

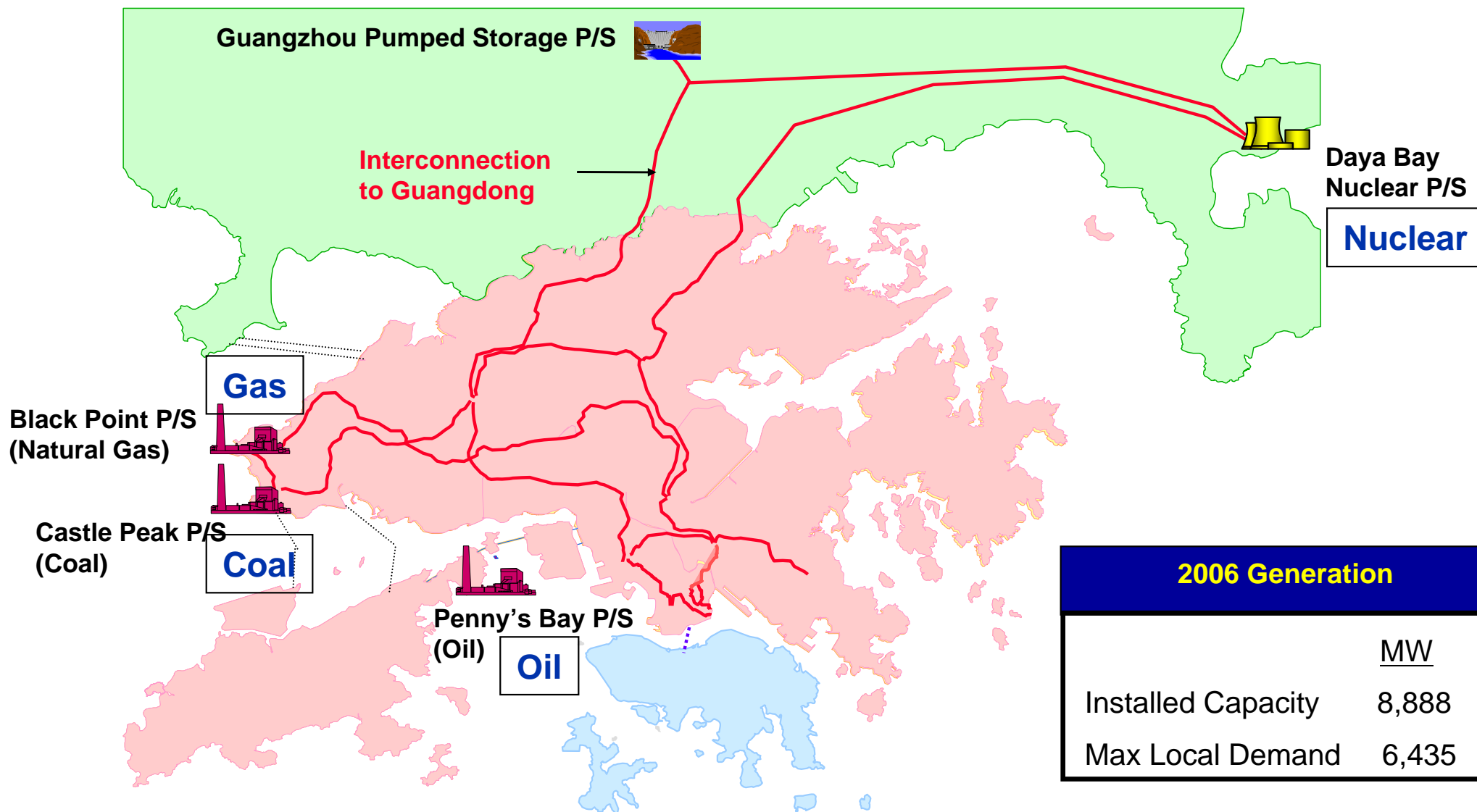
- **CLP**
- **Generation Assets & Performance**
 - *CLP Power (HK) Electricity Generation Portfolio & Fuel Diversification*
 - *Environmental Performance*
- **Plant Performance Improvement Case Examples**
 - *Distribution Control System*
 - *Boiler Combustion Optimisation*
 - *Efficiency Monitoring Tool*
 - *Units Start-Up Optimisation*
- **Way Forward**

