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# THE SOUTH WALES ELECTRICITY BOARD AREA

Regional and Local Electricity Systems in Britain

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### LLANDRINDOD WELLS

*Opened in 1897 by a company, the small DC station served the spa town until the early 1950s. The original steam engines (capacity 670kW in 1909) were supplemented with diesel units from the 1920s.*

*Ordnance Survey Six Inch Map, Radnor XXIII. SW, 1902 (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 South Wales.

## The South Wales 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.<sup>1</sup> 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 South Wales Area included the whole of the counties of Brecknock, Carmarthen, Glamorgan, Monmouth, Radnor, Pembroke and the southern part of Cardigan. The boundary lines drawn in 1947 continue to be entrenched in the distribution franchise area of the present day.

## Constituents of the South Wales Electricity Board

When the Board began operations on 1 April 1948, it incorporated the distribution services and areas of 31 local authorities and 11 companies. Two other company areas, of the Shropshire, Worcestershire and Staffordshire Electric Power Co. and the West Gloucestershire Power Co., were added a year later when the assets in Wales had become separated from those in England.<sup>2</sup> There were enormous variations in the size of the constituent areas varied

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<sup>1</sup> Ministry of Fuel and Power, *Electricity Supply Areas*, Cmd 7007. (London: HMSO, 1947).

<sup>2</sup> South Wales Electricity Board, *First Annual Report and Accounts*, 1948-49 HC344 (London: HMSO, 1949), Appendix 1.

enormously in size. West Cambrian Power covered about 1,796 square miles while Cwmbran Urban District occupied an area of around six square miles.

With a total area of about 4,556 square miles and an estimated population of nearly two million, the South Wales Board was one of the medium-sized areas in the new structure of British electricity supply. The distinctive economic geography of the region was reflected in a very high proportion of industrial sales (79.3 percent) and a correspondingly low proportion of domestic sales (15.1 percent).<sup>3</sup>

The South Wales Electric Power Company was the largest undertaking in the region with sales to industrial, commercial and domestic customers as well as bulk supplies to many local authorities. In 1946 the company's sales amounted to 764 million kWh. At nationalisation the company's generating capacity of 215,000kW represented about 36 percent of the total regional capacity. At the other end of the scale were small local authority systems such as that of the Penarth Urban District which had sales of 3.6 million kWh in 1946 and a generating capacity of 2,200kW.

## Development of Electricity Supply Areas

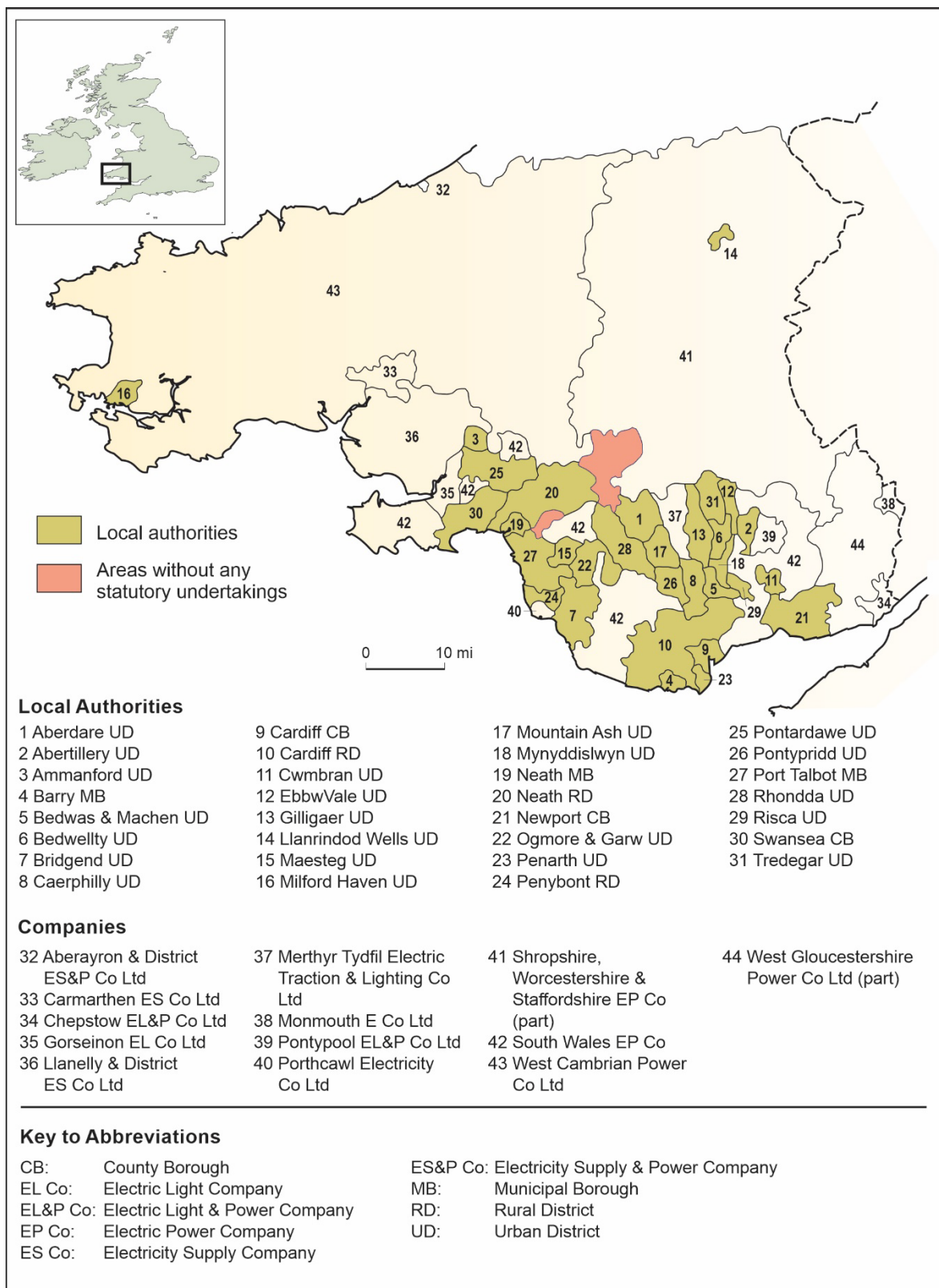
The 1948 pattern illustrated in **Figure 1** represented the climax of over 50 years of development. Unusually for a new innovation, electricity for public supply was subject to tight national regulations from an early stage. The Electric Lighting Act 1882 required "undertakings" to apply for a licence or provisional order from the Board of Trade.<sup>4</sup> 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 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 the early technology.

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<sup>3</sup> 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.

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



**Figure 1 and Table 1 CONSTITUENT AREAS OF THE SOUTH WALES ELECTRICITY BOARD, 1948.**

Two of the applications in 1882 came from the South Wales. The Great Western Electric Light & Power Co. applied for Electric Lighting Orders for Cardiff and Newport. They were however “...not considered as the provisions of the Act had not been complied with.”<sup>5</sup>

Although general urban electrification failed to take off in the 1880s, there was significant development of private systems which provided a market for electrical equipment, a stimulus for training electrical workers, and opportunities to refine details of the new technology. The Anglo-American Brush Electric Light Corporation opened a small system in central Cardiff in late 1884. A DC generating plant in The Hayes supported arc lamps in theatres and shops in the district until operations ceased in 1889.<sup>6</sup>

Electric lighting elsewhere in South Wales was noted at the time in the Rhymney Iron Works rail rolling mill which was ...“illuminated at night, where necessary, by the Brush electric light.”<sup>7</sup> Other installations included Siemens lights powered by Otto gas engines at the entrance to the Alexandra Dock, Newport, and construction of the Severn railway tunnel facilitated by 1000 candlepower lights suspended every 220 yards in the tunnel.<sup>8</sup>

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. Over the next decade another 459 applications were filed with the Board of Trade.<sup>9</sup> Successful applications were made by local authorities in 1891 and ELOs were granted to Cardiff, Llanelli<sup>10</sup> and Newport. Swansea had been granted an ELO in 1889 but was slow in implementation.

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 standardization 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.

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<sup>5</sup> “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.

<sup>6</sup> South Wales Electricity Board, *A Century of Electric Light. South Wales 1884-1984* (Cardiff: The Board, 1984, 12 pp.) A copy is located in the Glamorgan Archives. The Anglo-American Brush Co. and its affiliates were very active in the 1882 round of applications for Electric Lighting Orders. Some 47 applications were submitted for places between Aberdeen and Folkestone including 25 in London and Suburbs. Although many ELOs were granted, all were revoked by 1885 since the companies were unable to raise capital to fulfil their obligations. Emil Garcke joined the company as Secretary in 1883 and later became Managing Director of the successor company, Brush Electrical Engineering Co.

<sup>7</sup> Institute of Mechanical Engineers, *Proceedings*, 1884, Cardiff meeting, Works visits p.385.

<sup>8</sup> *Ibid.* p.396.

