Central Electricity Generating Board South Eastern Region

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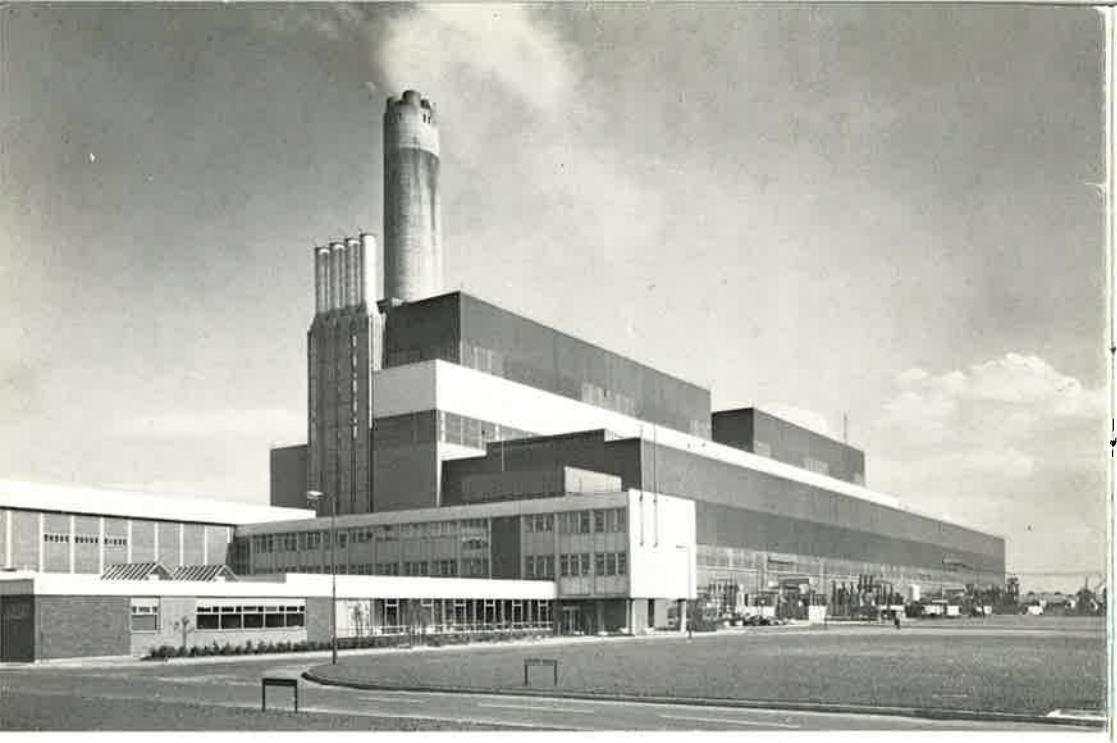
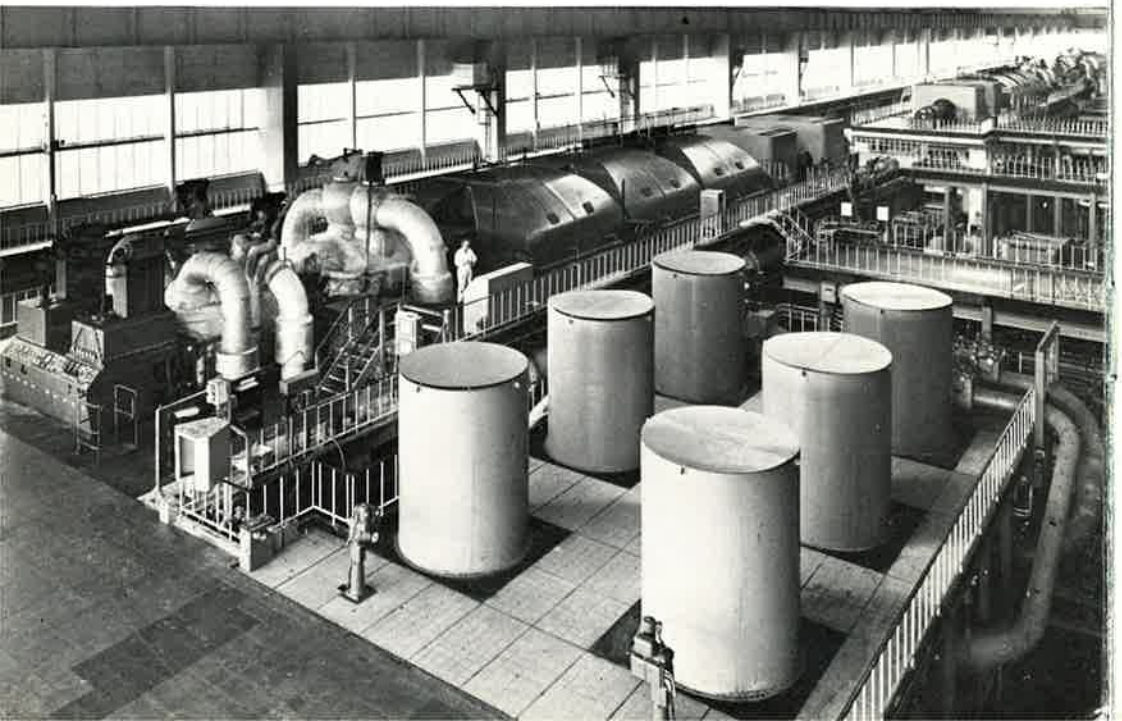


