

EVOLUTION
OF
PYRMONT POWER STATION

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Sydney Electric Lighting Generating Station and Offices / 1904

Pymont Power Station, 1904 - 1983

The Pymont Power Station was the original generating station for the general reticulation of electricity through the Sydney city area and was one of the largest and most important generating stations in NSW for many years. It was also a major part of Pymont life and contributed greatly to its development, as well as to that of wider Sydney. (NSW Government Office of Environment & Heritage)

The Coming of Electricity

In November 1888 Tamworth became the first city in the southern hemisphere to have electric street lighting. Although the local gas company had reduced its prices, the city aldermen did not regard the quality of gas as commensurate with the price. Tamworth was soon followed by Young, Penrith, Moss Vale and Broken Hill: all, by 1891, had a power supply system. Sydney remained a 'gas' city, until the start of the twentieth century. Seventy percent of gas production was still used for street lighting, and the Australian Gas Light Company was upgrading installations and seeking new customers, supplying gaslights in homes, shops and offices, and cookers in wealthier homes.

By the 1890s many councils saw the manufacture and sale of electricity as a route to independence, avoiding contracts with gas companies. Many had been proclaimed within the past three decades so they were keen to embrace an endeavour that was synonymous with progress.

Six bills to enable the supply of electricity were introduced into the NSW Parliament between 1887 and 1893 but none were successful. Some key members of the assembly saw electricity as a threat to their interests in the Australian Gas Light supply.

Finally in 1896 the Legislative Council passed the Sydney Municipal Electric Lighting bill which empowered the Sydney Municipal Council to design, build and operate a power house which would primarily supply power for electric street lighting.

In 1899 the Sydney Municipal Council engaged British electrical engineers Preece and Cardew to draw up plans for a power station to generate from the Council's Kent Street site.

Construction would have commenced in 1900 but for the outbreak of Bubonic Plague. On public health grounds, the government resumed all of Darling Harbour water frontage, including the Kent Street site. In 1902 the Council purchased a new site in Pymont near the foreshore, with good access to cooling water and coal delivery by rail and sea.

Evolution of Pyrmont 'A' Power Station

Pyrmont Power Station's history had two distinct phases: Phase I: Pyrmont 'A' Station (1902-1925) and Phase II: Pyrmont 'B' Station (1949-1983).



Pyrmont 'A' Power Station Stage 1, c. 1904

The first phase began in late 1902 with the staged development of 'A' Power Station. The first stage comprised five Babcock & Wilcox chain-grate, coal fired boilers supplying steam to three Ferranti vertical reciprocating steam engines; one of 500HP and two of 1,000HP, each driving a Dick-Kerr three-phase generator for a total output of about 1,500 Kilowatts.

The steam was superheated after it left the boilers, in an external separately fired superheater using coal in a different furnace to that consumed in the boiler to generate steam. The boiler chain-grate stokers were fed from overhead 500-ton capacity coal bunkers which were filled with coal by a bucket conveyor, delivered from railway trucks.

The boilers were operated under natural draft conditions which were created by a very high (60.96 metre) brick chimney stack. The imposing structure was circular, with a 3.35 metre internal diameter. The boilers were housed in a brick structure 32.3 metres long by 14.6 metres wide and 14.93 metres high.

Ashes were removed from the rear of the chain-grate stokers and deposited into the coal bucket conveyor which doubled as the ash extractor. The ash was tipped into a bin to be loaded into railway trucks or horse-drawn carts.

The boiler plant, electrical machinery and cables were all supplied by contractors from London, and the equipment layout resembled British power stations of the time. The administration building, structural steelwork, chimney stacks, lamps and sub-station buildings were all supplied by Sydney contractors. The overall project costs were £183,000.

Power was generated at 5,000 volts AC and transmitted by underground cables to five substations. Rotary converters in some substations converted the alternating current (AC) to direct current (DC) needed for customers who already had DC lamps and motors connected to their own DC generators.

The Beginning of an Era

The ceremony to mark completion of the first stage of 'A' Station took place on 8 July 1904 when the Lady Mayoress, Mrs. S.E. Lees, turned a switch-key at the Pyrmont Powerhouse. "I have much pleasure in switching on the electric light for the city of Sydney," she announced to the government officials, engineers and professionals who gathered in the rain to witness the birth of Sydney's electric era. "I trust it will be a boon to the citizens and an encouragement to the enterprise of the City Council," said Lees as the electric current was transmitted to 343 arc lamps in the inner city just after dusk. (SMH, 9 July 1904)

From Circular Quay to Redfern Railway Station, and from Hyde Park to Darling Harbour, the city was aglow with electric-powered light, but almost a decade elapsed before the last gas lamp was removed from the city.

