



Historic England

# 20th-Century Coal- and Oil-Fired Electric Power Generation

Introductions to Heritage Assets



# Summary

Historic England's Introductions to Heritage Assets (IHAs) are accessible, authoritative, illustrated summaries of what we know about specific types of archaeological site, building, landscape or marine asset. Typically they deal with subjects which lack such a summary. This can either be where the literature is dauntingly voluminous, or alternatively where little has been written. Most often it is the latter, and many IHAs bring understanding of site or building types which are neglected or little understood. Many of these are what might be thought of as 'new heritage', that is they date from after the Second World War.

Power stations are among the largest and most recognisable complexes built in the British landscape during the C20. They had a profound impact on the British landscape, visually, environmentally, and culturally, and the electricity they generated had a transformational effect on our economy and society. Reaching an unrivalled scale and level of technological sophistication by the 1960s, many power stations are now becoming obsolete, as cleaner, more efficient and renewable forms of energy production find favour in the 21st century. This document provides an overview of our understanding of these power stations, especially those of the later C20 which until recently have been little studied. It outlines the history of electricity production from the advent of the first public power stations in the 1880s, through the growth of the industry (c.1900-1918), rationalisation (c.1919-1947), nationalisation (c.1948-1990) and privatisation (c.1990-2000). This is followed by a summary of the development of the building type during the C20, including their construction, materials, main components (eg cooling towers), architectural treatment, engineering and associated landscaping.

This guidance note has been written by Jonathan Clarke and edited by Paul Stamper.

It is one of several guidance documents that can be accessed [HistoricEngland.org.uk/listing/selection-criteria/listing-selection/ihas-buildings/](https://HistoricEngland.org.uk/listing/selection-criteria/listing-selection/ihas-buildings/)

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**Front cover: Didcot 'A' Power Station, Power Station Road, Didcot, Oxfordshire.**  
General view of north west natural draft cooling towers.

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# Introduction

Coal- and oil-fired power stations are among the largest and most recognisable industrial complexes of the 20th century. They had a profound impact on the British landscape, visually, environmentally, and culturally, and the electricity they generated had a transformational effect on our economy and society. Reaching an unrivalled scale and level of technological sophistication by the 1960s, now many of these ‘great temples to the carbon age’ are becoming obsolete, as cleaner, more efficient and renewable forms of energy production find favour in the 21st century.

All power stations (also historically known as generating stations, powerhouses or generating plant) contain one or more generators that convert mechanical power into electrical power by means of the relative motion between a magnetic field and a conductor. They can be classified by the prime mover (for instance steam turbine or gas turbine), or according to their duty within the energy production system (for instance base load power stations, providing continuous power). But the principal classification has traditionally been by the source of heat (fossil-fuels, nuclear, geothermal, biomass etc) or motive power (hydroelectricity and wind power). In England, from the advent of the first public power stations in the 1880s until the end of the 20th century, fossil-fuel power stations – above all, coal – significantly outnumbered all others, reaching a peak in the second quarter of the century. In the second half of the century, as electricity production was nationalised, and truly rationalised, numbers decreased, with energy production concentrated in larger, more efficient installations, mostly on coalfields remote from towns and cities. In this period, oil-burning became briefly competitive, resulting in a number of purpose-built oil-fired stations, or those adapted to burn this fuel.

This document reviews our current understanding of 20th-century coal and oil-fired power stations, especially those of the second half of the century which until recently have been little studied. Whilst there is a considerable literature on the history of the electric power generating industry, this has focused largely on technological and business history, especially its pioneer and early, pre-Nationalisation phases. Similarly, individual sites, and their architecture, have featured in a wide spectrum of local and specialist journals and other publications, but this too has largely favoured buildings and machinery from the late 19th and early 20th centuries. This imbalance began to be addressed in the 1990s, with the compilation of English Heritage’s Monuments Protection Programme Step Reports on Electric Power Generation, and the Royal Commission on Historical Monuments of England’s thematic report on ‘The Power Stations of the Lower Thames’. More recently, England Heritage commissioned desk-based research on post-war coal-fired (2013) and oil-fired (2014) power stations, and has issued guidance on the recording of those installations that have not benefited from statutory protection. [Historic England’s Selection Guide on Utilities and Communications Structures \(2011\)](#) sets out the current designation thresholds of the building type, to which this introduction provides an additional factual overview.

# 1 Historical Background

By the turn of the C20, the electricity industry in Britain had already witnessed considerable development which laid the key foundations for untrammelled growth in the 20th century. From Michael Faraday's discovery of magnetoelectric induction in 1831, to the perfection of the high speed reciprocating steam engine and the introduction of the steam turbine in the 1890s, a whole series of technical innovations and developments had seen electric power generation become progressively more large-scale, manifest and refined. Four principal types of power house or power station had emerged in the late 19th century, mostly using steam engines, gas engines and by the turn of the century, increasingly, steam turbines. The first of these were power houses that served private houses or estates, a development pioneered hydroelectrically in 1878 at Cragside, the Northumberland stately home of industrialist Sir William Armstrong (R. Norman Shaw, 1863; listed Grade I). One of the earliest surviving electricity generating stations is No. 46, Kensington Court (Royal Borough of Kensington, London, by A. Slater; listed Grade II), built in 1888 to supply electrical lighting to a development of middle class houses and flats of the same name. The second were power stations which provided lighting and power for selective industrial concerns, such as steel mills, shipyards, coal mines and textile mills. Third, there were generating plants that powered street tramways and electric railways, including those serving the Sheffield Tramway (1899) and the Liverpool Overhead Railway (1893) – the world's first electric elevated railway. And fourth, there were power stations built to serve the urban populace, mainly in the form of lighting. These were both privately or