Above: Main buildings of the Station
Below: Turbine hall



Kingsnorth power station

Kingsnorth power station is one of a generation of ten 2,000 megawatt stations built by the CEGB and is the largest one at present operating in the South Eastern Region. Four 500 MW steam turbo-generators are installed together with four 22.4 MW gas-turbine driven generators for 'peak lopping' and emergency standby use. Work started on the site in March 1963 and up to 2,000 men were employed during the construction stages. The first power was generated in 1967 and the station reached full operational potential in February 1973.

Kingsnorth is situated on the Hoo peninsula on the north Kent coast. It stands on 400 acres of reclaimed marshland on the northern bank of the estuary of the River Medway ; Rochester and Chatham are a few miles upstream. The site presented great difficulties because of the high water table (it is four feet below the highest tide level) and the poor load-bearing qualities of the land ; this and the river frontage had to be extensively piled with various types of piling. However the proximity of the site to the load centre of London and the plentiful supply of cooling water from the Medway as well as the availability of the land were good reasons for choosing it.

Site Layout

The main buildings of the power station, that is the turbine hall and the boiler houses with the single chimney, stand on what was once a marsh known as Damhead Fleet into which Damhead Creek originally extended. To the south is the River Medway with the cooling water intake, and to the north the administrative offices, workshops, control room and the direct current converter house. Farther north is land suitable for future development. On the western side of the site is the large indoor switch house for the 400,000 volt switchgear and to the east are nine fuel storage tanks, the ash lagoons, and the circulating water outfall at Damhead Creek.

Control Room

The general administration buildings at the northern end of the station contain the control room where comprehensive control desks and panels monitor each machine. Thousands of steam and water valves and dampers have been monitored and since a similar number of temperatures, pressures and other variables can be monitored centrally, the very minimum of supervision is needed outside the control room. Data is produced by computer with visual displays and logged with high speed typewriters.

