

Coloane Power Station - Macau

232 MW 2-Stroke Low Speed Diesels



Companhia de Electricidade de Macau



The Coloane Power Station Extensions 1-3

◆ *The Largest 2-Stroke Low Speed Diesel Power Station in the World*

◆ *The Largest 2-Stroke Stationary Low Speed Diesel Units in the World*

High Reliability & Availability, low Specific Fuel Consumption and a long Service Lifetime were the determining factors for Companhia de Electricidade de Macau, CEM S.A.R.L., in their decision, taken in 1985, to extend their generating capacity with 2-stroke low speed diesel units, the first 2-stroke diesel units to be installed in Macau.

In February 1996 the second and final section of the third low speed diesel extension at The Coloane Power Station was handed over to Companhia de Electricidade de Macau, by the international consortium consisting of the Consortium Leader Burmeister & Wain Scandinavian Contractor A/S (BWSC), Mitsui Engineering & Shipbuilding Co. Ltd. (MES) and MAN B&W Diesel A/S (MBD).

The completion of the third extension, which includes the two largest 2-stroke stationary diesel engines built to date, brings the installed 2-stroke capacity to a total of 232 MWe, across the three plants, each with two units, all built on turnkey contracts by members of the same international consortium.

For the third extension, the Consortium Leader Burmeister & Wain Scandinavian Contractor A/S carried responsibility for plant design & system engineering, civil and building works, supply and erection of mechanical, electrical, and control systems and test & commissioning of the completed plant.

Mitsui Engineering & Shipbuilding Co. Ltd., as senior licensee of MAN B&W Diesel A/S, has been responsible for the supply, erection and testing of the diesel engines.

MAN B&W Diesel A/S has been responsible for the engine design.