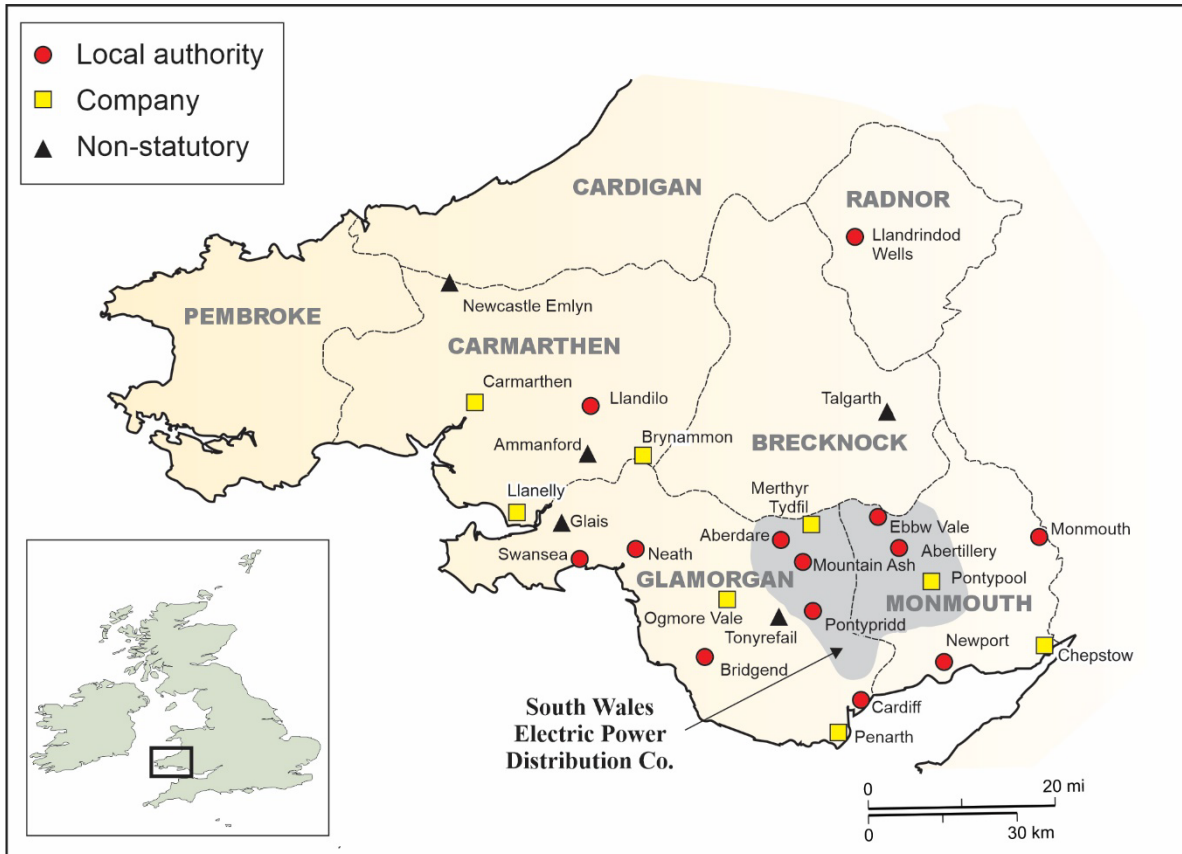
<sup>9</sup> Board of Trade, “Proceedings under the Electric Lighting Acts,” *Parliamentary Papers* 1899. HC 273.

<sup>10</sup> The Local Board in Llanelli failed to implement the order and a public supply in the town had to wait for nearly 20 years until begun by a private company.



## 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.



*Figure 2 ELECTRICITY UNDERTAKINGS IN SOUTH WALES C.1912.*

The 14 local authorities were clear examples of local initiative in developing electric lighting and power. Cardiff as the largest urban centre in the region was first to develop a system. Some smaller places such as Monmouth and Llandilo (population 1,951 in 1911) were also early developers. Neath Road District Council was unusual in operating a power station from 1908. Few other rural local authorities were active in generating electricity.

A variety of companies served large centres such as Merthyr Tydfil as well as smaller places like Llandrindod Wells (population 2,779 in 1911). Ten of the companies were non-statutory undertakings which operated outside the constraints of the Electric Lighting Acts. Some of these would later become “legitimised” when granted an Electric Lighting Order.

Most of the larger companies had been developed by outside interests. The British Electric Traction Co. owned the systems in Merthyr Tydfil and Penarth. Balfour Beatty brought new capital and management to develop electricity in Llanely. The location of the head office of the Llandrindod Wells company in Chester also suggests outside control even in some small centres.

Table 2 SOUTH WALES ELECTRICITY SUPPLY UNDERTAKINGS c.1912.

<b>UNDERTAKING</b>	<b>COUNTY</b>	<b>SUPPLY BEGAN</b>
<b>Local Authorities</b>		
<i>Aberdare</i>	Glamorgan	1911
<i>Abertillery</i>	Monmouth	1910
<i>Bridgend</i>	Glamorgan	1903 <sup>1</sup>
<i>Briton Ferry UD</i>	Glamorgan	1910?
<i>Cardiff</i>	Glamorgan	1894
<i>Cardiff RD</i>	Glamorgan	1908
<i>Ebbw Vale</i>	Monmouth	1906
<i>Llandilo</i>	Carmarthen	1902
<i>Monmouth</i>	Monmouth	1899
<i>Mountain Ash</i>	Glamorgan	1910
<i>Neath</i>	Glamorgan	1905
<i>Neath RD</i>	Glamorgan	1905 <sup>2</sup>
<i>Newport</i>	Monmouth	1895
<i>Pontypridd</i>	Glamorgan	1905
<i>Swansea</i>	Glamorgan	1901
<b>Companies</b>		
<i>Ammanford N/S</i>	Carmarthen	1909
<i>Brynammon N/S</i>	Carmarthen	1905
<i>Carmarthen</i>	Carmarthen	1910
<i>Chepstow</i>	Monmouth	1904
<i>Glais N/S</i>	Glamorgan	1910
<i>Glantawe</i>	Brecknock	1910
<i>Gorseinon</i>	Glamorgan	1894
<i>Llandrindod Wells</i>	Radnor	1897
<i>Llanelly &amp; District</i>	Carmarthen	1911
<i>Maerdy N/S</i>	Glamorgan	1898
<i>Merthyr Tydfil</i>	Glamorgan	1901
<i>Narberth N/S</i>	Pembroke	1912
<i>Newcastle Emlyn N/S</i>	Carmarthen	1908
<i>Ogmore Valley</i>	Glamorgan	1892 <sup>3</sup>
<i>Penarth</i>	Glamorgan	1901
<i>Penybank N/S</i>	Carmarthen	1910
<i>Pontypool</i>	Monmouth	1893
<i>Radyr</i>	Glamorgan	1908 <sup>4</sup>
<i>South Wales EP Distn Co</i>	Glamorgan/Monmouth	1904
<i>Talgarth N/S</i>	Brecknock	1912?
<i>Tonyrefail N/S</i>	Glamorgan	1904?

**Notes:** N/S non statutory undertaking (outside 1882/1888 Acts).

<sup>1</sup> Established by South Wales Power Co. Taken over by UDC 1908.

<sup>2</sup> Established by South Wales Power Co. Taken over by RDC 1908.

<sup>3</sup> Originally a non-statutory undertaking. an Electric Lighting Order granted in 1900

<sup>4</sup> This small company served the parish of Radyr under an Electric Lighting Order granted to the Llandaff & Dinas Powys Rural District Council in 1908.



The South Wales Electrical Power Distribution Company was authorised by a Private Act of 1900 to supply electricity to industrial establishments and authorised undertakings in Glamorgan and the western part of Monmouthshire. Unlike other public supply organisations, the company was not subject to any 42-year limitations on its installations. The foundation stone of the Upper Boat, Treforest power station was laid on 30 April 1902 and public supply began two years later when the three 1500kWh generators were started up.<sup>11</sup> Market prospects which looked very promising in the late 1890s proved difficult as colliery companies and other large power users had invested in private generation. The neighbouring Pontypridd Urban District Council built its own DC power station and even 20 years later purchased only 14 percent of its electricity needs from the power company. Fears of the company's collapse prompted the formation of a new cooperative entity, the Treforest Electrical Consumers Co. Ltd which essentially took over control of the power company.<sup>12</sup> Operations were rationalised: the unprofitable power stations at Bridgend and Neath were sold to the local authorities in 1908 and the small generating plant at Cwmbran was closed in 1909. By 1914 the company had established a firm base in a very competitive regional market. The Upper Boat power station had been expanded to 15,500kW and some Electric Lighting Orders for full retail supply had also been added. Only from the mid-1930s, however, did the company achieve a dominant position in the region.

Electrification in South Wales around 1912 was still incomplete and mostly confined to major towns and some smaller places where local enterprise had developed a system. Significant towns without a public electricity service included Gelligaer (population 35,521 in 1911), Barry (33,763), Caerphilly (32,844) and Maesteg (24,977). The Rhondda Urban District (152,781) opened its public electricity system in February 1915.

Lighting was 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.