Fuel

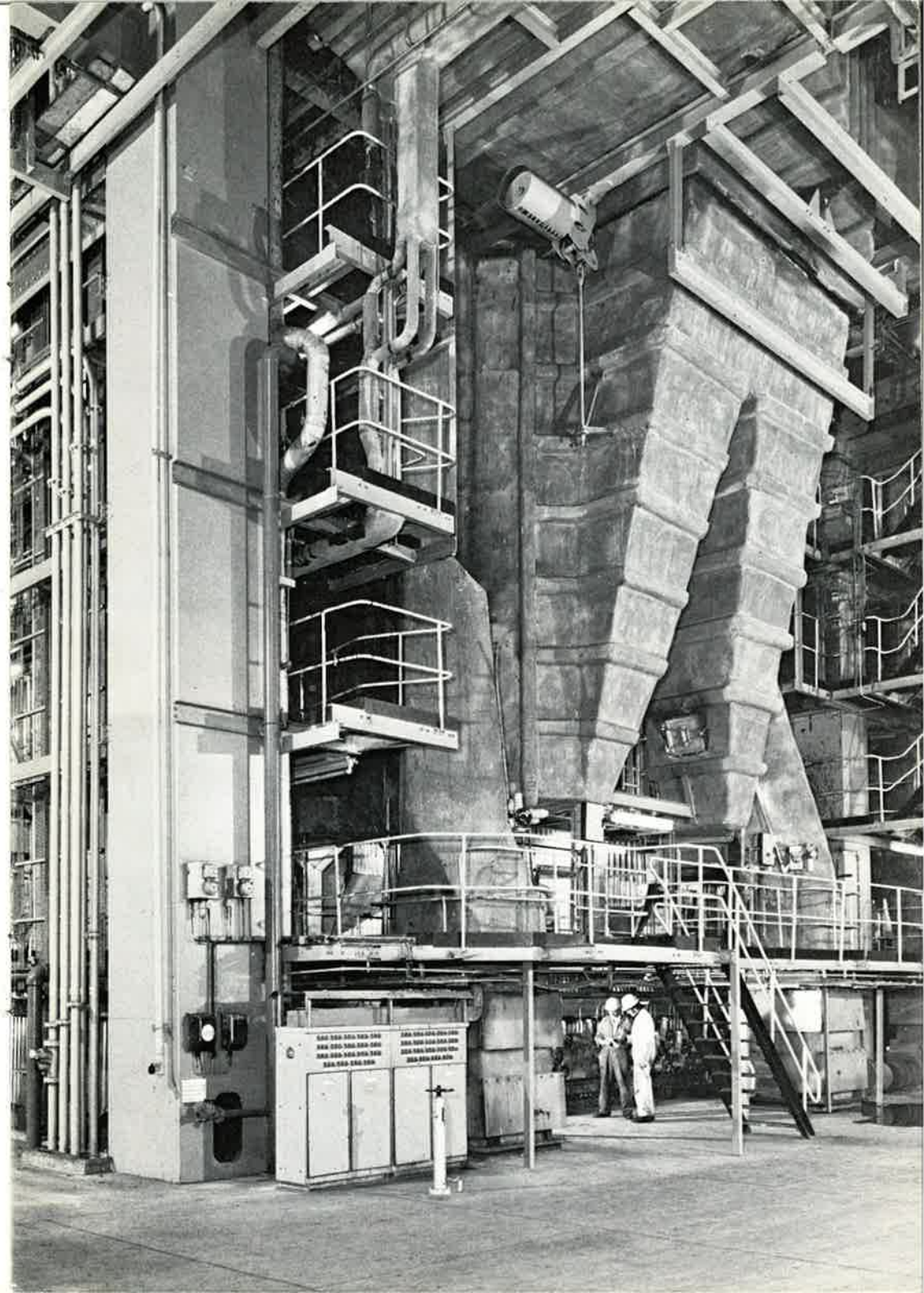
The principal characteristic of this station is that it was designed as a dual-fired station able to burn coal or oil according to the availability and price of these fuels – it is the largest dual-fired station in Europe and the only one in Great Britain. Here again having the Medway alongside is of great value since it provides deep water berths for oil tankers and colliers to the extent that Kingsnorth can also be used as a fuel storage depot for other stations. The deep water loading facility has the incidental advantage of permitting the 'roll-on-roll-off' ships to bring heavy indivisible loads with their transporters ashore on their journeys from manufacturers' works to various sites in the vicinity, thus freeing the roads from further congestion.
Fuel supplies are received at two jetties, Long Reach and Oakham Ness. Long Reach handles colliers and oil tankers of up to 10,000 tons. All coal comes to this jetty and is taken by conveyor to boiler bunkers and stocking out bunkers from where it is later reclaimed. There is also a pumping system to reload small tankers at this jetty for the supply of oil burning stations on the Thames and at Richborough in Thanet. Oakham Ness is an ocean tanker terminal capable of receiving tankers of up to 45,000 tons ; oil is normally received here and is pumped to a tank park of six 25,000 ton and three 50,000 ton storage tanks.

Cooling Water

Water for cooling the turbine condensers is drawn from the Medway at the rate of 52,000,000 gallons per hour and after passing through screens and, if necessary, being chlorinated to combat marine fouling and mussel growth it is pumped to the condensers. After use it is discharged into Damhead Creek in the north east corner of the site and flows back into the river a mile and a half downstream from the intake. There is thus no possibility of the cooling water being re-circulated, and no need for cooling towers. The boiler feed water comes from the same source but is de-ionised, de-mineralised, scrubbed, degassed and filtered and refined several times before it is fit to be used as 'make-up' in high pressure boilers.

Electrical Power Transmission

Electricity is generated at Kingsnorth at 23,500 volts and is transformed up to 400,000 volts to feed into the Supergrid ; overhead transmission lines connect with Tilbury, with Northfleet and with Canterbury. There are also transformers which reduce the voltage from 400,000 volts to 132,000 volts and the station is thus able to supply the Medway towns by underground cable. Both the 400,000 volt and the 132,000 volt busbars and switches are in a covered enclosure so that airborne pollution will not affect the electrical



View of boiler from 53 feet level

qualities of the insulators. The space enclosed for the 400,000 volt switchgear measures 700 feet by 440 feet with a height of 75 feet – a total air space of 23,100,000 cubic feet.