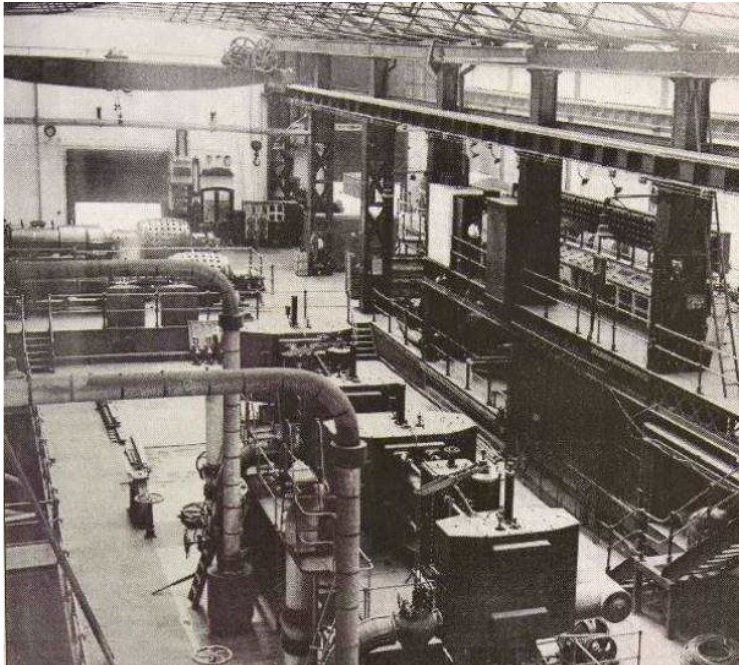
The lighting of Sydney's arc lamps marked the beginning of an era. Electricity was widely available for the first time, and Sydney-siders could buy it to light, heat and power their homes. The new era also gave business owners the power to prosper. "There are many inquiries from factories, which want power to drive machinery," reported the Herald. By the end of 1905, electricity reached Paddington, Camperdown and Kings Cross. While most people still lit gas lamps or candles at home, used steam to power their machinery and cooked on gas or fuel stoves, more than 500 customers were by then using electricity. .



This tinted postcard, posted in 1907, illustrates George Street looking north from Bathurst Street. In the left foreground is a blockboy leaning on an arc lamp post. Note also the decorative tram wire posts.

Pymont 'A' Station - 2nd Stage Extensions

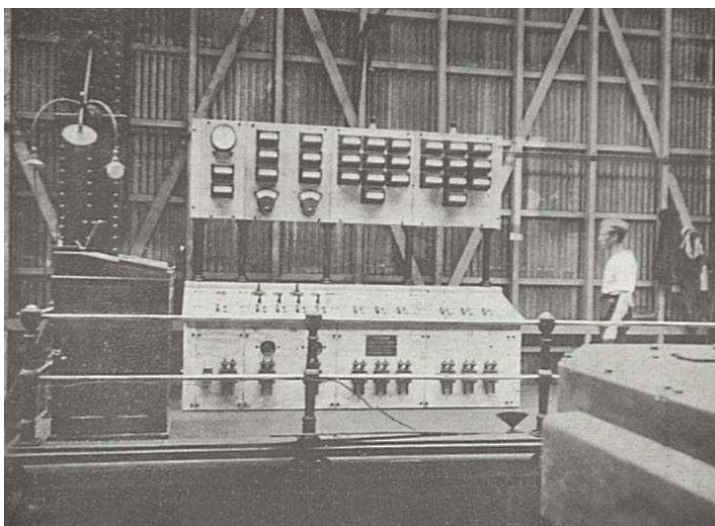
In late 1905, due to increasing demand, the generating station was extended to the east. Two more 1,000 HP Ferranti vertical reciprocating steam engines and their generators were installed, increasing the maximum output of 'A' Station to 2,700 Kilowatts. All new plant installed by Sydney Municipal Council from then on was the more efficient steam turbine-generators.



