NOMINATION OF

ULTIMO POWER HOUSE

AS A SITE FOR AN

HISTORIC ENGINEERING MARKER

November 1994

View of the ornate main entrance to the Office and Accommodation Block following closure of Ultimo Power House in October, 1963.

Prominently shown is the massive delicately carved stone lintel of which the main feature is a plaque with the legend "N.S.W.G.T." (standing for "New South Wales Government Tramways")"Power House 1899".

Surrounding the plaque are multiple stylised representations of electricity, while above it is an embellished version of the N.S.W. Coat of Arms.

CONTENTS

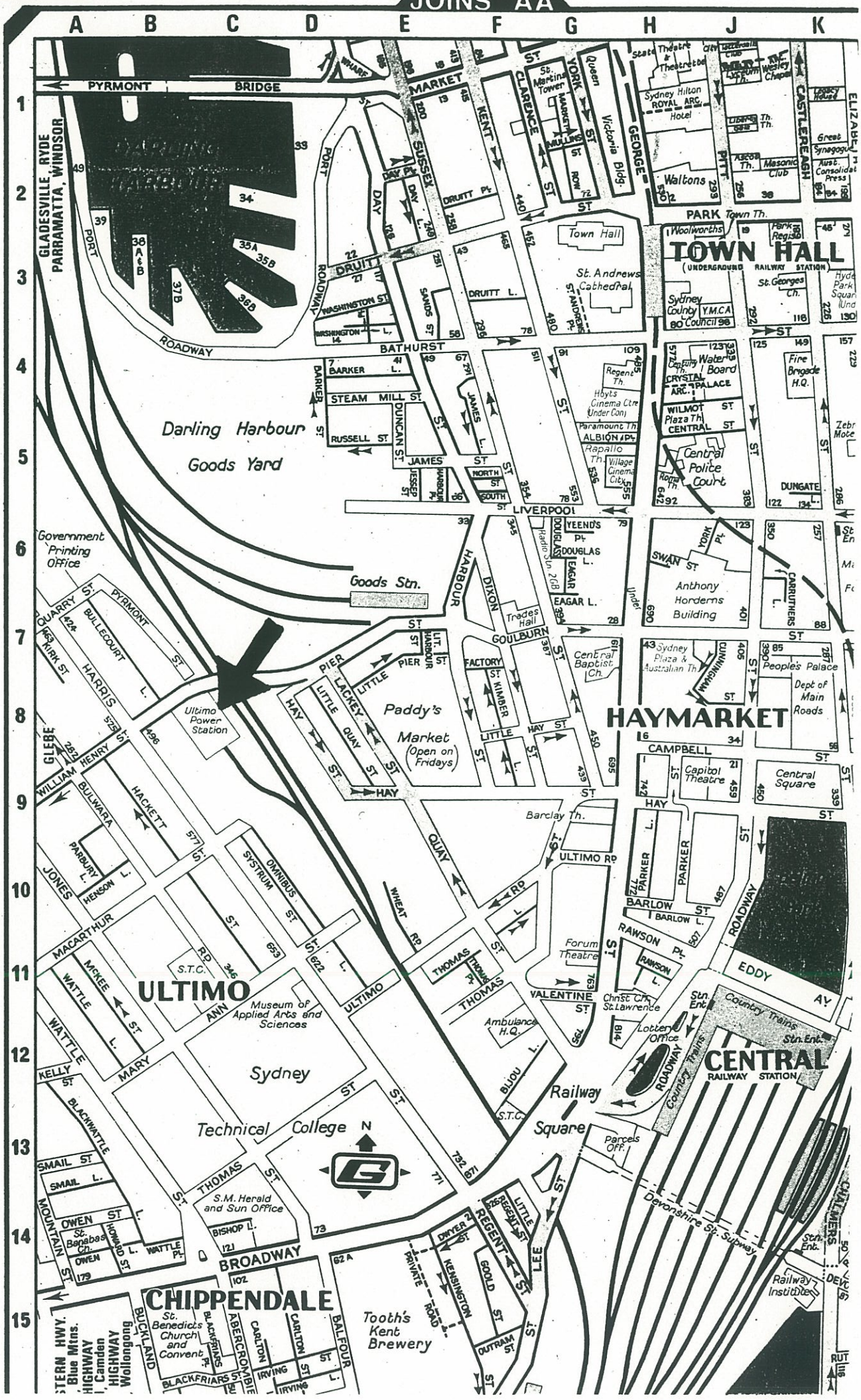
INTRODUCTION

The history of the Ultimo Power House and its provision of electrical energy played a fundamental part in the evolution of Sydney. Particularly is this so in the generation of power for the very first City electric tramway, cars for which were housed in the adjoining Ultimo Tram Depot.

The evocative, awesome brick enclosure to the complex of power generators since removed, inspires all who view it as a mute reminder of past uses and past technology.

This study concentrates on the development of the Power House and Tram Depot. It was undertaken to give a greater understanding of the processes and decisions that shaped the existing remnant now the Powerhouse Museum.

JOINS AA


A B C D E F G H J K
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15
PYRMONT BRIDGE
GLADESVILLE, RYDE PARRAMATTA, WINDSOR
ROADWAY
PORT
DARLING HARBOUR
WHARF
MARKET
KENT
SUSSEX
CLARENCE
YORK
Queen Victoria Bldg.
GEORGE
CASTLEREAGH
ELIZABETH
DAY
DRUITT
WASHINGTON ST
SANDS ST
Town Hall
St. Andrews Cathedral
PARK
TOWN HALL
UNDERGROUND RAILWAY STATION
Sydney Hilton
ROYAL ARC. Hotel
Waltons
Sydney County Council
Y.M.C.A
Water Board
Fire Brigade H.Q.
Central Police Court
BATHURST
BARKER
STEAM MILL ST
DUNCAN ST
JAMES
RUSSELL ST
JESSEP
HARBOUR PL
NORTH ST
SOUTH ST
LIVERPOOL
Darling Harbour Goods Yard
Regent Th.
Hoyts Cinema Ctre Under Con.
Paramount Th.
ALBION PL
Rapallo Th.
Village Cinema City
CRYSTAL PALACE ARC.
WILMOT Plaza Th.
CENTRAL ST
DUNGATE
Government Printing Office
Goods Stn.
HARBOUR
DIXON
DOUGLAS
YEEND'S PL
EAGAR
EAGAR L.
Trades Hall
Radio 2UW 2GB
SWAN ST
YORK PL
Anthony Horderns Building
CARRUTHERS L.
GOULBURN
QUARRY ST
PYRMONT BRIDGE
BULLECOURT L.
HARRIS ST
PIER
LITTLE PIER
FACTORY
KIMBER ST
Central Baptist Ch.
Sydney Plaza & Australian Th.
CUNNINGHAM
People's Palace
Dept of Main Roads
HAYMARKET
Ultimo Power Station
LITTLE LACKEY
QUAY
Paddy's Market (Open on Fridays)
HAY ST
CAMPBELL ST
Capitol Theatre
Central Square
GLEBE
WILLIAM
HENRY
BULWARA
HACKETT
PARBURY L.
HENSON L.
JONES
Barclay Th.
ULTIMO RD
PARKER L.
BARLOW ST
RAWSON PL
ROADWAY
EDDY AV
OMNIBUS STRATUM ST
WHEAT RD
MACARTHUR
S.T.C.
ULTIMO
MCKEE L.
WATTLE
ANN
Museum of Applied Arts and Sciences
THOMAS PL
THOMAS
VALENTINE ST
Forum Theatre
Christ Ch. St. Lawrence
Ambulance H.Q.
Lottery Office
Stn. Ent.
Country Trains
CENTRAL
RAILWAY STATION
BLIJOU L.
Railway Square
Parcels Off.
KELLY ST
MARY
BLACKWATTLE
SMAIL ST
SMAIL L.
MOUNTAIN ST
OWEN ST
St. Barnabas Ch.
HOWARD ST
WATTLE PL
S.M. Herald and Sun Office
BISHOP L.
BROADWAY
Technical College
N
CHIPPENDALE
St. Benedict's Church and Convent
BLACKFRIARS ST
ABERCROMBIE
CARLTON
IRVING
BALFOUR
BUCKLAND
Tooth's Kent Brewery
PRIVATE ROAD
DWYER ST
KENSINGTON
GOOD ST
REGENT ST
LEE ST
OUTRAM ST
Devonshire St. Subway
Railway Institute
CHALMERS
DEV
RUT
STERN HWY. Blue Mtns.
HIGHWAY Camden
HIGHWAY Wollongong

STATEMENT OF SIGNIFICANCE

The Ultimo Power House was the first large central power station to be constructed in NSW, and by 1905 was for a time, the largest in Australia. Its construction was part of major social progress in the City of Sydney in the form of the introduction of an extensive electric tramway network. At its peak the Sydney tram system was reckoned to be the second largest in the British Empire.

The construction of this tramway system would have had important environmental consequences in that it contributed significantly to the reduction of atmospheric pollution by the elimination of the steam tramway locomotives which preceded the electric tram. In his Presidential Address in 1902 to the Electrical Association of NSW (one of the learned technical societies which preceded the Institution) J R Bainton commented as follows on Sydney's smoke problem. (While his remarks were directed at the steam boilers of his day, including those of the private generators in the inner city, they would have applied with equal force to the steam tramway locomotives which by then were being phased out of service).

J R BAINTON ON SMOKE PROBLEMS

"If the Council had been foresighted enough and able to furnish a cheap reliable source of electricity (such as it ought to have done years ago) it would have had a tangible alternative to offer and one that would have overcome all the smoke troubles of those who at present produce their own power by stem and who are content to send a large portion of it up the chimney in the form of smoke. The certain cure for users of power is a cheap supply of electricity generated at one central point where all known precautions can be taken for the minimisation of smoke troubles. This is one that must be faced sooner or later by all supply stations operating in this city and may become of serious moment unless early steps are taken for its proper treatment".

Clearly the tramway authorities were more alive in the potential social value of electrification than were the civic fathers of the day.

Constructing Authority for the power station was the NSW Public Works Department. The Railways and Tramways Department only later assumed responsibility for power supply to its tramway system. This occurred in

Because of the PWD role in this matter it was that department rather than Railways which produced the definitive historical account of the development of the Ultimo power station and its subsequent expansion, notwithstanding that those later developments were carried through by the Electrical Branch of the Railways and Tramways Department.

Relevant portions of the PWD book, "Ultimo, the Power House, Ultimo the Tram Depot", published in 1988, are appended to this submission as an authoritative account of the technical features of the power station and tram depot.

Some of the highlights, to which reference is made in the proposed plaque, include the fact that ultimo was the first power station in the State to use stem turbines (in 1903) and the first to use pulverised coal fired boilers (1929).

Following its shutdown as an active power station (as a result of the post-war development of more cost-efficient power stations on the coalfields), Ultimo remained little used for a decade or more until the decision was made that it should be re-developed as the Powerhouse Museum. Today it is the State's leading technology Museum, a most appropriate adaptive use of the site and buildings of the State's first large power station.

Ultimo was the scene of pioneering electrical development in NSW and is recommended as an appropriate site to be honoured by the affixing of one of the Institution's Historic Engineering Markers.

THE NOMINATION

The Institution of Engineers, Australia
ELECTRICAL COLLEG
Chairman
Clive Cooper, FIEAust CPEn

24 October 1994

To: Commemorative Plaque Sub-Committee
The Institution of Engineers, Australia
11 National Circuit
BARTON ACT 2600

From: The Board
College of Electrical Engineering
The Institution of Engineers, Australia
11 National Circuit
BARTON ACT 2600

Commemorative Plaque Nomination

The following work is nominated for an Historic Engineering Marker award:

Name of Work: Ultimo Power House

Location: Powerhouse Museum
Harris Street
ULTIMO NSW UBD Map 3, C, 5

Owner: Trustees, Museum of Applied Arts and Sciences

Supporting Information:

In support of the nomination the following information is provided:

(1) Proposed working on HEM – See Attachment 1

(2) Justification – please make data as complete as possible – See Attachment 2

Permission of Owner:

The nomination has been discussed with the owner of the work who has indicated its support for the affixing of the plaque within the Museum at a mutually agreed location.