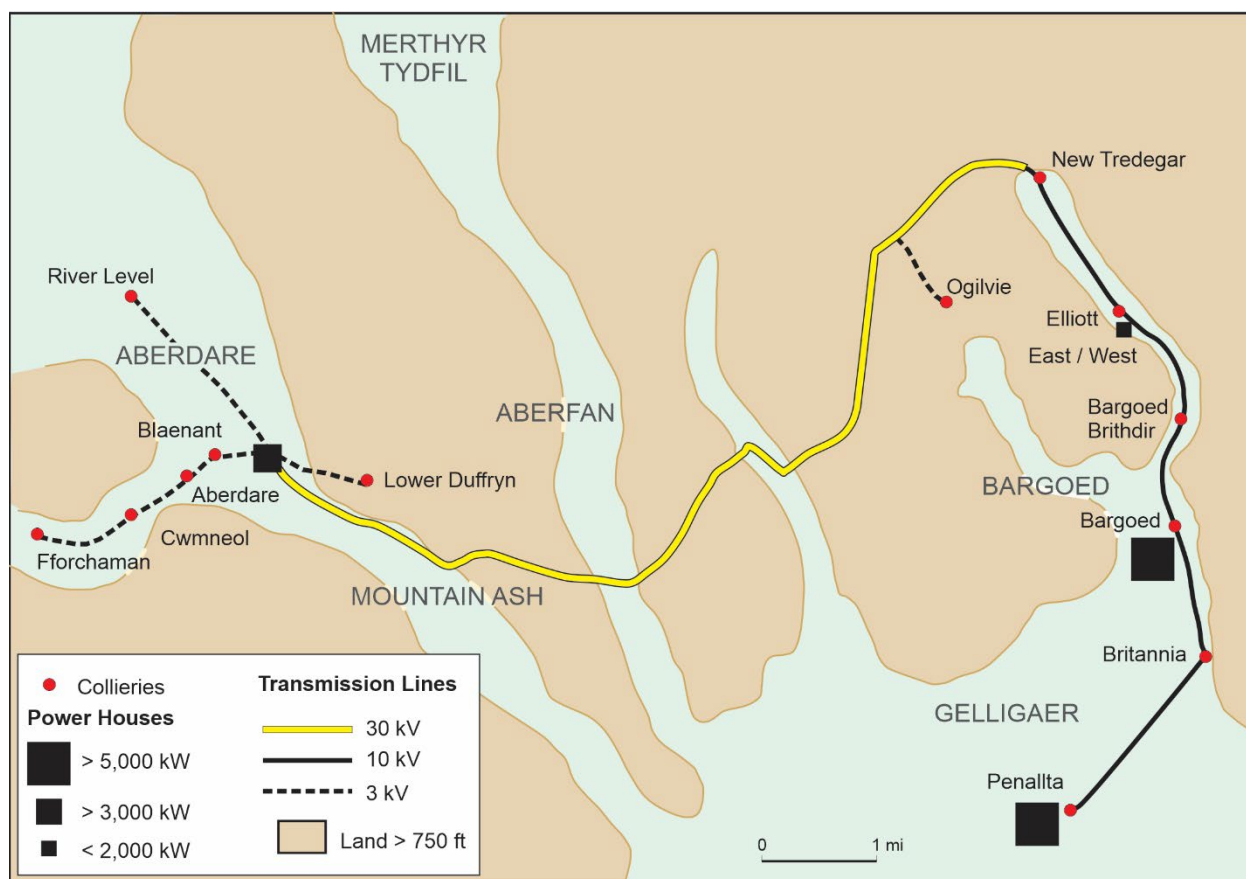
The 1912 data do not cover private generation which was very important at the time, not only in isolated establishments but also in urban centres where there was already a public supply. Some examples are outlined here to give a sense of the scale and scope of private generation otherwise absent in many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

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<sup>11</sup> "Jubilee of Upper Boat Power Station," *The Engineer*, Vol.194, 1952, p.84.

<sup>12</sup> R.H. Morgan, "The development of the electricity supply industry in Wales to 1919," *The Welsh History Review* vol. 11(3), 1983, pp.317-337.

Large colliery companies were particularly strong in the private generating sector of South Wales and remained a powerful force into the 1930s.<sup>13</sup> In 1917 the Powell Duffryn Steam Coal Company produced more electricity (71.2 million kWh) than the combined output of the South Wales Electrical Power Distribution Company and the three largest municipal operations (59.1 million kWh).<sup>14</sup> The company had opened a new AC power house at Middle Duffryn near Aberdare in 1905, replacing earlier DC installations at local collieries.<sup>15</sup> Middle Duffryn also provided a bulk supply to the municipal systems in Aberdare and Mountain Ash in 1910/11. Similar modernisation followed at the Powell Duffryn pits in the Rhymney Valley. The two areas were connected by a 30kV transmission line completed in 1916.<sup>16</sup> By 1918 the coal company's four power stations had a combined capacity of 24,575kW (Middle Duffryn 11,240, Elliot pits 1,750, Bargoed 4,875 and Penallta 6,750). Further investment continued after the war when a new power station at Bargoed was commissioned. The initial capacity was 18,000kW.<sup>17</sup>



**Figure 3 POWELL DUFFRYN CASE STUDY.**

<sup>13</sup> T. Boyns, "The electricity supply industry in South Wales to 1949," *The Welsh History Review*. vol.15(1), 1990, pp.79-107.

<sup>14</sup> The details are from Boyns, Table 1, p.80.

<sup>15</sup> Charles P. Sparks, "Electrical equipment at the Aberdare collieries of the Powell Duffryn Company," *Journal of the Institution of Electrical Engineers*, Vol.36, 1905-6, pp.477ff.

<sup>16</sup> Stephen Hughes et al., *Collieries of Wales: Engineering and Architecture* (Royal Commission on the Ancient and Historical Monuments of Wales, 1994), p.16.

<sup>17</sup> *The Engineer*, Vol. 133, 1922, pp.202-203.

Iron and steel companies often followed a similar pattern of development. The Ebbw Vale Steel, Iron and Coal Company in 1920 had a substantial power station at Victoria (14,500 kW) serving the steel and iron works. A 3kV transmission line connected with the Six Bells station (3,000 kW) and various collieries and works in Abertillery. Plans for extending the transmission line to the Trefil quarries and the isolated Prince of Wales station (3,500kW) were being made in 1920. At this time about 45 million kWh were being generated by the company which also provided a bulk supply to the Ebbw Vale UD system.

Railway companies had adopted electricity for lighting and some power needs by this time. The Rhymney Railway workshops at Caerphilly were fully electrified by 1906 and other railway company docks at Barry and Newport were illuminated by electricity, although using hydraulic power for the coal hoists.<sup>18</sup> At Fishguard Harbour, a new packet port for the service to Ireland opened in August 1906, the Great Western Railway had invested in an all-electric operation. The power station (240kW) not only served the quayside cranes but also the 120 houses in the workers' village.<sup>19</sup>

Industrial establishments continued to build private generating stations after 1912. The National Oil Company at Llandarcy, begun in 1922 near Swansea, had a capacity of 7,500kW in 1938, which provided about half the demand for the works (12.5 million kWh) the remainder being purchased from the public supplies.<sup>20</sup> Aberthaw & Bristol Channel Portland Cement Co. built power stations at its Aberthaw and Rhose works with capacities of 4,500kW and 5,000kW respectively.<sup>21</sup>

Hotels were early adopters of electric lighting, with advertisements emphasizing this as one of the necessities of a first-class modern establishment. The hotel market was clearly an important factor in the development of a public supply in Llandrindod Wells from 1897. For isolated hotels such as the Lake Hotel and Barium Springs at Llangammarch Wells private generation was the only option.<sup>22</sup> Other large institutions of a different type also built private power stations. The Cardiff City Lunatic Asylum at Whitchurch, opened in 1908, featured a large powerhouse at the core with a 150-foot tower and chimney. Throughout the region, country houses and large estates added electricity, particularly after 1900 when small oil and petrol generating sets became available.

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<sup>18</sup> See: Institution of Mechanical Engineers, *Proceedings*, 1906, for details of the Cardiff meeting works visits.

<sup>19</sup> See: *The Engineer*, Vol.102, 1906, pp.209-211, 239-242, 273-274. Photographs of the new harbour and workers' village were published in Vol.108. 1909, pp.570-572, 593-594.

<sup>20</sup> Institution of Mechanical Engineers, *Proceedings*. Vol.139, 1938, pp.439-331

<sup>21</sup> *The Engineer*, Vol. 164, 1927, pp.127-129.

<sup>22</sup> Advertisement in *Bradshaw's April 1910 Railway Guide* (Reprinted Newton Abbot: David & Charles, 1968), p.1098.

ELECTRIC TRAMWAY SYSTEMS IN THE SOUTH WALES<sup>1</sup>

	YEARS OPERATING	ROUTE MILES	MAX NO OF CARS
<i>Aberdare</i>	1903-1935	5.8	26
<i>Cardiff Corporation</i>	1902-1950	19.5	242
<i>Llanelly &amp; District Co..</i>	1911-1938	6.2	16
<i>Merthyr Tydfil Co.</i>	1901-1939	3.5	20
<i>Newport Corporation</i>	1903-1937	8.5	57
<i>Pontypridd UDC</i>	1905-1931	5.3	31
<i>Rhondda Tramways Co.</i>	1908-1934	20.9	54
<i>Swansea Tramways Co.</i>	1900-1937	13.3	107
<i>Swansea &amp; Mumbles Railway</i>	1929-1960	5.4	13

Eight electric tramway systems were opened between 1900 and 1913. The Swansea and Mumbles line was a conventional railway electrified on tramway principles in 1929. Two of the companies--Llanelly & District and Merthyr Tydfil--combined tramway operation with public electricity supply.

Both the Rhondda and Swansea companies built their own power stations for supplying the tramway network. In 1927-28 Rhondda stations generated 3.49 million kWh.<sup>2</sup> Rhondda was also unusual in providing an electric tramway seven years before public supply began in the urban area.