Direct Current Link

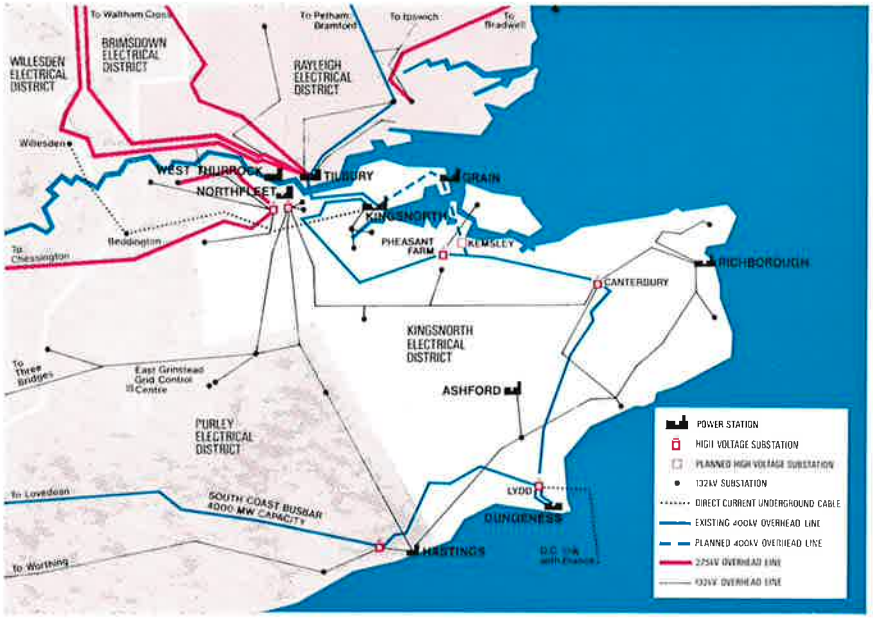
In addition to the conventional transmission connections using alternating current (ac) to supply the Supergrid, Kingsnorth has an underground cable connection with London using direct current (dc) at 266,000 volts. This is the only dc link in England apart from the Cross Channel cable to France. The use of dc requires converter stations at both ends, one at Kingsnorth to convert the ac produced by the generators to dc, and others at Beddington and Willesden to reverse the process and feed ac into the Area Board distribution networks.

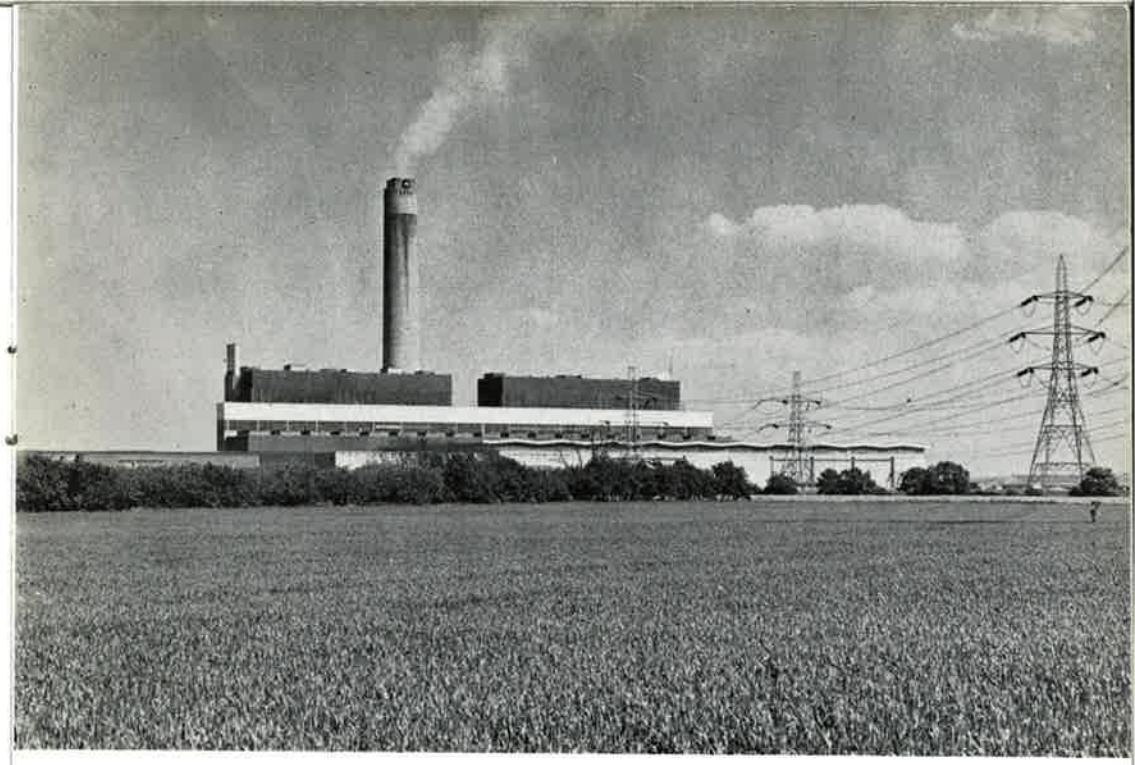
Although dc cables are smaller in diameter than equivalent ac cables of similar power rating and therefore considerably cheaper, any advantage is offset by the additional cost of the converter stations. There are, however, a number of reasons why, in this case, dc was used :

(i) It enables the CEGB to gain valuable development and operating experience in the transmission of large blocks of power by this method in anticipation of further power links with the Continent in the future

(ii) It makes possible the injection of power direct into the 132,000 volt ac transmission system in west and south west London without increasing the existing system fault levels

(iii) It permits fine control of power flows across London.