A copy of this submission has been sent to the Secretary Sydney Division and the Chairman of that Division's Engineering Heritage Committee.

In the event of this nomination being approved the nominating body will organise a suitable presentation/unveiling ceremony.

Clive Cooper
Chairman, Electrical College Board

Linda Tregonning
Executive Officer Colleges

cc Director, IEAust Sydney Division
Chairman, IEAust Sydney Division Engineering Heritage Committee

Proposed wording for the plaque is as follows:

ULTIMO POWER HOUSE

CONSTRUCTED IN 1897 - 1899 BY THE DEPARTMENT OF PUBLIC WORKS FOR SYDNEY'S TRAM NETWORK, THIS WAS THE FIRST LARGE POWER STATION IN NSW. IT CONSISTED OF FOUR RECIPROCATING ENGINES DRIVING 850 KILOWATT DIRECT CURENT GENERATORS. UNITS ADDED FROM 1902 ONWARD OPERATED AT 25 HERTZ. THE FIRST STEAM TURBINE IN THE STATE WAS COMMISSIONED HERE IN 1903. BY 1942 THE STATION'S CAPACITY HAD GROWN TO ... MEGAWATTS. IT WAS DECOMMISSIONED IN 1963.

Final wording:

ULTIMO POWER HOUSE

CONSTRUCTED BETWEEN 1897 AND 1899 BY THE DEPARTMENT OF PUBLIC WORKS FOR SYDNEY'S TRAMWAY NETWORK, THIS WAS THE FIRST LARGE POWER STATION IN NEW SOUTH WALES. INITIALLY IT COMPRISED FOUR RECIPROCATING STEAM ENGINES DRIVING 850 KILOWATT DIRECT CURRENT GENERATORS. ALTERNATING CURRENT GENERATORS OPERATING AT 25 CYCLES WERE ADDED FROM 1902 AND TURBOALTERNATORS FROM 1905. THE STATE'S FIRST PULVERISED COAL FIRED BOILERS WERE COMMISSIONED HERE IN 1923. BY 1942 THE STATION'S CAPACITY HAD GROWN TO 79.5 MEGAWATTS. IT WAS DECOMMISSIONED IN 1963.

DEDICATED BY
THE INSTITUTION OF ENGINEERS, AUSTRALIA, 1994

SUPPORTING EXTRACTS

FROM

"ULTIMO, THE POWER HOUSE, ULTIMO THE TRAM DEPOT"

compiled by

NSW DEPARTMENT OF PUBLIC WORKS

J W Thomson, Government Architect
L Glendenning, Principal Architect
Government Buildings
W Upton, Research Assistant

Origins of Tramway Operation.

Sydney's first mechanically drawn tramway began operation in 1879 using steam locomotives on a line originally built to serve the Garden Palace Exhibition in the Botanical Gardens. It was laid along Elizabeth Street to connect the original Sydney Railway Station and Hunter Street. So successful was the line that tramways were built to the suburbs beginning with a line to Randwick, opened in 1880.

The first line to be electrified was the 1 mile 30 chain long Randwick-Waverley Extension route on which three experimental electric tram cars began operation in November 1890. However, because of its pioneering nature, electric operation was beset with problems and breakdowns so that operation lasted only seventeen months, after which the line reverted to steam operation for an extended period.

Permanent Sydney electric tram operation was inaugurated at North Sydney between St.Leonards Park and Spit Road on 20th September, 1893. A small generating station was established at Ridge Street, North Sydney.

Another small generating station was set up at Rushcutters Bay Depot to operate the new electric tram line beyond Ocean Street cable tram terminus to Rose Bay. This line opened on 4th October, 1898.

Apart from these two isolated electric lines, the N.S.W. Government Railways and Tramways as operators of rail transport in the State were looking at proposals to electrify all lines on the main Sydney tramway system. Power was to be generated in a new large centralised power house. This plan would eliminate all steam trams from the City of Sydney.

Accordingly, "The George Street and Harris Street Electric Tramway" was sanctioned by Act of Parliament and assented to on 14th September, 1896, after the basic proposal to build an electric tramway along George Street was put before the Legislative Assembly during September, 1895.

Associated with this, and to enable its operation was the construction of Ultimo Power House and Ultimo Tram Depot, (the Depot was originally referred to as "Ultimo Car House). At the time the whole site was described as being "approximately 4 acres" with the resumption of the land for tramway purposes being gazetted in May 1897.

Ultimo Power House

"Power Plant

Steam engines and generators - contract let - material delivered.
Boilers - contract almost completed.
Boiler settings and mountings - under construction - drawings in progress.
Accumulators - contract let.
Circulating and feed pumps - tenders invited.
Steam piping - drawings complete - specifications being prepared.
Travelling cranes - material delivered.
Steel columns and crane girders - contract let - work well advanced.

Power House

Power House and offices - contract let on 27th June,1898. Work about to be commenced.
Excavation, Power House site - contract let 8th November, 1897-work completed.
Chimney - contract let on 28th February,1898 - in course of construction.
Water conduit - contract let on 2nd May,1898 to J. McSweeney. In course of construction.

Position in detail

Messrs. G.& C. Hoskins have nine boilers out of fourteen ready for testing and work on five is well advanced. The electric 30 ton travelling cranes have been delivered by the contractors, H.W. Peabody & Company. The contract for the manufacture of the steel columns and crane girders for the Power House has been let to Scrutton & Company, who have commenced work.

The Power House site will enable the building to be extended to accommodate additional boilers and generating equipment (this was done by extension at the south end where there was originally a temporary wall of galvanised iron in 1902).

"Power House.

A tender has been accepted for the erection of the Power House and offices, Stewart & Company being the contractors. The contract for excavation of the site was let to Mr.C. McClure and has been completed.

The contract for the chimney, which is of a capacity sufficient for 5000 horse power and will be 200 feet high from flue level, with a minimum diameter of 6 feet, has been let to Phippard Brothers. Good progress has been made. It contains some 890,000 bricks. (This was the original stack at the north east end of the building demolished in 1960 after being disused from circa 1931).

The conduit from the Boiler House to Darling Harbour for the supply of sea water for condensing purposes has been let to Mr. Justin McSweeney, who has made good progress with the sinking of the shafts. (An essential requirement for the Power House was an abundant supply of cooling water for its condensers. This was supplied from the southern end of Darling Harbour and discharged heated condenser water back to the Harbour not far from its intake).

The front portion of the engine house facing William Henry Street for a distance of 98 feet has accommodation in the basement for foremen, line repairers and greasers, together with bathrooms, lavatories etc.

On the first floor are the testing room, chemical laboratory, officers quarters, storeroom, lavatories, bathrooms, etc.

The second floor to which a goods elevator has been provided is set apart exclusively for accumulators.

The roof of the accumulator room (where storage batteries were kept to boost output at peak periods if necessary) covering the same area, is flat to allow for future extension (however, extra floors were never added). The whole of the floor and dividing walls in the office portion of this building are rendered fireproof by being constructed of terra cotta lumber, the flat roof being covered with patented asphaltum with lead flashing around the parapet walls." (This building is of red double pressed brick in English bond, using moulded bricks of the same type for trimming. Beneath the first floor front windows there is panelling with the bricks laid in herringbone bond. The building has sandstone dressings, while the front elevation features an arched stereobate of cyclopean stone. In the centre of the front elevation is a triangulated sandstone pediment above a tripartite lunette containing coloured lead lights. This, in turn, surmounts a massive delicately carved stone lintel incorporating a descriptive legend with the opening date and a stylised representation of electricity).

As the beginning of the electrification of the whole Sydney main tramway network, the opening of the George Street and Harris Street electric tramway was originally planned for September, 1899. However, because of delays which gave rise to heated debates in State Parliament, the Line and the Power House did not officially open until 8th December, 1899. These delays were due to a number of considerations: the line was extended during construction beyond the originally planned terminus and the capacity of the generating units in the new Ultimo Power House was raised from 800 to 850 kilowatts. The equipment was apparently installed before the completion of the roof of the Power Station in May 1898 and several days of rain thoroughly saturated the generators, which delayed

satisfactory trials of the generating plant. These Ultim generators could each provide an output of 1545 amps at 550 volts. A check on the tramway overhead wiring during late November, 1899, carried out by transmitting 2500 volts through the overhead wires instead of the then usual 550 volts proved that the installation was ready for servi

The original engine room at Ultimo Power Station was contained in a section 147 feet by 105 feet divided into two bays. Two travelling cranes, each capable of lifting 30 tons were provided above. In each bay two sets (a total of four) of right and left hand horizontal cross compound steam engines built by E.P.Allis & Company of U.S.A. (Allis-Chalmers) were each directly coupled to General Electric multi-polar, compound wound generators each rated at 850 kilowatts or 1100 horsepower at 550 volts Direct Current with a maximum overload of 50%. The engine beds were of coke breeze concrete, each one being 35 feet long x 29 feet wide x 12 feet deep.

Each steam engine unit consisted of one high pressure 26 inch diameter cylinder and one low pressure 48 inch diameter cylinder, working at 100 revolutions per minute and capable of developing 1250 horsepower. Each engine carried two governors. One was of the special weighted high-speed type driven by eccentrics from the main shaft and regulated to shut off the steam automatically if the engine exceeded the normal speed by 5 revolutions per minute. The other governor was belt driven and regulated the engine speed within 2% for normal operations. The condensers were of the Wheeler surface type with "Blake" direct acting air pumps. The condensing water supply circulated from Darling Harbour through conduits 1000 feet long and three feet 3 inches in diameter.

The Power House boilers, built by Babcock & Wilcox of London and Renfrew, Glasgow, were placed in a room originally 105 feet b y 86 feet and were arranged in two groups of seven. Each boiler measured 16 feet long by 7 feet diameter and was able to generate 300 horsepower at a pressure of 140 pounds per square inch. During the initial stages of power production only two boilers were mechanically fired; the remainder were hand fired from small narrow gauge rail tructs, but were later converted to mechanical firing. The main flues passed through the pump room to a chimney stack 200 feet high with a minimum internal diameter of 6 feet. This stack was located at the north east corner of the complex. It was out of use from circa 1931 and was finally demolished in 1960. Twelve of the boilers were sufficient at first to work the Power House at full capacity, so that two boilers were in reserve.

There were two complete systems of feed mains, one being for hot water and the other for cold water. The pump room measuring 86 feet x 47 feet, had two triplex plunger pumps capable of delivering 125 gallons of water per minute against a steam pressure of 140 pounds per square inch. Each pump was driven by means of a 25 horsepower electric motor. The hot well was located near the feed pumps and the water discharged from the pumps through a "Reeves" filter before entering the boilers.

A tram car made the first trip over the new George Street line on Wednesday,22nd November, 1899 and on Monday 27th November, members of the State Parliament rode on the line. However, trouble with the overhead wires deferred the public opening until the morning of Friday 8th December, 1899. In the first two days of public operation on the line, a total of 95,000 passengers was carried.

Installation of Alternating Current Plant.

As the Sydney tramway electrification scheme progressed the original Ultimo steam engines , rated at 1250 horsepower, were regularly worked at a higher loading of 1600 horsepower each. During June 1902 the first of three vertical cross compound reciprocating steam engines, each coupled directly to a General Electic alternator, was installed in a new engine room of 176 feet x 99 feet, built at the southern end of the original direct current generating unit towards Harris Street. These vertical 2500 horsepower condensing engines each had one 32 inch diameter high pressure cylinder and a single 64 inch diameter low pressure one working on a 60 inch stroke at 75 revolutions per minute. The General Electric 1500 kilowatt, 6600 volt 3-phase generators were placed between each pair of cylinders and consisted of stationary armatures. There were 40 field poles attached to the periphery of the 23 feet 4 inch diameter flywheel, turning at 75 revolutions per minute to give alternating current at 25 cycles per second.