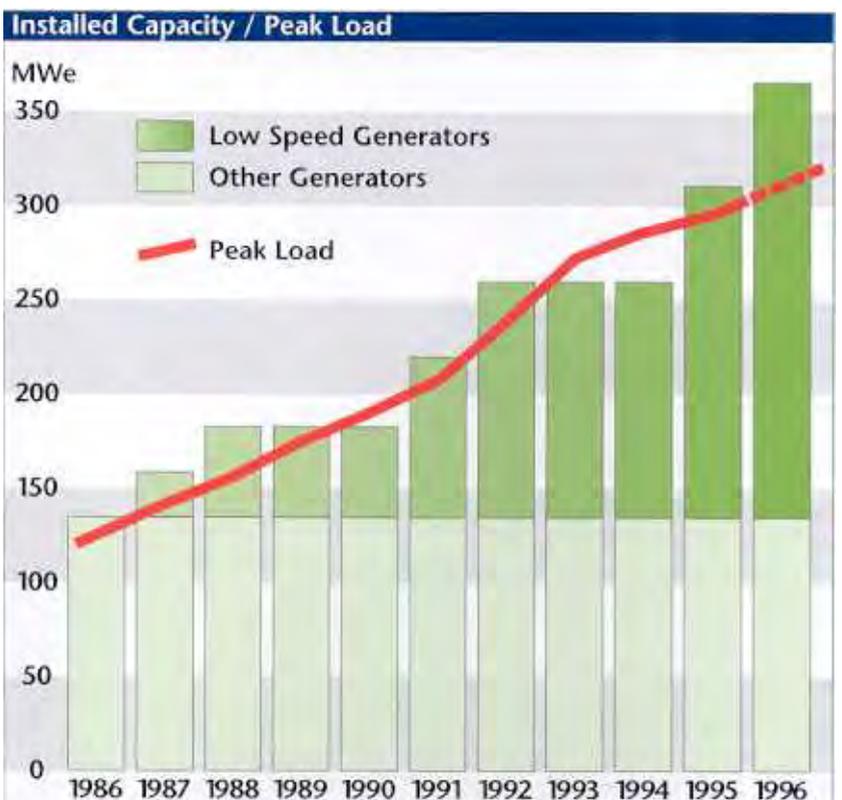
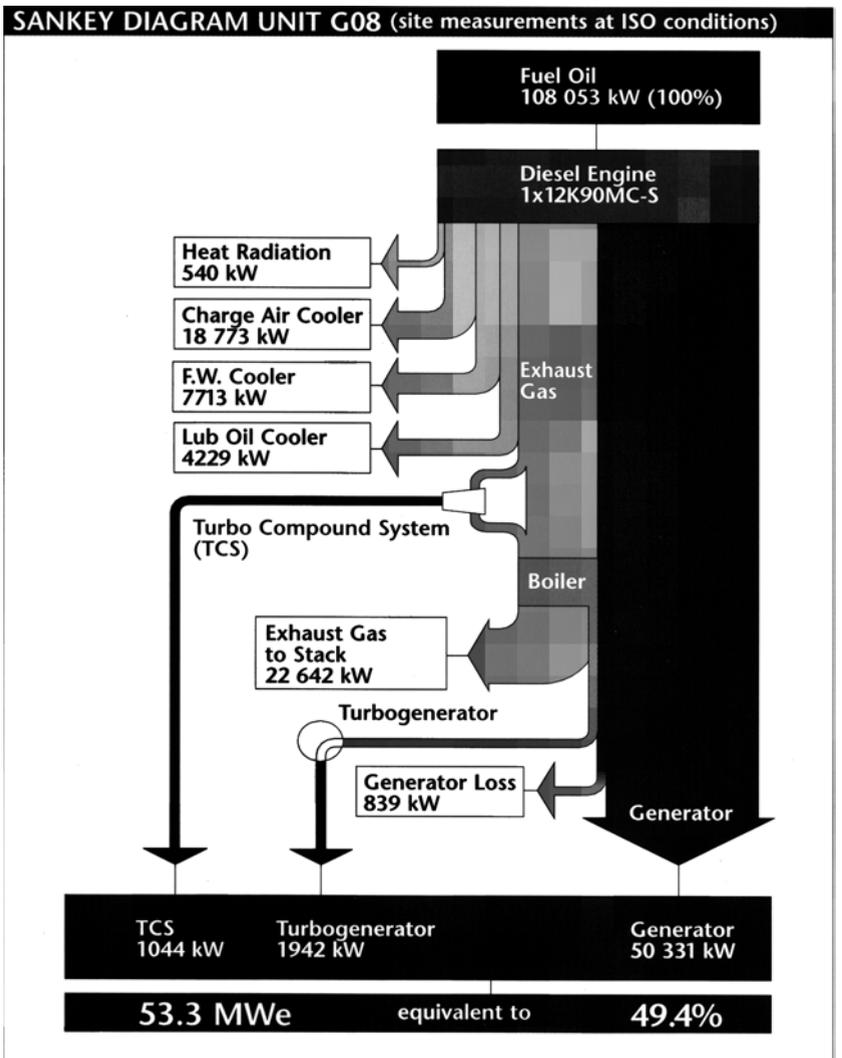
Companhia de Electricidade de Macau, CEM, was founded in 1904 and serves the territory of Macau, a Portuguese enclave close to Hong Kong with a total area of 23 sq.km and a population of 410,000 (1996 figures).

Though the Macau network became interconnected with China in 1984, to cover for the increases in power demand, CEM found it feasible to extend their own generating capacity.



In the time between the signing of the first Extension Contract in 1985 and the present day CEM has increased its total generating capacity by 232 MWe - all based on low speed diesels.







SUMMARY

CONTRACTS

Contract award
Handing over

PERFORMANCE

Running hours per 951231
Acc. Production per 951231

TECHNICAL DATA

Diesel Engines

Make
Type / RPM
Bore / Stroke
Output TCS 100% load

Alternators

Make
Type / No. of poles
Rating
Rated voltage / Frequency
Inertia
Excitation system
Output 100% load

Exhaust Gas Boilers

Make
Steam capacity
Steam pressure

Steam Turbine Generators

Steam turbine make
Generator make
Output 100% load

Power Station Buildings

Area
Height
Overhead crane load/span
Concrete stack height/diam.