**Figure 1**

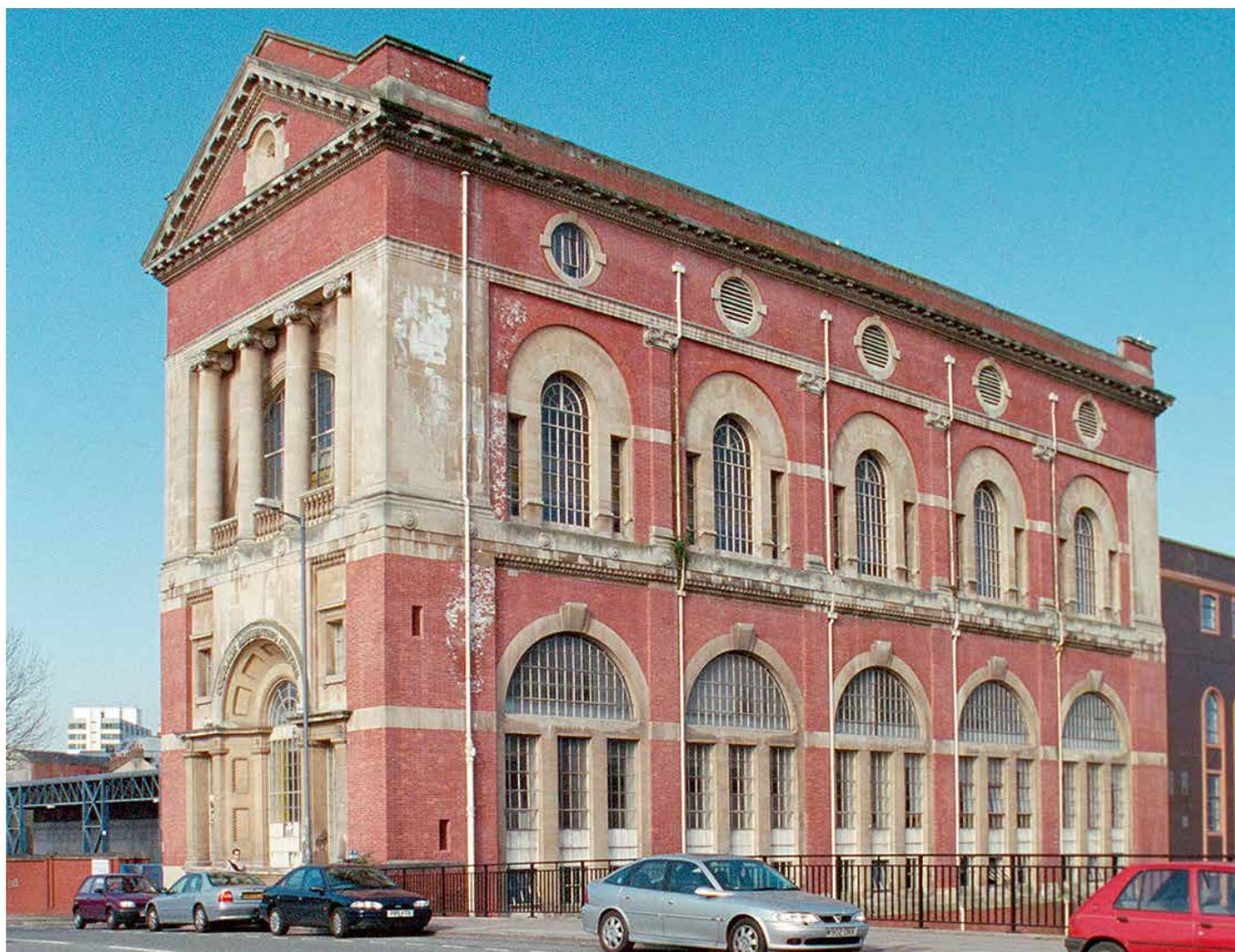
No. 46, Kensington Court, London, was erected in 1888-90 for the Kensington and Knightsbridge Electric Lighting Company, established by REB Crompton. Replacing a temporary wooden generating station, this building originally housed three Babcock and Wilcox boilers linked to seven Willans-Crompton generating sets.

© Mr Adam Watson

municipally operated, with private companies mostly supplying smaller towns, and municipal authorities providing for larger towns and cities. Most were low-capacity, small, shed-like structures quickly erected – or adapted – for local supply, although there were superlative exceptions.

Deptford Power Station (London Borough of Greenwich) was the world's largest power station when it opened in 1891, and also the most advanced, pioneering the use of high voltage (10kv) alternating current (AC) and generating 800 kilowatts by means of 80 Babcock & Wilcox boilers and four 10,000 hp Corliss engines. Designed by

Sebastian de Ferranti for the London Electric Supply Corporation, this long-demolished coal-fired powerhouse was built to supply central London via underground mains, albeit with mixed success. Whilst the advantages of large scale AC production gained widespread recognition in the 1890s, there was still considerable variation in the type of supply – with both DC (direct current) and AC systems at different voltages and frequencies – as well as fuel type (coal, refuse, gas engine, hydro-electric, waste heat and gas). Apart from private country estate installations, the rural populace was almost entirely without electricity.



**Figure 2**

The Bristol Tramways & Carriage Company's Power Station, Counterslip Street, Bristol was given fine neo-Baroque elevations by W Curtis Green which masked

the American-designed, -fabricated and -erected steel structure within (1899-1900, listed Grade II\*).