Foundations had been provided for an extra three similar reciprocating engines in the new machinery room, but in the brief interval of two years, when the generating capacity of Ultimo had again to be enlarged, steam turbines had reached a stage of efficient development and plans for the commissioning of any further large reciprocating engines were abandoned.

To provide steam for this new unit and the other two engines placed in service soon afterwards, a total of 24 Babcock and Wilcox water tube boilers were installed, arranged in two tiers with overhead coal bunkers. Each had a nominal capacity of 450 horsepower at 160 pounds per square inch pressure. They were installed in a new 176 feet x 84 feet boiler room situated at the southern end of the original building in 1902. This increased the overall

length of the Boiler House to approximately 274 feet. The Boiler House was originally roofed in galvanised iron which was laid using pneumatic riveters, but was replaced in the 1930s with corrugated asbestos cement. During 1954, this was replaced with coated metal corrugated sheeting.

There is some confusion on the total number of boilers available at Ultimo at the end of 1902. Reports of the day and photographs clearly show that 14 boilers were installed in 1899, while 24 units followed in the 1902 expansion programme. However, reports of the period assert that a total of 32 boilers comprised the full complement at Ultimo, while for 1908 the figure is given as 48. The probable explanation is that six of the original 1899 boilers were removed during the 1902 expansion works. To cater for the new boilers, two chimney stacks, each 224 feet high were built side by side in the new southern extension to the Boiler House in 1902. The stacks were erected from within with brick hoists being placed internally. The Railways Department gives the total number of bricks used in building the 1902 extensions as just on 3,000,000.

With the installation of the three alternating current units and the capability to reticulate power more economically at higher voltage, substations began to appear around the Sydney tramway system. The City substation, which was originally built on the site of the present Library of New South Wales was typical - its two separate buildings housed the transformers, converters, switch gear and batteries. It was, however, demolished circa 1906 for building of the Mitchell Library.

Installation of Turbo-Alternator.

In order to be able to supply power for further conversion of the remaining steam tram lines and the Ocean Street cable tram line, new generating plant was ordered for Ultimo Power House. This comprised a Parsons 3000 horsepower steam turbine, operation at 1500 revolutions per minute coupled to an alternator rated at 1875 kilowatts. The new generating equipment required an additional 16 Babcock and Wilcox water tube boilers. The enlargement also involved increasing the height of the original Boiler House walls (towards the north end of the complex) in 1904 except at the northern extremity where the original roof line remains in damaged condition (1980).

The new plant came into operation on 9th January, 1905. It made Ultimo, at the time, the largest generating power station in the Southern Hemisphere with an output of 17800 horsepower. To illustrate the remarkable growth in Sydney's electric tramways and, of course, in the output of Ultimo Power House, is best shown by pointing out that electricity generated here increased by over 680% between 1904 and 1914.

It has now been found that the dimensions of the Power House as extended are based on the Golden Mean proportioning system.

During 1905 Ultimo's generating output was sufficient to enable one alternating current and one direct current unit to remain out of service even during peak periods. However, by early 1907 electricity demand again forced the expansion of the power station. Thus in mid-1907 the Railways ordered two 5000 kilowatt turbo-alternators (with an overload capacity of 7500 kilowatts or 10000 horsepower) from Parsons of Newcastle-upon-Tyne, England.

After a delay of six months, due to an industrial strike in England, a ship wreck, and a steam pipe found to be fractured on delivery, the first unit arrived in November, 1908 and entered service in January, 1909, while the second unit came into operation in September, 1909. At this stage 32 boilers out of a total of 48 operated each day at Ultimo.

During the year ended June, 1909, a contract was let to Babcock and Wilcox to supply 12 additional water tube boilers complete with superheaters. Installation of these was completed in October, 1910.

In 1912-1913, the eight water tube boilers originally provided were replaced by the same number of boilers of a larger capacity.

Advent of White Bay Power House.

With the rapid increase in demand for electricity for traction, power and lighting purposes it became apparent to the N.S.W. Government Railways and Tramways by 1910 that Ultimo Power House had very definite limits to its potential for expansion. It was hemmed in by the existing use of Darling Harbour Railway Goods Yard and Ultimo Tram Depot, the relocation of which were viewed as impracticable for the foreseeable future at that stage. Accordingly, construction of a new Railway and Tramway power house at White Bay was begun in 1912.

The first two temporary boilers at White Bay were put into steam during 1913. From this point it was obvious that Ultimo Power House would eventually be eclipsed by power houses elsewhere, where there was more scope for site expansion. By 1923, the power output from White Bay Power House exceeded that of Ultimo and continued to do so thereafter.

The maximum yearly output recorded for Ultimo Power House was 291,289,115 kilowatt hours in 1944/45.

Ash Removal.

During the period from 1911 to 1915, two pneumatic ash ejector plants were erected in the Power House for delivering ashes from the boilers into railway trucks for removal.

However, from circa 1931 the main method of ash removal was by means of an eight wheel electrically propelled rail hopper truck which carried ash from each boiler to a wet sump. From here it was pumped through 2240 feet of pipe into hopper barges on Darling Harbour.

Tramway Instruction "Room".

The Tramway Instruction "Room" is a sizeable single storey brick building with asbestos shingle roof. It stands immediately to the west of the Office and Accommodation block fronting William Henry Street and was built circa and by 1913. A wooden cottage built and occupied by 1889 was demolished to allow for its construction. It was used for instructing trainee electric tram drivers and contained major items of tram car equipment such as motors, controllers, switchgear and braking equipment. However, it was replaced by the newly built Dangar Street Training School at Randwick which was officially opened in June 1953. After the building was vacated, it was converted into a store for the Electricity Commission of N.S.W. in 1954.

Water Conduits.

In connection with the reclamation of Darling Harbour by dumping spoil excavated when tunnelling the City Railway, new circulating water conduits were built. This extensive

and expensive work began in 1923-1924 and was finally completed in 1928. These conduits are still serviceable and will be re-activated as part of the heat source and sink system for the air conditioning system in the Museum.

Switch House.

The new multi-level, multi-room Switch House incorporating transformer banks, new control room and with accommodation for the whole of the high tension switchgear was begun in 1922 and completed in December, 1926.

Extracts from Railway and Tramway Department Annual Reports are as follows:

Year ended June, 1922: "The site is being cleared for the erection of a new Switch House and orders have been placed for the necessary oil switches."

Year ended June, 1923: "Work has made considerable progress, the whole of the foundations and trenches for cables having been completed and a commencement made with the erection of the steelwork."

Year ended June, 1924: "The building of a new Switch House at Ultimo to accommodate the whole of the high tension switchgear is nearing completion; a large amount of switch gear has been delivered and will be erected in the course of the new year."

Year ended June, 1925: "The building of the new Switch House has been completed and the work of installing the switchgear is proceeding."

Year ended June, 1926: "The erection of the new Switch House has been completed and the work of transferring the load from the old switchgear to the new is in progress."

Year ended June, 1927: "The new Switch House has been put into service and the lighting and power wiring installations have been practically completed."

The "completion date" of the Switch House is given as December 1926 - this appears to exclude the lighting and power wiring (see above).

Modernisation Programme.

At the time of embarking on an extensive modernisation programme for Ultimo Power House in 1929, the steam raising plant consisted of no less than 60 relatively small Babcock and Wilcox water tube boilers arranged in two tiers beneath three large coal storage bunkers. Modernisation was undertaken during 1929-1931 and involved replacing all 60 of the old boilers with 6 single drum boilers with a maximum continuous evaporative capacit of 110,000 pounds of steam per hour at 350 pounds per square inch, and designed to burn pulverised coal. It also included the installation of two 20000 kilowatt turbo-alternators as well as a pneumatic coal handling plant and ask handling plant.

The coal storage bin on the east side of the Switch House was built in 1930-1931. It was designed for a capacity of 10000 tons of coal stockpiled at ground level. Construction of the storage bin allowed the Power House to be independent of short term interruptions in the delivery of coal supplies.

A power drag line scraper was used for trimming and reclaiming coal within the coal storage bin. Coal was conveyed by balanced telescopic suction pipe from railway trucks either to the coal storage bin or alternatively direct into overhead coal bunkers in the Boiler House. The combined capacity of these bunkers was 800 tons.

The waste steam pipes from the new boilers' superheater safety valves were led into the brick chimney stacks to muffle their objectional noise when blowing off.

To discharge flue gases from two of the new boilers two plate metal stacks were erected north of the southern pair of brick stacks. They were noticeably lower in overall height than the earlier brick stacks. Unlike the latter, they had no embellished cap or gracefully tapered profile.

The last new major items of plant were installed in 1941. They comprised two further single drum boilers with chain grate stokers each with a maximum continuous evaporative capacity of 110,000 pounds of steam per hour at 400 pounds per square inch and one extra 20000 kilowatt turbo-alternator. However, because of war time delays in building the condenser, this new turbo alternator did not enter service until July 1942.

A secondhand 18750/200000 Kw turbo-alternator was installed in 1949 after removal from White Bay Power House. It replaced two/5000 kilowatt turbo-alternatores dismantled and removed in 1948.

During 1948 and 1949 the boilers were converted to burn furnace oil because of shortages in the supply of coal at the time.

After the passing of the Electricity Commission Act of 1950, Ultimo Power House and its operations passed from the control of the N.S.W.Government Railways to the Electricity Commission of N.S.W. on 1st January, 1953.

Demolition of First Smoke Stack.

Following the major modernisation programme undertaken during 1929/1931, the first chimney stack erected during 1898 and 1899 was taken out of service. It was allowed to remain in a disused state until one of the mild steel retaining bands corroded completely and fell off during 1958. An inspection showed that over £500 would be required to return the chimney to a reasonable condition by renewing the retaining bands.

As it had not been used for years and would not be used for future generating requirements, quotations were called in the following terms for its complete demolition:-

"Demolition and removal of unused brick chimney at Ultimo Power Station. Height 200 feet, average outside diameter 14 feet. Demolition to be performed brick by brick. Felling or demolition by explosive charge will not be permitted. Bricks to be dropped inside chimney to prevent damage to surrounding structures."

Tenders were invited on 17th December, 1958, and closed on 6th January, 1959, with the tender being awarded on 4th March, 1959. As the contractor made no apparent effort to begin work, the contract was cancelled and quotations recalled in September, 1959. Johnmann Constructions Pty. Ltd., were the successful tenderers on this occasion and were awarded the contract in October, 1959, for the sum of £3,405/5/0. Demolition work began on 25th January, 1960 and was completed on 1st April, 1960 to a stage where 25 feet in height of the base was allowed to remain. However, to permit construction of the new, and much wider second William Henry Street Bridge across Darling Harbour Goods Yard in 1967-1968, part of the chimney base towards the north was hacked away so that the part of the base towards the south remains to a height of about 25 feet.

Returning to the demolition of the two southern smokestacks, work continued slowly, but was fraught with delays and difficulties. An important obstacle to the work was a large heavily reinforced concrete framework incorporating ¾ inch steel around an opening about half way down the stacks. This was not shown on plans and was not visible until demolition was well advanced. The contractor resorted to the use of explosives for the removal of the reinforced concrete. The two stacks were demolished to just below roof level and the bases filled with rubble by August, 1977, but masonry falling during the demolition process damaged two roof trusses, roof sheetings in the general area and the upper portions of the walls. Demolition procedures further damaged the base of the walls at a number of openings.

In view of the problems associated with demolishing the stacks, it was decided not to proceed further in removal, so that the lower section of the chimney stacks remain to this day. Because the roof adjacent to the stacks was damaged, the contractor removed trusses, rafters, purlins and sheeting in this area - their removal was finally completed in December, 1977.