Ferranti vertical cross compound reciprocating steam engines

Pymont 'A' Station - 3rd Stage Extensions

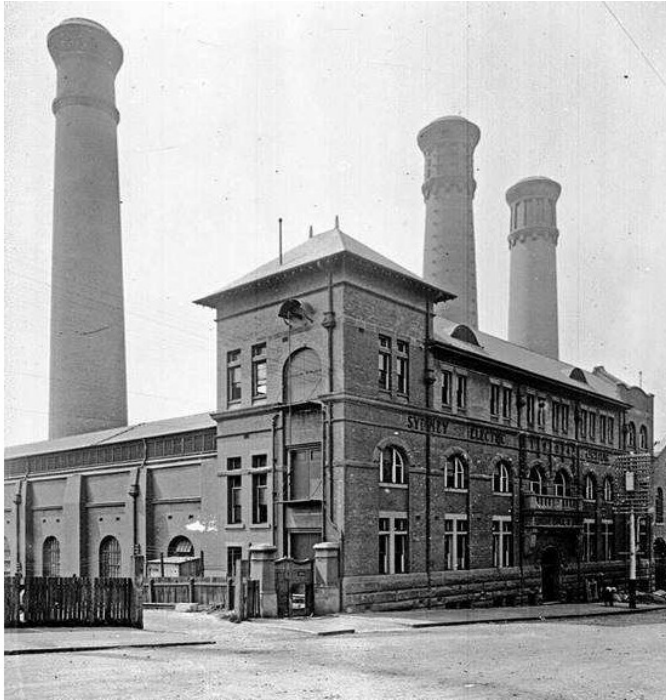
In late 1907 two Willans & Robinson Reaction steam turbines of 2,000 Kilowatts each were installed, as well as four Stirling vertical tube boilers, increasing output to 6,700 Kilowatts.



Pymont 'A' Power Station. Main Switchboard and Control Bench, 1908

The total generation of electricity between 1905 and 1907 increased from just over 1 million kWh to 6 million kWh. The five-fold increase in demand required extensions to both the engine and boiler houses to accommodate additional plant.

Between 1908 and 1910 the system demand had doubled as consumption mushroomed. The Council was forced to duplicate the power station by adding a second boiler house (No. 2) and chimney stack, and a new engine room.



Pyrmont 'A' Power Station c. 1910

Pyrmont 'A' Station - 4th Stage

Between 1910 and 1915 fourteen more Babcock & Wilcox boilers were added, and three Willans & Robinson Reaction turbo-alternators and a single Curtis Impulse steam turbine/AEG German-made alternator. The original Ferranti reciprocating steam engine plant was decommissioned in 1915 and the machinery sold.



Pyrmont 'A' Power Station. Poor chimney stack emission from inefficient chain-grate boilers

As the network expanded and demand continued to grow it was necessary to increase the output voltage. In 1910 step-up transformers were installed raising the output voltage from 5,000 Volts to 10,000 Volts, and raised again in 1916 to 33,000 Volts.

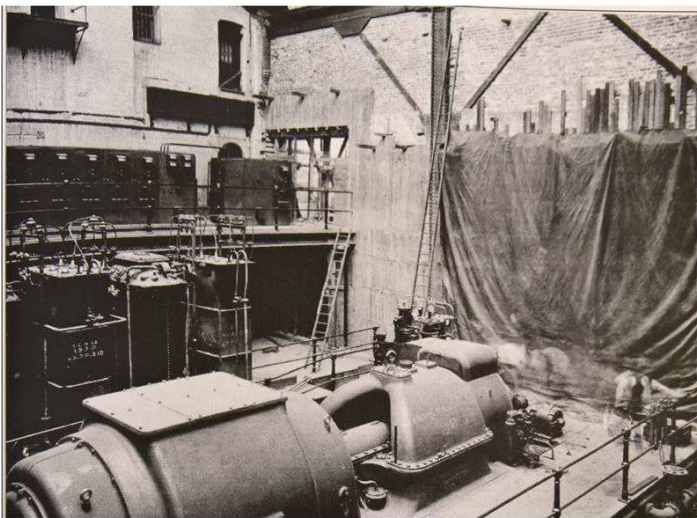
By 1915 there were six steam turbo-alternators in service, supplied with steam from twenty-three boilers. The new generating plant increased the station output to 15,000 kW

Interconnection to Railways Commission Network

After World War I, increasing demand required rapid development in generation and distribution capacity. Early in 1916 when it was clear that that it would be difficult to obtain plant from Europe, the City Engineer urged Council to negotiate an interchange agreement with the Railways Commission (RC) which had its own power generation plant (Ultimo Power Station) to supply tramways and the railways. The Sydney Municipal Council was unable to install new generating plant until 1921 by which time sales had more than doubled and remained at that level between the wars. Meeting this demand would have been impossible without this interconnection.