© Ms Ruth Povey

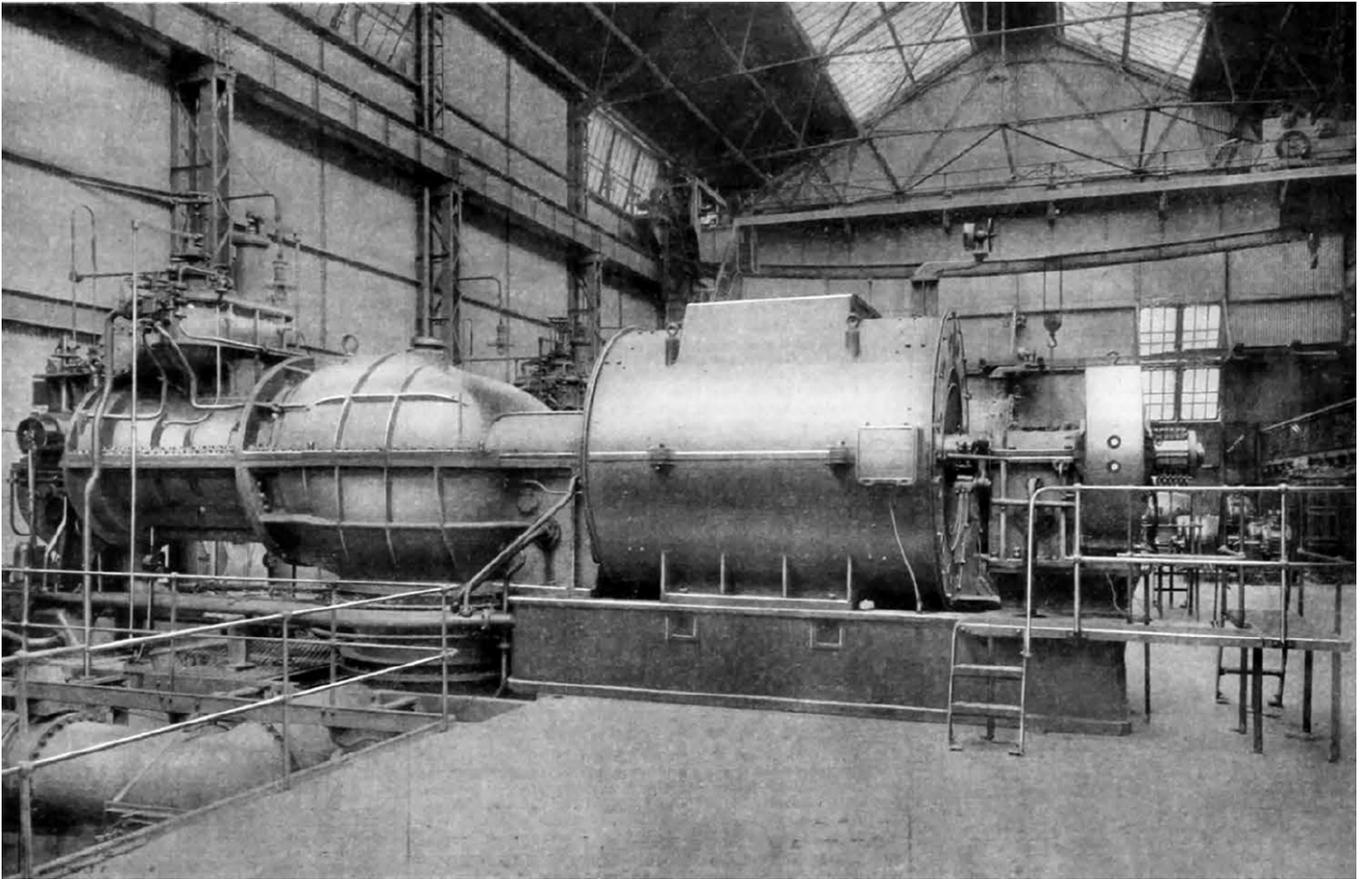
# 2 The Growth of the Electricity Industry in the 20th Century

## 2.1 1900-18: More light, more power

Building on the technical and organisational developments of the 19th century, the first two decades of the new century saw the establishment of numerous power companies serving most of England not covered by the existing municipal authority supply districts. A series of private Acts between 1897 and 1905 alone created around 20 large power companies, which along with the municipal authorities began building larger power stations with larger distribution areas. Many were built along increasingly optimised designs, especially those designed by the firm Merz & McLellan, consulting engineers, for the Newcastle upon Tyne Electric Supply Company (NESCo). Their coal-fired Neptune Bank Power Station on the River Tyne at Wallsend (1900-1) was the first power station in the United Kingdom to generate three-phase electric current. Carville 'A' station, Wallsend (1903-4), also by Merz & McLellan for NESCo, was equipped entirely with turbo-alternators and instanced the first use of a central control room, rather than having instrumentation distributed around the station. London, which remained at the forefront of technical developments until the mid 20th century, saw the erection of a number of enormous, progressive power stations in this period to power its tramways, underground trains, and street lights, including those built at Greenwich (1902-10) and Lots Road, Chelsea

(1902-5). By 1905, due to unchecked competition, there were 12 local authorities and 14 private companies supplying electricity with widely different supply systems within the capital – a circumstance unlike anywhere else. Charles Merz, of NESCo. and Merz & McLellan, sought to rationalise matters through the County of London Electric Power Bill, 1905. This would have allowed a private company to supply the capital's electrical power (and a large area outside of it), but was narrowly defeated. The Electric Lighting Act, 1909, accepted the need for reorganisation of supply in the wake of technical developments in generation and transmission, authorising, among other things, local authorities and companies (as distinct from 'power companies') to supply electricity in bulk, and requiring Board of Trade consent for the erection of power stations.

By 1910 steam turbines had become the general form of prime mover, and coal the dominant fuel. Whilst hydro-electricity remained important for a number of small-scale private estate supplies and small rural supplies its application to public, urban supplies was limited. Similarly, the limited output of refuse destructor/generator stations (which in 1912 accounted for about one fifth of public supply stations) saw hardly any built after the First World War, and gas engine-fired, waste-heat and gas-fired power stations all declined in popularity. Lighting remained the dominant use of electricity, but as supply became more reliable



**Figure 3**

One of the enormous turbo-generators at Carville 'A', Wallsend. Manufactured by CA Parsons, of Newcastle, their normal capacity of 700 electrical horsepower

made them the largest steam turbines in operation in the UK in 1904.

*The Engineer*, 16 September 1904, p. 275

and extensive it was increasingly adopted for power applications. Nevertheless, in most towns lighting was by gas, and electricity supplies hardly existed outside urban areas.