Since closure the Ultimo Power House complex has been victim of the combined ravages of salvage operations, partial demolition, decay and rampant vandalism.

Plan for Conversion to a Museum.

The possibility of Ultimo Power House being used as a Museum was outlined in an official report of January, 1978, at which time it was still vested in the Minister for Transport.

On 13th August,1979, the N.S.W.Government announced its intention to convert the former Power House and Tram Depot into a new home for the Museum of Applied Arts and Sciences. The complex will contain dynamic displays covering all fields of science, technology and Applied Arts.

Change of Name.

During the period of planning, construction and operation until 1929, the Power House was officially referred to as "Ultimo Power House". However, by the time of the Railways Report of June 1930, the title had become "Ultimo Power Station." This was continued in official use by both the Electricity Commission and Railway Department until plans were announced in 1979 for its redevelopment, when it reverted to "Power House."

Despite the name change, the title "Power House" remains in carved stone above the main entrance to the office and accommodation building fronting the William Henry Street Bridge.

Design and Construction.

The individual Architect for the Power House and Car House has not yet come to light in any Public Works or Railways reports. The plans for both as originally built, including the office and accommodation block, bear the signature of the Engineer in Chief, Railway Construction Branch of the Public Works Department, Henry Deane,M.A., M.Inst., C.E. The 1902 major southern extension to the Power House was designed by J.G.White & Co. of College Hill, London, and also of New York: the firm did work for a number of British electric tramway systems, both to establish them and to enlarge them. They were designed during the regime of Colonel Walter Liberty Vernon, the first Government Architect, but there appears to be no imprint of his hand on the architecture.

An architect would have greatest scope for self expressio in this complex on the office and accommodation block fronting William Henry Street. In this case it follows rather classical lines with Romanesque overtones in its arcuation. However, Vernon, during the middle period of his regime seemed to have been considerably influenced by the American Shingle stype of architecture and the "overgrown Domestic Style" used at the time by London County Council, following his overseas trip during 1897. At Ultimo such influences cannot be detected.

The constructing authority for Ultimo Power House and Ultimo Car House, as originally built, was the Public Works Department, but all further extensions and modifications to the complex were carried out by the N.S.W Government Railways.

Finally, the contractors for both Power House and Car House, Messrs. Stewart & Company, with offices at 187 Castlereagh Street, Sydney were in business by 1891 and were last listed in business in circa 1907.

Unrealised Post War Plans for the Powerhouse.

In 1946 it was planned to install two new extra boilers within space made vacant by the removal of boilers during the 1929-1931 modernisation programme. The space was available at the north end of the original Boiler House and would have increased the number of boilers to ten but the scheme was later abandoned by 1949.

Further, another unrealised project was to increase the height of the walls at the northern extremity of the original Boiler House. This would provide basically a new stores building which would also incorporate a machine sho workshop, recreation rooms and toilets with basement, ground floor and three upper floors below a flat roof on

which was to be placed a pair of 15000 gallon water tanks. A lift was also to be provided. This extra accommodation was designed in 1949 and would have significantly altered the northerly elevations to the complex especially as it was to be built around the disused northern chimney by means of an open fronted three sided recess. However, once again the scheme did not reach fruition.

Apart from the installation of the second hand turbo-alternator previously mentioned, Ultimo Power House was to remain untouched by postwar expansion and modernisation.

Ultimo Post Office.

Although not part of the Power House complex, Ultimo Post Office at the south east corner of Harris Street and William Henry Street adjoins the site. Despite being dwarfed by the Power House, it nevertheless maintains its own identity and emphasises the scale of the Power House.

It was built in 1901 by the N.S.W. Public Works Department for the then newly formed Commonwealth Government. It was designed by Walter Vernon, the N.S.W. Government Architect of the period, and is a single storey Romanesque influenced exposed brick building with stone sterobate and slate pitched roof. It is of stepped level because of the falling site. The dominating feature is a small, but ponderous stone arched double faceted corner entrance porch.

It first opened for business on 16 July, 1901.

Brief Technical Aspects.

For the whole of its life Ultimo remained essentially a power house supplying current for tramway and railway traction purposes, although from 1939 facilities existed for transferring power to the 50 cycle general system through a frequency changer located at White Bay Power Station.

Ultimo generated at a frequency of 25 cycles per second. As it was sometimes asked why this was so, it might be pointed out that direct current is usually used for railway and tramway traction purposes and until the development of large mercury arc rectifiers during the 1920s, the most practical way of rectifying large amounts of alternating current to form direct current, was by use of rotary converters. This system presented difficulties in design for operation on a frequency of 50 cycles per second. Hence 25 cycles was the standard frequency for traction distribution systems.

Power at Ultimo was originally generated at 600 volts direct current, but a major change was made in 1902 when a 25 cycle alternating current distribution system was introduced operating at a pressure of 6,600 volts to regional substations where power was converted to direct current at 600 volts for tramways and later also 1500 volts for electric railways.

From 1902 until closure, Ultimo Power House produced electricity at 6,600 volts and 25 cycles per second.

After 1953 the 25 cycle load began to decrease with the progressive abandonment of electric tramways.

Accordingly, it was decided in 1959 to proceed with the elimination of the 25 cycle supply in Sydney. The decision inevitably sealed the fate of the ageing plant and restricted inner-city site for power generation.

1. Outline Arrangement of Power House.

The upper diagram shows the arrangement prior to modernisation beginning in 192

The lower diagram shows the arrangement after completion of the 1929-1931 modernisation.

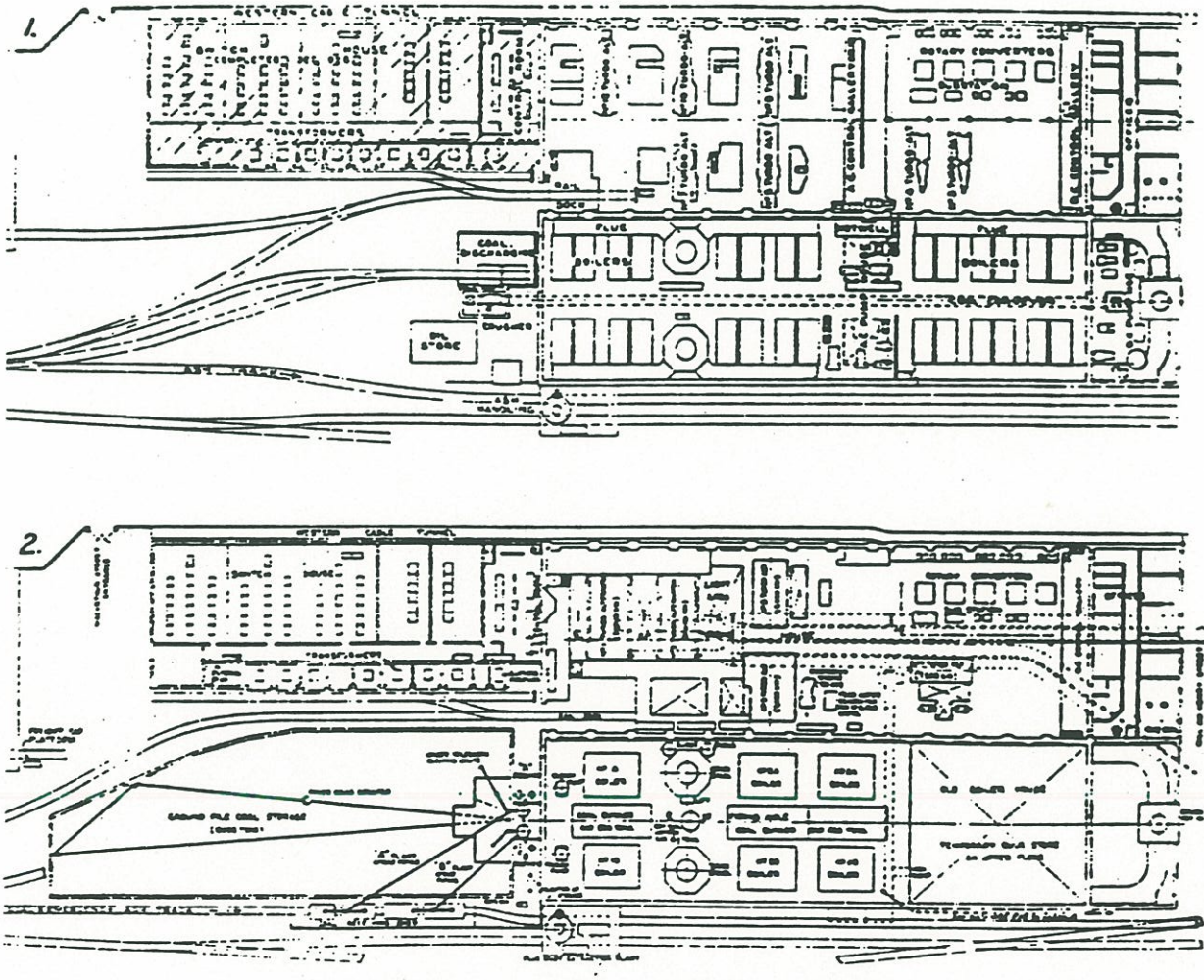


Fig. 1.—Outline Arrangement of Old Station at Ultimo.
Fig. 2.—Outline Arrangement of New Station at Ultimo.

ULTIMO

TRAM

DEPOT

Ultimo Tram Depot

Ultimo Depot was built for the electric tramcar fleet used on the then newly-constructed George Street, City-Harris Street, Pyrmont line. Including its front yard, the depot occupied the whole site bounded by Mary Ann Street, Omnibus Lane, a prolongation eastward of Macarthur Street and Darling Harbour Railway Goods Yard. The constructing authority was the Railway Construction Branch of the Public Works Department, which reported in June 1897 that sketch plans for the building had been approved by the Railway Commissioners.

Below is a summary of the position relating to progress on building the Depot as at June 1898, some eighteen months before it became operational, quoting verbatim from official reports but with interpolations from N.S.W. Government Gazettes added:

"The contract for the Car House was let to Stewart and Company (whose offices were in Castlereagh Street, Sydney) on 3rd January, 1898 and the work is well advanced; the main walls are completed, also the offices. The ironwork for the roof and columns is well advanced and the erection will be gone on with almost immediately.

The track layout for the entrance to the Car House has been obtained from Wharton and Company, Philadelphia, U.S.A., while H.W.Peabody & Company are the local contractors. Arrangements have been made for the erection of a store and repair shop in connection with the car House at an estimated cost of about £3,000. Plans for this are now being prepared." (This was towards the north east.)

It was opened as an operational depot on Friday 8th December, 1899. With the expansion of the electric tram line network, (as well as the George Street City to Pyrmont line) it provided cars for other routes such as Drummoyne, Gladesville, Ryde, Golden Grove and Erskineville and Darling Street, Balmain to Canterbury, as well as the Central Railway to Coogee service on a partial weekend basis.

The depot was originally erected as a structure 275 feet long and 130 feet wide, having 9 bays and accommodating 108 cars. At this time ground space was provided to extend the building to accommodate a further 72 cars when this became necessary in the future.

The building accommodated 12 tracks across in a low brick walled structure with engaged piers and constructed in English Bond. The front, or southern elevation was always completely open until June, 1953, when security barriers were installed. The uninsulated roof was sheeted in galvanised iron with some glass skylights (replaced during the mid 1970s with fibreglass sheets) in sawtooth pattern. It had inclined southern faces to give an assymetrical profile to each bay.

The roof was carried on light steel trusses. These were supported on transversely placed fabricated plate web joists intermediately resting on metal columns between

As had been earlier planned, the depot was extended 150 feet northwards during the financial year ended June, 1908, in externally matching brickwork. Along the eastern side of the Depot building was a series of skillion roofed brick offices. Part of this accommodation was built in 1899 to provide amenities for drivers and conductors but the remainder was built subsequently.

