borough of Loughborough, Report of Gas Committee, 16 November 1903.
[42] Letter from Board of Trade dated 9 February 1904, presented to Gas Committee 23 February 1904.
[43] Special Report of Gas Committee submitted 30 March 1904.
[44] *The Electrical Review*, 57, 8 September 1905, 283/4.
[45] *The Electrical Review*, 60, 1 February 1907, 193.

the time stipulated in the agreement between the Council and the company.[46] Presumably this company had moved its works to the town with a promise of a public electricity supply which had not been met; there was obviously some friction between the company and the Borough as is borne out by a subsequent court case. The company was later to sue the Loughborough Corporation for breach of contract over the non-supply of electricity. Their case concerned a failure in supply on 22 November 1905, when the firm was without power for six hours. 200 of their workers were left idle and sent away, whilst the plaintiffs had lost profits and were seriously inconvenienced. Morris and Bastert lost the case, but then appealed against the verdict and won.[47] The only liability under the 1899 Act for failure to supply was 40 shillings per day! The generator station building on the Morris site is still extant, close to the Great Central railway (SK 54371947).

The growth of demand is substantiated by the replacement of the original dynamos in the generating plant by 350kW units in 1911, and AC generation commenced in 1914 when a Brush-Ljungstrom 1000kW turbo-alternator was commissioned.[48] A second 1500kW alternator and two new boilers were installed in 1917. In 1920, following the establishment of the Joint Electricity Authority, which had one Loughborough representative, the Council appointed C.H. Wordingham to make recommendations on the future development of the Loughborough undertaking.[49] In March 1920, the Electricity Committee resolved to inform the Derbyshire and Nottinghamshire Electric Company that they did not wish to take up their offer to supply the Loughborough area in conjunction with the Leicestershire and Warwickshire Electric Power Company.[50] Wordingham instead recommended the provision of increased capacity at their own plant and was instructed to prepare a scheme for a 6000kW capacity extension. It was then thought that the possibility of obtaining a supply from the Leicester undertaking was remote.[51]

In spite of the original ruling of 1919 that Loughborough should only be retained until generating capacity in the four large stations was enough to replace it, consent was given by the Electricity Commissioners in September 1920 to proceed with a new building to house one 3000kW Brush-Ljungstrom alternator and three new boilers. Provision was made to house a second alternator in due course, the plant came into service along with a 1000kW rotary converter.[52] The Loughborough undertaking continued operations until nationalised in 1948, when it was vested in the East Midlands Electricity Board. The undertaking then had three Brush-Ljungstrom turbo-alternators with a total capacity of 5,500kW, with four rotary converters; it was supplied by four steam boilers and its output in 1947 was 28,102,342 units.[53] Generation at Loughborough probably ceased in the early 1950s and in 1955, one of the turbo-alternators, the 1,000kW unit installed in 1914, probably the second to be built by the Brush Company, was handed back to them by the Electricity Board.[54] This unit is now on static display at the Leicester Museum of Technology in Corporation Road. The

[46] Borough of Loughborough, Report of Gas Committee, 16 November 1903.
[47] Kings Bench Division (in the Court of Appeal, 18 October 1907.
[48] *The Electrician*, 13 June 1913, 464.
[49] Report of Electricity Committee to special meeting of the Town Council, 12 January 1920.
[50] Electricity Committee, minutes 30 March 1920.
[51] Report of Electricity Committee to special meeting of the Town Council, 12 April 1920.
[52] Loughborough Library, LO 621.3, *Official Opening of new Generating Plant*, 5 June 1924.
[53] *Garcke's Manual of Electricity Supply*, 46, 1948–49, A-70 & B 329–30.
[54] *Brush Broadsheet*, 123, January 1956.

buildings at Bridge Street remained in use until 2002 when they were demolished as part of a new shopping centre.

A private generating station at the Loughborough College, then located on Ashby Road (SK 534197), was described in February 1937.[55] Previously the power supply has been taken from the town mains, but the college purchased two diesel-powered DC generators and battery equipment from the Admiralty which had been removed from German submarines. The first unit was commissioned in 1925, and then the second, and then additional new plant. The new generator house opened in January 1927 had five diesel-powered generators and a rotary converter and was expected to provide valuable training for their engineering students.

Electricity Supply elsewhere in Leicestershire & Rutland

The gradual extension of the area of supply through the area can be traced from the twenty plus deposited Quarter Sessions papers, mostly during the period 1910 to 1930. Some of these proposals were submitted by the Leicestershire undertakings whilst others came from undertakings outside the counties. Some appear to be from companies wishing to supply a specific area, possibly buying bulk supplies from a separate undertaking.[56] The actual dates of commencement of supplies in other areas of the county has not been ascertained, but information on specific installations in the following places has been found.