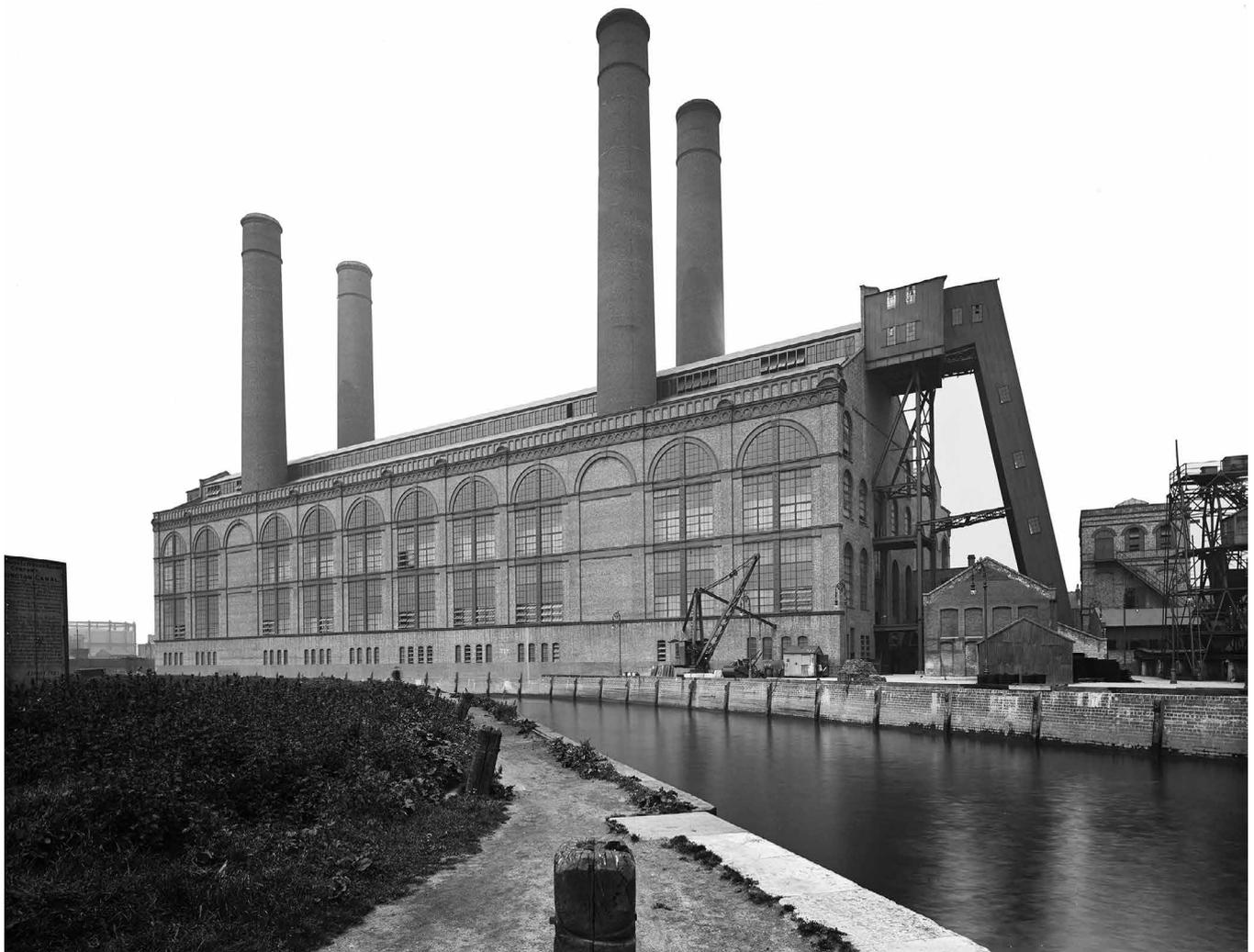
## 2.2 1919-47: Rationalisation

During the First World War there was growing discontent with the disorganized, piecemeal and uneconomic nature of electricity supply and distribution. Government committees urged for larger generating units in fewer power stations, with generation and transmission combined in a single unified system under some form of public ownership. The Electricity (Supply) Act of 1919 saw the creation of joint authorities which could combine to provide power economically for particular regions. It led to the creation of the London Power Company (see below) and the

building of a number of so-called 'super stations' in the next decade such as Stourport, Hams Hall 'A' (Worcestershire) and Ironbridge (Shropshire), but the efforts of the Electricity Commissioners appointed to persuade electricity suppliers to reorganise were thwarted by rival, vested interests and a lack of compulsory power. In 1925 the report of a new government committee headed by Lord Weir described this 'policy of persuasion ... a failure', and its recommendations – which sidestepped the thorny question of public ownership – were embodied in the Electricity (Supply) Act of 1926. This put the industry under the overall direction of a public corporation, the Central Electricity Board (CEB), to concentrate generation in a limited number of 'selected stations', and to interconnect these stations, and the regional distribution networks, into a 'national gridiron'. The National Grid, a 4,000-mile network of overhead power lines suspended from

pylons and operating at 132 kV (132,000 volts) was constructed in an eight-year programme in 1927-35. Of the 438 power stations identified in the Weir Committee report, only 140 larger, central stations supplied the grid. Many smaller, isolated, stations were closed down, although some establishments bought from, and sold surpluses to the grid, whilst others continued to generate electricity for their own use in factories, hospitals and country estates. This period of rationalisation saw increasingly large, higher-output coal-fired stations being built. In the mid 1920s the complete output of most was 5 MW or

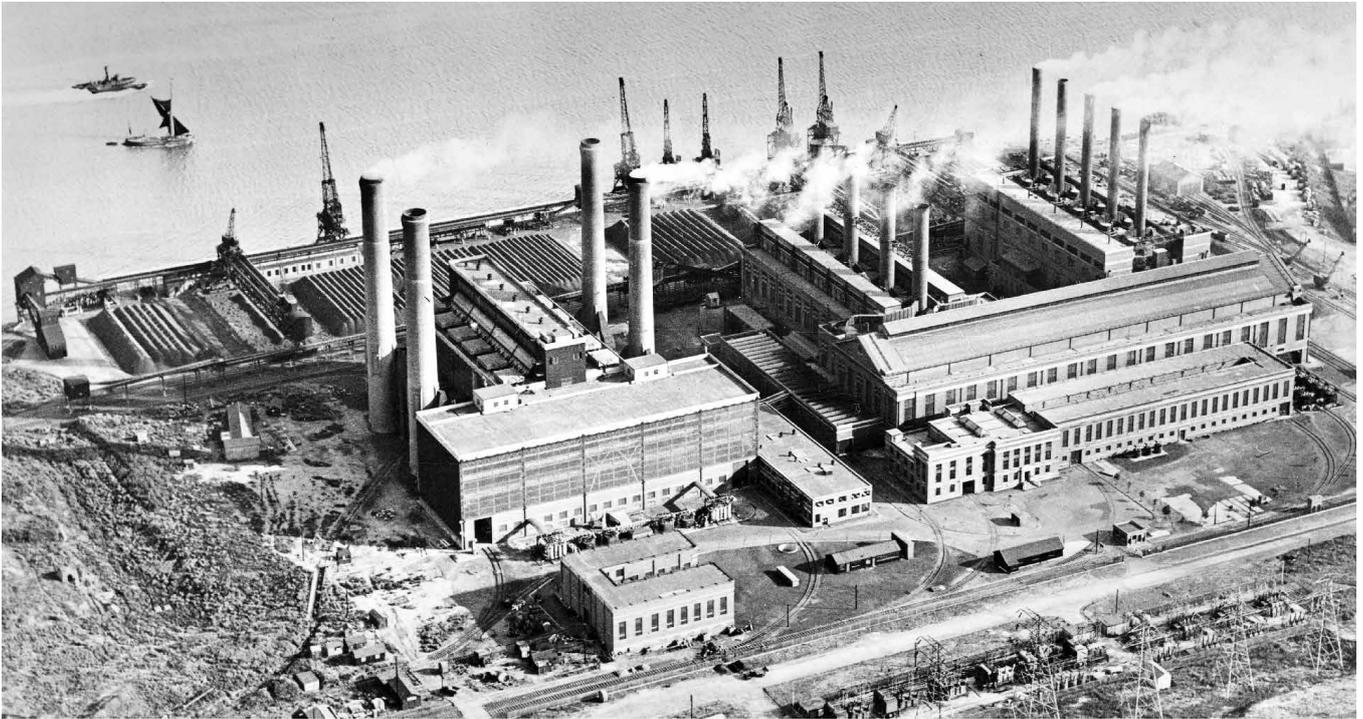
less, and the generating units of even the 'super stations' rarely exceeded 25 MW. By the mid 1930s sets of between 20 MW and 50 MW became normal, and there was experimentation with bigger units of 75 MW and 100 MW at Barking 'B' (London Borough of Barking and Dagenham) and Battersea 'A' (London Borough of Wandsworth) power stations. The latter used the largest set in Europe when it began generation in 1933, and was proclaimed as a 'landmark in the development of larger London's light and power'. The flagship of the new London Power Company – a consortium of ten electricity companies