At the northern end of the eastern side the walling was stepped in plan and clad in galvanised iron. Towards the north east corner of the car shed there was a section walled off from the rest of the depot with the floor level raised up to rail head level. To allow the lifting of car bodies off their trucks, two travelling cranes extending over three bays were provided here. It is understood that in this area tramcar repairs, overhauls and painting were carried out until expansion at Randwick Workshops allowed this work to be centralised there from circa 1902.

Belonging to the depot and situated separately along the eastern side of its yard were the former Traffic Offices previously accommodating the Depot Master, Chargeman, Revenue Room and Roster Room. This was a brick building built in single storey in 1898 but to which was added an extra storey towards the south end in circa 1908. Along the western side of this building was a galvanised iron verandah roof with balustered frieze, but this was demolished during the mid 1950s.

Until circa 1930, one of the tramtracks in the depot, (designated "10 Road") continued northward through a doorway and out of the building to connect up with the railway line running from Darling Harbour Goods Yard into the adjoining Ultimo Power House.

This connection was removed to allow construction of the coal storage bin for the Power House.

As part of the policy of abandoning the whole Sydney tramway system, Ultimo became the first victim among a total of eight depots on the main system. Accordingly it closed on Saturday 27th June, 1953 as an operational depot. Thereafter, it was used as a non-operating storage depot for stabli ıg over 70 surplus tramcars awaiting scrapping at Randwick Tramway Workshops. It served this purpose until removal of the last batch of these tramcars in October, 1956.

Immediately the Transport Department removed the last trams from the depot, the rails, walkways between the tracks and supporting beams and piers were removed from the building to enable the depot to be used for storage. In addition, access ramps were put in from the depot yard down to the floor of the building to allow road vehicle access. Following these alterations the depot was used for storage concurrently by the Museum of Applied Arts and Sciences and Brambles Industries Limited during the late 1960s. Later, the Museum was the sole occupier and actually stored two of their own preserved Sydney tram cars, "O" class 805 and "R" class 1738 there until their removal on 19th April, 1979. This event marked the last direct association of the Depot in its un-rebuilt form with tram cars.

In July 1964, the Tram Depot was vested in the Board of Trustees of the Museum of Applied Arts and Sciences for the purpose of establishing a transport museum. In 1964 the Government Architect's Branch prepared plans and an item was included in the Loans Estimates so that work could proceed in the following year on the construction of the Museum.

In 1965 however, the Trustees were informed by the Department of Main Roads that the depot was in the path of the proposed Western Distributor and the project was

suspended indefinitely in 1967. With the curtailment of Freeway plans in 1977, the depot again became available for development of a Museum.

At this point it is appropriate to comment on the differing names applied to the Ultimo Depot over the years

During the period of planning,construction and operation for its first few years, it was called "Ultimo Car House", an American term for a house for stabling 'street cars' in American parlance, or 'tramcars' in British usage. It should be remembered that American influence was very marked in the early period of Sydney electric tramways in rolling stock, plant and equipment. During the early 1900s the name "Ultimo Tram Depot" began to supplant the original and was used continuously thereafter. Nevertheless, the name "Ultimo Car Shed" was often used officially by 1908 until the 1950s.

Ultimo Tram Depot, as part of the Sydney Tramway system, was operated by the New South Wales Government Railways and Tramways until August, 1930. After a period of interim control, the newly formed Department of Road Transport and Tramways took over in 1932. In 1952,the latter Department became the Department of Government Transport.

PHOTOGRAPHS

Copy of the cover and first page of the specification for the construction of the Ultimo Power House and Offices dated 23 March, 1898.

The original, held by the State Rail Authority of New South Wales, recently came to light.

NEW SOUTH WALES GOVERNMENT TRAMWAYS.

GEORGE-STREET AND HARRIS-STREET ELECTRIC TRAMWAY.

POWER-HOUSE AND OFFICES.

CONTRACT No. 12.

SPECIFICATION.

Nature of Contract.

1. The work for which Tenders are invited and to which this Specification refers, embraces the [illegible] construction and completion, with all necessary works, of a Power-house and Offices on a site at William Henry-street, Ultimo.

2. The Contract comprises the supply of all materials (excepting such as shall hereafter be specified [illegible] to be supplied by the Minister for Public Works), tools, plant, scaffolding, temporary fencing, carriage, labour, and every other thing which may be necessary for the full and proper completion of the work embraced under the same; and the whole of the work is to be constructed in a good substantial and workmanlike manner, in accordance with this Specification and the accompanying Drawings, to the full extent and meaning of the same, and to the entire satisfaction, approval, and acceptance of the Engineer-in-Chief for Railway Construction, and under the supervision and direction of such assistant or assistants as he may appoint.

Drawings.

3. The Drawings accompanying this Specification are thirteen in number, and show the design, [illegible] arrangement and details of the works to be executed.

Traffic on Public Roads not to be obstructed.

4. Under no circumstances will any delay, impediment, stoppage or obstruction to the traffic, either [illegible] on the tramway or the public roads, be permitted in carrying out this Contract; and the whole of the [illegible] works under the same are to be done in such a manner and at such [illegible] as not to hinder such traffic. The Contractor will be required to provide, erect and maintain, at his own expense, at all times during the currency of the Contract, all necessary temporary fencing for the protection of the public whilst the works are in progress and also all requisite lights and watchmen, the above to be [illegible] to the satisfaction of the Engineer, but also to the satisfaction of the Municipal Council and its officers; and the Contractor will be held strictly and exclusively responsible for all delays, accidents or damage to property or persons, of whatever nature, that may occur through the carrying out of the works.

5. The Contractor must make good, at his own expense, any damage done to water-mains, supply-[illegible] pipes, gas-pipes, sewers, or any other subterraneous existing services, to the thorough satisfaction of the [illegible] Engineer and of the Municipal Council and its officers. The alterations and deviations, however, to gas and water pipes will be carried out by the Department.

Materials, Workmanship.

6. The whole of the materials and workmanship under this Contract shall be of the best quality [illegible] and description of their respective kinds. All materials intended to be used in the work shall be subject [illegible] to the approval of the Engineer and if not approved of, the same shall be removed from the neighbourhood of the works without delay.

Inspection.

7. The whole of the work under this Contract shall be subject to the inspection and testing by the [illegible] Engineer or his assistant during all the stages of manufacture; and the said Engineer or his assistant [illegible] shall power at any time to select any of the material to be used, whether such material be in a [illegible] te or not and have cut from the same specimen pieces of such size and form as shall be [illegible] subject them to the tests specified, or any other reasonable test. Should the pieces so tested [illegible] the same, or the work found to be defective in any way, and not in compliance with the [illegible] ts and intention of this Specification and the accompanying Drawings, the same will be [illegible] rejected. The cost of applying the tests as to labour, plant and material, shall be borne by [illegible] tor, who will also be required to forward samples to such public testing works as shall be [illegible] by the Engineer and have them tested at his own expense.

NEW SOUTH WALES GOVERNMENT TRAMWAYS.

GEORGE-STREET AND HARRIS-STREET ELECTRIC TRAMWAY.

POWER-HOUSE AND OFFICES.

SPECIFICATION.

CONTRACT No. 12.

[illegible] (a)

DEPARTMENT OF PUBLIC WORKS.

ADMIT BEARER TO

Power House, George and Harris Sts. Tramway,

BETWEEN 7 p.m. and 9.30 p.m.,

NOVEMBER 29th or 30th, 1899.

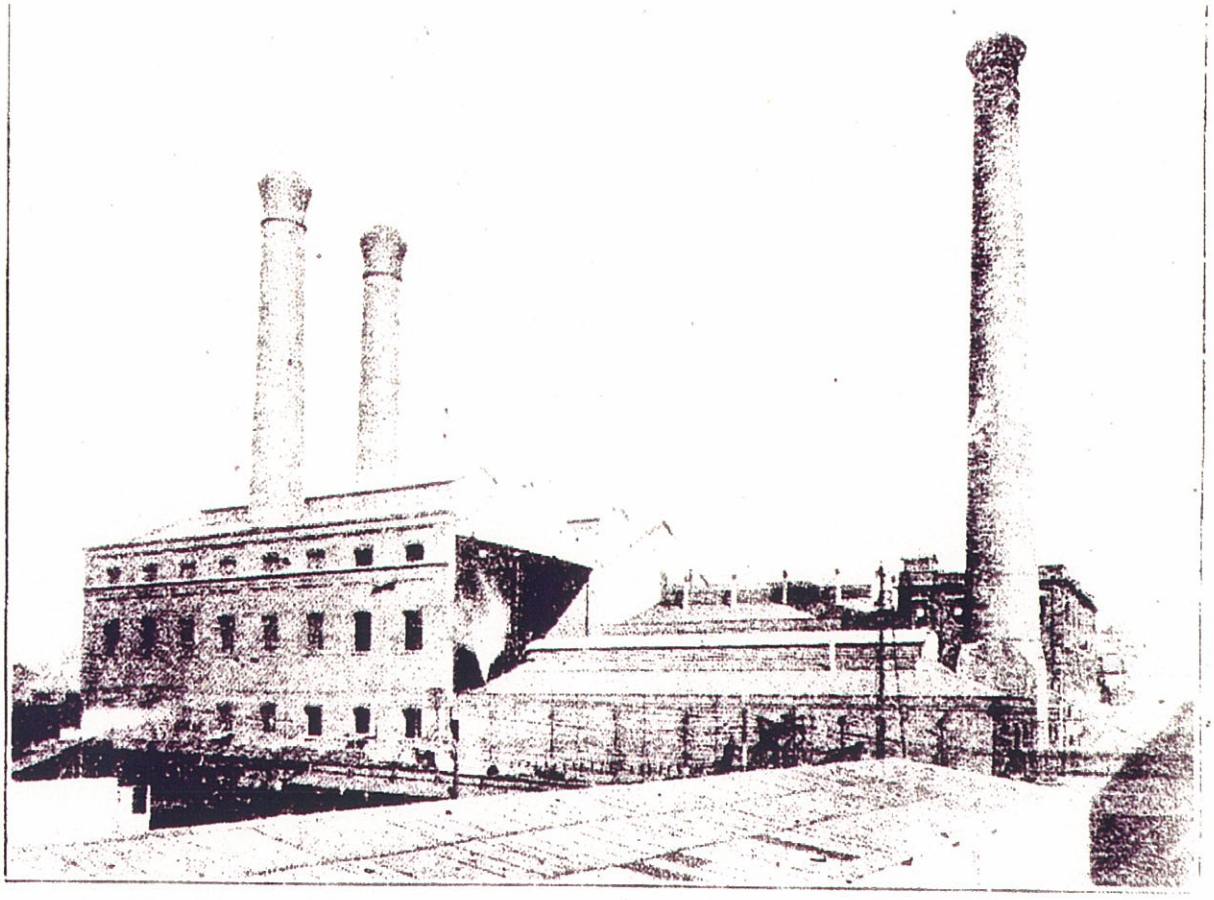
This TICKET must be given up at the Door.

R R. P HICKSON,
Under Sec. and Commissioner for Roads.

Photograph of Special Pass to admit visitors to inspection of Ultimo Power House before it became fully operational.

After over 80 years one of these passes is still preserved by the State Rail Authority of New South Wales.