Asfordby

At Nationalisation vesting day in 1948, some 260 consumers in the village were supplied by T Cowman & Sons Ltd. In 1941, this firm was listed as Steam Rolling Contractors and the village had 'gas and electricity available'.[57] The station was later taken over under section 48 of Act by the East Midlands Electricity Board. The diesel engine-powered DC generating sets broke down in January 1950 and the network was connected to the Board's AC mains by April.[58]

Hinckley

The Leicestershire and Warwickshire Electricity Supply Company sought to supply power to parts of Leicestershire and Warwickshire. Their first scheme in 1898 envisaged a generating station at the junction of the Hinckley-Nuneaton Road and the Watling Street.[59] A later proposal in 1901 included three sites for generating stations in the county, one at Nutts Lane, Hinckley, between the London & North Western Railway and the Ashby Canal, a second at Glenfield adjacent to the Midland Railway (West Bridge branch) and the third at Measham between the Ashby Canal and the Ashby & Nuneaton Joint Railway.[60] Of the three proposals, only one station was built, that at Nutts Lane (SP 411928) in Hinckley which operated alongside the company's Avon station at Warwick. Hinckley was one of the undertakings selected for retention in the

[55] 'Loughborough College Power Station', *Engineering*, 5 February 1937.
[56] LLRRO, Quarter Sessions Deposits QS 76/5, /7, /9, /11, /12, /17, /18, /19, /20, /22, /24, /25, /26, /27, /28, /29, /30.
[57] Kelly's Directory of Leicestershire and Rutland, 1941.
[58] East Midlands Electricity Board Report, 1949/50.
[59] LLRRO, Quarter Sessions Deposits QS 76/5, 29 November 1898.
[60] LLRRO, Quarter Sessions Deposits QS 76/7, 29 November 1901.

Central Electricity scheme of 1928 and was still generating power at Nationalisation, with a capacity of 6,000kW as part of the West Midlands Electricity Board network. Power generation at Hinckley ceased in the early 1950s.[61]

Market Harborough

A Provisional Order to provide an electricity supply for parts of High Street, St Mary's Road, Great Bowden Road, Northampton Road and Coventry Road was sought in 1905 by the Urban District Council.[62] No record has been found of any outcome of this and electricity does not seem to have reached Market Harborough until about 1920 when a connection was made to the Kettering power station.[63] An application for a Provisional Order was submitted in 1923 to supply the Urban District of Market Harborough and Lubenham parish.[64]

Melton Mowbray

The Melton Mowbray Electric Light Company Ltd was registered on 18 June 1897 and a Provisional Order to supply the district was sought in 1898.[65] A DC generating plant was established in Regent Street (SK 757190). Conversion from DC to AC began in 1936, but stopped during the war only to recommence in 1947 when 1650 consumers were still on DC and the changeover not completed until 1949.[66] Power generation at Melton Mowbray thereafter ceased.

Oakham

Electricity generating plant was installed in the gas works on West Road (SK 856087) by the Oakham Gas & Electricity Co. Ltd. which was registered on 4 September 1924. A further order was sought during the 1931–32.[67] There were three gas- and one petrol-engine driven generators which maintained a supply until the advent of the connection in 1932, to the Central Electricity Board works at Peterborough via premises in Station Road.[68]

Stathern

At vesting day for nationalisation in 1948, J.E. Green provided a supply for about 80 consumers. In 1941, John Ernest Green was listed as a tool maker.[69] Nothing further is known.

[61] East Midlands Electricity Board Report, 1955/6.
[62] LLRRO, Quarter Sessions Deposits, QS 76/9, *c.*1904.
[63] *Victoria County History*, V, 1964, 136.
[64] LLRRO, Quarter Sessions Deposits, QS 76/19, Kettering Electricity (Extension), 1923.
[65] LLRRO, Quarter Sessions Deposits, QS 81/3/1, draft 1898.
[66] East Midlands Electricity Board Annual Report 1949/50.
[67] LLRRO, Quarter Sessions Deposits QS 80/13, Session 1931–2.
[68] LLRRO, Quarter Sessions Deposits QS 76/31, Mid-East England Electricity, 26 June 1929.
[69] Kelly's Directory of Leicestershire and Rutland, 1941.

Conclusion

Of the several electricity generating schemes described above, the only generating capacity remaining is at the much curtailed Freemen's Meadows site in Leicester. All the other stations, constructed by private enterprise or local authorities, have closed.

Other considerable sized stations in the region, Burton-on-Trent, Coventry, Derby, Northampton, Nottingham and Warwick (Avon) have all closed. New stations have been built along the River Trent near Leicestershire borders at Castle Donington (opened 1958, now demolished), Drakelow, Ratcliffe and Willington (opened 1957, now closed) as well as others further downstream. These and the National Grid maintain supplies in the county.

Public electricity therefore came to Leicestershire and Rutland late in 1894. The area was not in the vanguard of innovation, in spite of the fact that one of the major manufacturers of generating plant, the Brush Company, had moved to Loughborough in 1889. Both the councils of Leicester and Loughborough do not appear to have proceeded rapidly with electricity supply, since gas met the demand for street lighting and there was a reluctance to incur new expenditure which could only be financed by public borrowing. Large factory consumers of electricity in Leicester installed their own generating plant and do not seem to have pressed the Corporation for a supply.

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