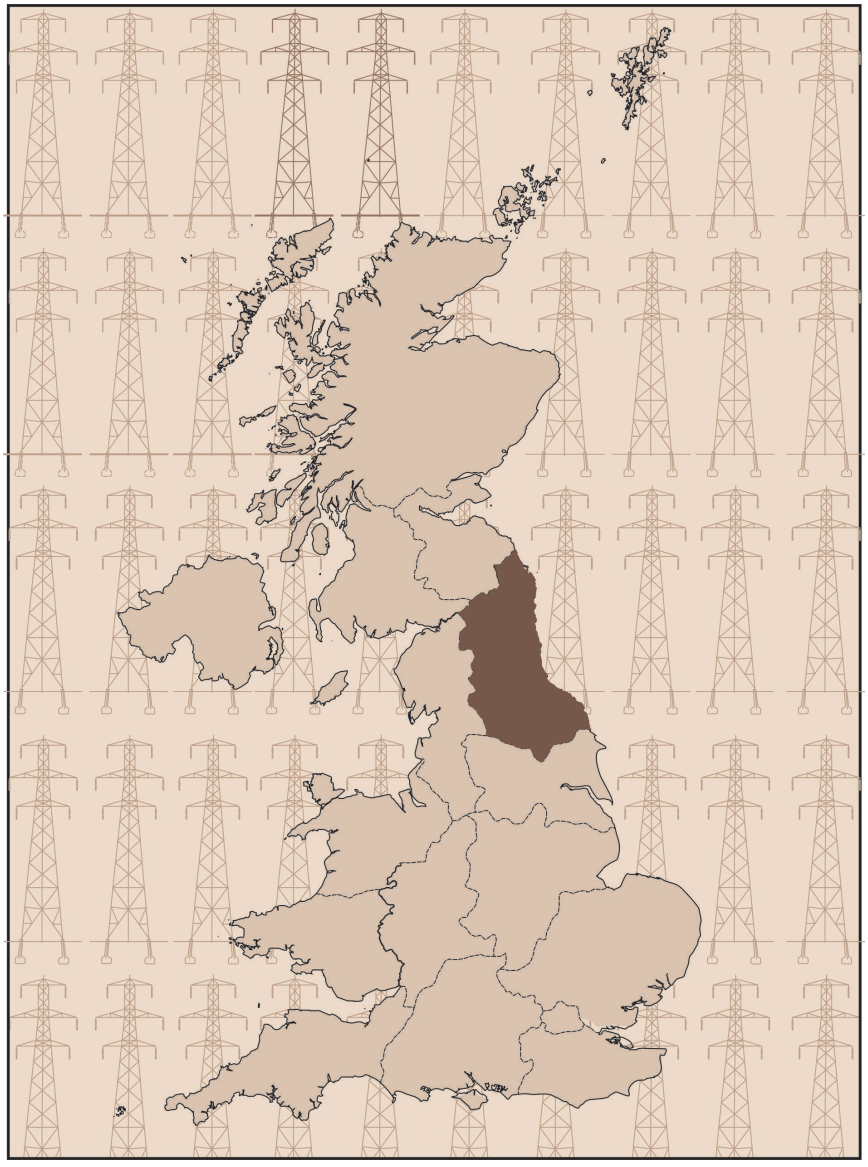

THE NORTH EASTERN ELECTRICITY BOARD AREA

Regional and Local Electricity Systems in Britain

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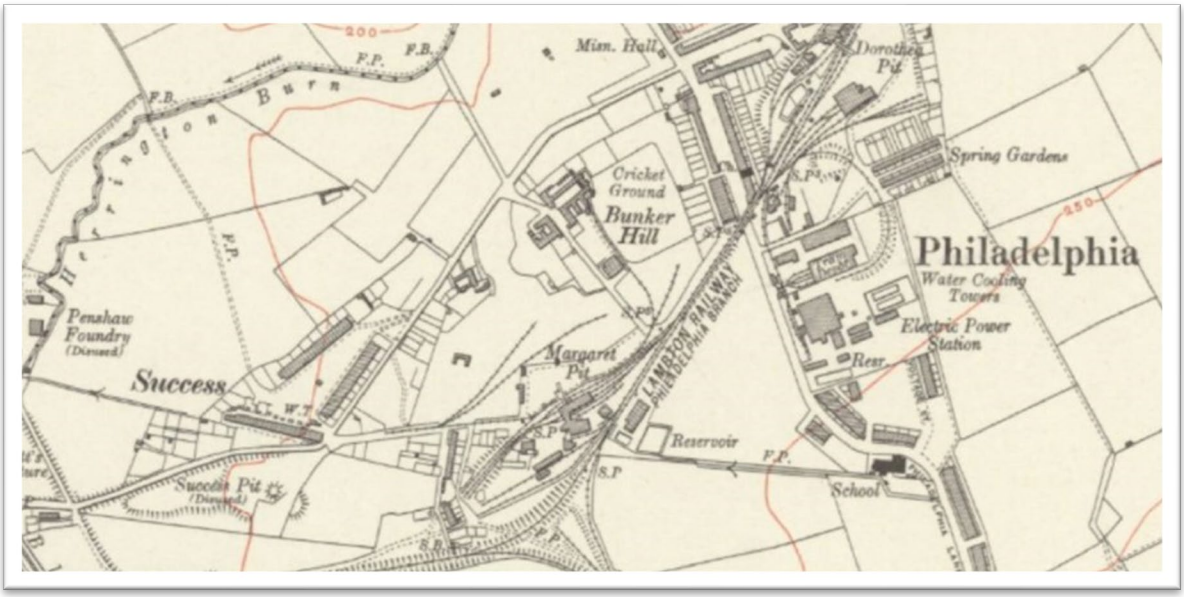

PHILADELPHIA

This small community, east of Chester-le-Street, was dominated by the generating station of the Durham Collieries Electric Power Co. and the adjacent depot of the Sunderland District Tramways Co. Opened in 1905, the power station became part of the NESCO system two years later. By 1913 the plant had a capacity of 9,000kW. Although closed in the early 1920s, the turbine hall has escaped demolition and Voltage Street also survives.

Ordnance Survey Six Inch Map series, Durham, XIII, 1915 (National Library of Scotland)

Introduction

Public electricity supplies began in Britain during the 1880s. By 1900 most urban places with over 50,000 population had some form of service, at least in the town centre. Gradually the isolated points on the national map began to coalesce, especially when the national grid helped local organisations to connect small towns, villages and eventually farms.

In the process of electrification, hundreds of municipal and company organisations developed local and sometimes regional systems. Before nationalisation in 1948, however, there was little consolidation of areas.

The study of British electricity systems is a remarkably daunting task. While there is a rich legacy of detailed annual surveys, these publications have to be tracked down. The user is then faced with immense alphabetical listings of all sorts of enterprises, often in places which no longer have much meaning except to local residents. Since there are few contemporary maps, listing and grouping the electricity organisations geographically is difficult and often time- consuming.

These notes are offered as an outline guide to the pre-1948 local authorities and companies which developed electricity supplies in North East England.

The North Eastern Electricity Board Area

The area was first defined by the Ministry of Fuel and Power in a White Paper published in January 1947, a month before debate began on the Electricity Bill.[1] Fourteen area boards were to be established for electricity distribution or retailing. Generation and transmission were to be the responsibility of the British Electricity Authority. Each area board was defined to provide a diversity of load between urban and rural areas and, where possible, avoided cutting across distribution networks.

In detail the North Eastern Electricity Board Area included the counties of Durham, Northumberland and the North Riding of Yorkshire (including York).[2] The northern part of Northumberland including Berwick-on-Tweed, previously part of the Scottish Southern Company system, was to be operated by the South East Scotland Electricity Board.

Constituents of the North Eastern Electricity Board Area

When the North Eastern Electricity Board began operations on 1 April 1948 it incorporated the services and systems of 21 local authorities and 4 companies. There were enormous variations in the size of the constituent areas. The North Eastern Supply Co. (NESCO) had a distribution area of 4,669 square miles while the Crook & Willington Urban District occupied only 6.3 square miles. Harrogate Corporation's electricity department served an area of about 270 square miles, many times larger than the Municipal Borough (13 square miles).

With an area of about 5,670 square miles and an estimated population of 2.95 million, the North Eastern Electricity Board Area covered every type of district from the sparsely populated parts of the Cheviot Hills to the densely settled area of central Middlesbrough. The distinctive economic geography of the

[1] Ministry of Fuel and Power, ***Electricity Supply Areas***, Cmd 7007. (London: HMSO, 1947).
[2] Electricity Act 1947, 10 711 Geo 6, Ch 54, First Schedule.

region resulted in a high proportion of industrial sales (68.7 percent) and a correspondingly low proportion of domestic sales (20.4 percent).[3]

The new Board established its head office in Carliol House, Market Street East, Newcastle-upon-Tyne. Originally built by NESCO as a commercial venture and opened in 1927-28, the 7-storey block also included the company offices and showroom.

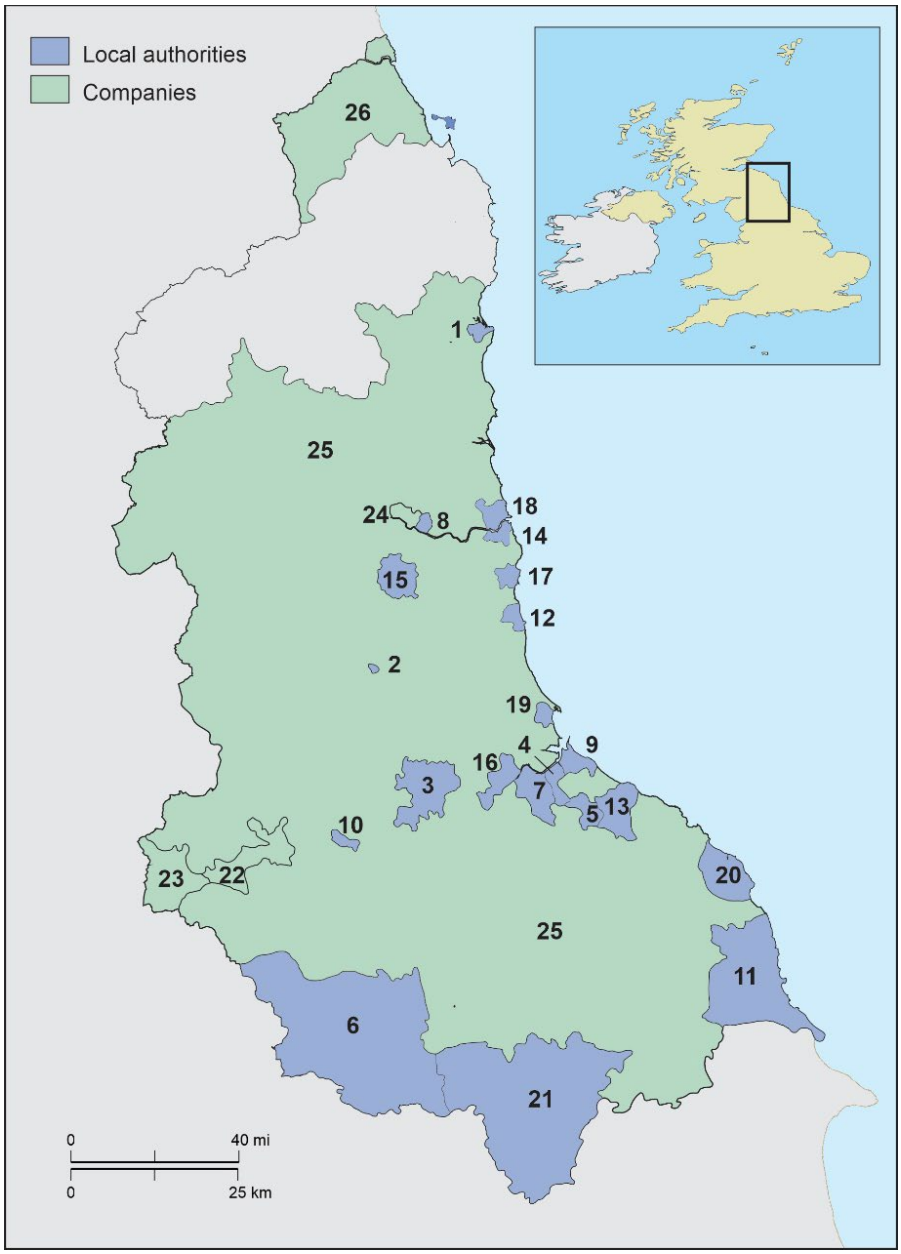

Figure 1 NORTH EASTERN ELECTRICITY BOARD CONSTITUENT UNDERTAKINGS 1948.