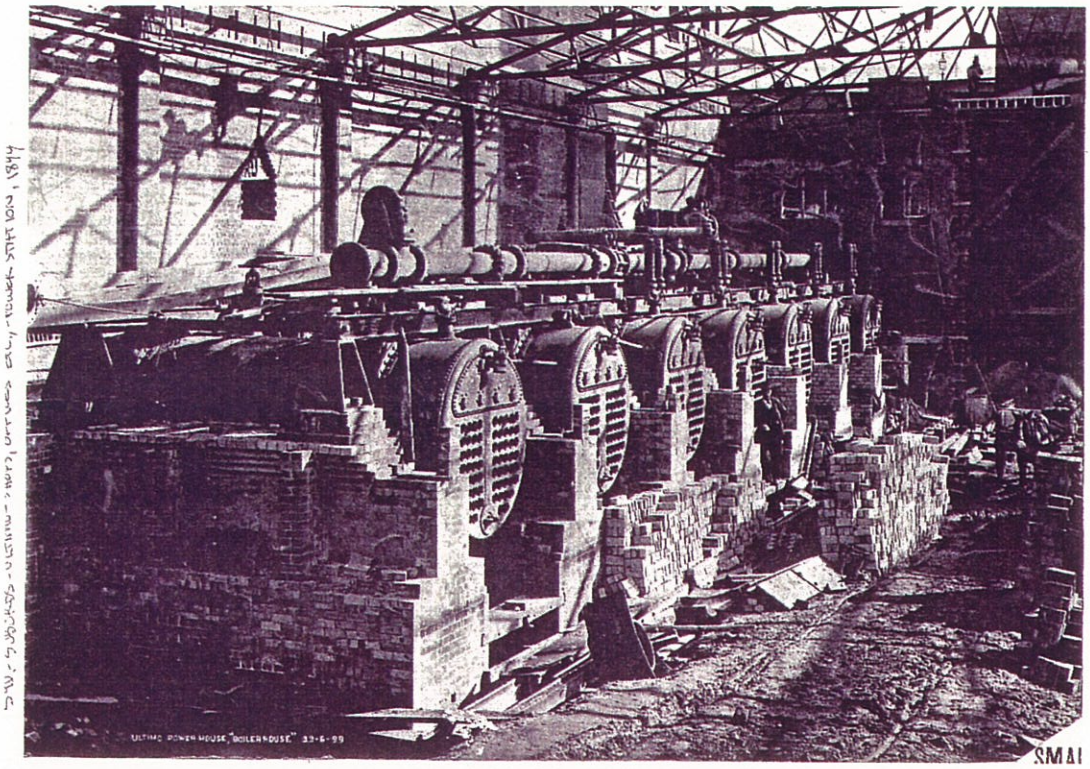
Exterior view of Ultimo Power House. The original section of the station is at the right of the photograph. This section has since been demolished with only a fragment of the brick chimney stack to the right being visible from William Henry Street. The building behind this chimney now houses offices of the Powerhouse Museum.



ULTIMO POWER HOUSE EXTENSION BEFORE BOILER ROOM WAS ENCLOSED

View depicting construction of the original section of the Boiler House during 1899 after installation of the western bank of boilers.

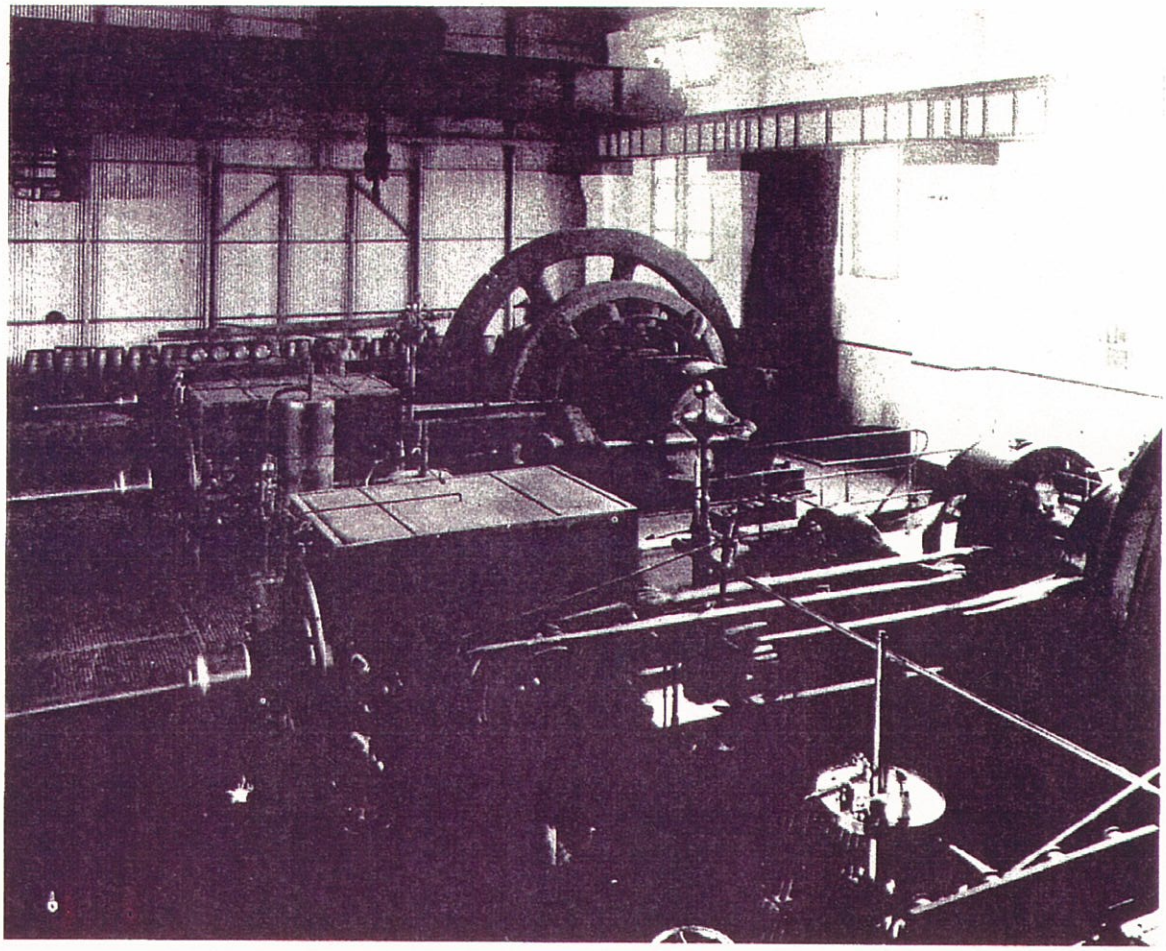
At this stage the boiler installation was incomplete while the firing floor had not been laid.



Interior of the original Engine House looking towards the temporary galvanised iron southern wall.

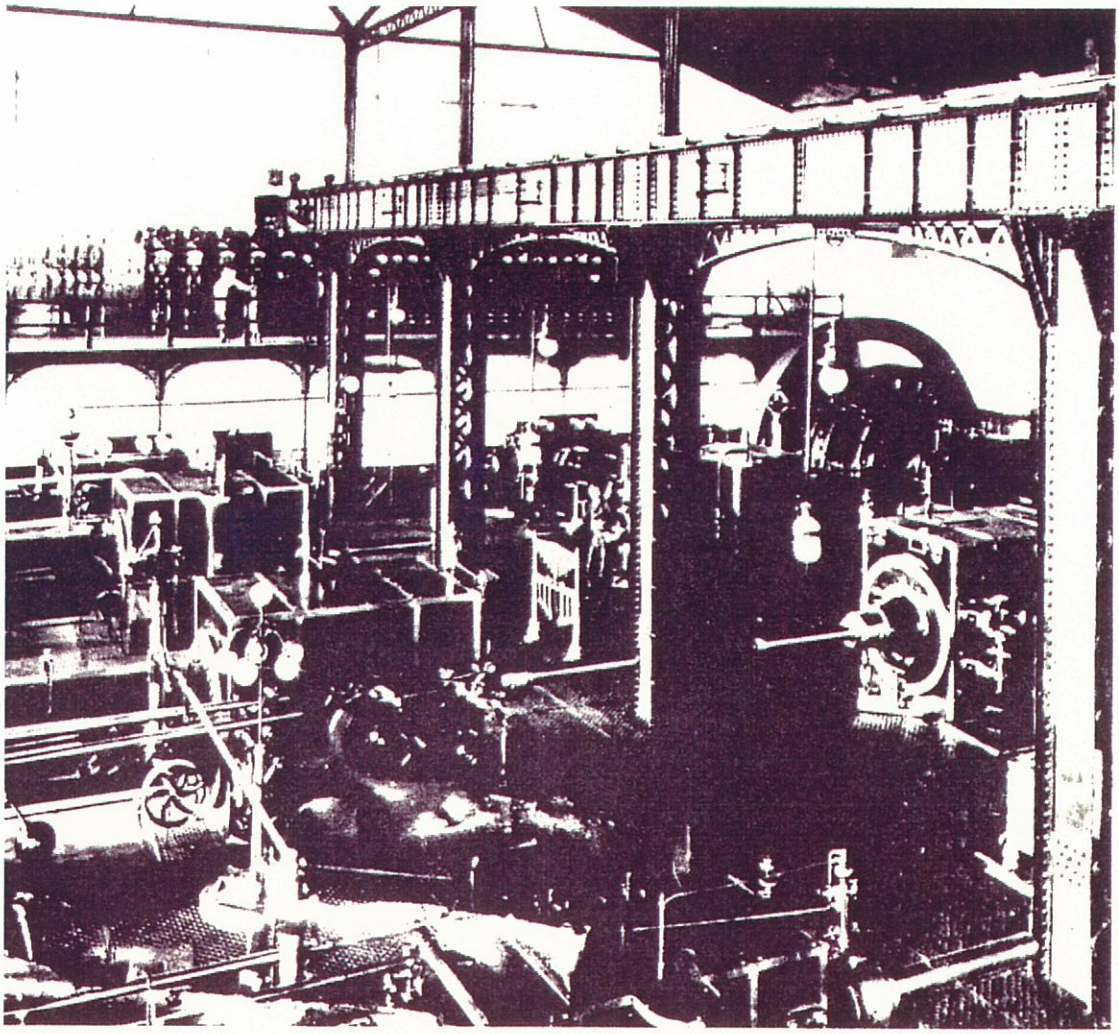
The view taken in 1899-1900 shows the overhead travelling crane and two sets of horizontal engines and generators.

The last of these engines and generators was not removed until 1915-1916.



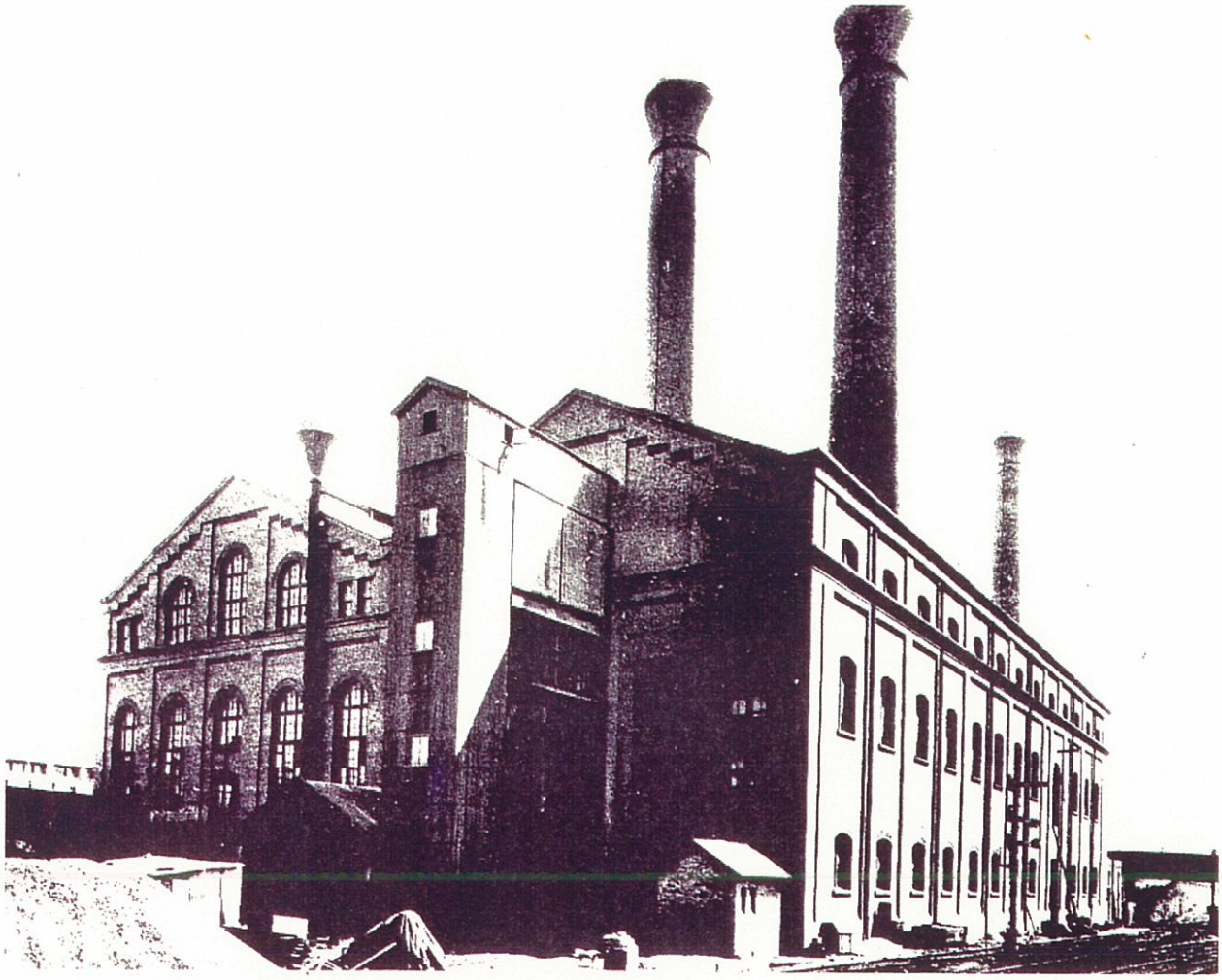
Interior of the original Engine House looking northwards towards the old Direct Current switchboard gallery, taken in 1899-1900.