**Figure 4**

Lots Road Power Station, Chelsea, upon completion in 1905. This early steel-skeleton-framed structure was likened to 'an elephant lying on its back with its

four legs in the air'. Only two of the enormous brick chimneys survive.



**Figure 5**

Barking 'A' (1925-8; on right) and 'B' Power Station (1931-9; on left), on the north bank of the river Thames,

about 1935. The difference between the older 'brick cathedral' and modern, glass-walled structures is palpable.

formed in 1925 to supply parts of the metropolis – it was a symbol of modernity, 'perpetually in London's eye'. London then was one of seven regional control centres, but following reorganisation in 1938, it became the national control centre, with control rooms at Bankside.

### 2.3 1948-1990: Nationalisation

Despite steps to rationalise the industry in the inter-war period, desperate fuel and power shortages following the Second World War underscored the need to nationalise the plethora of municipal and privately owned electricity generation and supply utilities. By today's standards generation and supply was chaotic and wasteful, with considerable diversity in the range and quality of supplies available and the size and arrangement of power stations to the public. Furthermore, the National Grid was not truly national, and operated at low voltages (primary distribution was at 132 kV, with secondary distribution at 66 kV and 33 kV). The 1947 Electricity Act saw the replacement of the CEB

with a new body, the British Electricity Authority (BEA) which had a remit for England, Wales and the South of Scotland. This was administered through 14 Area Boards and 12 Generating Divisions, arranged geographically, with each Area Board responsible to the central authority for retail distribution and each Generating Division responsible to the BEA for the generation and transmission. The Divisions initiated a degree of standardisation of 30 MW and 60 MW plants which were individual boiler/turbine units instead of the more usual steam range systems. Between 1948 and 1952, some 5,800MW of plant comprising 150 units of 30MW and 60MW was installed in 66 power stations. Conservative by French and American standards (where more fuel-efficient 200MW sets were being experimented with), the gap was closed by the mid to late 1950s when five 200 MW units were ordered for High Marnham, Nottinghamshire. When opened in October 1962, this 1,000 MW station was the largest in Europe, consuming coal from 17 collieries. Such edifices not only signalled the rapidly increasing size and output of electricity generation in the second half of the 20th century, but also a broad geographical



**Figure 6**  
The neo-Classical Stourport power station, Worcestershire, photographed soon after completion in June 1933.

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shift in which stations were relocated from town centres into the countryside, their locations determined by fuel source and water supply rather than load supply. With its vast amounts of cooling water and coal from the Nottinghamshire and Yorkshire coalfields, the Trent Valley formed the hub of the nationalised industry, supplying a quarter of the electricity needs of the UK and becoming known as ‘Megawatt Valley’, the biggest concentration of power in Europe.

From the 1950s there was experimentation with alternatives to coal, including oil, gas and diesel. When the first of half of Bankside ‘B’ power station ((London Borough of Wandsworth; now Tate Modern) opened in 1953 it was the first large public supply station to be specially designed for oil-firing in Britain. A number of other large power stations in the Thames and other estuaries in southern Britain were converted or purpose-built to burn oil or both fossil-fuels, depending on the relative price and competitiveness of supplies, and in 1967 natural gas firing was introduced. Yet throughout the 20th century, coal remained the dominant fuel, and only three of the 14 ‘super

stations’ the largest power stations ever built by the Central Electricity Generating Board (created in 1957 from the Central Electricity Authority, which had replaced the British Electricity Authority three years earlier), based on turbo-alternator units of 500 MW and 660 MW output – were oil or dual-fired. Thus banks of gigantic concrete cooling towers – essential for coal-fired stations – typified thermal power stations of the latter 20th century, and dominated their landscapes for miles around.

## 2.4 1990-2000: Privatisation

In the late 1980s the electricity industry was privatised, and in 1990 it returned to the private sector. With government policy lessening dependence on home-produced coal, and encouraging the construction of relatively small gas-fired plants, the last decade of the 20th century saw the proliferation of stations based on the combined gas turbine process (CCGT), as well as others employing a range of other fuels and sources of energy such as nuclear power and biofuel.

# 3 Development of the Building Type

By the start of the 20th century, the purpose-built power station had emerged as a distinct, recognisable building type. Its chief features were a parallel arrangement of boiler and engine houses, tall chimneys to disperse smoke from the boiler furnace, and allied buildings and structures including jetties, bunkers and stores. Steel-frame