[3] The averages for the area boards in England and Wales were 34.5 percent domestic and 50.2 percent industrial in 1948/49. Calculated from data in Electricity Council, ***Handbook of Electricity Supply Statistics*** 1977 edition, pp.64-65.

Table 1 NORTH EASTERN ELECTRICITY BOARD AREA CONSTITUENT UNDERTAKINGS 1948.

Local Authorities	
1	Amble UD
2	Crook & Willington UD
3	Darlington CB
4	Eston UD
5	Guisborough UD
6	Harrogate MB
7	Middlesbrough CB
8	Newcastle-upon-Tyne CB
9	Redcar MB
10	Richmond (Yorks) MB
11	Scarborough MB
12	Seaham UD
13	Skelton & Brotton UD
14	South Shields CB
15	Stanley UD
16	Stockton-on-Tees MB
17	Sunderland CB
18	Tynemouth CB
19	West Hartlepool CB
20	Whitby UD
21	York CB
Companies	
22	Askrigg & Reeth ES Co
23	Hawes EL Co
24	Newcastle & District EL Co
25	North Eastern ES Co
26	Scottish Southern ES Co

Key to Abbreviations
CB: County Borough
EL Co: Electric Light Company
ES Co: Electricity Supply Company
MB: Municipal Borough
UD: Urban District

Development of Electricity Supply Areas

The 1948 pattern illustrated in **Figure 1** and **Table 1** represented the climax of over 50 years of development. Unusually for an innovation, electricity for public supply was subject to tight national regulations from an early stage. The Electric Lighting Act 1882 required "undertakings" to apply for a licence or provisional order from the Board of Trade.[4] This requirement followed the precedents for earlier public utilities which had to "break up the streets" to lay mains or tracks. Electric Lighting Orders provided the basic conditions of a franchise to operate within a defined area, limiting the maximum prices that could be charged to consumers and, for private companies, a time limit of 21 years after which the local authority could purchase the system. An amendment in 1888 extended the time period

[4] Basic details of this Act and subsequent legislation are outlined in ***Electricity Supply in Great Britain: A chronology*** (London: Electricity Council, 1977).

to 42 years. All the Electric Lighting Orders were subject to Parliamentary approval. Major changes such as amalgamation of companies and extension of area required special acts.

Only a few public electricity systems were established under the 1882 Act. By 21 December 1882 the Board of Trade had received 109 applications for Electric Lighting Orders. After scrutiny by the office and Parliament, 69 ELOs were granted to local authorities and companies. Eight of these came to fruition over the next decade, while the others were abandoned as the early optimism waned given the uncertainties of the market for electricity and the limitations of early technology. Two of the applications in 1882 came from the North East. Electric Lighting Orders were granted to both applicants—Scarborough Corporation and the North Eastern Electric Light and Power Co. for Sunderland.[5] Neither scheme was implemented.

Although general urban electrification failed to take off in the region, private systems began to develop. Private systems provided a market for electrical equipment, helped in the training of electrical workers, and gave opportunities to refine details of the new technology.

The North East was the centre of several major innovations at this time. Sir William Armstrong had installed an arc lamp at his country retreat Cragside near Rothbury in 1878, powered by a water turbine.[6] Two years later he added 45 incandescent lamps made by his friend Joseph Swan (1828-1914) who had already installed this new type of light at his Gateshead residence. The Swan Electric Light Co. was formed in 1881 and began manufacturing light bulbs at a factory in Benwell. After a merger with the Edison interests in 1883, production of the "Ediswan" lamps was transferred to Ponders End, Middlesex. Charles A. Parsons (1854-1931)[7] developed the steam turbine for electricity generation in 1884 at the Gateshead works of Clarke, Chapman & Co.[8] He established C.A. Parsons & Co. with works at Heaton In 1889 and was one of the founding members of the Newcastle& District Electric Light Co.

The Royal Jubilee Mining, Engineering and Industrial Exhibition opened by the Duke of Cambridge in May 1887 was the first major exhibition to be held in Newcastle. As in all the exhibitions of the decade, electric lighting was a feature, not only in the buildings but also for illuminating the gardens. Most of the generating equipment was supplied by Clarke, Chapman & Parsons Co. which was able to display the benefits of the recently developed Parsons steam turbine. Although overshadowed by the much larger Manchester exhibition, the Newcastle venue attracted around two million visitors.[9]

Public electricity supply schemes began to take off in 1889-90 when applications for Electric Lighting Orders resumed. Nationally, there were 17 applications in 1889 and 161 in 1890. Two companies, the Newcastle and District Electric Light Co. and the Newcastle-upon-Tyne Electric Supply Co., had applied for licences in 1889 and both were granted on 21 March 1890 and full public service was inaugurated shortly afterwards.[10] Twelve applications from the North East were submitted to the Board of Trade for the 1890 Parliamentary session. Four were made by the House-to-House Co. affiliates, the most active

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[5] "Report by the Board of Trade respecting the applications to and Proceedings of, the Board of Trade under the Electric Lighting Act 1882," ***Parliamentary Papers*** 1883. HC 237.

[6] Geoffey A. Irlam, "Electricity supply at Cragside," ***Industrial Archaeology Review*** 11 (2), 1989, pp.187-195. See also: Maureen Dillon, ***Artificial Sunshine: a social history of domestic lighting*** (London: The National Trust, 2002). Chapter 6 "Lighting by electricity''.

[7] A.T. Bowden, "Charles Parsons--Purveyor of Power", in E.G. Semler ed***. Engineering Heritage: Highlights from the history of mechanical engineering*** Vol.2 (London: Heinemann for Institution of Mechanical Engineers, 1966), pp.139-144.

[8] T. McGovern & T. McLean, "The growth and development of Clarke, Chapman from 1864 to 1914", ***Business History*** 55 (3), 2013, pp.448-478.

[9] K.G. Beauchamp, ***Exhibiting Electricity*** (Stevenage: Institution of Electrical Engineers, 1997), pp.151-152.

[10] Board of Trade, "Proceedings under the Electric Lighting Acts", ***Parliamentary Papers*** 1889. HC 229.

enterprise nationally in that year.[11] None were successful. Only three Electric Lighting Orders were granted—to the Corporations of Darlington, Stockton-on-Tees and York.[12] These municipalities were, however, very slow in taking any action and began a public supply only in 1900.

The two Newcastle companies were active in development after 1890 and were soon granted Electric Lighting Orders to supply the whole city area and divided their operations by a "gentleman's agreement". Newcastle & District took the western half and NESCO the eastern; Grainger Street was part of the boundary between the companies. A company in Scarborough, to which the Corporation had transferred the ELO, was the next to develop a public services, in 1893. By its early use of Parsons steam turbines, the Scarborough operation had some linkages with Newcastle.[13]

While the Board of Trade developed regulations for safety, inspected and approved new systems as well as collecting annual returns, the Board provided no guidance on general policy or technical matters. These were left to the operator and consulting engineer to decide. Consequently after 1888 large numbers of fragmented operators developed DC and AC systems with little attempt at co-ordination. AC systems with frequencies varying from 25 cycles (Hz) to 100 cycles were established. The lack of standardisation would become a major problem when interconnection between areas became advantageous.

An outline of development is presented in three phases: local initiatives from the 1880s to World War I, state intervention to the 1940s, and nationalisation from 1948.

I Local Initiatives

Figure 2 and **Table 2**, derived from a rare map of electricity undertakings in the British Isles, provide a snapshot of the development of public supply areas over the previous three decades.

The 10 local authorities were clear examples of local initiatives in developing electric light and power. Sunderland Corporation (population 172,471 in 1911) was the largest of the local authorities. Whitby Urban District (population 11,139) was the smallest on the list. South Shields and Sunderland had opened municipal systems in 1896, several years later than the private companies that had begun operations in Newcastle-upon-Tyne (population 266,603).

[11] In Darlington, Newcastle-upon-Tyne, Scarborough and York. The House-to-House Electric Lighting Co. had been formed in 1888 by Robert Hammond (1850-1915). He had begun his electrical interest a decade earlier in the North East where he had installed arc lighting in several iron works. As a consulting engineer Hammond designed the municipal system in Middlesbrough opened in 1900. See: Brian Bowers, "Hammond, Robert (1850-1915), Consulting electrical engineer", in D.J. Jeremy ed., ***Dictionary of Business Biography*** Vol. 3, (London: Butterworth, 1985), pp.21-23. Obituary, ***The Engineer***, Vol.120, 1915, p.156.

[12] Board of Trade, "Proceedings under the Electric Lighting Acts", ***Parliamentary Papers*** 1890. HC 279.

[13] R.H. Parsons, ***The early days of the power station industry*** (Cambridge: Cambridge University Press for Babcock & Wilcox Ltd, 1939), pp.176-178.

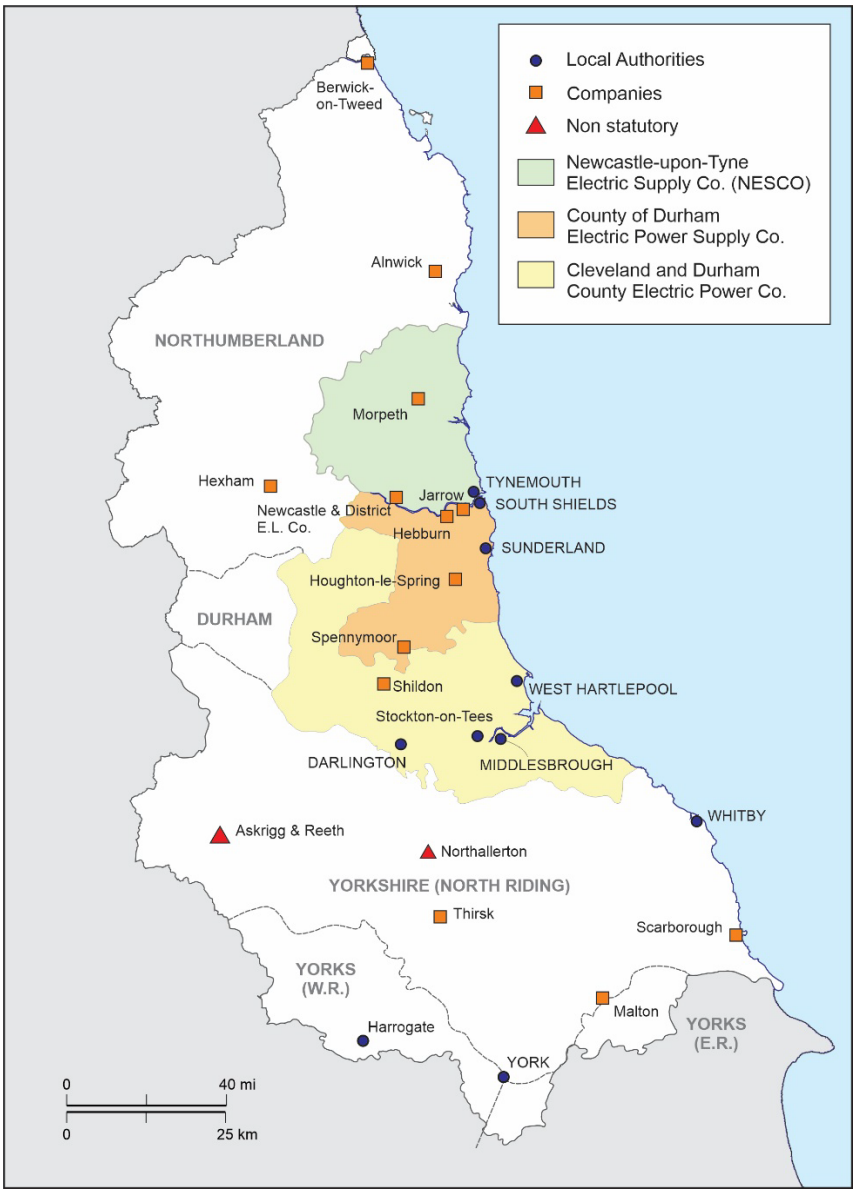

Figure 2 NORTH EASTERN ENGLAND ELECTRICITY UNDERTAKINGS, 1912.

The 20 company undertakings in the table also resulted from local or regional initiatives. Berwick-on-Tweed was the only undertaking owned by an organisation from outside the North East. The companies varied in size from large city-region operations to small rural non-statutory entities. By this time, 12 company undertakings were part of the Newcastle-upon-Tyne Electric Supply Co. (NESCO) and Associated Companies group.[14] The only remaining major independent companies were the Newcastle & District Electric Lighting Co. and Scarborough Electric Supply Co.

