Ref. PD/504/00/00

LAMMA POWER STATION

Proposed L4/L5 Repowering

July 2000

The Hongkong Electric Co Ltd
香港電燈有限公司

1. BACKGROUND

This paper serves to describe the extent of modification works involved for the proposed repowering of Units 4&5 of Lamma Power Station, and the likely environmental impacts arising from the construction and operation of the repowering project.

2. OUTLINE OF PROJECT

Eight coal-fired units are at present installed at Lamma Power Station comprising 5x350MW and 3x250MW units. The proposed repowering work of Units 4&5 is basically to rehabilitate the generating units and to cultivate the built-in design margins to help boost up the efficiency and output in a cost-effective manner. The work involves refurbishment/replacement of some of the steam turbine internal components to enhance the turbine efficiency and increase the steam intake capacity to boost up the generator output. Since the boilers have sufficient design margins to generate more steam, no modification is required except changing of the safety valve settings. After modification, the rated output from Units 4&5 will each be increased by about 25MW to 375MW.

The repowering work will be carried out during the scheduled outages of Units 4&5 for a short period of about 4 months. The tentative schedule is indicated below, subject to further review of the need for such repowering in the light of HEC's updated demand forecasts:

	Commissioning Date
- Repowering of Unit 5	May 2002
- Repowering of Unit 4	May 2003

3. REVIEW OF ENVIRONMENTAL ASPECTS

3.1 Construction Phase

The repowering of Units 4&5 will involve the following modification works:

a) Replacement of the turbine control stage nozzle blocks.

b) Replacement of the seal fins of the high pressure (HP) and intermediate pressure (IP) turbine blade rings, glands and dummy rings.

c) Replacement of the HP turbine Stage I to III stationary blades.

Figure 3.1a shows the cross section of the HP/IP steam turbine. It should be noted that all the steam turbines of the existing coal-fired units are required to be stripped down for major overhauls every 4 years. It is not uncommon to replace the turbine blades in case of serious erosion, corrosion or cracking. Adjustment or replacement of the seal fins is also a standard maintenance item to reduce the internal steam leakages inside the turbine. As such, the above modification works can be regarded as part of the on-going overhaul works regularly carried out at Lamma Power Station.

3.2 Operational Phase

3.2.1 Licence Conditions

Units 4&5, with a nominal rating of 350MW, can operate under emergency condition by isolating the top 2 feedwater heaters to generate an output of about 380MW each. The existing licence conditions for Units 4&5 under the APCO and WPCO have taken into account the emissions and discharges from these units under all operating conditions including the emergency output of 380MW.

The repowering exercise is basically to increase the output of Units 4&5 by 25MW each under normal operating mode. This can be achieved by replacing the seal fins to improve the efficiency and replacing the turbine inlet nozzles and some of the turbine stationary blades such that the turbine can swallow more steam flow while maintaining the normal pressure distribution along the flow path. No modification is required for the boiler as it has sufficient design margin to generate more steam flow to the turbine. The total fuel input to the boiler after repowering is still within that allowed for in the original design. Hence, the units after modification will generate 375MW under normal operating conditions without any constraints, while the emissions/discharges are still within the existing licence conditions as stipulated by EPD.

3.2.2 Air Quality

(a) Local Air Quality

The emission characteristics of Units 4&5 before and after repowering are shown in the table below.

	Units 4 &5			
	Current Specified Process Licence	Actual Emissions Before Repowering		Estimated Emissions After Repowering
		Normal	Emergency	
Output	350MW	350MW	380MW	375MW
Flue Gas Volume	1,900,000m^3/h	1,760,000m^3/h	1,860,600m^3/h	1,860,000m^3/h
Particulates	125mg/Nm^3	125mg/Nm^3	125mg/Nm^3	125mg/Nm^3
	160kg/h	< 160kg/h	< 160kg/h	< 160kg/h
Sulphur Dioxide	1,910mg/Nm^3	1,910mg/Nm^3	1,910mg/Nm^3	1,910mg/Nm^3
	2,540kg/h	< 2,540kg/h	< 2,540kg/h	< 2,540kg/h
Nitrogen Oxides (expressed as NO_2)	1,200mg/Nm^3	1,200mg/Nm^3	1,200mg/Nm^3	1,200mg/Nm^3
	1,600kg/h	< 1,600kg/h	< 1,600kg/h	< 1,600kg/h

Notes: (1) The concentrations of the air pollutions are expressed at 0°C, 101.325 kilopascals pressure and 12% CO_2 dry condition.

(2) Flue gas volume is at conditions of 138°C temperature and slightly below atmospheric pressure.

(3) Total pollutant emission = pollutant concentration x flue gas volume

As indicated in the above table, the flue gas volume flow after repowering as estimated by the supplier will still be below the actual flow rate of emergency operation measured during the acceptance test, and both are within the flow rate assumed in the licence for calculation of the emission loadings. This demonstrates that emissions from the units after repowering will not exceed the current licence conditions.