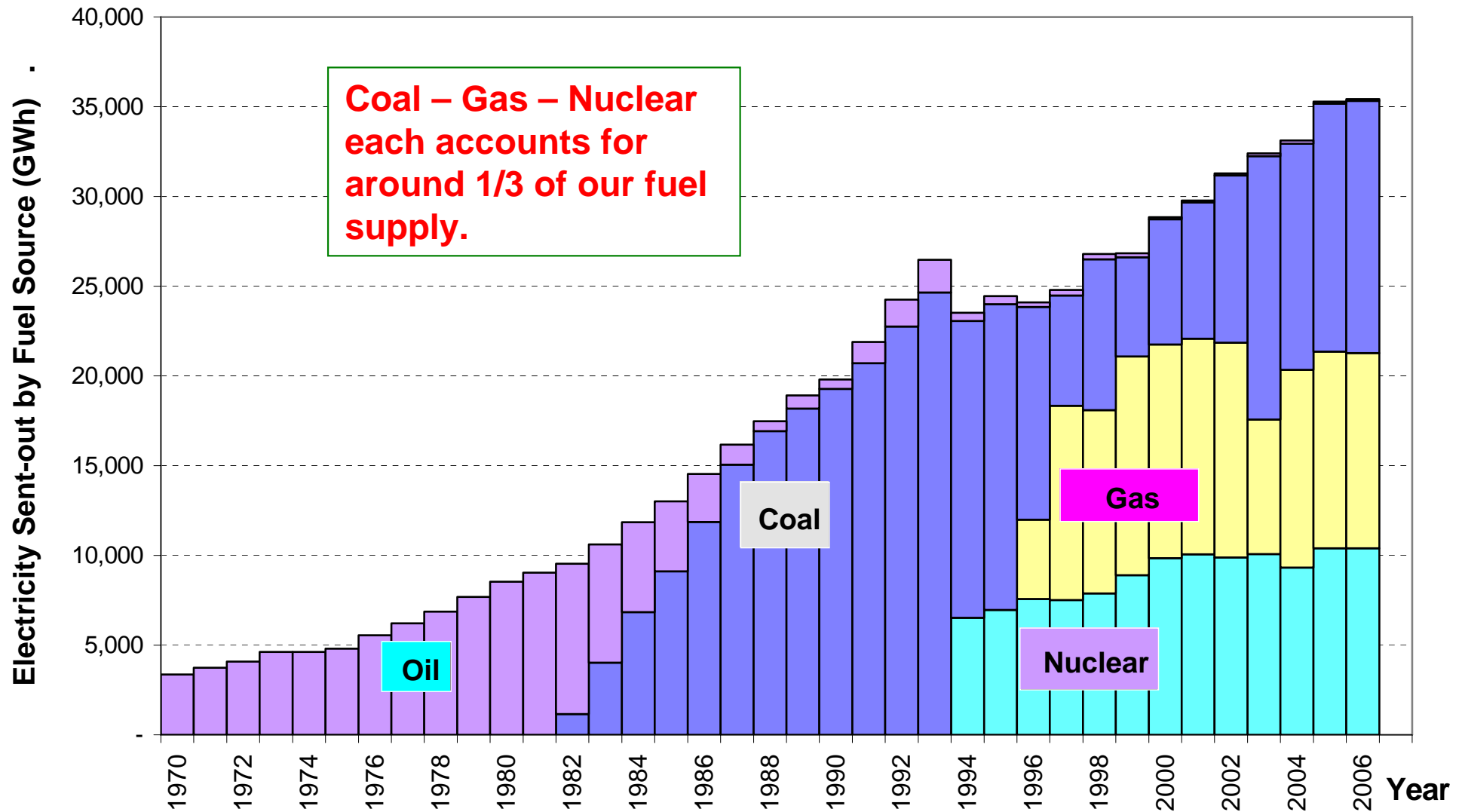
Our Assets & Investments

- We are continuing our expansion in energy-related investments in the *Chinese Mainland* and the *Asia-Pacific* region:
- ‘TRUenergy’ and ‘Roaring 40s’ in Australia
- ‘One Energy’ JV with Mitsubishi



CLP(HK)'s Electricity Generation Portfolio





A stable, secure, clean and economical fuel mix has an important role to play in the economic development of Hong Kong.