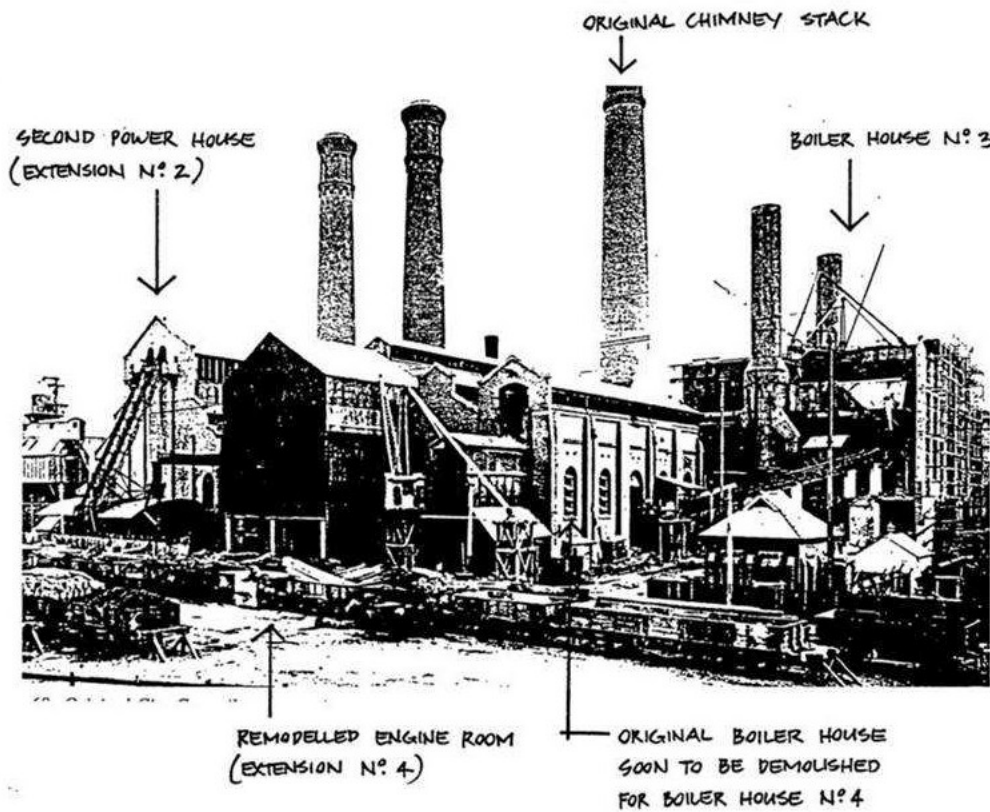
Pymont 'A' Station - 5th Stage Extension (Final)

Clearly additional extensions were needed as reserve capacity had reduced to critical levels in 1917. In 1919 British Westinghouse was contracted to supply two 12,000 kW turbo-alternators and modern high pressure boiler plant from Babcock & Wilcox. The new machines were to be installed on the site of the original steam engines and additional turbo-alternators were secured for the plant extensions. The five original B & W boilers, the tall brick chimneys and all generating plant installed up to 1907 were removed to make way for the new plant (with the exception of the administration building).