1st Extension Units G03 / G04

Dec 1985 / Dec 1986
May 1987 / Mar 1988

61,671 / 55,064 hours
1,348,016 / 1,199,623 MWh

Mitsui/MAN B&W
2 x 9K80MC-S / 100 rpm
800 mm / 2,300 mm
2 x 0.5 MW

GEC
2 x GL 60-880 / 60 poles
2 x 29.8 MVA
11 kV / 50 Hz
9,140 tsq.m
Brushless
2 x 23.2 MW

Sunrod
2 x 7,720 kg/h
9 bar

Peter Brotherhood
ASEA
1.2 MW

1,400 sq.m
25 m
120 tons / 27.5 m
77 m / 5.3 m

2nd Extension Units G05 / G06

Aug 1989 / Jun 1990
Apr 1991 / Feb 1992

34,433 / 28,777 hours
1,203,104 / 996,435 MWh

Mitsui/MAN B&W
2 x 12K80MC-S / 100 rpm
800 mm / 2,300 mm
2 x 0.9 MW

GEC-Alsthom
2 x RF 955-95 / 60 poles
2 x 45.8 MVA
11 kV / 50 Hz
11,600 tsq.m
Brushless
2 x 36.4 MW

Sunrod
2 x 9,720 kg/h
9 bar

Peter Brotherhood
ABB Strömberg
2.6 MW

2,400 sq.m
27.8 m
150 tons / 33.3 m
77 m / 6 m

3rd Extension Units G07 / G08

Jul 1993
May 1995 / Feb 1996

4,985 / 0 hours
237,025 / 0 MWh

Mitsui/MAN B&W
2 x 12K90MC-S / 103.4 rpm
900 mm / 2,300 mm
2 x 1.0 MW

ABB
2 x W 945-115-58 / 58 poles
2 x 63.4 MVA
11 kV / 50 Hz
19,950 tsq.m
Static
2 x 50.2 MW