Tramway supply as a proportion of total electricity sales in 1925-26 varied from 47.0 percent in Aberdare to 29.4 percent in Pontypridd, 22.9 percent in Merthyr Tydfil and 18.8 percent in Cardiff.<sup>3</sup>

Electric tramways provided fast, efficient and cheap urban transport and were very profitable before 1914. Motor bus competition after the war quickly ended the viability of the smaller systems.

<sup>1</sup> Compiled from Keith Turner, *Directory of British Tramways*, Vol 1 (Stroud: Tempus Publishing, 2007).

<sup>2</sup> Electricity Commissioners, *Generation of Electricity in Great Britain, Year ending 31<sup>st</sup> March 1928* (London: HMSO, 1928).

<sup>3</sup> Electricity Commissioners, *Engineering and Financial Statistics 1925-26*.

## II State Intervention

Difficulties of interconnection, differences in AC frequencies, and the need for coal conservation by the use of large-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.

A key mandate of the Commissioners was the restructuring of generation and transmission, by voluntary means, since the earlier regulatory powers had been deleted from the legislation. The first stage of the procedure for establishing Joint Electricity Authorities was the definition of a series of Electricity Districts covering parts of the country where reorganisation seemed most necessary. All the electricity undertakings were then invited to submit proposals for reorganisation schemes emphasising the technical, administrative and financial aspects of a JEA.

The South Wales Electricity District was defined in October 1920 and covered an area almost identical to the later Electricity Board (except for Eastern Monmouthshire). Proposals for reorganisation were to be submitted by November 1921. A conference was held in Cardiff in January 1923, attended by the Electricity Commissioners. An Advisory Committee was formed in May “with a view to the formulation of a scheme for submission to the Commissioners.”<sup>23</sup> Unlike all the other 15 Electricity Districts, no scheme was ever submitted.

The absence of any reorganisation scheme or support for a Joint Electricity Authority reflected the independence of the three large municipal undertakings, Cardiff, Newport and Swansea, and the caution of South Wales Power Co. after its earlier difficulties. All this was in contrast to North Wales where the ambitious local power company was actively promoting a large area JEA with little opposition. Any possible reorganisation in South Wales required frequency standardisation, an important provision in the Electricity (Supply) Act 1926.

**Table 3** lists the statutory supply undertakings in 1925/26. Eleven local authorities had been added after 1912. Ammanford had taken over a non-statutory company and Llandrindod Wells had exercised its rights of purchase of the company undertaking. The Rhondda UD system had begun operation in 1915, the others after the war. Port Talbot was the most recent, having opened in February 1926.

Only two new companies were formed in this period. One at Aberayron, a very small system on the Cardigan coast, and the Glantawe company, an earlier non-statutory “legitimised” by Special Order in 1923.

**Table 3 SOUTH WALES: ELECTRICITY SUPPLY UNDERTAKINGS 1925/26.**

<b>UNDERTAKING</b>	<b>COUNTY</b>	<b>SYSTEM</b>	<b>FREQUENCY Hz</b>	<b>GENERATING CAPACITY kW</b>	<b>PER CAPITA CONSUMPTION kWh</b>
<b>Local Authorities</b>					
<i>Aberdare</i>	Glam	AC/DC	50	– <sup>a</sup>	38.1
<i>Abertillery</i>	Mon	AC/DC	50	166	8.6
<i>Ammanford</i>	Carms	DC		320	22.4
<i>Bedwas &amp; Machen</i>	Mon	AC	25	– <sup>b</sup>	5.5
<i>Bedwellty</i>	Mon	AC	50/25	– <sup>a,b</sup>	14.2
<i>Bridgend</i>	Glam	AC	60	770	46.4
<i>Caerphilly</i>	Glam	AC	25	– <sup>b</sup>	5.5
<i>Cardiff</i>	Glam	AC/DC	50	27,200	147.5
<i>Cardiff RD</i>	Glam	AC	25	– <sup>b</sup>	16.2
<i>Ebbw Vale</i>	Mon	DC		– <sup>c</sup>	22.4
<i>Gelligaer</i>	Glam	AC	50/25	– <sup>a,b</sup>	17.9
<i>Llandilo</i>	Carms	DC		84	25.2
<i>Llandrindod Wells</i>	Radnor	DC		531	37.7
<i>Maesteg</i>	Glam	AC	50	– <sup>d</sup>	8.3
<i>Monmouth</i>	Mon	AC	60	174	18.5
<i>Mountain Ash</i>	Glam	AC	25	– <sup>a</sup>	221.9
<i>Mynyddislwyn</i>	Mon	AC	26	– <sup>b</sup>	3.9
<i>Neath MB</i>	Glam	AC	50	– <sup>e</sup>	19.6

<sup>23</sup> *Third Annual Report of the Electricity Commissioners, 1922-23* (London: HMSO, 1923,), p.11.

<b>UNDERTAKING</b>	<b>COUNTY</b>	<b>SYSTEM</b>	<b>FREQUENCY Hz</b>	<b>GENERATING CAPACITY kW</b>	<b>PER CAPITA CONSUMPTION kWh</b>
<i>Neath RD</i>	Glam	AC	50	2,400	14.6
<i>Newport CB</i>	Mon	AC/DC	50/87.5	14,850	252.0
<i>Ogmore &amp; Garw UD</i>	Glam	AC	25	- <sup>b</sup>	5.3
<i>Pontypridd UD</i>	Glam	AC/DC	25	1,250	57.3
<i>Port Talbot UD</i>	Glam	AC	50	350	0.1
<i>Rhondda UD</i>	Glam	AC	25	800	10.9
<i>Swansea CB</i>	Glam	AC/DC	50	25,800	189.3
<b>Companies</b>					
<i>Aberayron Dist ES&amp;P Co</i>	Card	DC		70	9.4
<i>Carmarthen ES Co</i>	Carm	DC		300	30.0
<i>Chepstow EL&amp;P Co</i>	Mon	AC	50	-- <sup>f</sup>	42.1
<i>Glantawe ES Co<sup>1</sup></i>	Brecknock	DC		170	16.1
<i>Gorseinon EL Co</i>	Glam	AC/DC	50	- <sup>g</sup>	41.1
<i>Llanelly &amp; Dist EL&amp;Traction Co</i>	Carms	AC/DC	50	11,250	304.9
<i>Merthyr Tydfil ET&amp;L Co</i>	Glam	AC/DC	25	820	23.5
<i>Ogmore Valley EL&amp;P Co</i>	Glam	AC	50	- <sup>b</sup>	16.6
<i>Penarth EL Co</i>	Glam	AC/DC	50	1,720	65.0
<i>Pontypool EL&amp;P Co</i>	Mon	AC/DC	25	260	24.1
<i>South Wales EP Distrbtn Co.</i>	Glam	AC	25	48,750	-

Notes:

<sup>1</sup> The electricity works was located in Ystradgynlais. Source of bulk supply:

a Powell Duffryn Steam Coal Co.

e Neath RD

b South Wales Electrical Power Distribution Co.

f West Gloucestershire Power Co.

c Ebbw Vale Steel, Iron & Coal Co.

g Swansea Corporation

d North's Navigation Collieries

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

The 36 undertakings in 1925/26 operated a variety of systems. Only seven were wholly DC and, except for Ebbw Vale (population 35,381 in 1921) were all located in small towns such as Llandilo. With an economic operating radius of 1 to 1.5 miles from the generating plant, DC was suitable only for city centres or small towns and villages. The dominant AC systems were divided by frequencies: 14 operated at 50 cycles (Hz); 11 worked at 25Hz; two places combined both these frequencies; and two (Bridgend and Monmouth) used 60Hz.

This situation of incompatible AC systems which prevented further interconnection had begun with decisions made at the turn of the century. Cardiff Corporation had selected a frequency of 50Hz for the new Roath power stations built for the tramway system opened in 1902. Large private generators such as the Powell Duffryn Steam Coal Co. and Ebbw Vale Steam, Iron and Coal Co., were also deciding to use 50Hz for their new AC operations. By 1905, 50Hz was becoming a de facto national standard.

In contrast the consulting engineers for the South Wales Electrical Power Distribution Co., Bramwell & Harris, decided on 25Hz for the Upper Boat and Cwmbran generating stations.<sup>24</sup>

<sup>24</sup> Curiously, the same consulting engineers adopted 50Hz for the Neath power station and 60Hz at Bridgend. These two generating stations were sold to the respective local authorities in 1908. See: "District Electric Power Development," *Electrical World*, vol. XLV(4), February 1905, pp.191-194.

This frequency had been used for the Niagara Falls power development and was introduced to Britain for the Central London underground railway and the electrification of Glasgow tramways. As the South Wales network expanded, new local authorities and some existing companies followed with 25Hz systems.

The data for generating capacity show that only nine undertakings of the 23 with generating plant had capacities of over 1,000kW. Steam turbines were dominant in all the larger stations and varied in size from one at 18,750kW at Upper Boat to a small 500kW machine at Bridgend. A few places such as Merthyr Tydfil, Pontypridd and Rhondda were wholly served by reciprocating engines. Other types of generating technology included gas engines at Pontypool and Port Talbot.