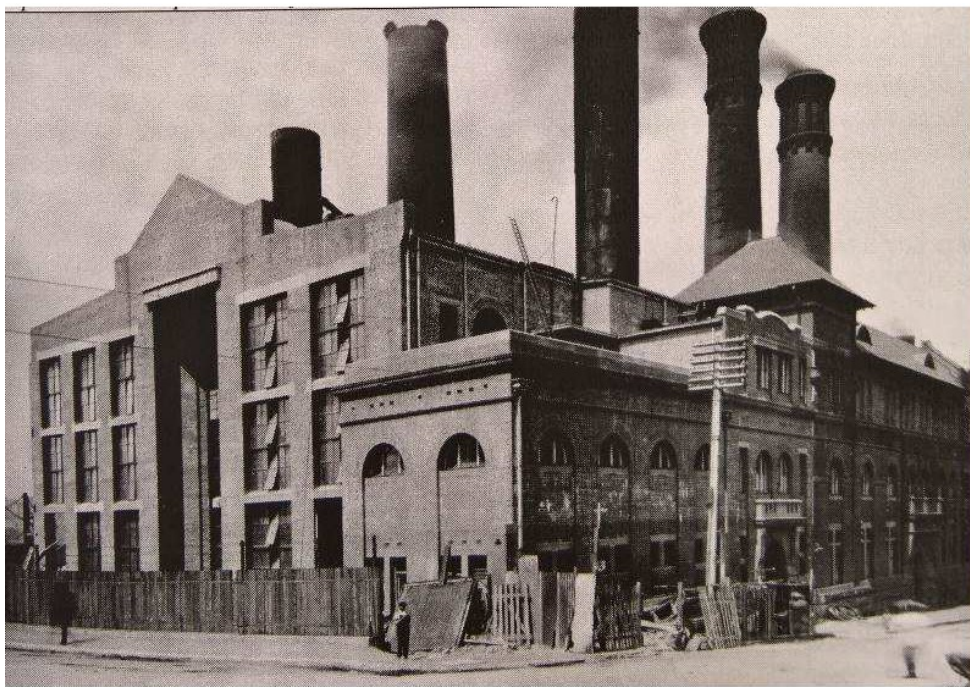


*Pymont 'A' Power Station 12,000 kW
Metro-Vickers Impulse Turbo-alternator,
installed January 1921*

Two large brick buildings were constructed to house the new boilers: boiler houses 3 & 4, including two short steel chimney stacks.



Pyrmont 'A' Power Station during construction of Boiler House No. 3, c. 1922



Pyrmont 'A' Power Station - Front facades of Boiler House No. 3 and Office block. Original brick chimney appears to be in the course of demolition, c. 1922

Between 1921 and 1924, eight newer type B & W chain-grate boilers and five Impulse steam turbo-alternators were installed. This was the last expansion of the 'A' station plant while controlled by the Sydney Municipal Council.

By 1924 the generating capacity of the station reached 75,000 kilowatts. However the demand forecast in 1924 was in excess of 60,000 kilowatts and another source of supply would soon be needed to ensure reserve capacity. The Sydney Municipal Council expanded its supply system with the Bunnerong Power Station which came into service in 1930 with a capacity of 150,000 kilowatts.

During the construction of Bunnerong, Pyrmont was being stretched to the limit; in the peak operational year, 1928, the station generated over 300 million kWh.

When Bunnerong came on stream, Pyrmont 'A' was wound down due to its aging plant, near the end of its service life. By 1935 Pyrmont was only used for back-up or peak-load duties.

A Change in the Governance of Power Supply

In 1936 the State Government took over the supply of electricity, and established the Sydney County Council (SCC) to operate Pyrmont Power Station and others, including Bunnerong.

By the late 1930s the SCC was faced with rapidly increasing demand for power as the nation recovered from the Great Depression. The Council needed to maintain sufficient generating capability to ensure supply was available to cover machinery breakdowns.

In May 1938 SCC accepted the General Manager's proposal to replace Pyrmont 'A' Station with a larger, more modern generating station.

The principal officers of the Council had decided the redevelopment of the Pyrmont site was the most economic option and Pyrmont was the best site as it was already connected to the 33kV network and there was no need for step-up transformers.

Plans were drawn up in 1941 for a large-scale remodelling and expansion of Pyrmont Power Station, rather than an earlier decision to expand Bunnerong. Experts had reported that, in view of bombing of power stations in Britain and Europe, massing generating units at one station was imprudent.

Moreover, it was strongly recommended that the power stations of Pyrmont, White Bay, and Balmain should be progressively developed to meet industrial and commercial requirements: for defence reasons, these stations should be inter-connected to ensure continued supply of electricity in any emergency.

Immediately after the end of the war SCC began planning for its new generating station.

Demolition of 'A' Station took place progressively from 1949 to make way for the more advanced generating station. It was retired from service at the end of 1950s and over the next few years the generating plant was removed. The area of Pyrmont 'A' was used to store coal to supply the new station.

All that remained of the 1904 Pyrmont 'A' was the original four story sandstone and brick masonry office block and its façade fronting Pyrmont Street. The façade was recognised as an item of significance by the Heritage Council of NSW.