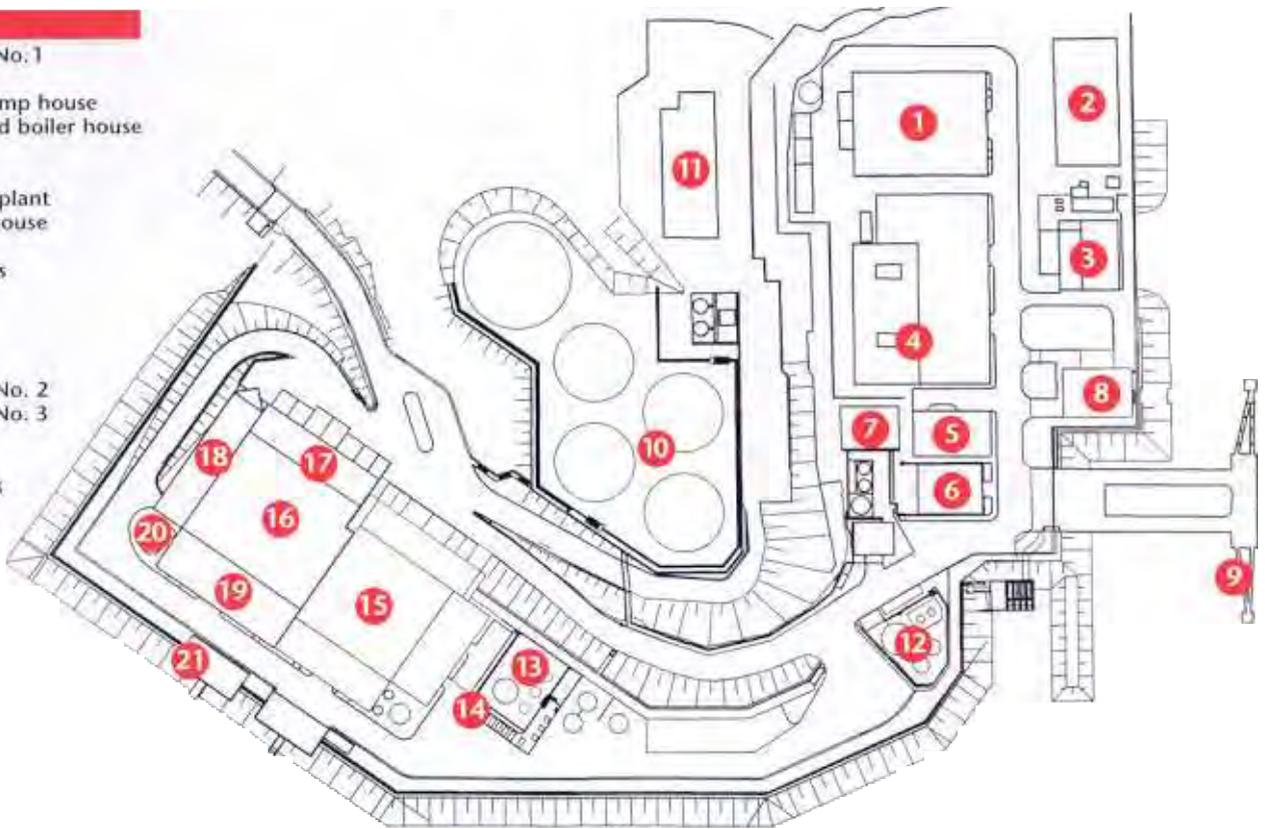
Aalborg Boilers
2 x 14,800 kg/h
9 bar

Peter Brotherhood
BRUSH
3.8 MW

3,500 sq.m
29.2 m
175 tons / 36.04 m
77 m / 8.2 m

SITE PLAN

- 1 Diesel extension No. 1
- 2 Workshop
- 3 Cooling water pump house
- 4 Steam turbine and boiler house
- 5 General store
- 6 Office building
- 7 Water treatment plant
- 8 Seawater pump house
- 9 Pier
- 10 HFO storage tanks
- 11 Substation
- 12 LO tanks
- 13 Tank farm
- 14 Transfer pumps
- 15 Diesel extension No. 2
- 16 Diesel extension No. 3
- 17 Electrical annex
- 18 Workshop annex
- 19 Mechanical annex
- 20 Stack
- 21 Central coolers



The First Extension

The first extension turnkey contract was signed with the Consortium in 1985, with subsequent delivery of the first unit (G03) in 1987 and the second unit (G04) in 1988, the plant having a total capacity of 49 MWe.

The Second Extension

In 1989 a contract was signed for the second extension with delivery of the first unit (G05) in 1991 and the second unit (G06) following in 1992, giving a total plant capacity for this extension of 77 MWe.

The Third Extension

In 1993 the latest turnkey contract was agreed between CEM and the Consortium for the delivery of the third extension of the Coloane Power Station. As for the other extensions the contract included delivery of a highly advanced plant based on 2 diesel generating units of the latest technology, providing full waste heat recovery with turbocompound systems (TSC) and a steam turbine generator, utilising the waste heat from the exhaust gas for electricity production.

The plant is fully supervised and controlled by a comprehensive computerised Supervisory, Control and Data Acquisition (SCADA) system, also including a fully automatic speed and load control system for the diesel units.

The plant is designed for operation on heavy fuel oil and is able to burn residual fuels up to 450cSt at 50 degrees C.

The first unit (G07) of the third extension was handed over to CEM in May 1995 with the second unit (G08) following in February 1996.

The two units have a total output of 106 MWe which brings the installed 2-stroke capacity at the Coloane Power Station to a total of 232 MWe, making it the largest 2-stroke diesel power plant in the world.

General Information

All the units are seawater cooled through centralised fresh water cooling systems, one for each.

With the second extension a fresh water distillation plant was

installed with a total capacity of 280 cu.m per day, utilising the waste heat from the engine cooling water systems.

All the diesel engines are of the MAN B&W MC design, constantly being developed and improved to meet the market demands for low fuel consumption rates, high reliability & availability and long service lifetime for components.

The fuel- and lubrication oil separators are all supplied by Alfa Laval.

The SCADA systems are all supplied by Alfa Laval Automation with the applications programmed by BWSC, having a rising degree of coverage throughout the extensions. This ensures the reliable operation of the plants and compensates for the increasing cost of manpower. The third extension has a total of more than 6,000 input/output signals for supervision, processing and control.

The plant efficiencies are close to 50% at ISO conditions.



BWSC

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