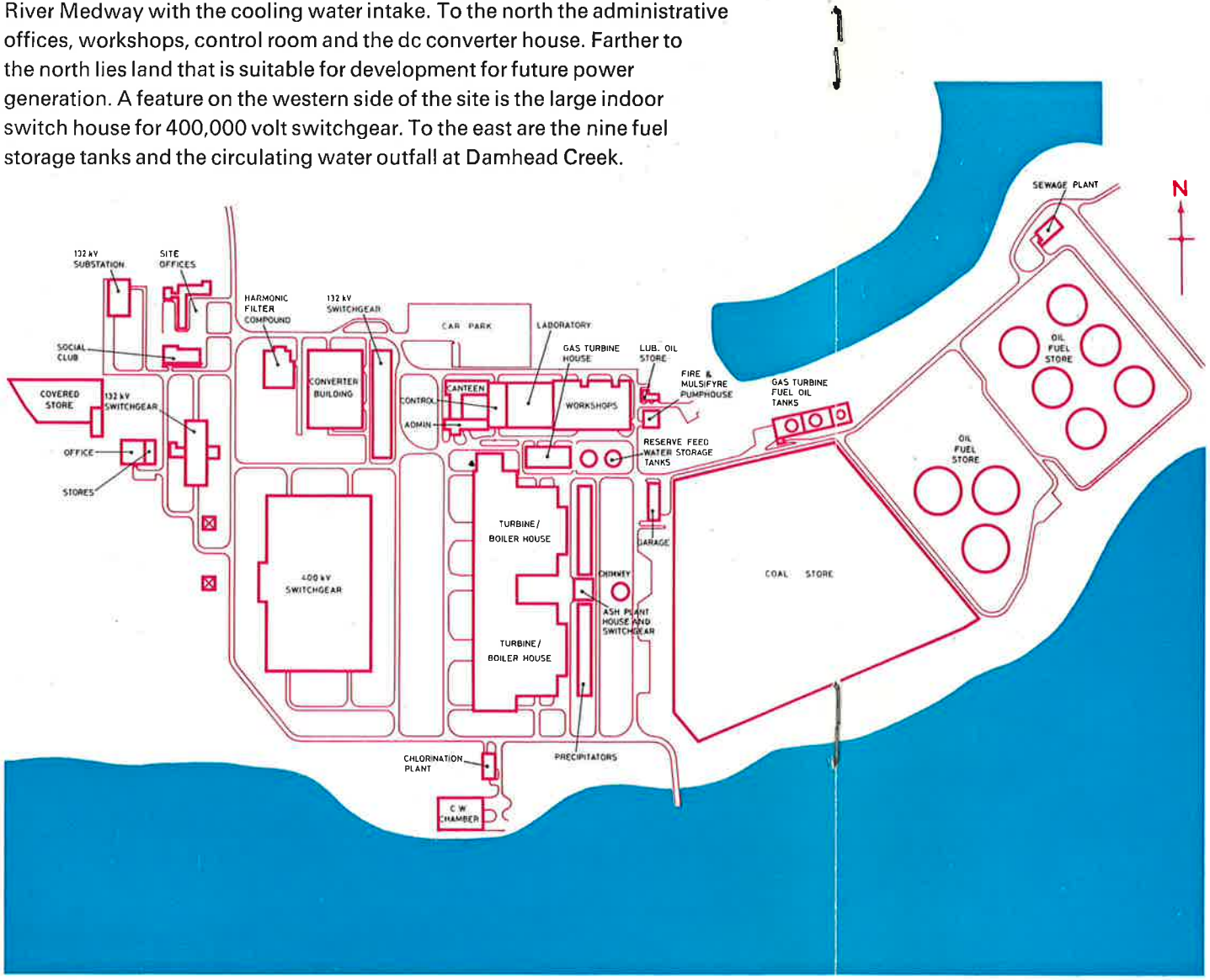
View of station from the west

Amenity

The Generating Board has taken pains to meet it's 'amenity' obligation in the building of Kingsnorth power station in spite of the fact that the provision of an economic and efficient supply of electricity is often incompatible with its duty to minimise the effect of these developments on the environment. Distinguished architects have been employed to design buildings which are visually pleasing and by careful use of colour and materials to make them blend with their surroundings. Landscape consultants too were engaged to advise on earth modelling and tree planting which should eventually screen much of the working area around the station ; the ash lagoons will eventually be grassed over and returned to agriculture. To avoid air pollution the CEGB has for some years carried out a policy of building very tall single multi-flue chimneys so as to discharge the effluent gases high into the atmosphere, and a 650 foot chimney is a feature of Kingsnorth. Electro-static precipitators at the base of the chimney remove ash and grit and the constituents of the gases are constantly monitored in order to minimise harmful emissions. Stringent precautions are of course taken against oil spillage.