Note the central heavy fabricated steelwork as support for the overhead travelling cranes (as well as acting as intermediate props for the roof trusses).



Close-up view of Ultimo Power House looking from the south east after enlargement of the Boiler House and Engine House (Turbine House). The photo was taken around 1905. The galvanised iron sheathed structure projecting from the end of the Boiler House wall was the coal elevator which fed the overhead bucket conveyors used to fill the coal bunkers located above the boilers.

Note the two tiers of arched multi-pane windows below the stepped corbelling to the gable sides at the end of the Engine House (Turbine Hall). The stepped corbelling is also featured at the end of the Boiler House, although partly obscured by the coal elevator in this view.



Interior view of the Engine House at Ultimo circa 1905.

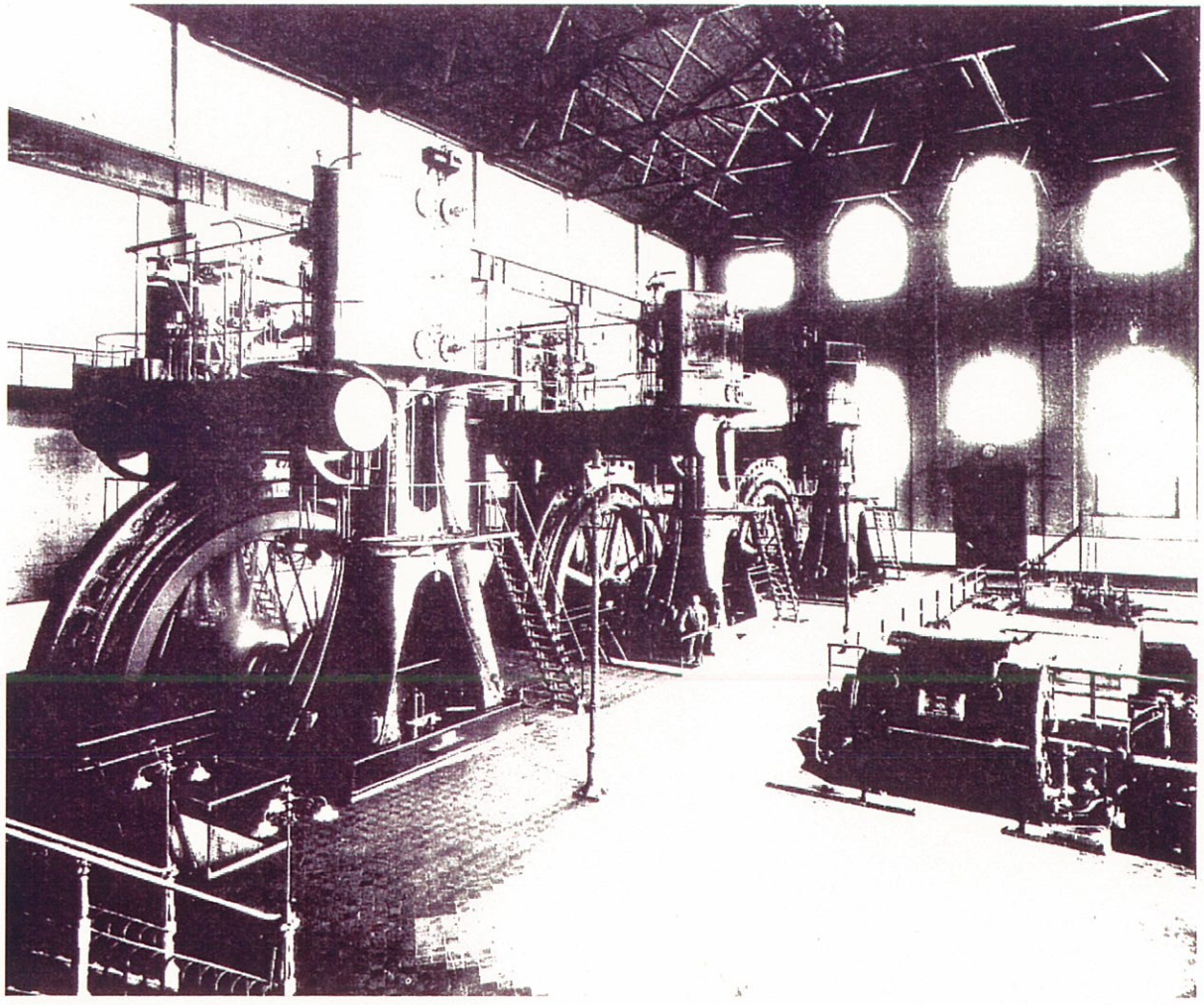
It was taken from the control gallery looking southwards shortly after the installation of the first Parsons turbo-alternator partly visible on the right.

Dominating the photo are the three mammoth vertical cross-compound reciprocating steam engines each coupled directly to an alternator. Note their size compared to the man standing beside the centre unit.

At the time of the photograph only the unit closest to the camera was actually running. The blur of its spoked flywheel rotating is apparent.

As can be judged from the view, a little less than half the diameter of the flywheels extends below floor level.

These engines were removed and replaced by steam turbo-alternators during the period from 1912 to 1914



CEREMONY REPORT

ULTIMO POWER HOUSE

28th November 1994
at

The Powerhouse Museum, Sydney

ULTIMO POWER HOUSE - AFFIXING OF HISTORIC ENGINEERING MARKER

INTRODUCTORY REMARKS BY F BRADY AM
MEMBER OF HERITAGE COMMITTEE, SYDNEY DIVISION
FORMER CHAIRMAN / GENERAL MANAGER, OF THE ELECTRICITY COMMISSION OF NSW

Mr Chairman, ladies and gentleman, in time to come, this era may well become known as the "Bronze Age " of the Institution of Engineers Australia. Archaeologists of the future will find discreet bronze plaques at several important sites, and if they can decipher the ancient runes, they will see that these sites celebrate achievements of great historical, engineering and social significance. So it is tonight at this brief ceremony to mark the construction of Ultimo Power House.

The affixing of an Historic Engineering Marker by the Institution has many purposes. To the public at large it is a reminder that competent engineers have been around for a long time, and that they have been and are responsible for works that are socially significant - indeed central to our quality of life.

To the practising professional engineer they serve as a reminder that innovation has always been central to the profession - a reminder too that the social value of their work is no less important than its economic or technical significance.

And finally, they remind us all of our professional responsibility to record and document, and where appropriate, to conserve engineering works or sites of outstanding heritage significance.

It is, I am sure, a cause of great satisfaction to the Electrical Engineering College that its proposal to affix an Historic Engineering Marker to Ultimo was accepted by the Institution's National Panel on Engineering Heritage; for Ultimo truly satisfies all of the Institution's criteria for such an honour.

This, the first large central power station in NSW, was at the heart of a socially important piece of engineering - to build a network of electric tramways throughout Sydney that would become in time the second largest in the then British Empire.

The electric tramway network made a significant contribution to pollution control in Sydney - by reducing the numbers of horse-drawn vehicles (and their inevitable ordure!) and by removing the smoky steam locomotives that powered most of the original tramway services.

Sydney's tramway designers were in close touch with their industry, to the point that the first experimental electric tramway in Sydney, between Randwick and Waverley, went into service in 1890, just three years after the first commercial tramway in the USA, and one year ahead of Leeds in the UK. The equipment from that experimental line was transferred to North Sydney to provide the first permanent electric service, between North Sydney and Spit Junction. This happened in 1893 and power was provided by a small generator at the Ridge St tram depot.

The next electric tramway was built between Ocean Street Woollahra and Rose Bay as an extension of the cable tramway that ran from King Street to Ocean Street.

Then from 1899 there began the "Golden Age" of electric tramways in Sydney, and to power it all the Public Works Department built the Ultimo Power House which we commemorate tonight. A few slides will remind you of that era.

King St Cable tramway. circa 1895 Note gaslight, no electricity for signalling so gent with flag very important.

George St near GPO at about the same time. No trams in George St, gaslight, hansom cabs. Note that Martin Place not at full width and note forest of telephone lines.

George St at GPO 1899. The first electric trams running, powered from Ultimo. Gaslight for street lighting, David Jones George St store.

George St 1907. Electric trams. Electric Street Lighting , no overhead telephone cables, Martin Place at full width.

The first generators at Ultimo 1899. Four at 850 kW, 550v. DC

The first boilers, seven of the first fourteen. Note the man in the "hard hitter".

The next stage, 1902 - three 1500 kW 25 cycle 6.6 kV generators and rotary converters. 23 foot diameter flywheels 75 RPM. These were the last of the reciprocating engines. In 1905 the first steam turbine, - a 3000 HP unit probably the first in permanent operation in the state. At this stage Ultimo was the largest power station in Australia.

1929 - 60 boilers in two tiers replaced by six much larger units. These were the first in NSW (and probably Australia) to be fired by pulverised coal. A technically innovative decision but environmentally not such a great idea given the poor standard of dust collection of that period . Central and southern parts of the city frequently covered in its gentle grey mantle. The lesson was learned and in the final stage of expansion of Ultimo, the designers reverted to chain grate stokers, with far less dust emission from the chimneys. This occurred in 1941/ 42 by which time total capacity had reached 79,500 kW.

The power station was finally shut down in 1963 with the commissioning of newer, more cost-efficient stations on the coalfields.

Happily the building has been preserved in this beautiful museum, an appropriate use for a site on which so much technical innovation occurred, and one which contributed so well to the social development of this great city.