Evolution of Pyrmont 'B' Power Station – 1952 ~ 1993

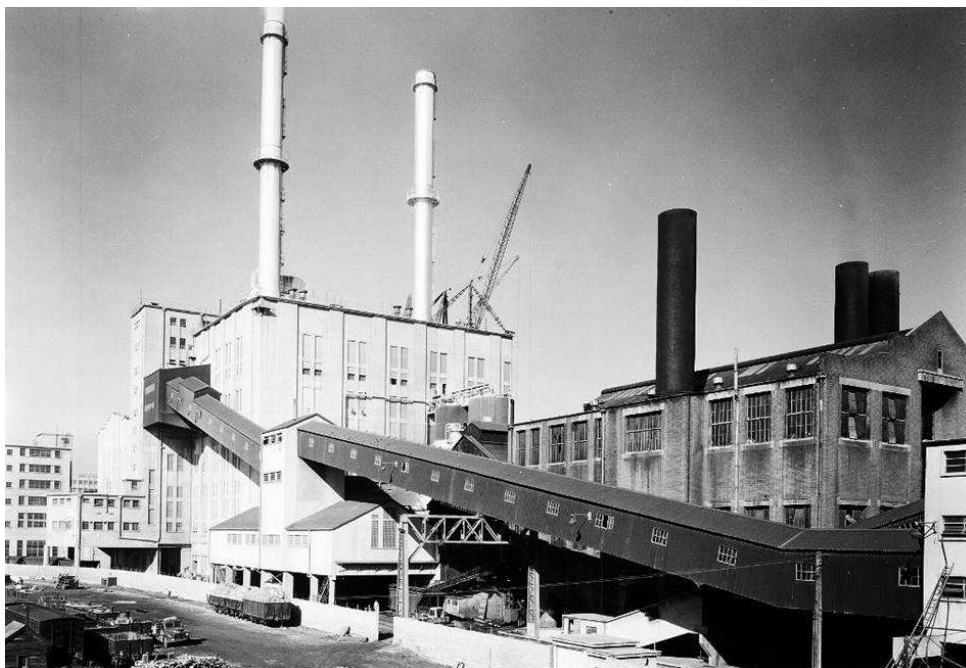
On 13 May 1941 the SCC agreed to reconstruct Pyrmont Power Station. The new generating station, Pyrmont 'B' Power Station, would replace the 'A' Power Station.

Tenders were called in 1942 to provide 50 megawatt (MW) generating units and associated steam raising plant. The Sydney County Council hoped that the station could open in 1947 to meet increased demand, but Britain was devoted to reconstructions, and exports of electrical plant were extensively delayed.

Between August 1944 and June 1947 orders were placed, totalling four 50 MW turbo-alternators and four ultra high-pressure boilers. Boiler design had evolved to the extent that one boiler could supply the whole steam requirements of one turbine. The alternators were designed to generate electricity at the high level of 33 kilovolts (kV), dictated by site limitations and removing the need for step-up transformers, and the space they required.

The war had complicated the plan of demolishing Pyrmont 'A' and building the new station on the site. Pyrmont 'A' Station was still needed and the designers had to reduce the dimensions of Pyrmont 'B' to fit alongside 'A' station while it was still needed. Internally, the revised design produced a cramped station with very closely spaced boilers.

Only the oldest 'A' Station's boiler plants were demolished and the site cleared for building to begin. A temporary coal and ash plant was commissioned to allow 'A' Station to continue operations while construction on 'B' Station proceeded.



Pyrmont 'A' & 'B' Power Stations c. 1952. 'B' Station in advanced stages of construction.

The erection of the main building commenced in 1946 along with ancillary plant in preparation for the first turbo-alternator. While the civil works would be completed for the scheduled date, completion of the first generating unit was much delayed.

In May 1947 the Council's representative reported from London that the machine would most likely be delayed until late 1949 rather than June 1948. Also the shortage of

material and labour lengthened the construction time for the steel framework which in turn slowed the installation of the first pair of boilers.

Finally the first unit of the Pymont 'B' Power Station was commissioned on 4 July 1952 and the second unit on 27 March 1953. The remaining two units were brought on-line in June 1954 and August 1955 bringing the total generation to 200 MWs. The power station had the most advanced steam conditions and became the leading base load station in the state. By 1957 it was generating a quarter of the state's thermal output.

General Description of the Main Plant of Pymont 'B' Power Station

Coaling Plant

Coal was delivered by rail or road and discharged into underground hoppers. The coal was elevated to overhead bunkers by belt conveyor with a capacity of 200 tonnes per hour. The coal plant was operated from a centralised control system. Coal gravitated by chute to the pulverising mills to be crushed to a powder before being blown into the furnace by forced draft air and exhauster fans. There were four pulverising mills per boiler; three mills were sufficient to supply the boilers to run at full capacity.

Boilers

The station consisted of four Lopulco twin-drum water-tube radiant boilers. The boilers were designed to produce 50 MWs of steam continually. Their design and performance were far more efficient than the chain-grate fired boilers of 'A' station. The energy produced from a unit of coal was much more than was produced in 'A' Station.