Statistics on electricity consumption per head of population reveal major contrasts. Only four places—Cardiff, Llanelly, Newport and Swansea—exceeded 100.0kWh per person. Many small places such as Monmouth and Ogmore Valley which had had electricity for more than 20 years still languished at 17.0kWh per capita. Each place had a distinctive market profile reflecting the local economic and social geography. Two places with local authority undertakings, Swansea and Rhondda, had similar populations (around 160,000) but very different market profiles. Swansea had sales of 29.8 million kWh, with the lighting segment accounting for 15.4 percent, public lighting 1.6 percent, tramways 10.3 percent and power 72.7 percent. Rhondda, in contrast had total sales of 1.78 million kWh, divided between lighting 74.7 percent, public lighting 2.9 percent and power 22.4 percent. In Swansea the County Borough controlled all sales within its boundaries, while electricity sales in the Rhondda were divided among the Urban District Council, the tramways company, the South Wales Power Co. and some private colliery generators. Per capita consumption in Swansea was 189.3kWh but only 10.9kWh in Rhondda.

Electrification and extension of supply areas were given a new impetus following the Weir Report (1925),<sup>25</sup> the Electricity (Supply) Act 1926 and the formation of the Central Electricity Board in 1927. Even before the detailed regional plans for the National Grid were announced, there was a quickening of interest in the formation of new companies and applications for Special Orders. Over the next decade almost all the empty areas of the map were covered by new supply territories.

Seven new local authority undertakings were established: Risca (1926), Barry and Penybont (1928), Milford Haven (1929), Cwmbran (1930), Pontardawe (1931) and Tredegar (1935). In the company sector, the Bryammon non-statutory business was legitimised by Special Order in 1926 and the Porthcawl company began supply in 1931,

Three large companies covered the remaining “unoccupied” areas of South Wales. First, the West Gloucestershire Power Co. expanded from its power station at Lydney to serve most of eastern Monmouthshire. This expansion was authorised by a Special Order dated 13 June 1928.

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<sup>25</sup> Ministry of Transport, *Report of the Committee appointed to review the National Problem of the Supply of Electrical Energy* (London: HMSO, 1927), 39 pp.



Then the Shropshire, Worcestershire and Staffordshire Electric Power Co. (19 December 1930) for the Abergavenny area. Electricity from the Hereford power station was switched on in the town in April/May 1932.<sup>26</sup> A further Special Order (13 May 1932) allowed the SWS Co. to expand in Radnor and Brecon. The West Cambrian Power Company began as a modest non-statutory company in Fishguard during 1929. With outside capital the company was able to promote a Special Order (approved 12 July 1933) covering a wide area of South Wales. With its main base now in Haverfordwest, the company quickly absorbed the small existing suppliers in Pembroke and Carmarthen.

Municipal extension was generally inhibited by the economic depression from the late 1920s. Monmouth Corporation was unusual in transferring its electricity undertaking to a private company in 1930. Merthyr Tydfil Corporation applied to the Electricity Commissioners in November 1934 for consent to exercise its powers of purchase of the local electricity company. The Commissioners concluded that:

*...if the undertaking were purchased on the terms which then applied, the revenue that could be reasonably anticipated would not be sufficient to pay the capital charges on the purchase price and that there would be a resultant deficit involving a charge on the local rates.<sup>27</sup>*

In these circumstances, the Commissioners did not feel justified in giving their consent. Penarth Council's application to take over the Penarth Electric Lighting Co. in 1936 was however approved by the Commissioners and came into effect on 24 March 1938. An earlier intention of transferring control to Cardiff Corporation had been dropped by this time.

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.<sup>28</sup> The South West England and South Wales Electricity Scheme was adopted by the CEB in June 1930, tenders were advertised, contracts made, and construction work began.

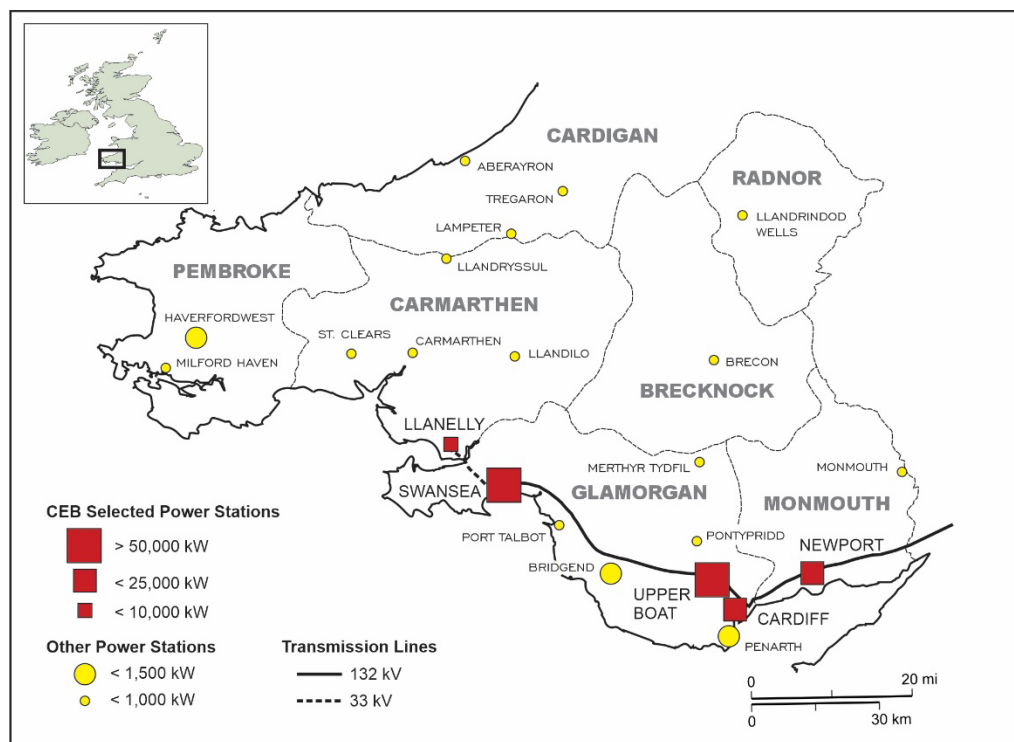
In South Wales a simple 132kv transmission line was built across the region to a western terminal at Llanelly. At Gloucester the power line connected with the other parts of the grid system and the Midlands grid scheme. The national grid was designed to link "selected" power stations. These were generally the largest and most efficient generating plants that also had some potential for expansion. Five power stations were on the selected list in 1934: Cardiff, Llanelly, Lydney, Newport and Upper Boat. Tir John, a new station at Swansea, was added later.

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<sup>26</sup> *The Engineer* Vol.153, 6 May 1932, p.500.34-35

<sup>27</sup> *Fifteenth Annual Report of the Electricity Commissioners 1934-1935* (London: HMSO, 1936), p.79.

<sup>28</sup> *Tenth Annual Report of the Electricity Commissioners 1929-1930* (London: HMSO, 1931), p.114.



*Figure 4 SOUTH WALES NATIONAL GRID.*

One expensive feature of the work in South Wales was the standardization of frequency of frequency at the Upper Boat power station, which required new or rebuilt equipment. All other customers using 25Hz also had to be converted to the new standard. The final result by 1937 was full interconnection of all AC electricity service throughout the region. Some pockets of DC continued into the 1950s.

When trading began on 1 January 1935, the grid had added a new layer to the complex of undertakings which operated the electricity supply system. The Bristol grid control office of the CEB 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 Cardiff, remained in the ownership and management of the Corporation but the daily operation was now directed from Bristol. The Upper Boat station worked continuously to serve the regional base load. Other selected power stations generally worked two shifts to serve the daily demand. Planning for the future became increasingly centralised, particularly from London.

**Table 4** shows the situation in 1935/36 when 46 undertakings were in operation. Over the previous decade many changes had taken place. AC systems had increased while the number of DC systems had declined. Frequency standardisation was almost complete by 1936, with most of the South Wales Electric Power Company's system converted to 50Hz. Most undertakings now drew their power requirements directly or indirectly from the grid. The most distant places still generated most of their needs: Milford Haven (100 percent), West Cambrian Power (76 percent) and Llandrindod Wells (66 percent). A few places in the core of the region continued to generate: Bridgend (81 percent), Penarth (74.2 percent) and Merthyr Tydfil (50 percent).

Table 4 SOUTH WALES: ELECTRICITY SUPPLY UNDERTAKINGS 1935/36.

UNDERTAKING	SYSTEM	GENERATING CAPACITY kW	PER CAPITA CONSUMPTION kWh
<b>Local Authorities</b>			
Aberdare	AC/DC	-	66.7
Abertillery	AC/DC	-	40.4
Ammanford	AC	-	53.0
Barry	AC	-	17.1
Bedwas & Machen	AC	-	28.7
Bedwellty	AC	-	49.6
Bridgend	AC	2,000	56.9
Caerphilly	AC	-	42.2
Cardiff CB	AC/DC	35,400	371.5
Cardiff RD	AC	-	62.0
Cwmbran	AC	-	29.8
Ebbw Vale	DC	-	53.3
Gelligaer UD	AC	-	40.5
Llandrindod Wells	DC	711	165.8
Maesteg	AC	-	39.9
Milford Haven	DC	815	64.8
Mountain Ash	AC	-	61.5
Mynyddislwyn	AC	-	27.6
Neath MB	AC	-	41.2
Neath RD	AC	-	259.6
Newport CB	AC/DC	29,250	471.0
Ogmore & Gawr UD	AC	-	24.4
Penypon RD	AC	-	53.7
Pontardawe RD	AC	-	30.5
Pontypridd UD	AC	-	92.2
Port Talbot UD	AC	600	24.7
Rhondda UD	AC	-	29.2
Risca	AC	-	25.6
Swansea CB	AC/DC	60,000	374.3
Tredegar	AC	-	9.8
<b>Companies</b>			
Aberayron	DC	74	47.0
Brynammon	AC	-	29.8
Carmarthen	AC/DC	200	146.9
Chepstow	AC	--	196.2
Gorseinon	AC/DC	-	120.4
Llanelly & District	AC/DC	17,500	184.5
Merthyr Tydfil	AC/DC	810	42.4
Monmouth	AC	170	96.8
Ogmore Valley EL&P	AC	-	32.3
Penarth	AC/DC	1,730	34.7
Pontypool	AC	-	24.3
Porthcawl	AC	-	123.1
Shropshire, Worcs & Staffs EP Co.	AC/DC	234	..
South Wales EP Co..	AC/DC	66,350	..
West Cambrian Power Co.	AC/DC	4,454	31.4
West Gloucestershire Power	AC	-	..