[14] In addition to the broad powers conferred by the Power Acts, the NESCO group held at least 36 Electric Lighting Orders covering the more closely settled areas.

Table 2 NORTH EASTERN ELECTRICITY BOARD AREA ELECTRICITY SUPPLY UNDERTAKINGS C.1912.

UNDERTAKING	COUNTY	SUPPLY BEGAN
Local Authorities		
Darlington	Durham	1900
Harrogate	Yorks (West Riding)	1897
Middlesbrough	Yorks (North Riding)	1900
South Shields	Durham	1896
Stockton-on-Tees	Durham	1906
Sunderland	Durham	1896
Tynemouth	Northumberland	1901
West Hartlepool	Durham	1901
Whitby	Yorks (North Riding)	1902
York	Yorks	1900
Companies		
Alnwick*	Northumberland	1902
Askrigg N/S	Yorks (North Riding)	1910
Berwick-on-Tweed	Northumberland	1903
Cleveland & Durham County EP Co*	Durham/Yorks (NR)	1906
Durham County EP Distn Co*	Durham	1901
Durham County EP Supply Co*	Durham	1901
Hebburn*	Durham	1903
Hexham	Northumberland	1906
Houghton-le-Spring Co*	Durham	1905
Malton*	Yorks (North Riding)	1904
Morpeth*	Northumberland	1904
Newcastle & District EL Co	Northumberland	1890
Newcastle-upon-Tyne ES Co*	Northumberland	1889
Northallerton N/S	Yorks (North Riding)	1899
Reeth N/S	Yorks (North Riding)	1910
Saltburn N/S	Yorks (North Riding)	1899
Scarborough	Yorks (North Riding)	1903
Shildon*	Durham	1905
Spennymoor*	Durham	1902
Thirsk*	Yorks (North Riding)	1904

Notes:
*NESCO and Associated Companies
N/S non statutory undertaking (outside 1882/1888 Acts).
Source: "Map showing Electric Lighting, Power and Traction Undertakings in Operation." Supplement to ***Garcke's Manual of Electrical Undertakings.*** Undated but c 1912. [Copy from National Library of Scotland].

The map is dominated by the Newcastle-upon-Tyne Electric Supply Company (NESCO) ad its Associated Companies. By 1912 this was an integrated power system with multiple generating stations and a high-voltage transmission system extending from Blyth in the north to the Cleveland iron mines in the south. NESCO was, by far, the largest and most successful of the regional power companies in Britain.[15]

[15] NESCO is well covered in the general histories. See: I.C.R. Byatt, ***The British Electrical Industry 1875-1914: the economic returns to a new technology*** (Oxford: Clarendon Press, 1979); Leslie Hannah, ***Electricity before Nationalisation*** (London: Macmillan, 1979); R.A.S. Hennessey, ***The Electric Revolution*** (Newcastle-upon-Tyne: Oriel Press, 1972); Thomas P. Hughes, ***Networks of Power: Electrification in Western Society 1880-1930*** (Baltimore: Johns Hopkins University Press, 1983). For a recent interpretation of NESCO development, see: T. McGovern and T.

From 1900 NESCO had expanded rapidly from its original urban base in the eastern half of Newcastle to cover an extensive area of southern Northumberland. This area included the densely developed industrial zone along the north bank of the Tyne, the northern residential suburbs of Newcastle and the seaside resort of Whitley Bay. The electrification of the North Eastern Railway's lines in 1904 (developed in association with NESCO) provided a new level of integration of these districts. Colliery towns and settlements were also an important market for electric power in the southern part of the NESCO area. The Newcastle & District Electric Lighting Co. (which was about the same size as NESCO in 1896) had been overtaken by its rival and was now confined to a small area of only 13 square miles in the western part of the city and Newburn Urban District.[16]

South of the Tyne, the closely related County of Durham Electric Power Supply Co. and the County of Durham Electrical Power Distribution Co. had been bought from the British Electric Traction Co. in 1905. Agreements with the Durham Collieries Electric Power Co. in 1907 added a new power station at Philadelphia which also served the adjacent Houghton-le-Spring Company with electricity.

Tees-side industrial area was served by the Cleveland & Durham County Electric Power Co. incorporated by an Act of 1901.Technical and financial problems brought this company into the orbit of NESCO by 1906 (although full control was delayed until 1917).

The Northern Counties Electricity Supply Co. formed in 1900 was very successful in acquiring Electric Lighting Orders in many of the smaller towns across the region. By 1906 it had become a subsidiary of the Cleveland & Durham Co. and some of the ELOs such as Consett were transferred to the new parent organisation. In 1912 Northern Counties were operating local systems in Alnwick, Morpeth, Hebburn, Spennymoor, Shildon, Thirsk and Malton.

Some of the main technical features of this innovative regional system are illustrated in **Figure 3**. At the core of the operation was the control room at Carville power station that directed the working of some 16 power stations located between the Tyne and the Tees.[17]

The principal generating stations in 1911 were:

	OPENED	***CAPACITY (KW)***
Neptune Bank	1901	5,200
Carville	1904	39,000
Dunston	1910	23,000
Hebburn	1903	3,200
Philadelphia	1905	9,000
Grangetown	1906	6,000

McLean, "The genesis of the electricity supply industry in Britain: A case study of NESCO from 1889 to 1914", ***Business History*** 59 (5), 2017, pp.667-689.

[16] F.A. Orchard, "The history of a pioneer undertaking", ***Journal of the Institution of Electrical Engineers*** Vol.84, 1939, pp.49-53.

[17] A visit by members of the Iron and Steel Institute in October 1908 observed the work of the System Engineer at Carville "who is in direct telephone communication with each sub-station in the area which now covers some 700 square miles." The Iron & Steel Institute, ***Proceedings***, Middlesbrough 1908. Works Visits. Grace's Guide to British Industrial History website (www.gracesguide.co.uk)

The first three stations were designed by Merz and McLellan for NESCO and incorporated many model features for their time.[18] All the stations were powered by turbines and worked at 40Hz, the frequency chosen by Merz when planning Neptune Bank in 1899-1900.[19]

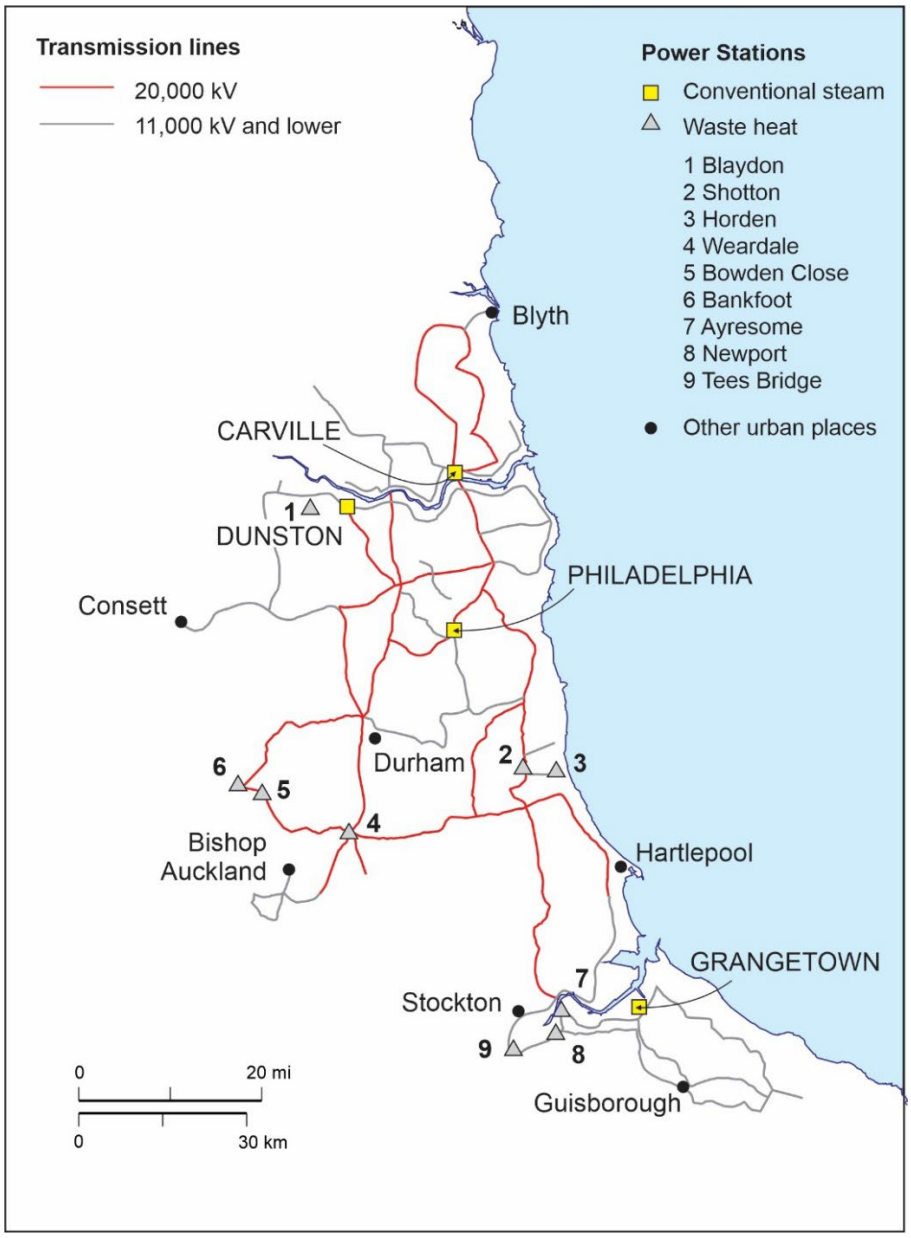

Figure 3 NESCO: REGIONAL POWER SYSTEMS, 1911.

[18] For some contemporary descriptions of these power stations, see: Neptune Bank—I.Mech.E. ***Proceedings*** 1902, pp.453-463; Carville—C.H. Merz and W. McLellan, "Power house design", ***Journal*** Institution Electrical Engineers, Vol.33, 1903-4, pp.696-747; Dunston—***The Engineer*** Vol.112, 1911, pp.2-6. 44-45, 64-65.

[19] John Rowland, ***Progress in power*** (Merz and McLellan, 1960), pp.24-25. The 40Hz frequency was a compromise, high enough to avoid any flicker in lights but low enough for rotary converters needed for DC traction. Only Cardiff, Derby and Ealing systems worked at this frequency.

Waste heat power stations were a distinctive feature of the North East. There was a co-operative arrangement between the power company and the owners of coke ovens and iron and steel plants. In the case of the Weardale station (5,000kW), waste gas from the coke ovens was used for firing the water tube boilers that fed the steam turbines. The Tees Bridge station (3,000kW) used the exhaust steam from the blowing engines at the iron works to power the turbines.[20]

All the power stations were linked together by a network of transmission cables and overhead lines. The initial Tyneside network at 5,500 volts was extended from Carville to Philadelphia in 1907 by a 20,000-volt cable, and this voltage became the standard for the whole network n Durham and Northumberland.[21] After World War I some new trunk lines were built at 66,000 volts. Beyond the regional transmission lines NESCO also operated several small power stations in places such as Alnwick, Morpeth, Thirsk and Malton.

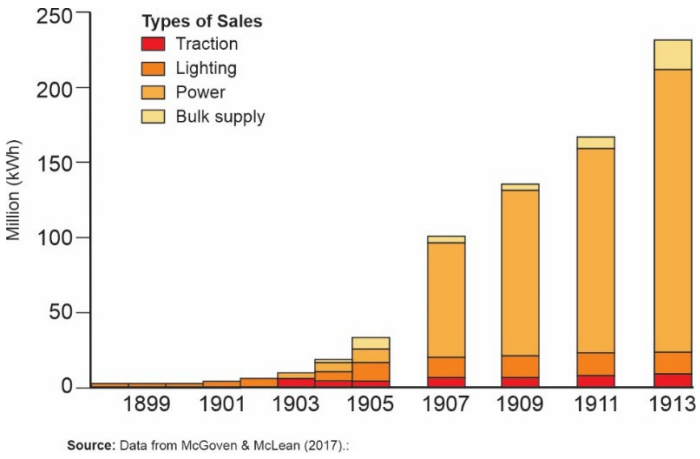

Figure 4 NESCO: GROWTH OF SALES 1898-1913.