Layout of site

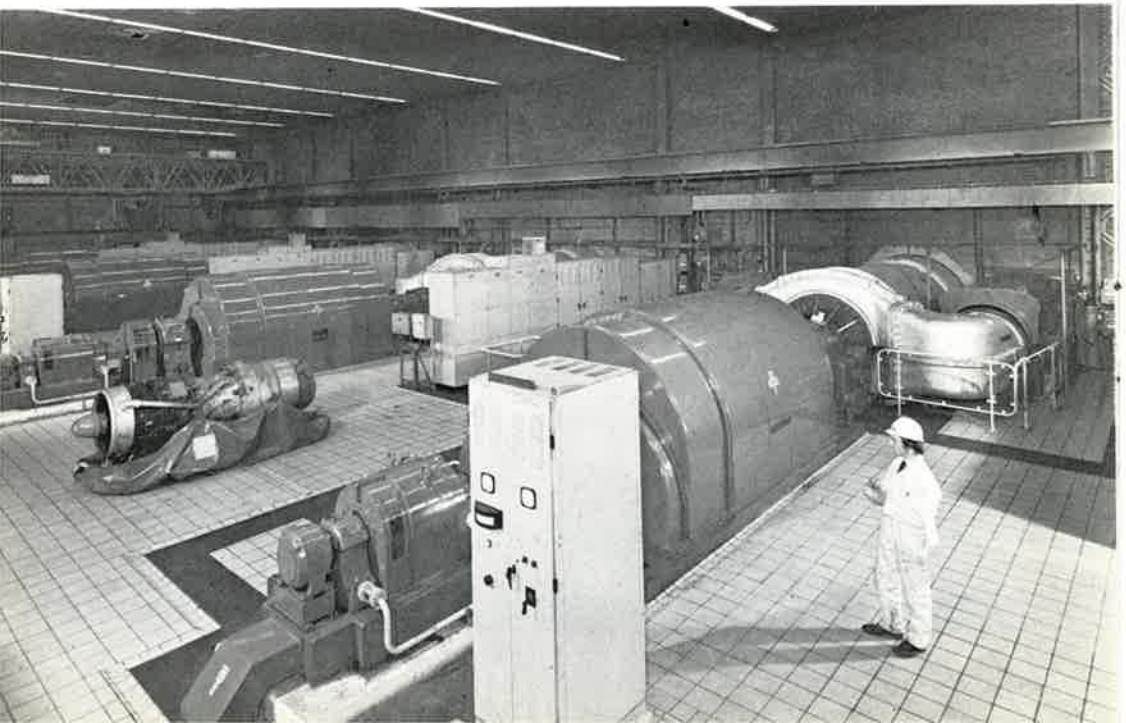
The main buildings forming the power station comprise the boiler houses, served by a common chimney and a turbine hall. On the south side is the River Medway with the cooling water intake. To the north the administrative offices, workshops, control room and the dc converter house. Farther to the north lies land that is suitable for development for future power generation. A feature on the western side of the site is the large indoor switch house for 400,000 volt switchgear. To the east are the nine fuel storage tanks and the circulating water outfall at Damhead Creek.