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

Generating technology emphasised economies of scale with larger units. Tir John power station in Swansea opened in late 1935 had two 30,000kW generators and Upper Boat had added a 25,000kW unit. Such machines and the larger boilers were much more economical in coal consumption. Upper Boat's coal consumption was reduced from 2.20lbs per kilowatt hour in 1925/26 to 1.46lbs a decade later. In contrast, the old Penyardren power station of the Merthyr Tydfil company had a coal consumption rate of 6.27lbs per kWh in 1925/26. By the mid-1930s, however, the Merthyr Tydfil company derived 70 percent of its electricity generated from five small hydro-electric plants, the extravagant coal-burning station being used for peak demand.

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 domestic electricity consumption. By 1935/36 there were ten places with per capita consumption levels above 100kWh, ranging from Newport at 476.0kWh to Gorseinon at 120.4kWh.

The growth of electrification, especially in the lighting segment, may be illustrated by the case of Swansea. Total electricity sales grew from 29.8 million kWh in 1925/26 to 61.8 million kWh in 1935/36. The lighting segment which included domestic uses expanded from 4.61m kWh to 21.17m kWh over the same period. Over the decade per capita consumption rose from 189.3kWh to 374.3kWh. Rhondda, in contrast, suffered heavily in the depression of the 1930s, losing population as the economy declined. Electricity consumption per capita increased only from 10.9kWh per capita in 1925/26 to 29.2kWh in 1935/36.

While the creation of new areas appeared to be making an even more fragmented map, much of the new development was controlled by holding companies which created a new form of integration. Table 5 and Figure 5 show the situation in 1934/5 when three organisations had a dominant position.

Edmundson's Electricity Corporation had in the late 1920s been revived by US capital and began new acquisitions. By 1935 the company was the second largest in Britain. In 1929 the company had bought the Shropshire, Worcestershire and Staffordshire Electric Power Company which in turn acquired the South Wales Electrical Power Distribution Co. in 1930.

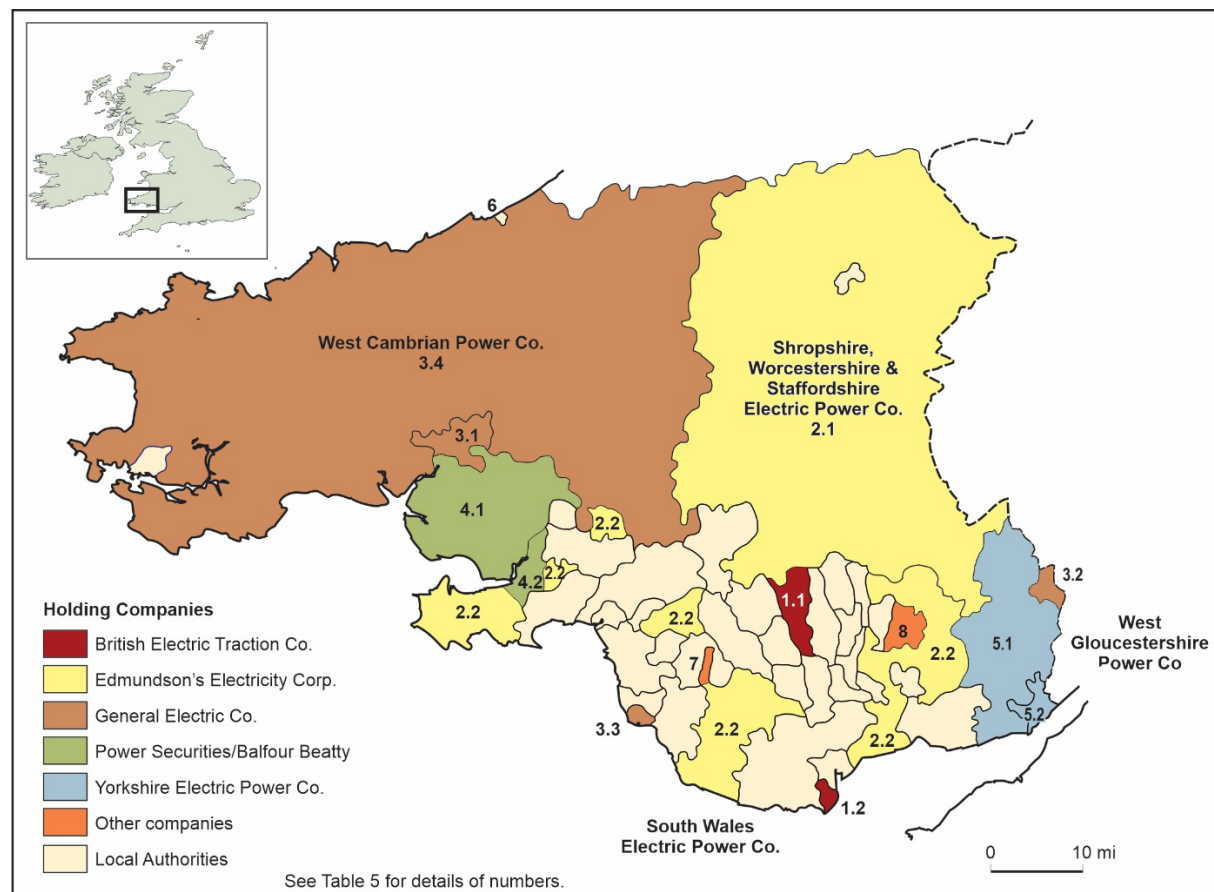
The General Electric Company was at the same time diversifying its interests into electricity distribution. Substantial investment in the new West Cambrian Power Co. changed the whole structure of southwest Wales from one of isolated non-statutory operations into an integrated unit. In the eastern part of the region, the Yorkshire Electric Power Co. acquired West Gloucestershire Power and the small Chepstow company.

Power Securities/Balfour Beatty continued to invest in the Llanelly company. British Electric Traction continued to hold the Merthyr Tydfil and Penarth companies. Only three companies—Aberystwyth, Ogmore Valley and Pontypool—remained outside the big groups.

**Table 5 SOUTH WALES: CORPORATE STRUCTURE OF ELECTRICITY HOLDING COMPANIES 1934/35.**

<i>British Electric Traction Co.</i>	1.1 Merthyr Tydfil ET & L Co. 1.2 Penarth E L Co.
<i>Edmundson's Electricity Corporation Ltd</i>	2.1 Shropshire, Worcestershire & Staffordshire E P Co. 2.2 South Wales E P Co.
<i>General Electric Co. Ltd</i>	3.1 Carmarthen E S Co. 3.2 Monmouth E S Co 3.3 Porthcawl E Co. 3.4 West Cambrian Power Co.
<i>Power Securities/Balfour Beatty</i>	4.1 Llanelly & District E Co. 4.2 Gorseinon E L Co.
<i>Yorkshire Electric Power Co.</i>	5.1 West Gloucestershire Power Co. 5.2 Chepstow E L & P Co.
<i>Other companies</i>	6 Aberayron 7 Ogmore Valley 8 Pontypool

Source: Political and Economic Planning, *Report on the Supply of Electricity in Great Britain* (London: PEP, 1936), pp.140-141.



**Figure 5 SOUTH WALES HOLDING COMPANIES 1934/5.**

Although state intervention had begun to rationalise electricity generation, the efforts of the Electricity Commissioners to reduce the very large numbers of distributors were unsuccessful. The McGowan Report published in May 1936<sup>29</sup> and the subsequent government proposals were strongly opposed by many sections of the electricity supply industry. A recommendation in the McGowan Report, that all undertakings with annual sales of less than 10 million kWh should be amalgamated, was particularly controversial, especially among the smaller local authorities. In South Wales, only four of the 30 local authorities –Cardiff, Neath RD, Newport and Swansea--were above this level. Thirteen local authorities had sales of less than one million kWh and objected to the idea of amalgamation with large companies. The government prepared an Outline of Proposals published in April 1937<sup>30</sup> but the continued opposition and more pressing issues of the time meant that reorganisation of distribution was set aside.

**Table 6** lists the various undertakings that were consolidated between 1920 and 1948. Only two were local authorities. Briton Ferry became part of Neath with an amalgamation. Brecon sold its small operation to the SWS Co.

Seven small power stations were closed between 1935/6 and 1948. The largest was at Lfor in Dowlais (5,000kW); the other stations at Brecon, Llandilo, Pencader, Port Talbot, Tregaron and Ystradgynlais all had capacities of less than 1,000kW.