Figure 4 shows the transformation of NESCO from an average town lighting company to a large regional industrial supply organisation. Sales expanded dramatically from 33.38million kWh in 1905 to 99.7m kWh in 1907 and grew at a fast pace thereafter.[22] As in many municipal operations, traction supply provided a valuable boost in the early years of the transformation.

By 1911 NESCO was substantially larger than other regional power companies in Britain. The Clyde Valley Electrical Power Co. which had begun operations in 1905 had total sales of 34.01m kWh.[23] North Metropolitan Electric Power Supply which had started a little earlier was selling only 26.45m kWh in 1911.[24] Sales by the Lancashire Electric Power Co. and the Yorkshire Electric Power Co. were somewhat smaller at this time.

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[20] John F.C. Snell, ***Power house design*** (London: Longmans, Green, 1911), pp.292-296.
[21] John Rowland, ***Progress in power*** (Merz and McLellan, 1960), pp. 49-50.
[22] The sales statistics are derived from Table 2 in T. McGovern and T. McLean, "The genesis of the electricity supply industry in Britain: A case study of NESCO from 1889 to 1914", ***Business History*** 59 (5), 2017, pp.667-689.
[23] John C. Logan, "An economic history of the Scottish electricity supply industry 1878-1930". PhD thesis, University of Strathclyde, 1983, Vol.2, Table 34, p.429.
[24] Garcke's ***Manual*** Vol.18, 1914/15, p.747.

Much of the development of NESCO and the Associated Companies in the formative period as a regional company came from the efforts of Charles H. Merz (1874-1940), "…the engineering brain behind the whole North-East scheme; a man with just the right combination of vision, optimism and technical skill."[25] His consulting firm Merz & McLellan designed the innovative power stations at Neptune Bank (opened by Lord Kelvin 18 June 1901), Carville and Dunston, developed the transmission system with high-voltage cables, and pioneered the waste heat power stations. A London office was opened by 1904 and became a base for Parliamentary work and negotiating overseas projects. Merz and McLellan continued to work for NESCO while expanding their roles elsewhere in Britain and beyond.[26]

R.P. Sloan, an early associate of Merz, was appointed manager of NESCO in 1903.[27] Over the next 40 years as managing director and chairman, he provided the company with effective management and stability.

Electrification in the region was still incomplete with only a small part covered by Electric Lighting Orders. Even when there were ELOs in place, they were not always developed by the local authorities or companies. Stanley Urban District (population 23,234 in 1911), Seaham Harbour (15,757) and Redcar all appear to have been without a public supply system. The smaller market towns such as Ripon (8,218), Knaresborough (5,315), Barnard Castle (4,757) and Richmond (3,934) were unserved.

Lighting was still the dominant use for electricity until the late 1890s. The most profitable demand was in shops, offices, hotels, theatres (and later cinemas) and public buildings. Residential sales were more limited—by the expense of installation and the high retail prices. With lighting, much of the load on generating equipment was confined to the evening hours, a feature that also contributed to the high prices. Diversification of the load to other uses, especially in the daytime, was essential if electricity was to become a viable alternative to gas. Such diversification began with the electrification of tramways and the substitution of electric motors for small steam engines and manual power.

The 1912 data do not cover private generation which was very important at the time, not only in isolated establishments but also in urban centres where there was already a public supply. Some examples are outlined here to give a sense of the scale and scope of private generation otherwise absent in most accounts of electrification.

Although NESCO established an early dominance in industrial power supply on Tyneside, some firms continued to generate their own power. In Jarrow, for example. Palmer's Shipbuilding and Iron Co. had a large central powerhouse with two 750kW generators by 1901.[28] The company continued its policy of self-sufficiency until bankruptcy and closure of the works in 1933.

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[25] I.C.R. Byatt (1979), p.117. See also Leslie Hannah, "Charles Hesterman Merz 1874-1940—Consulting engineer", in David J. Jeremy ed., ***Dictionary of Business Biography*** Vol.4 (London: Butterworths, 1986), pp.221-227.

[26] John Rowland, ***Progress in Power: The contributions of Charles Merz and his associates to sixty years of electrical development 1899-1959*** (London: Newman Neame for Merz and McLellan, 1960).

[27] Robert Patrick Sloan (!874-1947). See: "The retirement of Mr R.P. Sloan", ***The Engineer*** Vol 181, 1946, p.281. When he joined the company in 1903 annual sales were about 10 million kWh and the supply area covered 185 square miles. By 1945 sales had risen to 1,814m kWh and the area of supply had been extended to 5,640 sq. miles.

[28] ***The Engineer*** Vol. 91, 1901, p.507.

ELECTRIC TRAMWAY SYSTEMS IN NORTH EASTERN ENGLAND[1]

	YEARS OPERATING	*ROUTE MILES*	*MAX NO.OF CARS*
Darlington Corporation	1904-1926	4.87	24
Gateshead & District Co.	1901-1951	12.47	99
Hartlepool Electric Tramway Co.[2]	1896-1927	6.98	42
Jarrow & District Co.	1906-1928	2.54	12
Middlesbrough, Stockton & Thornaby Co.[3]	1898-1921	9.61	60
Middlesbrough Corporation	1921-1934	5.49	40
Newcastle-upon-Tyne Corporation	1901-1950	51.27	328
Scarborough Co.	1904-1931	4.78	29
South Shields Corporation	1906-1946	7.51	59
Stockton & Thornaby Joint Corp.	1921-1931	3.76	29
Sunderland Corporation	1900-1954	12.24	140
Sunderland District Co.	1905-1925	14.28	57
Tynemouth & District Co.	1901-1931	4.23	24
Tyneside Tramways Co.	1902-1930	10.99	30
York Corporation	1909-1935	8.49	50

Thirteen distinct electric tramway systems were developed between 1896 and 1909, eight by companies and five by local authorities. Newcastle and Sunderland Corporations owned the largest systems in the region. Independent power stations were built for the Hartlepool (1,258kW). Middlesbrough, Stockton & Thornaby (900kW) and Newcastle (5,100kW) systems. The Newcastle Corporation's station at Manors generated 19.2million kWh in 1927/8, larger than the total output of South Shields (12.6m kWh). Manors station closed in 1936 and the Corporation bought its supply from NESCO.

Tramway power supply as a proportion of total sales was very important in the early years and ensured the viability of many public supply systems. By 1925/26 tramway power sales in South Shields represented 24.0 percent of total electricity sales. In Stockton-on-Tees the proportion was also substantial at 22.9 percent. For other places such as Sunderland, Tynemouth and York the proportion at this time was around 10 percent.

Traction sales were also significant in the early expansion of NESCC as a power company, reaching a peak of 40.5 percent of total sales in 1905. These began with a supply to Tyneside Tramways and Tramroads in 1902. The electrification of the north Tyneside suburban lines of the North Eastern Railway, opened in March 1904, gave a major boost to sales and ensured the viability of the new Carville power station.[4] With this generating station in service NESCO had the capacity to meet the demands of Tyneside industrial concerns.

Other electrified railways in the region also depended on NESCO power supplies. The Horton Coal Company began operations on its colliery lines around South Shields in 1908.[5] A further collaboration between NESCO, Merz & McLellan (as consulting engineers) and the North Eastern Railway saw the opening of the Shildon-Newport (Middlesbrough) line in 1915. This overhead catenary 1500-volt DC system included ten locomotives each capable of handling 1,400-ton coal trains.[6] The line became a prototype for mainline railway electrification in Britain and other parts of the world. In the immediate postwar period, the Shildon line inspired plans for the larger-scale electrification of the North Eastern's York-Newcastle mainline.[7] These plans were however set aside in the economic recession and financial retrenchment of 1921-22.

Notes

[1] Compiled from Keith Turner, ***Directory of British Tramways***, Vol.3 (Stroud: The History Press, 2010).

[2] Sold to West Hartlepool Corporation.

[3] Sold to constituent local authorities in 1921 when the franchise expired.

[4] The work was described in a paper by Charles H. Merz and William McLellan at the British Association for the Advancement of Science, Cambridge: "The use of electricity on the North Eastern Railway and upon Tyneside". See: ***The Engineer*** Vol.98, 1904, pp.260-262, 283-284.

[5] William J. Hatcher, ***The Horton Electric Railway*** (Oxford: The Oakwood Press, 1994).

[6] "The Shildon-Newport electrification scheme", ***The Engineer*** Vol. 121, 1916, pp.433-437.

[7] R.A.S. Hennessey, ***The electric railway that never was, York-Newcastle 1919*** (Newcastle-upon-Tyne: Oriel Press, 1970).

Many of the shipbuilding and allied engineering works in Sunderland and the Hartlepools also had independent generating facilities by 1902.[29] On Tees-side the large iron and steel plants had a tradition of private generation from the 1890s.[30] In 1912 Dorman, Long & Co. opened a new power station (capacity 5,120kW) at the Britannia Iron & Steel Works in Middlesbrough. This plant was designed to power the electric drive at the new rolling mills.[31] Such development illustrated the limitations of public supply in the area. Middlesbrough Corporation's capacity (1,600kW DC) and the Grangetown station (6,000kW) of the Cleveland & Durham Co. were clearly inadequate for new demands.

Elsewhere other heavy industrial firms such as the Consett Iron Co.[32] and the Darlington Forge Ltd[33] continued to build new generating facilities in the 1920s although public supplies were available in both towns. Rowntree's cocoa and confectionery works in York was another early private generator where the availability of process steam in the factory and the absence of large-scale public supply were deciding factors.[34] The Rowntree's factory had given up generating by 1936 when it was using about 14 million kWh taken from the city system.[35] This level of power consumption was higher than the annual sales of Scarborough or West Hartlepool (each around 12m kWh).

Although private industrial growth was probably at its peak around 1920, some new firms continued to invest in new power plant. The Anglo-Scottish Sugar Beet Corporation at Poppleton, York opened in 1926, generated its own electricity.[36] At Billingham, a late World War I chemical complex had been closely linked with the building of the adjacent North Tees power station (a NESCO subsidiary). When Imperial Chemical Industries was formed in 1926, the new management decided to invest in a new facility producing process steam and electricity. The power plant with three 12,250kW turbines opened in 1930.[37] Later expansion more than doubled this capacity.[38]While NESCO continued to supply some of the ICI demand, no further extensions were made to the North Tees station after 1927. When ICI began to develop a new complex at Wilton on the south bank after 1945, the company also built a generating plant that had a capacity of 60,000kW by the mid-1950s.[39]

Hotels were early in adopting electric lighting as one of the amenities of high-class hospitality. This was evident in the resorts and spas of the North East such as Scarborough and Harrogate. The Zetland Hotel at Saltburn-by-the-Sea installed electric lighting in 1899 with the current supplied by the newly formed but non-statutory electricity company.[40]

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[29] Institution of Mechanical Engineers, ***Proceedings*** 1902, works visits at the Newcastle summer meeting.
[30] I.Mech.E. ***Proceedings*** 1893, works visits at the Middlesbrough summer meetings.
[31] ***The Engineer*** Vol.114, 1912, pp.218-221.
[32] This private plant had two 3,000kW turbines which also worked in parallel with the Cleveland and Durham County public system. ***The Engineer*** Vol.143, 1927, p.682.
[33] I.Mech.E. ***Proceedings,*** 1925. Works visits at the Newcastle summer meeting, p.1059.
[34] I.Mech.E. ***Proceedings,*** 1903. Works visits at the Leeds summer meeting, p.640. By this time Rowntree's was generating about one million kWh annually, equal to or larger than the York Corporation's Foss Island power station opened in 1900.
[35] I.Mech.E. ***Proceedings,*** 1936. Works visits at the York summer meeting, pp.184-185.
[36] I.Mech.E. ***Proceedings,*** 1936, pp.173-174.
[37] L. Hannah, ***Electricity before nationalisation*** (1979), pp.178-179.; H.A. Humphrey, D.M. Buist & J.W. Bansell, "The steam and electric power plant of Imperial Chemical Industries Ltd, Billingham", ***Journal*** Institution of Electrical Engineers, Vol.68, 1930, pp.1233-1275.
[38] This innovative power station had a capacity of 90,000kW in 1936. Using pulverised coal firing (unusual for the time in Britain) the boiler plant worked at 80lbs per square inch. I.Mech.E. ***Proceedings,*** 1936, p.193
[39] J.W. House and B. Fullerton, ***Tees-side at mid-century: an industrial and economic survey*** (London: Macmillan, 1960), p.178.
[40] Oliver Carter, ***An illustrated history of British railway hotels 1838-1983*** (St Michaels Lancs: Silver Link Publishing, 1990), p.85.