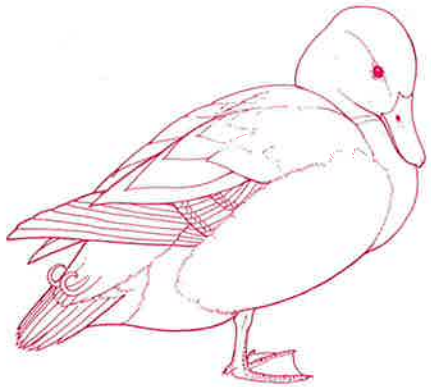


Facts and Figures

Net electrical output	2,000 MW
Net thermal efficiency	37.0% (coal) 36.5% (oil)
Main buildings	Turbine house, boiler house, administration block, 400 kV and 132 kV switchhouses
Chimney (4 flues)	650 ft
Fuel	Dual fired, coal/oil
Jetty approach	1,700 ft with head of 995 ft
Coal handling plant	3,000 tons per hour
Oil fuel storage	6 tanks, each of 25,000 tons capacity 3 tanks each of 50,000 tons capacity
Turbine/boiler houses steelwork	Total 33,000 tons
Boilers	4 x 3.55 M lb/hr
Steam outlet pressure	2,400 lbs per sq inch
Steam outlet temperature	541 °C
Reheat steam flow (per boiler)	2.90 M lb/hr
Turbo-generators	4 x 500 MW reheat
Steam pressure	2,300 lbs per sq inch
Steam flow to condenser	2,114,000 lb/hr
Gas turbo-generators	4 x 22.4 MW
Transmission voltage	400 kV and 132 kV
Cooling water requirements	51 million gallons per hour
Area covered by station buildings	22 acres
Full Load Coal consumption	140,000 tons/week
Full Load Oil consumption	65,000 tons/week

Above: Control Room
Below: Gas Turbine House





Kingsnorth wildfowl reserve

Contrary to fears expressed at the time, the building of the power station has not been detrimental to the bird life of the area. Duck – Mallard, Teal, Wigeon and Shell Duck – had started to increase in the mid-1960's but the increase after 1968 was dramatic. It was found that the shelter provided by the lagoons and the western bay of Oakham Island led to a concentration at Kingsnorth ; food is available in the eastern lagoon and off Oakham and many other types of duck have been seen there. As a result it was agreed to make the area of the two ash lagoons and Oakham Island into a reserve managed jointly by the Kent Wildfowlers' Association and WAGBI.

Many species of wading birds have been counted in the reserve in autumn and winter – Dunlin, Ringed Plover, Redshank, Grey Plover and others ; even one or two Greenshank have wintered there which is unusual in Kent. The banks and islands of the eastern lagoon, especially the beds of Norfolk Reed are popular breeding places ; Ringed Plovers and Oyster Catchers use the chippings by the side of the road on Oakham while the thick cover on the embanked part of the island holds many others.

As the lagoons fill up and change from islands and reed beds to mud flats, wading birds will increase rather than the breeding duck, but it all proves that there is room for heavy industry and wild life at Kingsnorth.