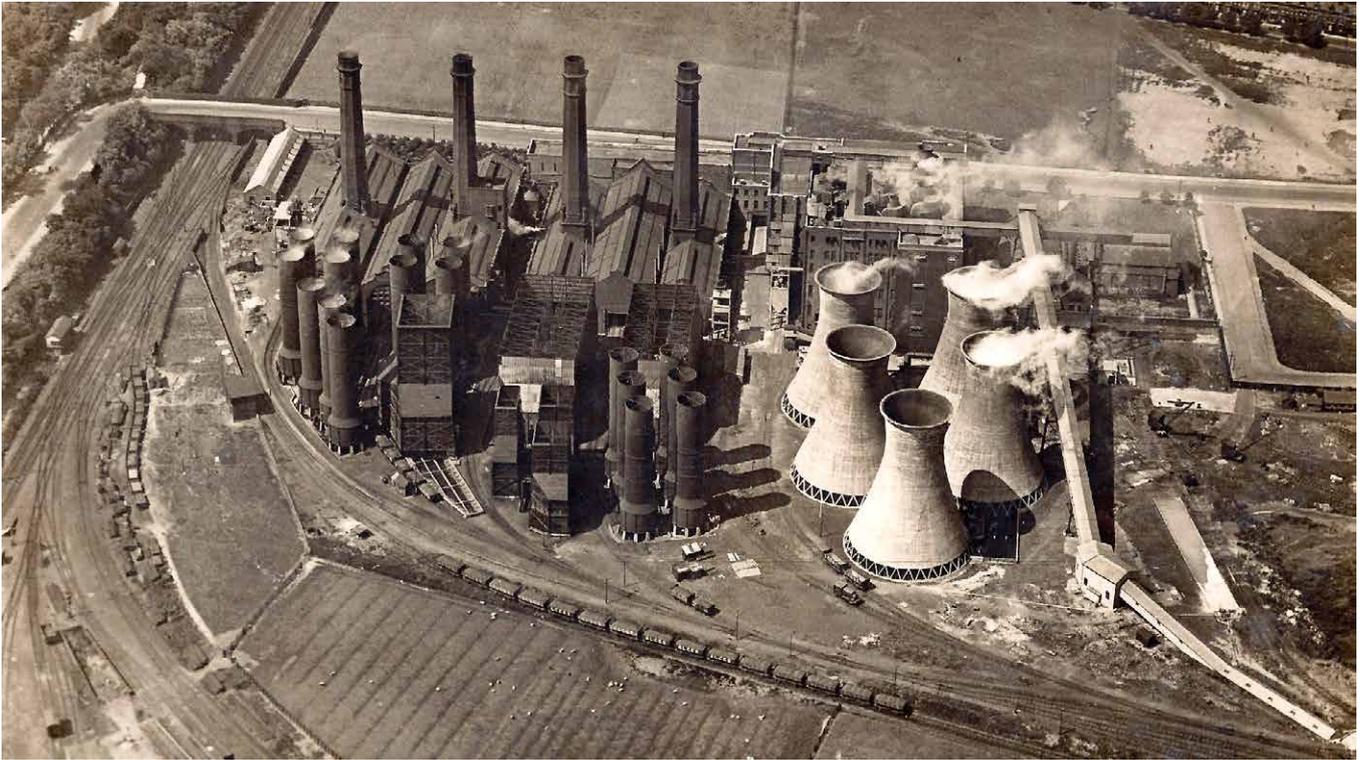
construction, which was fast and robust was used early on to frame the large spaces required and to carry overhead travelling cranes which facilitated the installation and maintenance of machinery. Early examples include the Bristol Tramways & Carriage Company's Power Station, Bristol (1899-1900, listed Grade II\*), the Central



Figure 7

Battersea 'A': perhaps the most iconic of all power stations, and one of London's most recognised landmarks, thanks in part to its immortalisation on

the front cover of Pink Floyd's 1977 album *Animals*. Decommissioned in 1983, this Grade II\* edifice now serves as a multi-million pound mixed-use development.



**Figure 8**

Lister Drive Power Station, Liverpool, in July 1930, showing Britain's first cooling towers of the modern, hyperbolic form.

© Bill Tubey; courtesy of Edward Quinn at [manweb.site88.net/](http://manweb.site88.net/)

Electric Supply Company's Power Station in Grove Road, St John's Wood (1902-4, demolished) and the enormous Lots Road Power Station, in the Royal Borough of Kensington and Chelsea (1902-5). Clad in brick, terracotta and glass, and set on concrete foundations, such edifices were among the largest buildings of the Edwardian period; Lots Road for example was over 137 m long, making it the largest power house in Europe when completed. Their prominence in the urban landscape meant that almost all were afforded some degree of architectural treatment, some to a monumental degree. The London County Council's Greenwich Generating Station, built to designs by its superintending architect, WE Riley, was an especially dignified monument to municipal pride, designed to power the capital's enormous fleet of tramcars. Erected in two phases, 1902-6 and 1906-10 its impressive brick exterior concealed over 6,000 tons of steelwork.

The steel frame became the standard means of construction for most power stations built in

the 20th century, enabling them to be erected rapidly, to have their plant installed ahead of the building's completion, and to bear the brunt of heavy, moving cranes and the vibrations of machinery. It also offered spatial openness and flexibility for the re-organisation and upgrading of plant, facilities that assumed greater importance as electrical engineering progressed and demand increased. But through the first half of the century, the frames continued to be hidden behind brick self-supporting, or curtain, walls, finding form by the 1930s in what was known as the monumental 'brick cathedral' style. In this approach, the two main visual components, the boiler house and the turbine hall, were arranged in a side-by-side, or occasionally T-plan, configuration. Epitomized by Sir Giles Gilbert Scott at the iconic Battersea power station (1929-35 and 1937-41, completed 1955, listed Grade II\*) it provided a tried-and-tested functional and stylistic idiom that suited the smaller set sizes and town-centre locations of the period, and persisted well into the 1950s. In London and the Thames

Estuary, edifices such as Brunswick Wharf (1947-56; John Bruce and Farmer & Dark; demolished), Tilbury 'A' (1949-58; Sir Alexander Gibb and Partners and Merz and McLellan; demolished) and Bankside (1947-60; Sir. G.G. Scott and Mott, Hay and Anderson) exemplified this monumental tradition, a norm echoed in most other English towns and cities. One prominent architectural critic of the period noted, 'Officialdom generally ... is said to like the 'brick cathedral' at least in towns where, as they put it architectural amenities matter.'

This conservatism began to be challenged in the 1930s with the construction of the consciously Modernist, glass-walled Barking 'B', Essex (1931-9) and Dunston 'B' at Gateshead (1933-4) to designs by the consulting engineering firm Merz and McLellan. But it was not until after the war that power station architecture saw fundamental, widespread, change. A report of 1953 backed by the Minister of Fuel and Power urged the BEA

'to encourage the experiment of new building techniques in the interests of economy'. It also recommended that architects 'be integrated as equal partners in the design team of each new power station.' The architectural practice Farmer and Dark took up the challenge, spearheading a more 'functional' approach to power station design. Enriched by the arrival of Architectural Association graduates Andrew Derbyshire and John Voelcker in 1952, this firm's stations at Marchwood (Hampshire, 1954-59; Fig 5), Belvedere (London Borough of Bexley 1954-60) and Willington (Derbyshire, 1954-60) were functionally and structurally expressive, characterised by bright colours, crisp aluminium, concrete and glass cladding, and exposure of the plant and pipework. The turbine hall at Willington employed a striking multiple barrel-vault pre-stressed concrete roof, whilst much of the weatherproof plant of the oil-burning Marchwood was left open to the elements, its



**Figure 9**  
The colourful West Burton Power Station, Nottinghamshire, as it looked soon after completion in 1967. The two dark-coloured cooling towers were

designed to prevent the lozenge group of towers visually 'blocking in' as one mass. Reproduced courtesy of RWE npower.