(b) Greenhouse Gas Emission

To meet the electricity demand, the existing units are put into operation in priority of efficiency under system computer control until the total generating output meets the demand. Hence, the total greenhouse gas emission is not directly related to the total installed capacity, but dependent on the system demand as well as the efficiency and types of fuels of the units being operated to meet such demand. As the 1st new gas-fired unit of Lamma Extension can only be commissioned in mid 2004 the earliest based on the latest land application progress and the lead time required for design and construction, the system demand in the interim years prior to 2004 has to be met by the existing units. With the proposed repowering in place, more output can be generated from the more efficient Units 4&5 to meet the system demand which will otherwise require operation of the less efficient Units 1,2&3. Once Lamma Extension is commissioned, HEC has committed to operate the new gas-fired units on base load operation followed by operation of the more efficient and environmentally friendly coal-fired units. As a result, the repowering of Units 4&5 will help to reduce the total greenhouse gas emission from HEC system before commissioning of Lamma Extension as they can take up more loadings which would otherwise be generated from the less efficient Units 1 to 3.

4. IMPLICATION TO GT5 & GT7 CONVERSION

The environmental assessment included in the Project Profile for GT5 and GT7 conversion is based on a hypothetical worst case of assuming all existing units operating at full outputs without allowing any reserve/standby capacity, i.e. 3,050MW. This is well above maximum demand of 2,814MW forcasted for year 2003. Furthermore, the emission loadings as stipulated in the existing licences have been adopted for the cumulative assessment which, as indicated in Sections 3.2.1 & 3.2.2, covers the increase in output of units 4&5 Repowering as well as all other possible operating scenarios of the existing units before commissioning of Lamma Extension. Hence, irrespective of whether the repowering project will actually be implemented or not, it will not invalidate the assessment included in Project Profile for GT5 and GT7 conversion.

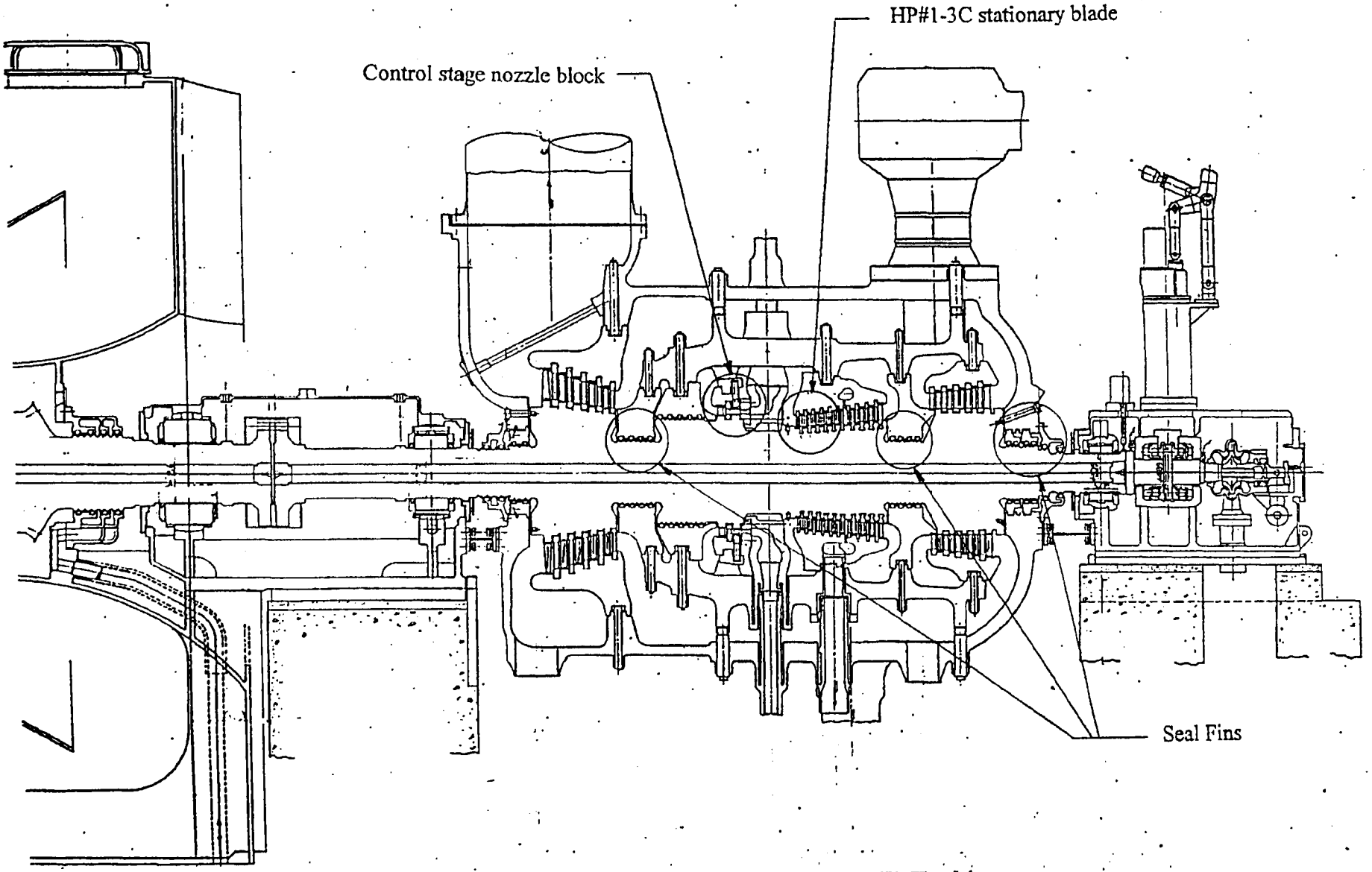

Figure 3.1a: Cross Section of HP/IP Turbine

5. FINDINGS

As the repowering of Units 4&5 will not result in any exceedance of the current licensed emission/discharge limits, it should not be classified as a material change to an exempted designated project under the EIAO.