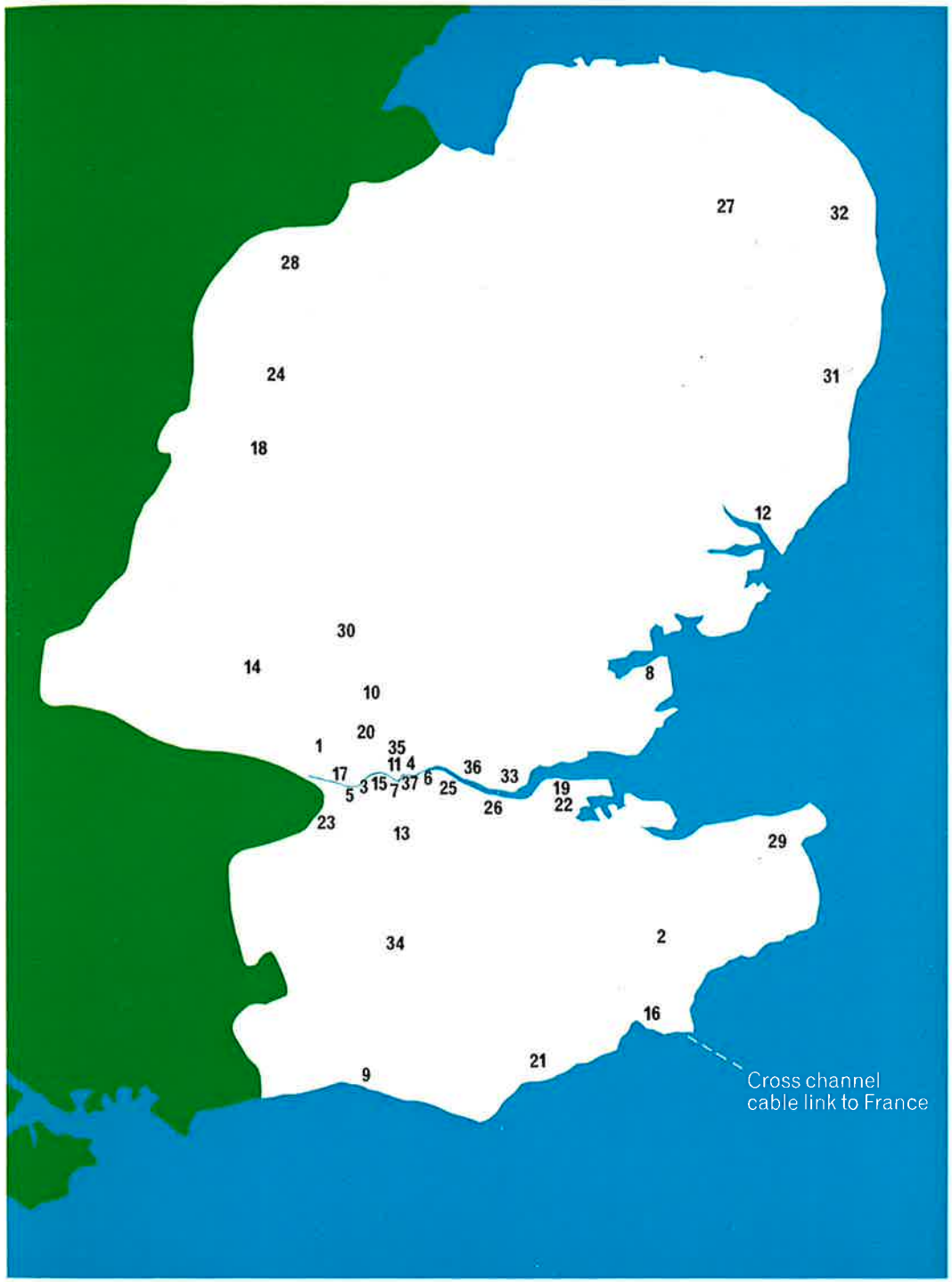
Organisation of the CEGB

The organisation of the Central Electricity Generating Board consists of a central headquarters in London and five Regions responsible for the operation of the power stations, transmission lines and substations within their areas. The construction, design and development functions associated with power stations and the transmission system are the responsibility of two Divisions – the Generation Development and Construction Division and the Transmission Development and Construction Division. The power generated in the Board's power stations is sent out at 275,000 volts or 400,000 volts over the grid network to distribution points where it is sold to the Area Electricity Boards, British Railways and other bulk supply customers. The map shows the location of power stations and grid control centres within the South Eastern Region, an area covering 11,000 square miles (29,000 square kilometres) stretching from the Wash to the south coast. Almost all of the heavy load area of London falls within the Region.

Key to map

1 Acton Lane/coal
2 Ashford/diesel
3 Bankside/oil
4 Barking/'B' coal/'C' oil
5 Battersea/coal
6 Belvedere/oil
7 Blackwall Point/coal
8 Bradwell/nuclear
9 Brighton/coal
10 Brimsdown/oil
11 Brunswick Wharf/oil
12 Cliff Quay/coal
13 Croydon/coal & gas turbine
14 Cumberland House/ Control Centre
15 Deptford/coal
16 Dungeness/'A' nuclear/'B' nuclear*
17 Fulham/oil
18 Goldington/coal
19 Grain/oil*
20 Hackney/coal
21 Hastings/gas turbine
22 Kingsnorth/coal, oil & gas turbine
23 Kingston/coal
24 Little Barford/coal
25 Littlebrook/'B' oil/'C' oil/'D' oil*
26 Northfleet/oil
27 Norwich/gas turbine
28 Peterborough/coal
29 Richborough/oil
30 Rye house/coal & gas turbine
31 Sizewell/'A' nuclear
32 South Denes/oil
33 Tilbury/'A' oil/'B' coal & gas turbine
34 Wealden House/ Control Centre
35 West Ham/coal
36 West Thurrock/coal & natural gas
37 Woolwich/coal

* Under construction



How electricity is made

Coal, oil or natural gas is burned in the boiler 1 of a power station, or carbon dioxide gas is heated in the reactor 2 of a nuclear power station and the heat boils water circulating at high pressure in the boiler tubes 3 to create high-pressure steam 4. The steam is taken by pipes to the turbine 5 where it is used to drive the shaft 6 at high speed. From the turbine, the steam enters the condenser 7 and passes over tubes containing cooling water. It is thus condensed back into water and creates a vacuum which helps improve the flow of steam through the turbine. The water is returned to the boiler under pressure by a series of pumps.

The generator consists of a rotor 8 and a stator 9. The rotor (an electro-magnet made of a number of windings mounted on a shaft) is coupled to the turbine shaft so that it is turned at high speed and generates electricity in more windings that make up the stator. A small generator 10 driven from the end of the rotor shaft, produces the current required to energise the rotor. In the largest modern generators electricity may be generated at about 25,000 volts but for efficient transmission over long distances the voltage is increased by transformers 11, to 275,000 or 400,000 volts.

The voltage is reduced by other transformers 12 to 132,000 volts for local transmission and reduced still further for distribution to consumers at suitable voltages – 33,000 volts for heavy industries, 11,000 volts for light industries and 240 volts for homes and farms.

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