‘machine-aesthetic style’ seemingly anticipating the ‘high-tech’ architecture of the 1970s.

Alongside these reformulations in architectural approach, engineering and amenity considerations related to the increasing scale of power generation, and its relocation from urban to rural settings, came to alter the character and appearance of power stations. Cooling towers, used to lower the temperature of water circulating through the heat exchangers, increased in size and number, becoming the most emblematic component of mid to late 20th-century fossil-fuel power stations. In the first years of the 20th century these were often rectangular, with timber, steel or ribbed reinforced-concrete walls, but from the 1920s the now-familiar hyperbolic reinforced concrete cooling tower began to be employed. This form offered numerous advantages in terms of maintenance, fire-resistance, longevity, structural strength and cooling efficiency, and

following their introduction at Lister Drive Power Station in Liverpool (1924), their use mushroomed. As boiler and turbine capacity increased, cooling towers kept pace, enabling power stations to be sited on coalfields that otherwise lacked plentiful supplies of cooling water. Most were of the natural draught type, with curved (hyperbola) outline, but the 1950s saw the introduction of natural draught towers with a conical/toroid geometry, for example at Rugeley ‘A’ Power Station, Staffordshire, in 1958. Oil-fired stations rarely needed much additional cooling, since their coastal or estuarine locations provided unlimited quantities of cold water, but at Ince ‘B’, Cheshire a single 117 m tall assisted-draft cooling tower of unique, experimental, design was introduced, designed to reduce visual impact and further the CEGB’s experience of such structures. By the early 1960s, the GEB had standardized its natural draft cooling towers, employing both hyperbolic and cone torroid types with a height



**Figure 10**

The first oil-fired 2000MW station to generate power, Fawley, Hampshire (1964-9) was also the last of the ‘glass cathedrals’. Consultant architects Farmer and

Dark also gave it a distinctive circular administration/control room, which housed advanced English Electric LEO KDF-7 computers.



**Figure 11**

The control room of Eggborough Power Station, North Yorkshire (1962-7), designed by George Hooper

of Sir Percy Thomas and Son, consultant architects. Reproduced courtesy of RWE npower

of 114 m in its largest, ‘First Division’ stations. Visible from tens of miles over level country, these enormous structures formed the most conspicuous elements of power stations in the second half of the 20th century.

The increasing size of individual generating sets resulted in larger but fewer power stations, culminating in a suite of enormous ‘super stations’ erected in the 1960s and 1970s. Designed around the new generation of 500 MW and 660 MW turbo-generators, a typical 2,000 MW coal-fired installation was simply enormous: occupying a 500-acre site, its main elements were a 244 m long turbine and boiler house, one or two 183 m tall chimneys, eight cooling towers, aircraft hangar-sized switchgear buildings, office, administration and technical blocks, dust precipitators, coal stores and sidings and a private ‘merry-go-round’ rail loop to bring coal in and take pulverised fuel ash away. Oil-fired stations tended to occupy smaller sites since cooling towers were mostly unnecessary, and plant for discharging, conveying and preparing the fuel for

the boilers was more compact. Nevertheless, they demanded fuel oil tank farms, wharves or jetties, outfall tunnels, water treatment and chlorination plant, and so forth. The unprecedented scale of these installations resulted in a new set of responses, designed to mitigate their visual effect on the landscape, especially from middle or long-range viewpoints. There was little that consultant architects could do about the shapes of the main orthogonal, hyperbolic and cylindrical forms, or, in most cases, their grouping, which were governed by engineering criteria. Their task, according the nationalised industry’s first architect, Michael Shephard, was ‘to simplify and clarify the elemental geometry’. In most power stations this was achieved through the massing of the main blocks in relation to the chimney or chimneys, the grouping of the cooling tower field, and through variation in the colour and texture of the cladding. At West Burton, Nottinghamshire (1961-67), consultant architects Rex Savidge & John Gelsthorpe of Architects’ Design Group split the cooling towers into two groups at either end of the station (four in lozenge formation and four

in a line), which greatly improved views from the surrounding country of the 200-hectare site. This grouping was arrived at following extensive model studies using a device called a heliodon to see how different groupings would appear at various dates and times of day. Some of the cooling towers were also made darker, to provide tonal contrast within the group thus preventing them forming a bulky, ill-defined mass in conditions of haze or mist. Colour was also used to pick out particular structures or elements, helping to unify or distinguish particular functions, or to serve as obvious reference points from mid-or long-range viewpoints. Subsequent power stations employed colour for similar reasons, whilst others used it to help ease the power station into the landscape. For example, the four cooling towers of the 1,000 MW Ironbridge 'B' (1963-8; Alan Clark of Sir Percy Thomas and Son) were coloured reddy-pink to imitate the local earth, thus forming a striking composition against the verdant, hilly backdrop of the Ironbridge Gorge. Surface finish

and material texture was used in place of colour in other stations. At Eggborough, North Yorkshire (1962-67; George Hooper of Sir Percy Thomas and Son) large expanses of anodised aluminium cladding and dark glazing gave a cool and defining architectural expression that subtly contrasted with the warm concrete towers and black-capped chimney. Few stations afforded the boiler/turbine house the degree of architectural distinction displayed by those of the pre-war era, although at Fawley, (Hampshire) the buildings' prominence when viewed from Southampton Water merited an unusual degree of styling. There the consultant architects Farmer and Dark gave particular prominence to the boiler house component of the 308 m turbine/boiler unit, enclosing it with side-wall vertical zigzag glazing that terminated in a distinctive geometric cornice. Recalling the early modernism of Dunston 'B', Barking 'B' and the firm's own Marchwood, it was the last extensively glazed turbine/boiler house, marking the end of that line of architectural expression.



**Figure 12**

Aerial view of the landscaped ash mound produced by Eggborough and Ferrybridge power stations, which are visible in the distance. Known as the Gale Common

Ash Disposal Scheme, this gigantic landform was devised by landscape architect Brenda Colvin, who was inspired by the distinctive contours of Maiden Castle.

Most stations however gave at least 'functional' expression to the number of enclosed turbo-generators, usually by means of four concrete coal bunkers that rose above the roofline of the turbine hall. Switching stations were predominantly of the enclosed type, and those stations that made use of 'open' or fully exposed type, such as Didcot (Oxfordshire) and Rugeley 'B', did so for reasons of practicality and economy (where local atmospheric conditions permitted), rather than explicit functionalism.