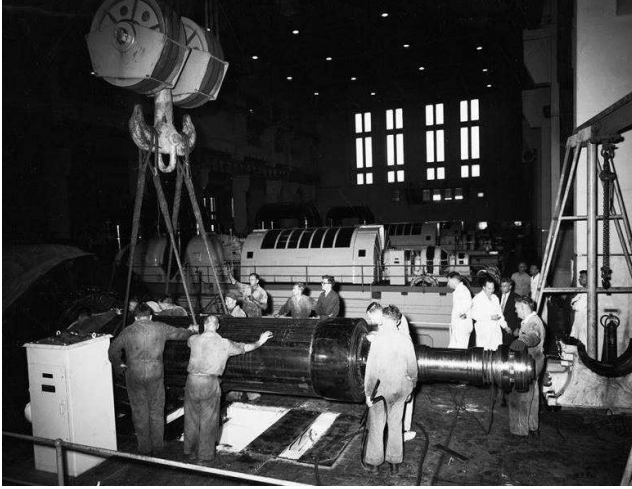
Each boiler exhausted to a single chimney 3.95 metres in diameter and 106.4 metres high. Electrostatic Precipitators were mounted just before the chimney to collect fly ash particles from the boiler exhaust gas before entering the atmosphere. This was a distinct improvement on the dense (black) emissions from the chain-grate boilers. The fly ash dropped into a dust-tight chamber which was then extracted for disposal by a vacuum system.

Turbo-alternators

Each of the four steam turbo-alternators consisted of three stages: High Pressure, Intermediate Pressure and a Double Flow Low-Pressure (LP) cylinder. The overall weight of each steam turbine (rotors and casings) was 152.5 tons.

The steam exhausted from the LP stage into twin condensers below where the condensing process occurred by cooling water flowing through the banks of condenser tubes. The condenser required 163,659 litres of sea water per minute for full operation.

Automatic voltage regulators controlled the generator voltage at the station busbar voltage of 33 kilovolts and were designed to maintain the voltage of between 31 & 34 kilovolts.



Pyrmont 'B' Power Station. No. 4 Alternator Rotor, removal for maintenance



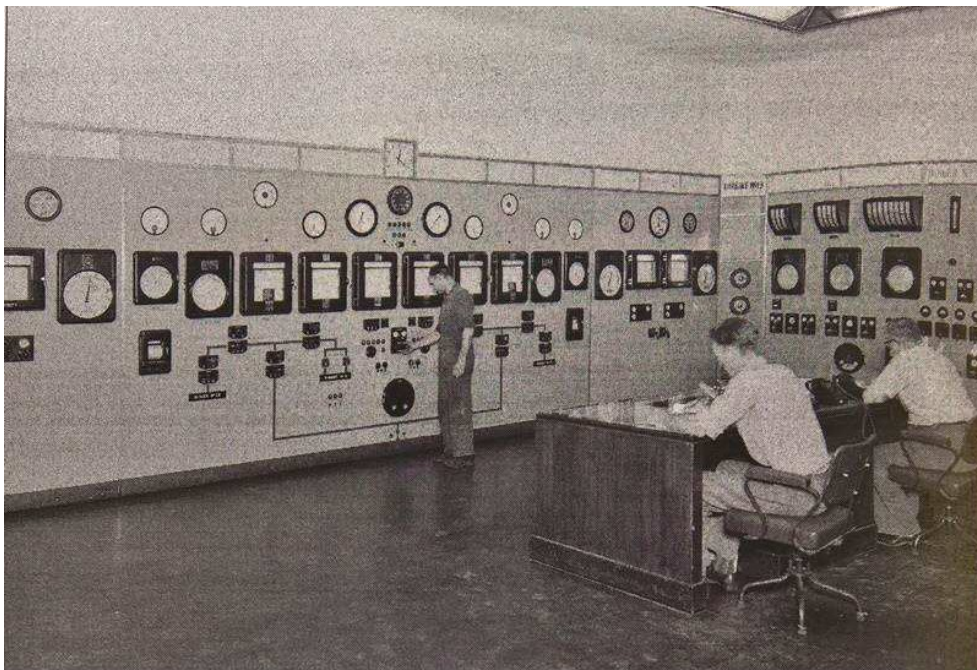
Pyrmont 'B' Power Station. Turbine Rotor Overhaul

Feed Pumps

Six centrifugal feed pumps supplied water to the four boilers. The pumps were arranged such that three pumps were available for each pair of boilers through interconnected pipework. Each pump could supply one boiler at full load.