Other large institutions of a different type were also introducing electric lighting. The York City Asylum at Naburn opened in 1906 had electricity service from the beginning.[41]

Throughout the region country houses, estates and large farms added electricity. A small hydro-electric plant was installed in 1889 to serve Alnwick Castle.[42] In contrast, two Parsons 32kW steam turbines were fitted in the new engine house at Lambton Castle during 1891-92.[43] Brancepath Castle, south of Durham, also included an electric power station in the extensive range of estate buildings.[44]

II State Intervention

Difficulties of interconnection, differences in AC frequencies, and the need for coal conservation by using larger-scale plant became major issues in World War I when electricity usage nearly doubled. The Electricity (Supply) Act 1919 created a new organisation, the Electricity Commissioners, to replace the role of the Board of Trade. While the initial proposals for national restructuring were thwarted, the Electricity Commissioners managed to develop plans for more efficient and lower-cost generation and to encourage the expansion of service areas to supply small towns and rural villages.

A key mandate of the Commissioners was the restructuring of generation and transmission in the major industrial regions. This was to be achieved by the creation of Joint Electricity Authorities. Many of the background ideas that shaped the legislation had stemmed from the work of Charles Merz on the wartime Coal Conservation Subcommittee and the later Board of Trade Committee.[45] Merz, using his experience with NESCO, emphasised the value of large power stations and a regional transmission system in generating and distributing electricity at low cost and high fuel efficiency. With these features already in place, there was little need for state intervention in the North East at this time.

The creation of new electricity systems by local authorities after 1912 was the only major change in the structure of the regional supply industry. New entrants were as follows:

1915 Skelton & Brotton
1920 Annfield Plain, Masham
1922 Eston
1923 Amble
1924 Crook & Willington, Knaresborough, Redcar
1925 Guisborough, Tanfield
1926 Scarborough MB

Annfeld Plain, Masham and Scarborough were municipal takeovers of companies; the others were wholly new creations.

NESCO built three power stations after 1912. Carville B station, opened in 1916, had a capacity of 55,000kW. The North Tees A station (40,000kW) was built 1917-21 in an isolated area beyond Stockton

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[41] Kathrin A. Webb, ***From County Hospital to NHS Trust: the history and archives of NHS Hospitals, sources and management in York 1740-2000*** Vol 1 (York: Borthwick Publications, 2002). For Naburn Hospital see pp.94-107.
[42] Christopher Hunwick. "A dynamo for a Duke: Hydro-electric power at Alnwick Castle", Chapter 8 in P.S. Barnwell and Marilyn Palmer, eds. ***Country House Technology*** (Donnington, Lincs: Shaun Tyas Publications, 2012) pp.124-135.
[43] "Electric lighting plant at Lambton Castle", ***The Engineer*** Vol.73, 1892, p.150.
[44] The power station is clearly marked on the Ordnance Survey Six Inch Map, Durham Sheet XXVI. Revised 1915 (National Library of Scotland).
[45] Ministry of Reconstruction, ***Coal Conservation Subcommittee, Interim Report on Electric Power Supply in Great Britain***, April 1917, Cmd 8880; ***Report of the Committee appointed by the Board of Trade to consider the question of Electric Power Supply***, 1918, Cmd 9062. See also Rowland, ***Progress in Power*** (1960), pp.65-70.

and included a model village of 73 houses for employees.[46] B station (70,000kW) was completed in stages between 1923 and 1927.[47]

York Corporation in 1923 opened the 750kW hydro-electric station at Linton Lock to provide supplementary power to the municipal system using the substantial flow of the River Ouse.[48]

The 31 undertakings in 1925/26 (**Table 3**) operated a variety of systems. Most were wholly AC or mixed AC/DC reflecting the shift away from DC that had been popular in the early years of electrification. With an economic operating radius of 1-1.5 miles from the generating plant, DC was suitable only for city centres or small towns and villages. Masham and Malton/Norton were the only remaining wholly DC systems, although many non-statutory companies continued to use DC.

The dominant AC frequency in the region was 40Hz selected by NESCO in 1899-1900 as the company planned its expansion. Sunderland, South Shields and Darlington all worked at 50Hz while Scarborough and part of the Newcastle & District worked at 80Hz. Standardising the regional system at 50Hz would be a major project in the coming decade.

Data on generating capacity show a huge range in size from NESCO with over 200,000kW to Masham UD with 30kW. Steam turbines were dominant, ranging from 20,000kW units at North Tees power station[49] to a small 150kW machine at Scarborough. Most of the reciprocating steam engines previously employed had already been retired from service.

Statistics on electricity consumption per head of population reveal major contrasts between electricity undertakings. Five places exceeded 100.0kWh per person; Darlington at 233.6kWh was the highest in the region.

Each place had a distinctive market profile reflecting the local economic and social geography. Sunderland's profile in 1925/26 consisted of 15.5 percent in the lighting segment, 5.0 percent in public lighting, 10.9 percent for the tramways and 68.6 percent in power. Two towns, Darlington and Stockton-on-Tees with similar-sized populations (around 66,000) had very different market profiles. Total sales of electricity in Darlington amounted to 15.37milion kWh while Stockton's sales were only 4.65m kWh. Industrial power sales in Darlington accounted for 74.3 percent of total sales while in Stockton this market segment was only 39.7 percent. Annual per capita sales in Darlington amounted to 233.6kWh in contrast to Stockton at 70.1kWh.

Electrification and extension of supply areas were given a new impetus following the Weir Report (1925),[50] the Electricity (Supply) Act 1926 and the formation of the Central Electricity Board in 1927.

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[46] Details of this station were noted in the I.Mech.E. ***Proceedings*** 1925, pp.1021-1022.
[47] Technical descriptions were published in ***The Engineer*** Vol.137, 1924, pp.664-667
[48] ***The Engineer***, Vol.136, 1923, pp.149-150.
[49] The North Tees A & B stations were not listed in the ***Engineering and Financial Statistics*** 1925/26. An estimate of 60,000kW capacity is included in the data for Table 3.
[50] Ministry of Transport***, Report of the Committee appointed to review the National Problem of the Supply of Electrical Energy*** (London: HMSO, 1927), 39 pp. Charles Merz was a member of the technical sub-committee that provided much of the evidence for the Weir report. In a paper presented to the British Association for the Advancement of Science, Newcastle, 1916, Merz had concluded: "What is fundamentally and immediately necessary is the establishment of a national trunk mains distribution system." See: John Rowland, ***Progress in Power*** (1960) especially pp.63-64, 78-80.

Table 3 NORTH EASTERN ELECTRICITY BOARD AREA ELECTRICITY SUPPLY UNDERTAKINGS 1925/26.

UNDERTAKING	COUNTY	SYSTEM	GENERATING CAPACITY kW	PER CAPITA CONSUMPTION kv
Local Authorities				
Amble UD	Northumberland	AC(40)	-	17.7
Annfield Plain UD	Durham	AC(40)	-	17.6
Crook UD	Durham	AC(40)	-	13.0
Darlington CB	Durham	AC(50)/DC	14,000	233.6
Eston UD	Yorks (North Riding)	AC(40)	-	18.7
Guisborough UD	Yorks (North Riding)	AC(40)	-	1.2
Harrogate MB	Yorks (West Riding)	AC(50)	7,810	97.7
Knaresborough UD	Yorks (West Riding)	AC(50)	-	10.5
Masham UD	Yorks (North Riding)	DC	30	11.1
Middlesbrough CB	Yorks (North Riding)	AC(40)/DC	2,300	62.3
Redcar MB	Yorks (North Riding)	AC(40)	-	15.0
Scarborough MB	Yorks (North Riding)	AC(80)/DC	4,250	53.0
Skelton & Brotton UD	Yorks (North Riding)	AC(40)	-	16.1
South Shields CB	Durham	AC(50)/DC	8,810	71.7
Stockton-on-Tees MB	Durham	AC(40)/DC	--	70.1
Sunderland CB	Durham	AC(50)/DC	23,000	132.3
Tanfield UD	Durham	AC(40)	--	5.6
Tynemouth CB	Northumberland	AC(40)/DC	--	115.3
West Hartlepool CB	Durham	AC(40)/DC	2,500	115.7
Whitby UD	Yorks (North Riding)	AC(50)/DC	1,050	47.9
York CB	Yorkshire	AC(50)/DC	15,000	164.2
Companies				
*Cleveland & Durham County EP Co**	Durham/Yorks	AC/DC	15,300	-
*County of Durham EPD Co**	Durham	AC/DC	-	-
*County of Durham EPS Co**	Durham	AC	-	-
Hexham & Dist ES Co	Northumberland	AC(40)	720	68.3
*Houghton-le-Spring & Dist EL Co**	Durham	AC(40)	-	-
Newcastle & Dist EL Co	Northumberland	AC/DC[1]	18,675	-
*Newcastle-upon-Tyne ES Co (NESCO)**	[2]	AC(40)/DC	224,230	-
*Northern Counties ES Co**	`[2]	AC(40)/DC	749	-

Notes:
*NESCO and Associated Companies
[1] AC at frequencies 40Hz and 80Hz.
[2] Northumberland, Durham, Yorkshire (North and East Ridings).

Source: Electricity Commissioners, ***Engineering and Financial Statistics 1925/26.***

Even before the detailed plans for the National Grid were announced there was a quickening of interest in the acquisition of new territory. The largest of these extensions came with the Cleveland and Durham County Electric Power Act 1928 which enlarged the NESCO subsidiary beyond Tees-side to the southern limits of Harrogate and York. Local authorities such as Darlington, Harrogate, Scarborough and York all extended their service areas in the late 1920s. An extensive zone of northern Northumberland which had very low population densities remained unclaimed territory until 1948.

Four new local authority undertakings were created after 1925/26 at Richmond, Ripon, Seaham Harbour and Stanley. Ripon had a short life being taken over by Harrogate Corporation in 1935. The only new company formations, Askrigg & Reeth and Hawes, were both old-established non-statutory undertakings "legitimised" by Special Order in 1929.

Transmission lines supported by tall steel towers became the most visible effect of state intervention as they appeared in the landscape during the early 1930s. Construction of a national grid was authorised by the Electricity (Supply) Act 1926. Plans were prepared by the Electricity Commissioners and consulting engineers for implementation by the Central Electricity Board.[51]

The North East England Electricity Scheme, prepared in part by the consulting engineers Merz & McLellan and submitted in June 1929, was adopted by the Board in January 1930. Six selected power stations-Darlington, Carville A and B, Dunston, North Tees and Sunderland—were to be connected to the grid system. The 132kv transmission grid consisted of a long spine from the Scottish Border to York with major substations at Dunston, Norton (near Stockton) and Osbaldwick on the eastern fringes of York. Lower- voltage lines from Dunston would linkup the Tyneside power stations and Sunderland. Others from Darlington to Northallerton and from Osbaldwick to Malton, Whitby and Scarborough would provide additional power to previously isolated local networks. All the transmission lines were in service by the end of 1933 (**Figure 5**).

Standardising the frequency to the national 50Hz was the major task in the North East. All generating plant of NESCO had to be rebuilt as well as the thousands of motors in use. This work was not completed until 1937/38.

When trading began on 1 July 1938, the grid had added a new layer to the complex of undertakings which operated the electricity supply system. The grid control office at Jesmond Road, Newcastle, now managed the flows of power on the transmission lines and directed the hour-to-hour operation of the selected power stations. These stations, such as the one in Sunderland, remained in the ownership and management of the Corporation but the daily operation was now directed from Newcastle. Planning for the future became increasingly centralised, particularly from London.

Dunston B power station, approved in 1930 as a major centre of the North East grid was the first NESCO station to work at the standard national frequency of 50Hz. Commercial service began on 1 February 1933 with an initial capacity of 150,000kW. Designed by Merz and McLellan, Dunston was unusual in the use of glass panels for most of the outer walls of the buildings.[52]

One effect of the completion of the grid was the closing of some small power stations by 1935/36. These closures included Masham, West Hartlepool and Whitby in the local authority sector and the company stations at Lemmington (Newcastle & District Co.), Malton and Thirsk.

[51] Merz & McLellan were the consulting engineers for the grid schemes in South East England (adopted by the CEB February 1928), Mid East England (March 1929), and East England (March 1930) as well as the North East England regional scheme.
[52] ***The Engineer*** Vol.155, 1933, pp.136-139, 164-165.