The South Wales industrial economy was revived by rearmament in the later 1930s. Demand for electric power soared and all the major power stations were extended. Upper Boat installed three 30,000kW generating sets between 1939 and 1942, and a new power station at Llynfi with an initial capacity of 60,000kW was initially commissioned in 1943. Similar extension work took place at the Cardiff and Newport power stations. Private generation was also expanded at the new high explosive plants at Pembrey and Caerwent. The latter site which covered nearly 2,000 acres had three power plants.<sup>31</sup>

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<sup>29</sup> 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.

<sup>30</sup> Ministry of Transport, *Electricity Distribution: Outline of Proposals* (London: HMSO, 1937).

<sup>31</sup> Wayne D. Crocroft, *Dangerous Energy: the archaeology of gunpowder and military explosives manufacture* (Swindon: English Heritage, 2000), p.206.

**Table 6 SOUTH WALES: CONSOLIDATION OF ELECTRICITY SUPPLY BEFORE 1948.**

<b>UNDERTAKING</b>	<b>YEARS IN OPERATION</b>	<b>NEW OWNER</b>
<i>Briton Ferry UD</i>	1910?-1922	Neath MB
<i>Llandilo UD</i>	1902-1933	West Cambrian Power
<i>Tenby Gas Co.</i>	1928-1933	West Cambrian Power
<i>Brecon MB</i>	1928-1935	S W S Co.
<i>Glantawe Co.</i>	1910-1936	South Wales Power
<i>Brynammon Co.</i>	1915-1938	South Wales Power
<i>Ogmore Valley E L &amp; P Co.</i>	1892-1943	Ogmore & Garw UD
<b><i>Municipal Takeover of Company Undertakings</i></b>		
<i>Cardiff RD</i>	1923 (Radyr Co.)	
<i>Llandrindod Wells UD</i>	1923	
<i>Ammanford UD</i>	1924	
<i>Penarth UD</i>	1938	

### III Nationalisation

After three decades of discussion the whole organisation of electricity was restructured following the Electricity Act 1947. From 1 April 1948, the South Wales Electricity Board took over the distribution assets of 31 local authorities and 13 companies (**Figure 1**). The generating stations and the transmission lines of the Central Electricity Board were transferred to the British Electricity Authority.

#### Electricity Distribution

Integrating the various undertakings was a huge task for the new Board. Systems had to be standardised and the multiplicity of tariffs reduced. For administrative purposes, the Board area was subdivided into four sub-areas and 25 districts. Initially the districts tended to reflect the pre-nationalisation company and municipal areas. Four districts were added on 1 April 1949 when the former areas of the SWS Company and West Gloucestershire Power were integrated.<sup>32</sup>

**Figure 6** shows the geographical organisation in 1957 when some further reorganization had taken place. One notable feature was the network of 84 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.

<sup>32</sup> South Wales Electricity Board, *First Annual Report 1958-0*.





Figure 6 SOUTH WALES, 1957.

The South Wales Electricity Board's first decade of operation coincided with a major phase of growth of demand in all segments of the market. Industrial growth was very strong, electrification had been extended especially in rural areas, and new residential construction was booming, including a New Town at Cwmbran. Between 1948/9 and 1958/9 the number of consumers increased from 436,200 to 628,027 and sales grew from 2,252 to 4,863 million kWh. To serve this growth, the Board's employees increased from 4,964 to 7,309.

### Electricity Generation and Transmission

The South Wales Division of the British Electricity Authority covered the area of the South Wales Board together with the western part of Gloucestershire. It was an amalgamation of the 132kv transmission developed by the Central Electricity Board and the power stations previously owned by 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.

**Table 7 BRITISH ELECTRICITY AUTHORITY POWER STATIONS IN THE SOUTH WALES DIVISION 1948/49.**

<b>POWER STATION</b>	<b>CAPACITY kW</b>	<b>TYPE<sup>1</sup></b>
<i>Upper Boat</i>	155,000	S
<i>Tir John</i>	147,750	S
<i>Newport</i>	89,250	S
<i>Cardiff</i>	87,600	S
<i>Llynfi</i>	60,000	S
<i>Llanelly</i>	28,000	S
<i>Lydney<sup>2</sup></i>	17,635	S
<i>Haverfordwest<sup>a</sup></i>	4,975	I
<i>Penarth</i>	2,200	S
<i>Bridgend</i>	2,000	S
<i>Pontypridd</i>	1,800	S
<i>Milford Haven</i>	815	I
<i>Penydarren<sup>b</sup></i>	520	S
<i>Lampeter<sup>a</sup></i>	400	I
<i>Llandrindod Wells</i>	231	I
<i>Carmarthen</i>	200	I
<i>Pont-y-cafnan<sup>b</sup></i>	190	H
<i>Llandyssul<sup>a</sup></i>	139	I,H
<i>St Clears<sup>a</sup></i>	113	I
<i>Monmouth</i>	110	I,H
<i>Aberayron</i>	100	I
<i>Cyfarthfa<sup>b</sup></i>	100	H
<i>Newquay</i>	35	I
	<b>599,183</b>	

**Notes:**

<sup>1</sup> S – Steam; H – Hydro-electric, I – Internal combustion (diesel).

<sup>2</sup> The Lydney station was part of the South Wales Division although in the distribution area of the Midlands Electricity Board.

<sup>a</sup> Stations formerly of West Cambrian Power Co.

<sup>b</sup> Stations formerly of Merthyr Tydfil E T & L Co.

**Source:** Compiled from BEA, *Annual Report 1948-49*, Appendix 15.

**Table 7** shows the 23 power stations in the new organisation. They varied in size from large turbine-powered stations at the top to small diesel-and hydro units at the lower end. Llynfi was a new station only five years old, while Merthyr Tydfil still used the equipment installed at its opening in 1901. A comparison with **Table 4** shows that most of the growth in capacity had taken place at the larger selected stations: Cardiff, Newport, Tir John and Upper Boat.

Private generation was maintained, although the Coal Board as the new owner of the collieries power systems did not invest in any expansion of the facilities. The larger iron and steel works also continued to generate electricity for their own use.

Within a decade, most of the objectives planned in the late 1940s had been fulfilled. Two existing stations, at Llynfi and Haverfordwest, had been extended and three new stations—at

Carmarthen Bay, Burry Port (1953-57), Rogerstone (1957)<sup>33</sup> and Uskmouth (1952-57)—had been completed. New stations at Aberthaw and Uskmouth B were under construction. These stations incorporated larger generating sets of 100/120,000kW capacity and had correspondingly larger boiler units working at a pressure of 1500lbs per square inch. Between 1948/9 and 1958/9 the number of power stations had been reduced from 23 to 13, while total generating capacity had more than doubled (**Table 8**).

**Table 8 CENTRAL ELECTRICITY GENERATING BOARD POWER STATIONS IN THE SOUTH WALES DIVISION 1958/59.**

<b>POWER STATION</b>	<b>CAPACITY kW</b>	<b>TYPE<sup>1</sup></b>
<i>Uskworth A</i>	360,000	S
<i>Carmarthen Bay</i>	345,000	S
<i>Tir John</i>	155,500	S
<i>Upper Boat</i>	155,000	S
<i>Llynfi</i>	120,000	S
<i>Rogerstone</i>	120,000	S
<i>Cardiff</i>	87,600	S
<i>Newport</i>	80,500	S
<i>Llanelly</i>	25,000	S
<i>Lydney</i>	17,500	S
<i>Haverfordwest</i>	8,465	I
	<b>1,474,565</b>	

**Notes:**

<sup>1</sup> S – Steam; I – Internal combustion (diesel).

**Source:** Compiled from CEBG, **Annual Report 1958-59**, Appendix 1.

The original grid transmission system had been extended during the war (**Figure 7**). A new line from Watford via Oxford and Gloucester to Ebbw Vale and Upper Boat added new capacity for the heavy demands of South Wales industry. In the 1950s West Wales was connected to the grid with a transmission line from Upper Boat to Haverfordwest. Additional transformer stations were built at Carmarthen, Ammanford, Ystradgynlais and Hirwaun as well as at Trostre and Margam to supply the expanded steel works.

By the late 1950s some of the results of new expansion plans were beginning to show in the landscape. Since the existing national transmission grid was limited in capacity, especially for inter-regional transfers of power, a new Supergrid at 275kv (later raised to 400kv) was being developed. A line from Melksham to Pyle, near Port Talbot, was under construction and the tall towers for the Severn crossing at Aust and Beachley Point had been completed. New generating technology in the form of nuclear power was also being introduced. No nuclear station were built in South Wales but two stations were developed on the Severn estuary at Berkeley and Oldbury in the 1960s.<sup>34</sup>

<sup>33</sup> The Rogerstone site was a substitute from an earlier proposal at Machen on the Rhymney River where after strong objections and a public inquiry the Minister of Fuel and Power had refused consent. **Electricity Report of the Minister of Fuel and Power for the year ending 31 March 1954**, Parliamentary Paper HC 249, 1953-54, p.9.

<sup>34</sup> A site at Portskuett for a nuclear power station in the late 1960s was rejected after strong local and regional opposition.