Control Rooms

Automatic control of the boilers was undertaken from two Plant Control Rooms (PCRs), 1-2 and 3-4. The starting up of the plant was supervised from the operating floor and the continued operations were taken over by the PCRs once the units had been synchronised to the electrical network. Boilers 1 and 2 control panels were located in one PCR and boilers 3 and 4 were located in the other. The control rooms were 20 metres above the turbine operating floor in the Auxiliary Bay.



Pyrmont 'B' Power Station. One of the two Plant Control Rooms showing Turbine control panel in the centre and Boiler panel on the right-hand side

Electrical synchronisation and electrical control of the alternators and interconnecting feeders were undertaken from the Electrical Control Room in a building sited adjacent to the switch house.



Pymont 'B' Power Station. Electrical Control Room including the Grid Control Centre. On the panel at left are controls for the four 50 MW turbo-alternators.

The station became the base of the State System Control Centre, responsible for load dispatching for the power stations scattered around the state, and overall control of the state network.

Pymont 'B' Power Station Production Slashed

Despite the high pressure and temperature steam circuit, the cost of transporting coal into the metropolitan area was much greater than the transport costs of the coal-field power stations. The new Electricity Commission of NSW committed to build future power stations at the coal fields, not in the metropolitan area. Pymont 'B' Power Station would be the last major power plant to be installed in the metro area.

Pymont 'B' remained a base-load station until the mid-1960s when it was reduced to two-shift load status. From 1962 onwards its production levels were slashed as the station was overtaken by larger power stations in the coal fields. By the end of winter in 1969 two-shifting ceased and 'B' Station only generated for the peak-load demand.

At the end of winter 1972 production and operating times were further reduced and the station did not see life again until the winter of 1973. Serious problems with the coal plant supplying the newly commissioned 500 MW unit at Liddell and widespread industrial problems meant that Pymont and other smaller stations had to make up the shortfall. Output again fell at Pymont in 1976 as the station was reduced once again to winter peak-load. The station was placed on standby in 1977 and was semi-retired by the following year.

Resurrection

Unexpected failures of large generators in the coal fields and growing industrial trouble in 1980 brought Pymont 'B' back into semi-regular service. The problems escalated when Liddell failed again and strikes at Vales Point and Munmorah stations halved their output. Pymont continued to operate after Liddell returned to service. By late 1983 the supply problems had diminished with the commissioning of an Eraring 660 MW generating unit.

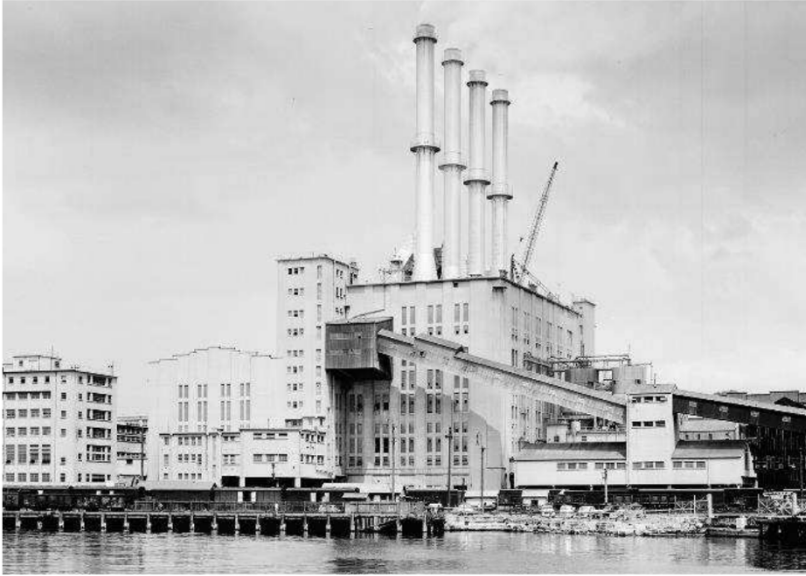
End of an Era

In the spring of 1983 Pymont 'B' was decommissioned and the plant placed in 'cold storage', after seventy-nine years. In 1989 it was announced that the steel chimneys would be removed as a prelude to the demolition of the power station. The Electricity Commission announced in 1991 that it would begin disposing and dismantling the retired power stations, including Pymont.

Pymont Power Station was removed from the Sydney landscape in the early 1990s. The site is now occupied by the original 1904 office block of the Sydney Electric Lighting Station which has been absorbed into the Star City Casino complex.

References

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*Pyrmont 'B' Power Station
from the water*



*Pyrmont 'B' Power Station. Aerial
view of power station and
associated buildings*