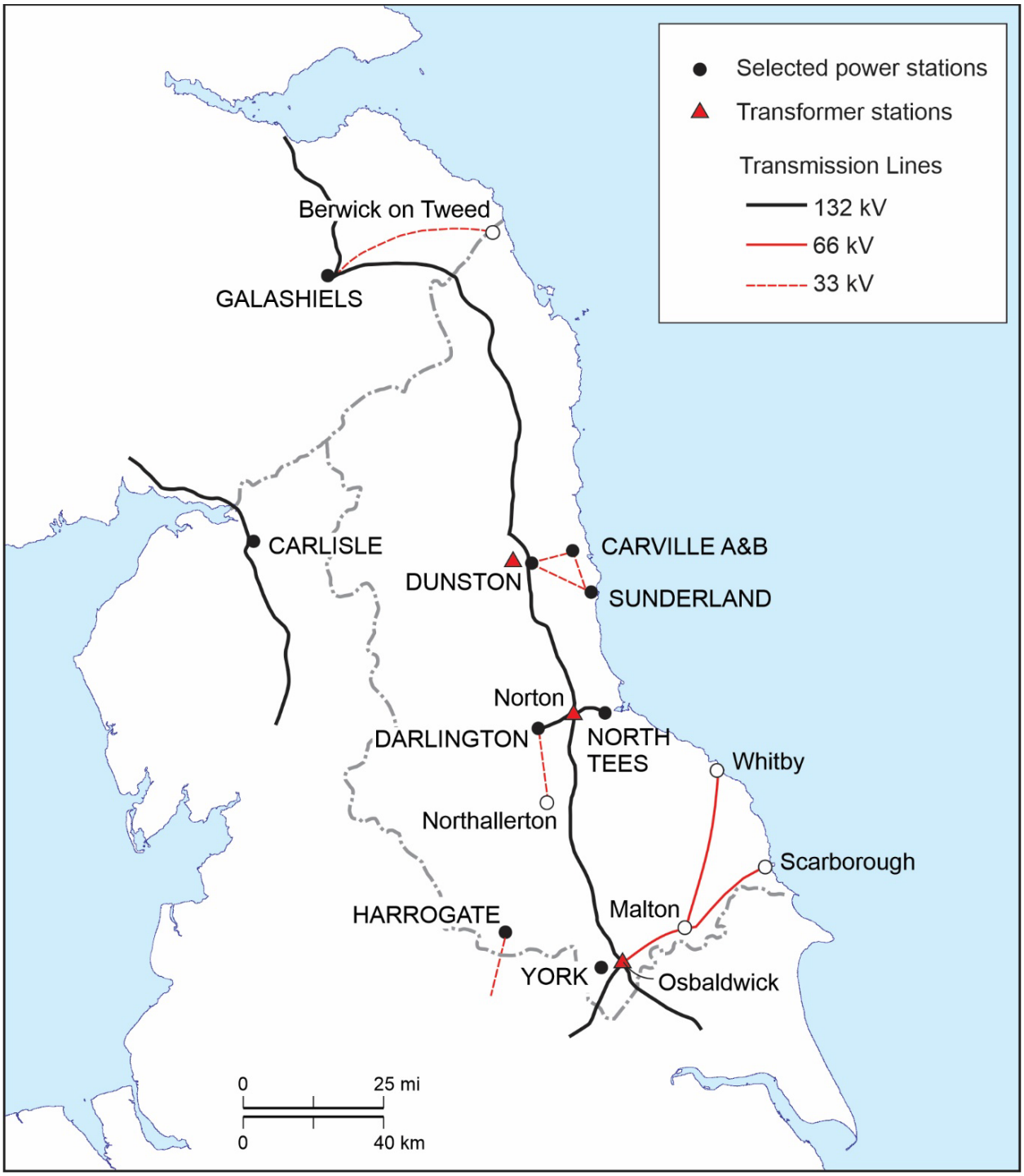


Figure 5 NORTH EAST ENGLAND ELECTRICITY SCHEME 1936.

Table 4 NORTH EASTERN ELECTRICITY BOARD AREA ELECTRICITY SUPPLY UNDERTAKINGS 1935/36.

UNDERTAKING	SYSTEM	GENERATING CAPACITY kW	PER CAPITA CONSUMPTION kv
Local Authorities			
Amble UD	AC	-	56.9
Annfield Plain UD	AC	-	39.2
Crook UD	AC	-	39.1
Darlington CB	AC/DC	21,000	513.3
Eston UD	AC	-	49.4
Guisborough UD	AC	-	64.1
Harrogate MB	AC	15,875	233.4
Middlesbrough CB	AC/DC	2,500	112.6
Redcar MB	AC	-	92.3
Richmond (Yorks) MB	AC	-	85.5
Scarborough MB	AC/DC	9,375	223.6
Seaham Harbour UD	AC	-	55.1
Skelton & Brotton UD	AC	-	48.5
South Shields CB	AC/DC	14,000	125.0
Stanley UD	AC	-	52.8
Stockton-on-Tees MB	AC/DC	-	170.3
Sunderland CB	AC/DC	31,000	295.0
Tanfield UD	AC	-	42.4
Tynemouth CB	AC/DC	-	164.5
West Hartlepool CB	AC/DC	-	168.8
Whitby UD	AC/DC	-	108.1
York CB	AC/DC	19,750	426.7
Companies			
Askrigg & Reeth ES Co	AC	38	31.7
Hawes EL Co	AC	55	21.3
Newcastle & Dist EL Co	AC/DC	17,875	79.4-
North Eastern ES Co (NESCO)	AC/DC	465,405	..

Source: Electricity Commissioners, ***Engineering and Financial Statistics 1935/36.***

Table 4 shows the situation in 1935/36 when 26 undertakings were in operation. One significant shift was the disappearance of wholly DC systems. There were still remaining DC customers in parts of Darlington, Middlesbrough, Newcastle, Tynemouth and West Hartlepool in 1957.

Generating technology emphasised economies of scale with larger units. The new Dunston B power station had three 50,000kW turbines. These machines and other improvements elsewhere brought significant reductions in coal consumption. The addition of two 3,750kW turbines at Scarborough brought coal consumption down to 2.19 lbs per kilowatt generated in 1935/36 compared with 5.02 lbs a decade earlier. In contrast Dunston B was consuming only 1.11 lbs per kWh.

Rationalisation of generation and interconnection of undertakings all contributed to reducing the cost of electricity. Other factors such as the growth of radio broadcasting and lower prices for small appliances helped to boost electricity consumption. By 1935/36 there were 10 places in the region with per capita

consumption levels above 100kWh. Darlington and York both had levels of consumption above the national average.

The growth of electricity sales, especially in the lighting segment, may be illustrated by the case of Sunderland. Total electricity sales grew from 21.05million kWh in 1925/26 to 47.61m kWh a decade later. The lighting segment that included domestic uses expanded from 3.26m kWh to 13.19m kWh. Over the same period, per capita consumption in Sunderland rose from 132.3kWh to 295.0kWh.

Table 5 NORTH EAST ENGLAND ELECTRICITY BOARD AREA CORPORATE STRUCTURE OF ELECTRICITY HOLDING COMPANIES 1934/35.

	SALES IN 1935 000 kWh	***PERCENT***
Electric Supply Corporation		
Berwick-on-Tweed ES Co[1]	666.0	
Other Companies		
Askrigg & Reeth ES Co	47.5	
Hawes EL Co	32.0	
Newcastle & District EL Co	24,703.3	2.4
North Eastern ES Co (NESCO)	756,373.6	73.2
	781,902.4	**75.7**
22 Municipal Undertakings	251,430.0	24.3
North East England total	**1,033,332.4**	**100.0**

Note: [1] Sold to Scottish Southern ES Co in 1936.
Source: Political and Economic Planning, ***Report on the Supply of Electricity in Great Britain*** (London: PEP, 1936), pp.140-141; sales from Electricity Commissioners, ***Engineering and Financial Statistics***, 1935/36.

Table 5 shows the effect of the North-Eastern Electric Supply Act 1932 that changed the name from Newcastle-upon-Tyne Electric Supply Co. to North Eastern Electric Supply Co. and consolidated all the subsidiary companies including such entities as the Tees Power Station Co. Ltd and the Carville Site and Power Co. Ltd.[53]

Most of the company development in the North East had come from local initiatives; outside interests were generally short-lived. The Urban Electric Supply Co. (an Edmundsons subsidiary) had been granted Electric Lighting Orders for Berwick-upon-Tweed and Bishop Auckland in 1900. The former franchise was retained until 1936 when it was sold to the Scottish Southern Co. while the Bishop Auckland was transferred to the Cleveland & Durham County Co. by 1906. The two County of Durham electricity companies were developed by the British Electric Traction Co. from 1900 to 1905, initially for the Gateshead electric tramway system. NESCO began providing a bulk supply in 1903 and took over the companies two years later. By 1906 NESCO had become a major regional company with a dominant role in the electrification of the North East.

Although state intervention in other parts of the country had begun to rationalise electricity generation, the distribution segment was very fragmented in most regions. The McGowan Report published in May

[53] ***Thirteenth Annual Report of the Electricity Commissioners 1932-1933*** (London: HMSO, 1933), pp.115-116.

1936[54] was a first move in the process of restructuring distribution. A recommendation in the McGowan Report, that all undertakings with annual sales of less than 10 million kWh should be amalgamated, was particularly controversial. Twelve of the 22 local authorities in the North East fell into this category. The government's Outline of Proposals published in April 1937[55] had little support and more pressing issues of the time meant that reorganisation of distribution was set aside.

Hyperbolic reinforced concrete cooling towers became a new landscape feature from the late 1920s. The first at a power station in the region was built at York by 1936 and others followed later with the rebuilding of Darlington and the extension of Sunderland power station. NESCO's proposal in June 1942 to build a 100,000kW station with six 170ft tall cooling towers on the River Wear at Kepier, only one mile from Durham Cathedral, met with immediate opposition. A local inquiry was held in Durham in December 1944. Although the Electricity Commissioners agreed with the technical case for a power station at this site, they were unable to issue a consent order given the strong opposition from local interests and the new Ministry of Town and Country Planning. The company agreed to withdraw its application in June 1945 when compensation would be paid for the expenses of the inquiry and the costs of preliminary site investigations. In addition, there were assurances that there would be no opposition to extensions at the Dunston and North Tees power stations.[56]

Table 6 NORTH EAST ENGLAND ELECTRICITY BOARD AREA CONSOLIDATIONS TO 1937.

UNDERTAKING	YEARS IN OPERATION	NEW OWNER
Masham UD	1920-1929	Cleveland & Durham EP Co
Knaresborough UD	1924-1930	Harrogate Corporation
Cleveland & Durham EP Co	1901-1932	NESCO[1]
County of Durham EP Distn Co	1901-1932	NESCO[1]
County of Durham EP Supply Co	1901-1932	NESCO[1]
Houghton-le-Spring & Dist ES Co	1905-1932	NESCO[1]
Northern Counties ES Co	1900-1932	NESCO[1]
Berwick-on-Tweed ES Co	1903-1934	Scottish Southern ES Co
Hexham & Dist ES Co	1906-1934	NESCO[1]
Ripon Corporation	1930?-1935	Harrogate Corporation
Annfield Plain UD	1920-1937	Stanley UD
Tanfield UD	1925-1937	Stanley UD

Notes:

[1] The North Eastern Electricity Supply Act 1932 consolidated all the holdings of the former Newcastle-upon-Tyne Electric Supply Co.

Table 6 lists the consolidations that took place from the late 1920s. The Newcastle-upon-Tyne Company had integrated the operations of its associated companies by 1918. Formal consolidation took place on 1 October 1932 when the North-Eastern Electric Supply Act came into operation. This Act which changed

[54] Ministry of Transport, ***Report of the Committee on Electricity Distribution***, May 1936 (London: HMSO, 1936). The report noted that there were no fewer than 635 separate authorised undertakings in Great Britain in 1934, comprising the Central Electricity Board, 3 Joint Electricity Authorities, 5 Joint Boards, 373 Local Authorities and 253 Companies and persons.

[55] Ministry of Transport, ***Electricity Distribution: Outline of Proposals*** (London: HMSO, 1937).

[56] John Sheail, ***Power in Trust: The environmental history of the Central Electricity Generating Board*** (Oxford: Clarendon Press, 1991), pp.33-37; ***Twentieth Annual Report of the Electricity Commissioners 1939-1945*** (London: HMSO, 1945), p.68. Consents for the extensions of Dunston and North Tees were issued in 1945/46 and 1946/47. Sir Giles Gilbert Scott who designed the architectural finish of the proposed Kepier station provided the final design for North Tees C. The first 60,000kW turbine at this station began service in December 1951.

the name from the city to the more appropriate regional title of North Eastern, also brought more order to the accounts of the company.