CEREMONY REPORT

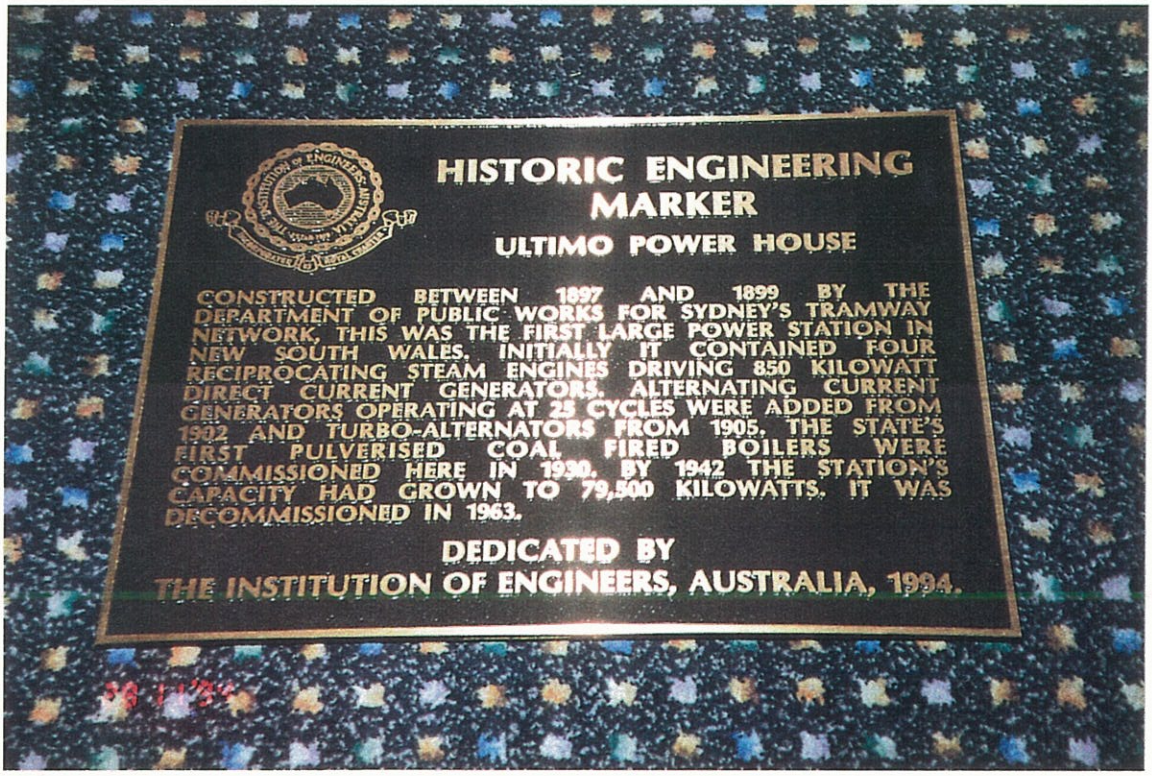
FOR

ULTIMO POWER HOUSE

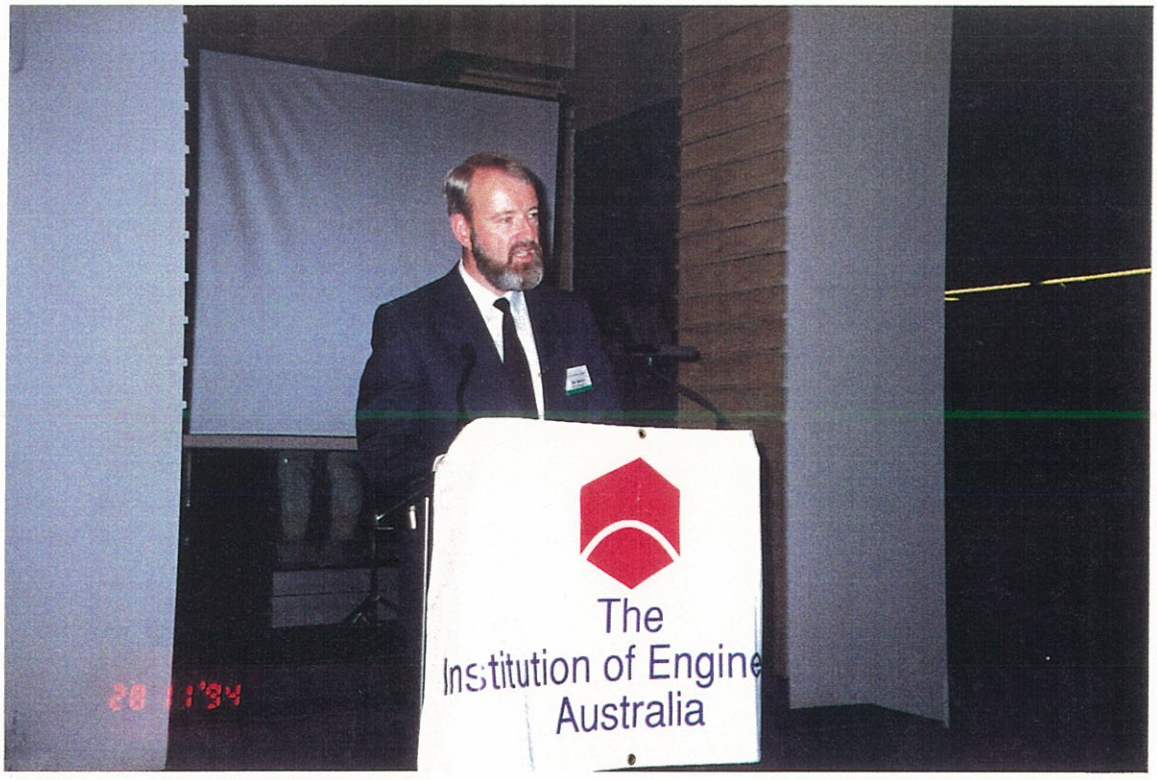
28 November 1994

at

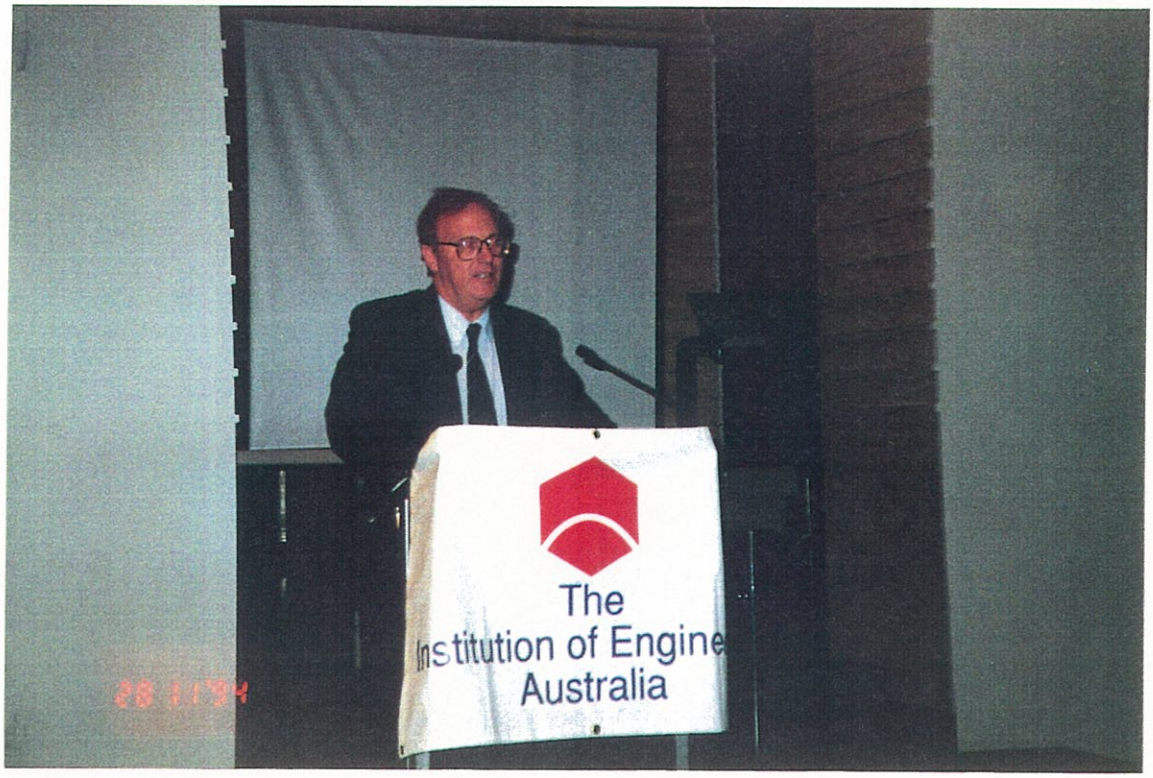
The Powerhouse Museum, Sydney



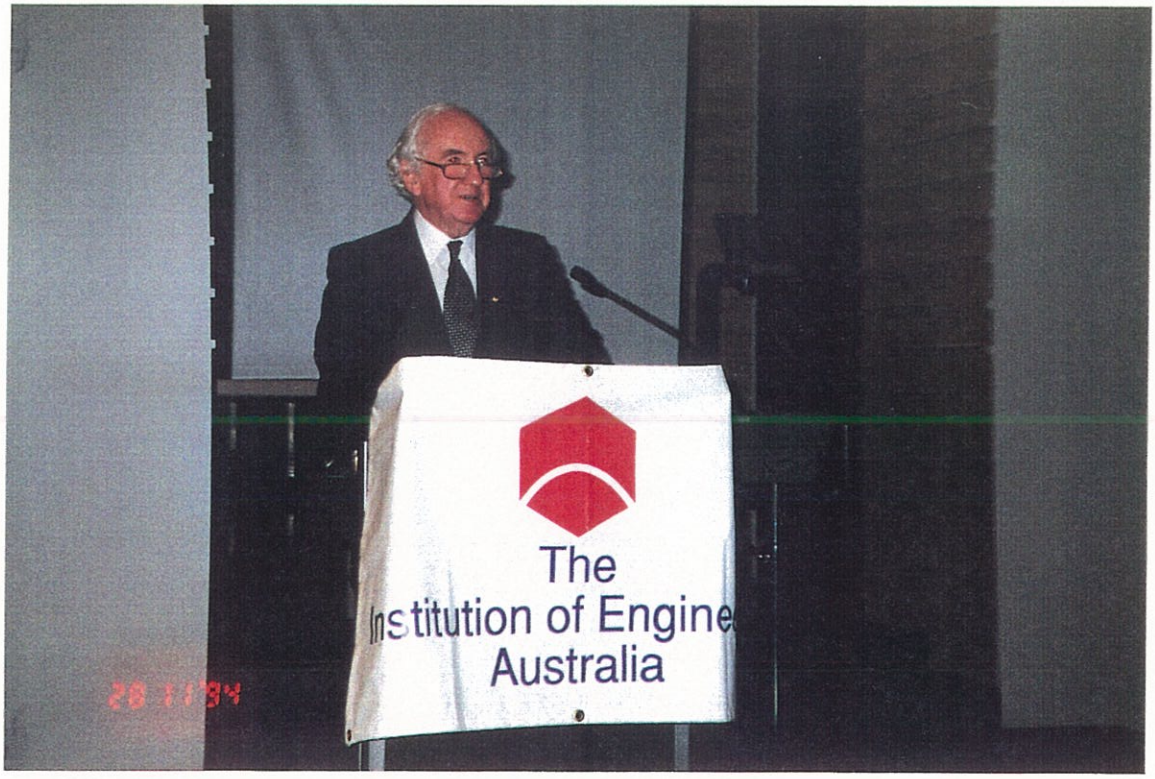
Clive Cooper, Chairman, Electrical College, I E Aust



Bob Hodgson, IPENZ



Terence Measham, Director, Powerhouse Museum



Frank Brady, Engineering Heritage Committee, I E Aust

Terence Measham and Clive Cooper about to unveil the plaque

The plaque unveiled

Terence Measham receiving the plaque from Clive Cooper

Terence Measham, Frank Brady, Clive Cooper and the plaque

The official party l to r, Dr Hingoran (EPRI), Peter Walsh (SAA), Linda Tregonning (IEAust), Frank Brady (IEAust), Alex Baitch (Vice-President IEAust), Clive Cooper (IEAust) and John Elsenhuth (Sydney Electricity)

Guests at the Electrical Congress l to r, Mrs Green, John Green, Barry Webb, Warwick Nichols, Mrs Nichols, Jeff Allen, Cardyn Allen and Barry Inglis