Administration and office buildings generally afforded consultant architects more scope for architectural input. At Ratcliffe (Nottinghamshire), the two-storey steel-framed administration/technical block was planned around a courtyard, designed to provide a more humanised, smaller-scale environment in contrast to the size and character of the gargantuan surroundings. Unusually, it also made use of open-air sculpture, an expressive piece by Richard Fowler called

'The Generators'. More outwardly-looking, and distinctive, was the 55 m diameter combined administration and control building at Fawley. This freestanding reinforced concrete structure took its cue from harbour control towers and afforded 360-degree views of the site as well as housing advanced English Electric LEO KDF-7 computers that remotely controlled the entire station. Most administration and office buildings of the 1960s and 1970s were influenced by Scandinavian or American modernism, but occasionally a tougher, Brutalist aesthetic was favoured. For the first phase of Drax, North Yorkshire (1967-7), Jeff King of Clifford, Tee and Gale, architects, designed these components in rough, precast concrete, their dark-glazed elevations echoing the ribbed surfaces of the adjacent dead-black boiler house. The interiors of these administration buildings were well-lit, orderly, and often clinical, housing banks of mainframe computers, control desks and panels, typically ranged round the periphery.

# 4 Associations

Power stations have particularly strong associations with their surrounding landscapes, which they changed through use, and, in the second half of the 20th century, modified by design. After road building, electricity generation and transmission had perhaps the largest impact on Britain's landscape than any other activity. The scale of civil engineering works involved in creating a suitable building site resulted in earth-moving on an enormous scale, and the legacy of outlying operational areas, such as fuel stocking grounds, ash tips and lagoons, and of transport infrastructure, is palpable. The 375 m long timber coal staithes at Blyth Power Station, constructed between about 1910-23 for the North Eastern Railway Company, and listed at Grade II in 1986, is one early example. Moreover, this 'landscape of power' extends upwards and outwards from each installation, through the national transmission system with its innumerable switching stations, overhead lines, and pylons. More subtly, and to many, more agreeably, are the designed landforms, water features, and planting used to mitigate the visual impact of power stations on the landscape. Until the CEGB era, and its duty to take account of the effect of its proposals on the natural environment, landscaping for power stations was for the most part cosmetic and low-key: flower beds in front of administration blocks; trees lining approach roads, planted by the Roads

Beautifying Association. This picture changed dramatically with the advent of the capital-intensive 500MW programme of the 1960s, which saw the CEGB become the most prominent patron of landscape architecture in the UK. Many of the power stations of this era employed judicious native tree-planting outside of the station's site (maintained through Tree Preservation Orders) to control or frame views or to integrate and relate the larger components to their surroundings. Extensive water barriers sometimes replaced unsightly security fences, providing imaginative settings for floodlit cooling towers (for instance at West Burton, Nottinghamshire, by Derek Lovejoy), and wildfowl nature reserves were created from flooded former gravel pits (for instance at Drakelow 'C', Staffordshire, by Brenda Colvin). Merry-go-round railways, horizontal conveyors and coal stores were often screened below verdant artificial embankments and plateaux. At Cottam Power Station (Nottinghamshire), a 15 m high tree-clad ridge was constructed to designs by Kenneth and Patricia Booth to shield Cottam village from the visual mass and noise of the station. Most ambitiously of all, the enormous ash mound produced by Eggborough and Ferrybridge power stations in North Yorkshire was landscaped over many decades as a three-hummocked 'prehistoric earthwork', now used recreationally for Motocross (Brenda Colvin, Landscape Architect).

# 5 Change and Future

By 2016, many 20th-century oil and coal-fuelled power stations supplying the National Grid will have reached the end of their productive lives. Others have already closed. The main reason for this programme of closure is that many power plants opted-out of meeting the clean air requirements of the European Large Combustion Plant Directive (directive 2001/80/EC). This limited airborne emissions of certain pollutants (sulphur dioxide, nitrogen oxides, and dust) from large (over 50 MW) combustion plants, and from 2007 included plant built earlier than 1987. Whilst coal and oil are still likely to account for a significant proportion of the country's generating capacity in the foreseeable future, this is declining and is likely to shift to new, more efficient

plant that produces less carbon, residues, and contamination. In the longer term, renewable energy is likely to increase.

Therefore, what have been described as the 'great temples to the carbon age', are likely to disappear from the landscape, as their sites are reused for new production plant, or are reclaimed for new uses. Historic England has been photographically recording many of the best surviving examples, and it has also produced guidance so that the energy-supply companies can record, archive and curate the physical and cultural legacy of these installations, and ensure that this information is safeguarded for posterity.

# 6 Further Reading

There is no published work comprehensively covering the history and architecture of power stations in the 20th century. A good overview is provided in Michael Stratton and Barrie Trinder's *Twentieth Century Industrial Archaeology* (2000), and some key aspects of architectural design in the post-war period are covered in Elain Harwood's forthcoming *Space, Hope and Brutalism* (2015). London, and especially the earlier part of the century is well covered by Gavin Stamp (ed), *Temples of Power: Architecture of Electricity in London* (1979), Ben Pedroche, *London's Lost Power Stations and Gasworks* (2013), and the chapter on Industrial Buildings in Jonathan Clarke, *Early Structural Steel in London Buildings: A Discreet Revolution* (2014). Few other regional studies have been published, a notable exception being D.G. Tucker, 'Electricity Generating Stations for Public Supply in the West Midlands, 1888-1977', *West Midlands Studies* 10 (1977).

Histories of the electricity supply industry from its origins to 1963 are provided by L. Hannah's definitive *Electricity before Nationalisation: a*

*study of the development of the Electricity Supply Industry in Britain to 1948* (1979) and *Engineers, Managers and Politicians: the first fifteen years of National Electricity Supply in Britain* (1982). R. Cochrane's *Power to the People: The Story of the National Grid* (1985) provides a very accessible overview of the development of the UK transmission system, whilst J. Sheail's *Power in Trust* (1991) examines the visual and environmental impact of power stations and transmission lines following nationalization of the industry in 1947, and how the CEGB mitigated it.

The most comprehensive, but often technical, published works on power stations of the second half of the 20th century are those produced by the CEGB, including the series *Modern Power Station Practice* (1963, 2nd ed. 1972; 3rd ed. 1986), and the booklets produced for the opening of individual stations. A particularly attractive publication, produced with the RIBA, is the exhibition catalogue *The Architecture of Power* (1963). Individual power stations are documented in the engineering and architectural journals.

# 7 Acknowledgements

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