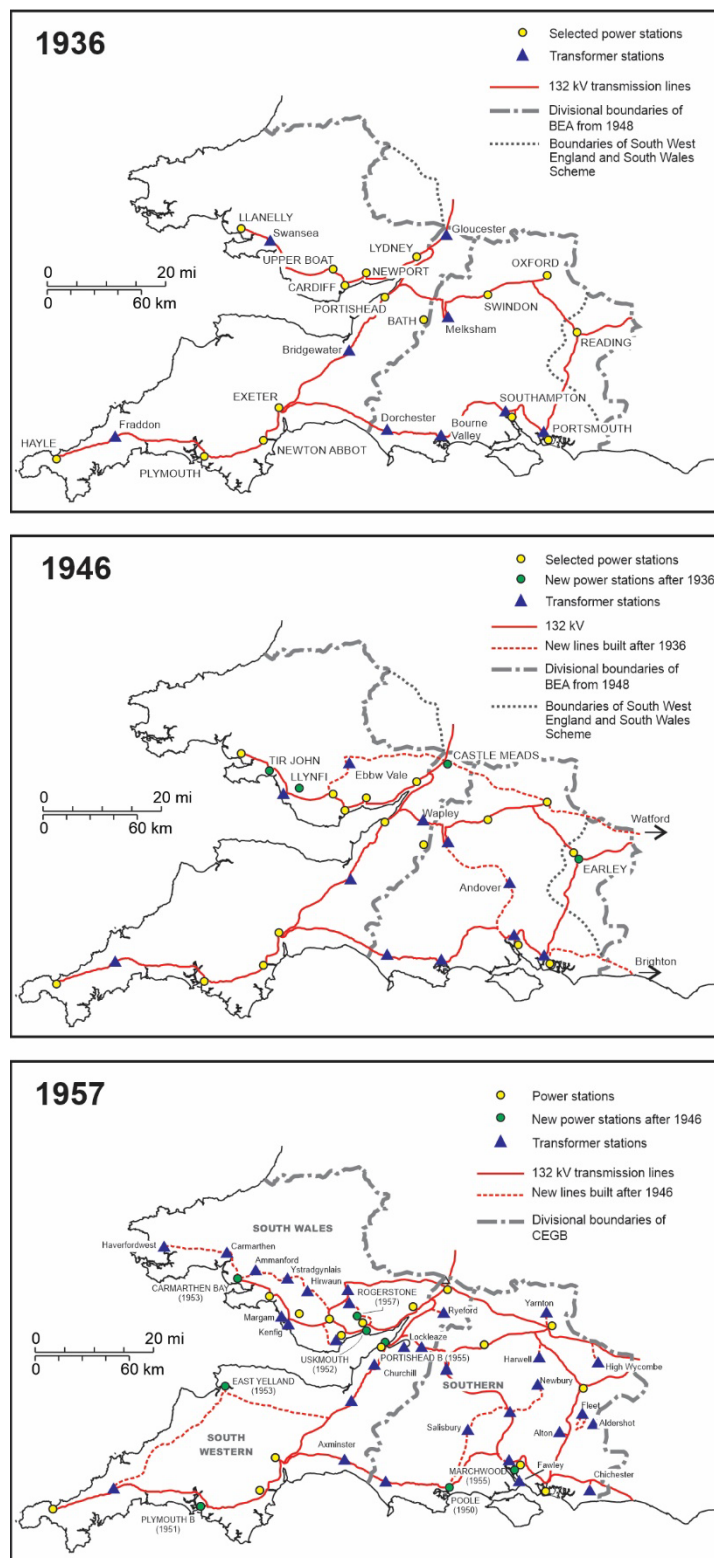


Figure 3 7 EVOLUTION OF THE GRID.

During the first decade of operation the South Wales Division built three new power stations and raised generating capacity from 599,183kW to 1,474,565kW. The whole system had been integrated and modernised, with 15 old, small stations being closed. Transmission line capacity was increased from XX to 371 route miles between 1948/9 and 1958/9. Over this period the number employed rose from 2,174 to 3,366.

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 South Western Region was established incorporating the Southern, South Western and South Wales Divisions. Under the new arrangements the regional director in Bristol became responsible for the higher-order planning and administration of 43 power stations, 1,768 miles of transmission lines and 8,979 employees. The divisional offices in Cardiff not only lost some administrative roles but design work was transferred to new project groups outside the region.

## Summary

**Table 9** shows various indicators of the growth of electrification from 1900. The number of undertakings grew rapidly from 1900 to 1912 and then continued at a slower rate to a peak in 1935/6. Power station numbers show a similar pattern. Rationalisation increased sharply after 1948/9.

A sense of the rapid growth of demand, especially after 1925/6 is illustrated by the two final columns in the table. Economies of scale are reflected in the increasing size of power stations. The largest station in 1912 at Upper Boat had an installed capacity of 10,500kW which was raised to 48,750 in 1925/6 and 61,500kW in 1935/6. By 1948/9 the capacity had been more than doubled to 155,000kW. The new Uskmouth A station had a capacity of 360,000kW in 1958/59.

Per capita consumption in South Wales (with Great Britain in parentheses) shows substantial rates of growth. The strength of the private generating sector, especially at collieries and steel works, tended to retard consumption levels during the interwar period compared to other industrial regions. With the industrial recovery of World War II, consumption in South Wales rose to higher levels, well above the national average.

**Table 9 SUMMARY OF DEVELOPMENT IN SOUTH WALES.**

	<b>NUMBER OF UNDERTAKINGS<sup>1</sup></b>	<b>LOCAL AUTHORITY UNDERTAKINGS</b>	<b>NUMBER OF POWER STATIONS</b>	<b>GENERATING CAPACITY (KW)</b>	<b>PER CAPITA CONSUMPTION (KWH)</b>
1900	6	3	6	..	.. (4) <sup>3</sup>
1912	25	14	26	..	.. (36)
1925/6	36	25	22	138,035	87 (133)
1935/6	46	30	28	219,698	196 (374)
1948/9	..	..	23 <sup>2</sup>	599,183	1,126 (821)
1958/9	-	..	11 <sup>2</sup>	1,474,565	2,385 (1,765) <sup>4</sup>

**Notes:**

<sup>1</sup> Excludes all non-statutory undertakings.

<sup>2</sup> Includes Lydney, Gloucestershire power station.

<sup>3</sup> 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.

<sup>4</sup> Calculated from data in Electricity Council, *Handbook of Electrical Supply Statistics 1977*, p. 63 and census returns.

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 late 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 also 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 (1<sup>st</sup>, 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 supervision 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 tabulations 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.<sup>35</sup> 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)<sup>36</sup> 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.

The South Wales Electricity Board Annual Reports and Accounts were also published as House of Commons papers until 1971-72. Many libraries subscribe to online Parliamentary Papers where these documents can be read.

From 1958-59 the Electricity Council, created to provide more linkages and coordination between 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 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 rare.

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<sup>35</sup> See *Annual catalogues of British government publications 1920-1970* (Bishop's Stortford: Chadwyck-Healey. 1974).

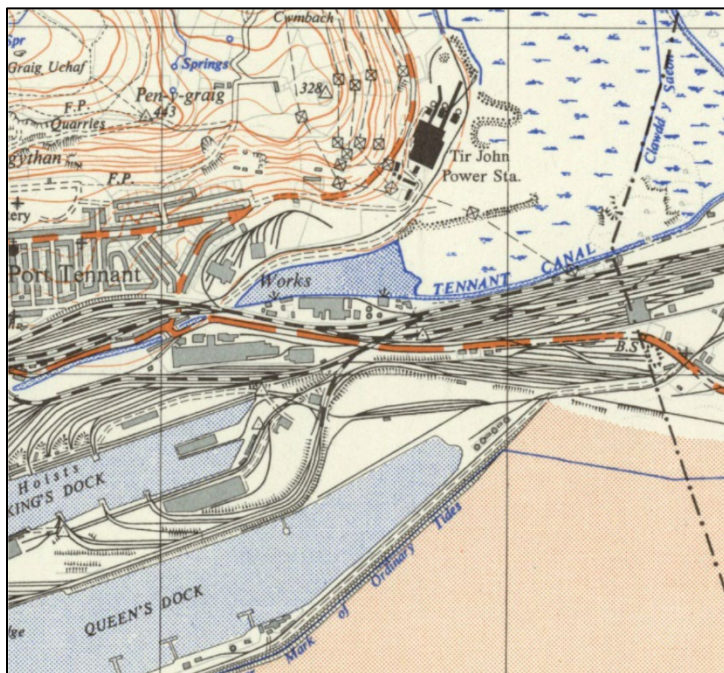
<sup>36</sup> The change of title from British Electricity Authority resulted from the formation of the autonomous South of Scotland Electricity Board from 1 April 1955.



Two collections have materials relevant to electrification in South Wales:

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

In Bristol, the Western Power Electricity Historical Society has a museum and extensive archival collection. The Society began in 1994 when employees of the former SWEB began salvaging records of all the former undertakings in the region. A set of Garcke's *Manual* is a valuable part of the collection for research beyond the South West. The Society has been very active in publishing articles of wide interest and has a particularly effective and comprehensive website at [www.wpehs.org.uk](http://www.wpehs.org.uk)



## SWANSEA

*Built by the Swansea Corporation as part of the South Wales grid scheme, Tir John was opened in June 1935 with two 30,000kW turbo-alternators. Wartime extensions raised the capacity to 155,500kW by nationalisation.*

*Ordnance Survey 1:25,000 series, Sheet SS69, 1951 (National Library of Scotland)*