III Nationalisation

After three decades of discussion, the whole organisation of electricity was restructured following the Electricity Act 1947. From 1 April 1948, the North Eastern Electricity Board took over the assets of 25 local authorities and companies (**Figure 1**). The generating stations and transmission lines of the Central Electricity Board were transferred to the British Electricity Authority.

Electricity Distribution

The North Eastern Electricity Board was responsible for integrating all the undertakings. Systems had to be standardised and the multiplicity of tariffs reduced. For administrative purposes, the Board area was subdivided five sub-areas and 41 districts.

Figure 6 shows the geographical organisation in 1957 when there were five sub-areas and 32 districts. One notable feature is the network of 56 service centres where consumers could pay their bills and purchase appliances. These service centres were an important and profitable part of the Board's business.

Among the many demands for electricity supply were new industries attracted to the region as part of the postwar economic diversification efforts. One example was the large Paton & Baldwin's woollen mill at Darlington begun in 1946. New Towns were designated at Aycliffe (April 1948) and Peterlee (March 1948). Aycliffe was developed around a wartime ordnance factory and Peterlee created a new residential area for scattered colliery settlements. By 1961 both places had populations of over 12,000. All this development required investment in laying new cables and building substations as well as the installation of service in new buildings. In the Tees sub-area of the Board for example, the number of substations was increased from 937 in 1951 to 1,755 in 1957.[57]

Over the decade 1948/9 to 1958/9, total sales of electricity in the North East grew from 2,593kWh to 4,735m kWh. The number of consumers expanded from 674,000 to 1,018,000 over the same period. Employees of the Board increased from 5,268 in March 1949 to 6,792 a decade later.

Electricity Generation and Transmission

The North Eastern Division of the British Electricity Authority covered the same area as the distribution board. It was an amalgamation of the 132kv transmission system developed by the Central Electricity Board and the power stations previously owned by the companies and local authorities. The main tasks from 1948 were to integrate the various generating stations and their workforces, to modernise and standardise operations, and to expand capacity to meet the rapidly growing demand.

[57] J.W. House and B. Fullerton, ***Tees-side at mid-century: an industrial and economic survey*** (London: Macmillan, 1960), p.302.

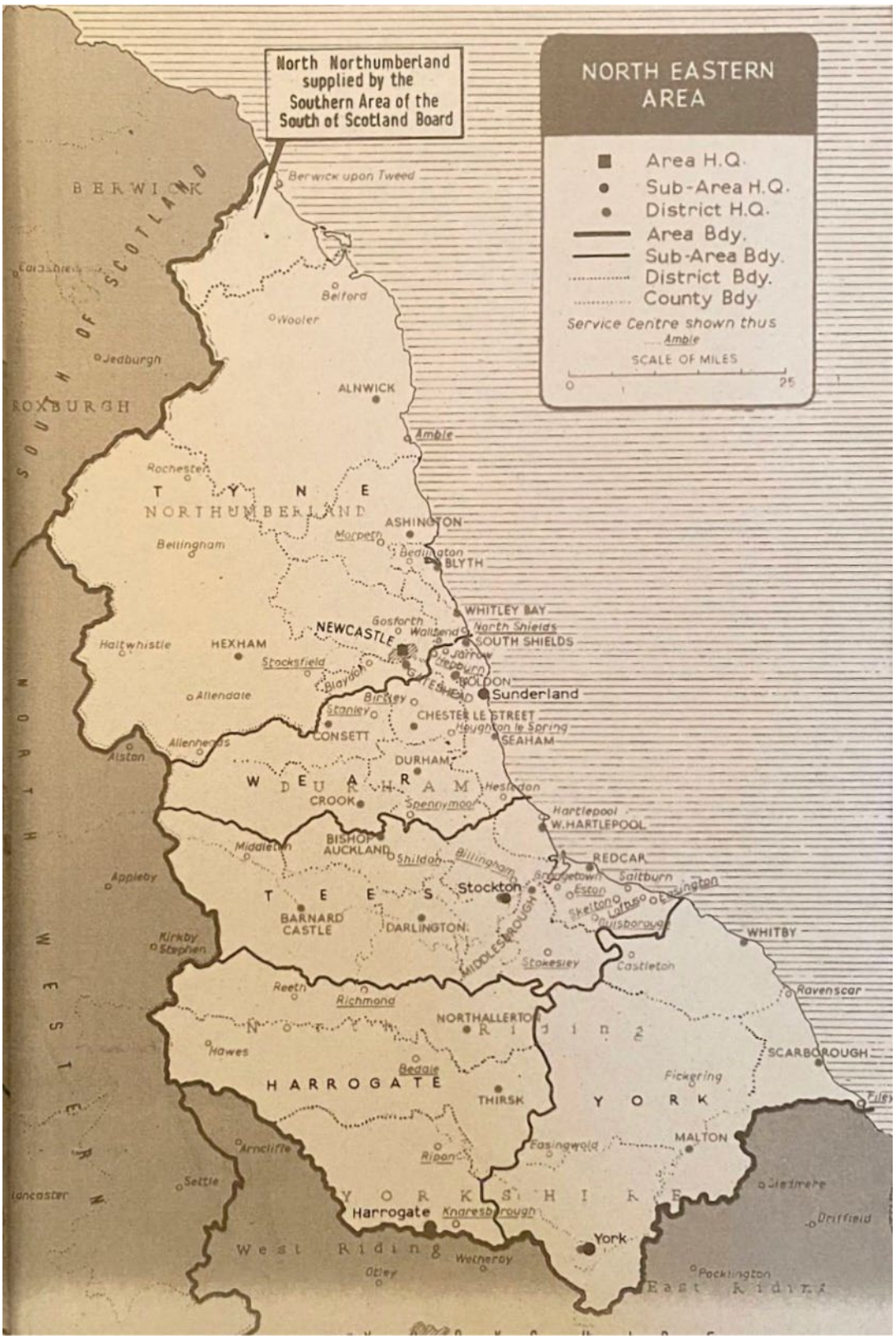

North Northumberland supplied by the Southern Area of the South of Scotland Board
NORTH EASTERN AREA
Area H.Q.
Sub-Area H.Q.
District H.Q.
Area Bdy.
Sub-Area Bdy.
District Bdy.
County Bdy.
Service Centre shown thus
Amble
SCALE OF MILES
0
25
BERWICK
SOUTH OF SCOTLAND
Berwick upon Tweed
Belford
Wooler
Jedburgh
ROXBURGH
ALNWICK
Amble
Rochester
TYNE
NORTHUMBERLAND
Bellingham
ASHINGTON
Morpeth
Bedlington
BLYTH
WHITLEY BAY
North Shields
SOUTH SHIELDS
Gosforth
NEWCASTLE
Wallsend
Jarrow
Hebburn
GATESHEAD
GOLDEN
Sunderland
Haltwhistle
HEXHAM
Stocksfield
Blaydon
Allendale
Birtley
Stanley
CHESTER LE STREET
Houghton le Spring
SEAHAM
CONSETT
Allenheads
Alston
DURHAM
WEAR
Hesleden
CROOK
Spennymoor
Hartlepool
W.HARTLEPOOL
Middleton
BISHOP AUCKLAND
Shildon
Billingham
REDCAR
Appleby
Stockton
Saltburn
Eston
Skelton
Loftus
Brotton
Guisborough
TEES
BARNARD CASTLE
DARLINGTON
WHITBY
Kirkby Stephen
Stokesley
Castleton
Ravenscar
Reeth
Richmond
NORTHALLERTON
NORTH RIDING
Hawes
SCARBOROUGH
Bedale
Pickering
HARROGATE
THIRSK
YORK
Filey
Arncliffe
Ripon
Fasingwold
MALTON
Settle
Lancaster
YORKSHIRE
Harrogate
Knaresborough
Driffield
York
West Riding
Wetherby
Otley
Pocklington
East Riding

Figure 6

Table 7 BRITISH ELECTRICITY AUTHORITY: POWER STATIONS IN THE NORTH EASTERN DIVISION 1948/49.

POWER STATION	***GENERATING CAPACITY* kW**	***TYPE*[1]**
Dunston A&B	247,500	S
North Tees A&B	110,000	S
Darlington	72,400	S
Carville	62,500	S
Sunderland	60,000	S
York, Foss Island	35,500	S
Harrogate	15,875	S
Close (Newcastle)	13,500	S
South Shields	10,500	S
Scarborough	9,375	S
Horden	6,000	WH
Ayresome	3,000	WH
Middlesborough	2,500	S
Blaydon	1,325	WH
York, Linton Lock	750	H
Askrigg	60	I
Hawes	56	I
	650,641	

Notes:
[1] S – Steam; H—Hydro-electric; WH –Waste Heat; I--Internal combustion (diesel).
Source: Compiled from British Electricity Authority, ***Annual Report 1948-49***, Appendix 15.

Table 7 lists the 18 power stations in the new organisation. They varied in size from large turbine-powered stations at the top to small diesel-engined and hydro units at the bottom. After 1948 extensions to Dunston B were completed, adding another100,000kW to the total capacity and improvements were made at Sunderland and York. Seven stations at Askrigg, Blaydon, Close, Hawes, Middlesbrough, Scarborough and South Shields were closed.

Four new stations were commissioned: North Tees C (December 1951), Stella South (December 1954)[58], Stella North (June 1955) and Blyth A (December 1958). All theses stations, mostly designed by Merz & McLellan, were larger than their prewar counterparts, operated at higher steam pressures (900lbs per square inch compared with 600psi at Dunston B) and used pulverised fuel firing technology. The dispersal of the fly ash after combustion became a new problem. From 1950 the British Electricity Authority acquired a fleet of five diesel-powered hopper barges to carry the waste ash from Dunston and the stations at Stella down the Tyne for dumping in the North Sea.[59]

The Blyth A station began a new trend of stations with much larger generating units (120,000kW) working at higher steam pressure (1,500psi). These stations were designed to serve national as well as regional demand and were linked to the new Supergrid with its higher capacity for long-distance transmission. Blyth A was essentially a “pit-head power station”, a type long considered but from the mid-1950s part of the national plan for electricity generation.

[58] Stella South was built on the site of the earlier Blaydon racecourse.
[59] D.R. Chesterton and R.S. Fenton, ***Gas and electricity colliers*** (Kendal: World Ship Society, 1984), pp.92, 110-112. The dumping of ash from the Blyth power station was a controversial issue in the planning stage. See Sheail (1991), pp.73-

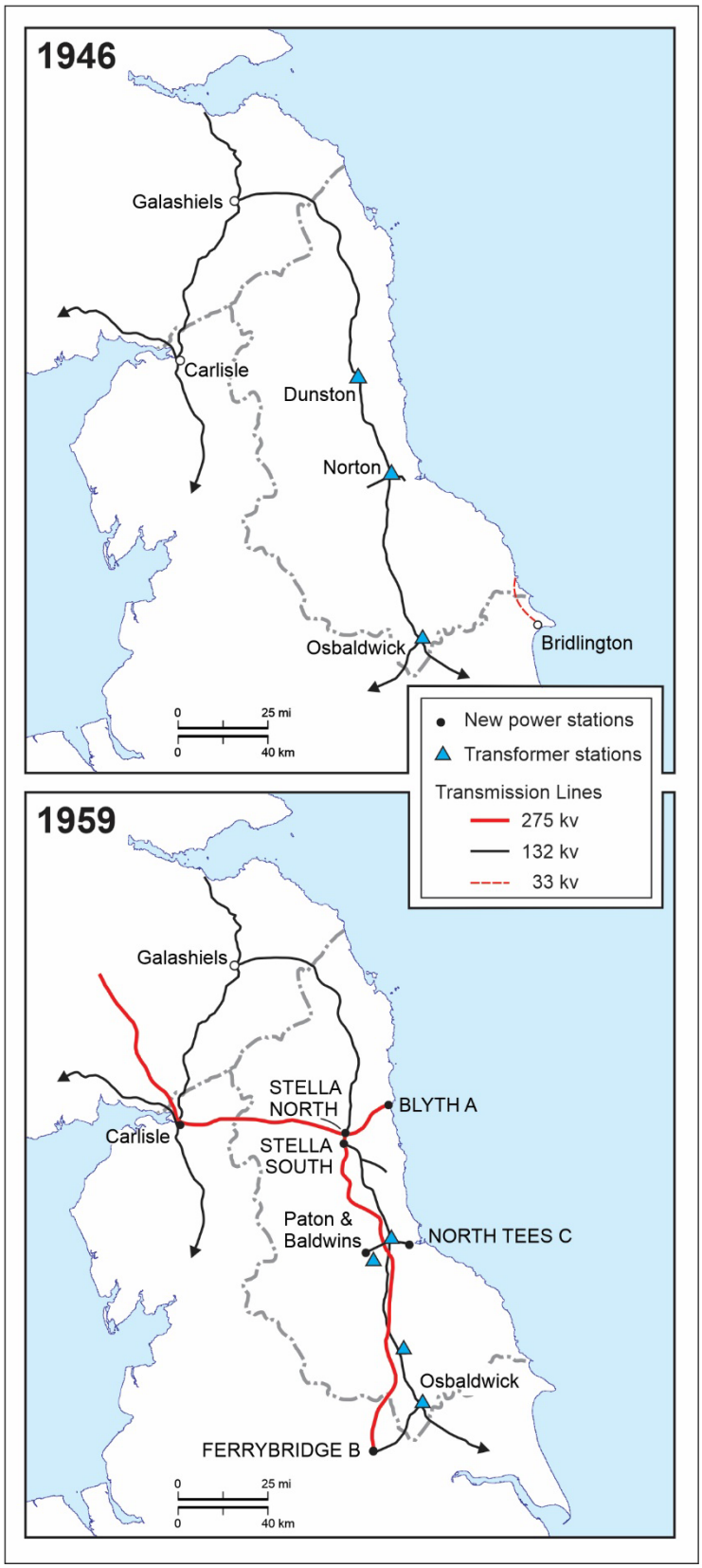


Figure 7 DEVELOPMENT OF THE NATIONAL GRID 1946 and 1959.

Figure 7 shows the development of the regional grid system which had served with few changes since 1933 and was enhanced 20 years later by the Supergrid. A higher-voltage transmission system had long been advocated by many in the industry, such as T.G.N. Haldane, a senior partner of Merz and McLellan. Initially planned by the British Electricity Authority as an interconnecting link between South West Scotland, the North East and Yorkshire, the line became part of a new national transmission system at 275kv which would allow for large-scale interchange of power.

A transformer station at Stella South generating station became the regional centre of the Supergrid. The northern line to Clyde's Mill, Glasgow and the southern line to West Melton, near Barnsley were completed in 1954/55. By 1959 a connection to the new power station at Blyth had entered service.

During the first decade of operation, the North Eastern Division built four new power stations and raised generating capacity from 650,641kW to 1,636,435kW.The transmission line capacity was increased to 311 route miles of which 134.5 were part of the 275kv Supergrid. Over the period the numbers employed rose from 2,053 to 2,755.

From January 1958 when the Central Electricity Generating Board took over from the Central Electricity Authority there were changes in the administrative structure. A new North Eastern Region was established, incorporating the North Eastern and Yorkshire Divisions, Under the new arrangements the new regional director at Becca Hall, Aberford near Leeds became responsible for the higher-order planning and administration of 34 power stations, 912 route miles of transmission lines and 7,840 employees. Design work on new power stations was transferred to the Northern Project Group at Agecroft Power Station, Manchester and transmission development was centralised in Guildford.

Table 8 CENTRAL ELECTRICITY GENERATING BOARD: POWER STATIONS IN THE NORTH EASTERN DIVISION 1958/59.

POWER STATION	***GENERATING CAPACITY kW***	***TYPE***[1]
Stella South	315,000	S
Dunston B	282,500	S
Stella North	250,000	S
North Tees C	250,000	S
Blyth A	120,000	S
North Tees A&B	110,000	S
Carville	62,500	S
Darlington	60,000	S
Dunston A	60,000	S
Sunderland	60,000	S
York, Foss Island	40,500	S
Harrogate	15,875	S
Horden	6,000	WH
Ayresome	3,000	WH
York, Linton Lock	750	H
	1,636,425	

Note: [1] S – Steam; H—Hydro-electric; WH –Waste Heat.
Source: Compiled from Central Electricity Generating Board, ***Annual Report 1958-59***, Appendix 1.

Summary

Table 9 shows various indicators of the growth of electrification from 1900. While seven of the eleven undertakings in that year were local authorities, they w ere soon overtaken by the rapid growth of NESCO and Associated Companies. This organisation was the largest electricity supplier by 1912 and dominated the region until nationalisation. The influence of Charles Merz and the close relationship between NESCO and Merz and McLellan gave the North East a unique place in the history of British electricity supply.

Table 9 SUMMARY OF DEVELOPMENT IN NORTH EASTERN ELECTRICITY BOARD AREA.

YEAR	*NUMBER OF UNDERTAKINGS[1]*	*LOCAL AUTHORITY UNDERTAKINGS*	*NUMBER OF POWER STATIONS*	*GENERATING CAPACITY (kW)*	*PER CAPITA CONSUMPTION (kWH)[3]*
1900	12	7	12	..	.. (4)
1912	26	10	26[2]	..	.. (36)
1925/6	31	21	22	338,414	234.0 (133)
1935/6	26	22	22	596,873	356.3 (374)
1948/9	..	..	17	650,641	875.1 (821)
1958/9	..	..	15	1,636,425	1,550.6 (1,765)

Notes:

[1] Excluding all non-statutory undertakings.

[2] Excluding waste heat power stations.

[3] Calculated from data in Electricity Council, ***Handbook of Electrical Supply Statistics 1977***, p.63 and census returns. Great Britain 1900-1948/9 from Leslie Hannah, ***Electricity Before Nationalisation: a study of the electricity supply industry in Britain to 1948*** (London: Macmillan, 1979), pp.427-8.

The North East reached its zenith in the mid-1920s with an efficient system of generation and transmission covering a wide area. NESCO served as a model for state intervention in other parts of the country where fragmentation of ownership and limited interconnection were the norm. The moves toward national integration following the Electricity (Supply) Act 1926 left the region isolated when the 40Hz frequency became a liability. At the same time the Depression undermined many of the traditional industries of the region.

Per capita consumption in the North Eastern Region (with Great Britain in parentheses) shows the high point in 1925/26 when the regional figure was well above the national average. Thereafter the region's growth was much slower and overtaken by more prosperous parts of the country.

Electrification was a much slower process than the enthusiastic promoters of the 1880s expected. Much effort and expenditure were needed to create viable electricity undertakings in the larger urban centres. This point of viability was reached about 1900 but extending the benefits of electricity over wider areas took much longer and universal electricity was probably not achieved until the 1950s.

Note on Sources

For the period before state intervention, Garcke's ***Manual of Electricity Undertakings***, first published in 1896, is the indispensable source. This annual volume lists all municipal and company electricity and tramway systems in comprehensive detail. Technical information on the generating and distribution systems is noted for each undertaking, as well as statistics on sales, revenue and expenditure. There are full details of personnel and company directors. Garcke also covers many of the non-statutory companies which were often significant in rural areas.

The contents of the ***Annual Reports*** of the Electricity Commissioners (1st, 1920-21 – 23rd, 1947-48) highlight the role of state intervention during this period and reflect the power of the Electricity (Supply) Act 1919. Under this legislation all power station and transmission line construction required consent of the Commissioners. Loans for local authority electricity undertakings, extensions of areas and transfers of ownership all required approval from London. Even the payment of subscriptions to associations such as the British Electrical Development Association and the Incorporated Municipal Electrical Association had to have the Commissioners' consent. The detailed control of expenditure also included the purchase of proceedings of conferences or meetings and the expenses of members and officers attending such meetings.

The ***Engineering and Financial Statistics***, also published by the Electricity Commissioners, were equally detailed. Local authorities and companies are separately listed with detailed tabulatios of generating equipment, fuel consumption, output as well as sales (by type). Such data provide effective evidence on the scale and depth of electrification. The financial statistics cover revenue, expenditure and capital investment.

The Electricity Commissioners also published more specialised reports on plans for integrating local systems which formed the basis for the 132kv grid developed from 1927. All the publications of the Electricity Commissioners were issued under the authority of the Minister of Transport.[60] They were, however, Non-Parliamentary Publications of HMSO and consequently were not always acquired by libraries at the time.

The Annual Reports of the Central Electricity Board from 1929 to 1947 contain, especially in the earlier years, comprehensive details of the progress of constructing the transmission grid. CEB reports were privately published and are rare items in library collections.

After nationalisation, details of the electricity supply industry become more accessible, although in some points less comprehensive. For the generating and transmission sector, the Annual Reports and Accounts of the British Electricity Authority (1948-1954), Central Electricity Authority (1955-57)[61] and the Central Electricity Generating Board (1958-1989) contain useful data. These reports were all published as House of Commons sessional papers until 1971-72. Thereafter they were no longer published by HMSO and became increasingly glossy in appearance and content. From 1964 many details, previously available in the Annual Reports were published in the CEGB ***Statistical Yearbook***. This was not published by HMSO and is comparatively rare.

[60] See ***Annual catalogues of British government publications 1920-1970*** (Bishop's Stortford: Chadwyck-Healey. 1974).

[61] The change of title from British Electricity Authority resulted from the formation of the autonomous South of Scotland Electricity Board from 1 April 1955.

The North Eastern Electricity Board annual reports and accounts were also published as House of Commons sessional papers until 1971-72. After this time the reports were no longer published by HMSO.

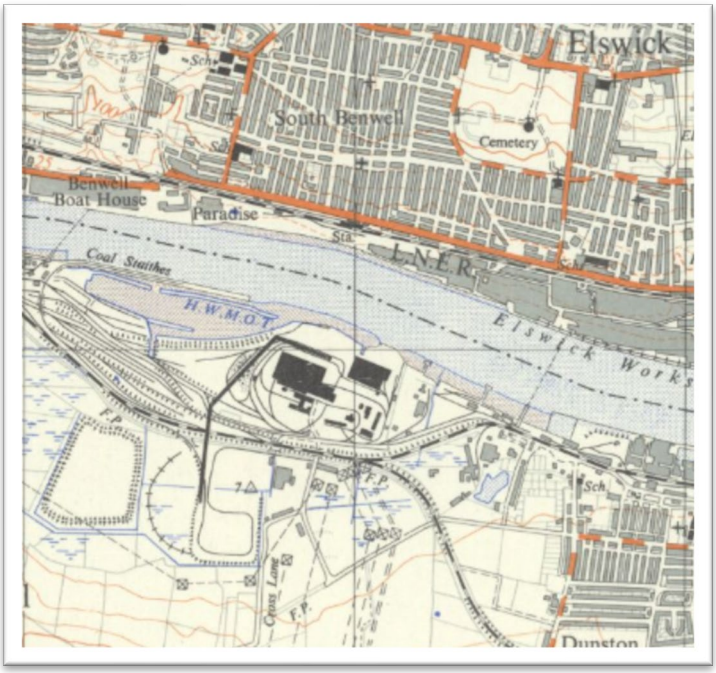
From 1958-59 the Electricity Council, created to provide more linkages and coordination beyond the national and regional bodies, also published annual reports and statistical compilations. The ***Handbook of Electricity Supply Statistics,*** published at intervals between 1966 and 1989, includes helpful summaries. ***Electricity Supply in Great Britain: A Chronology***, also published in various editions, is especially useful for details of legislation and major events, especially technical changes from Michael Faraday's fundamental discoveries of 1831.

In the postwar period the ***Electricity Supply Handbook*** (published annually by the ***Electrical Times*** from 1947) is a very useful compendium of facts, figures and personnel in the industry. The detailed maps of the grid system are especially important. Like many annual reference works of its type, these volumes are quite scarce.

Two collections have material relevant to the North East:

The Tyne and Wear Archives in Newcastle-upon-Tyne has the records of the North Eastern Electric Supply Co. 1889-1948 [Catalogue DU:EB] and a very large Merz & McLellan archive [DT:MZ]. There are also minute books of the Sunderland Corporation Electricity Committee 1897-1949 [CB:SU/34].

The Museum of Science and Industry in Manchester holds the records of the former Electricity Council. These include reports of the Electricity Commissioners, the Central Electricity Board, all the organisations after 1948 as well as a set of Garcke's ***Manual.***



DUNSTON

NESCO commissioned the first station at Dunston in 1910 and completed the second in 1933. Peak capacity of 347,500kW was reached 20 years later. The numerous transmission lines illustrate Dunston's position at the centre of the North East England grid scheme.

Ordnance Survey 1:25,000 series, Sheet NZ26, 1951 (National Library of Scotland)