Castle Peak Power Station



Black Point Power Station



Penny's Bay Power Station



Station B

- 1986-90
- 4 x 680MW
- Coal fired units (2 units can burn gas)

Station A

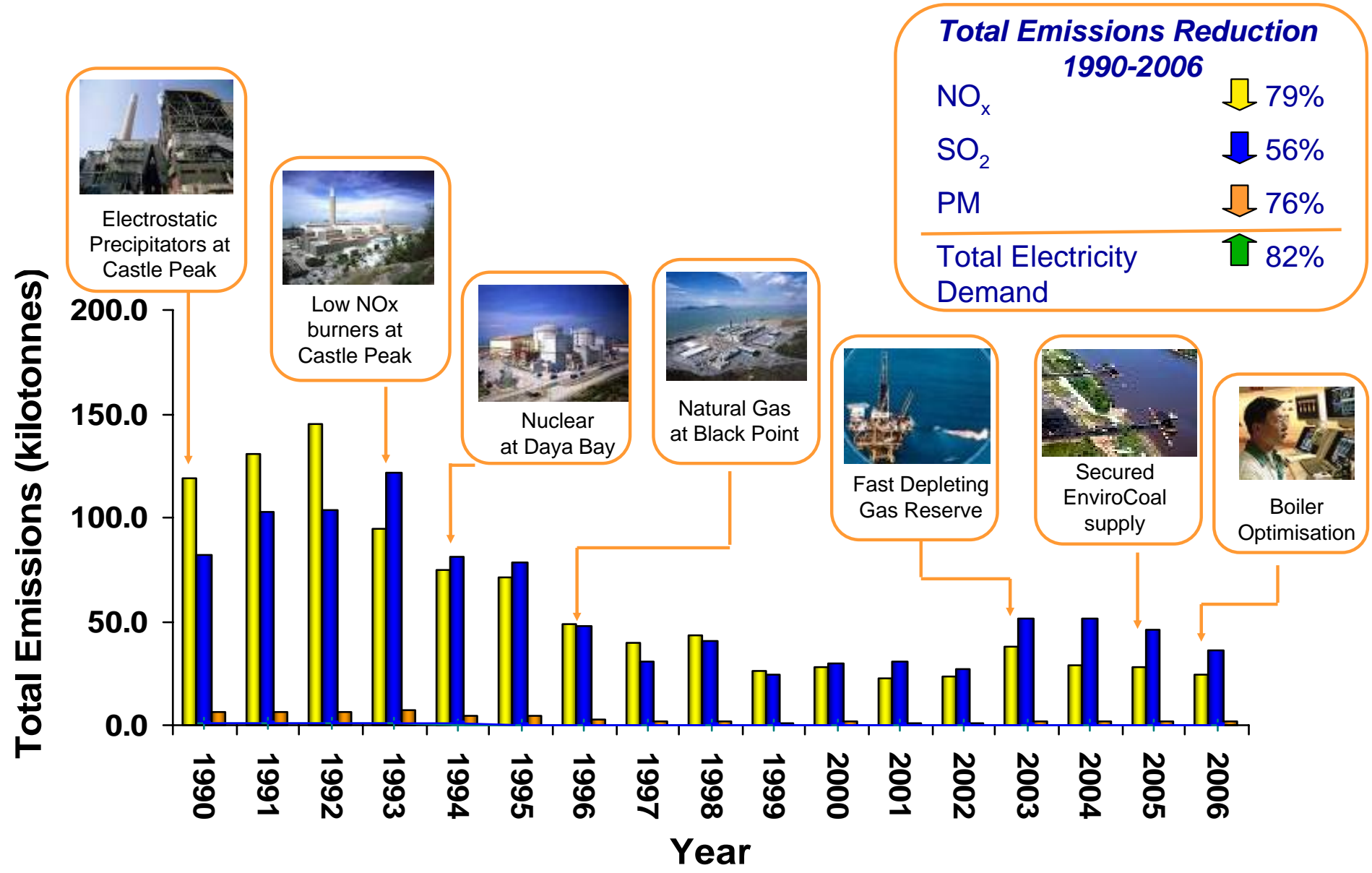
- 1982-85
- 4 x 350MW
- Coal fired units

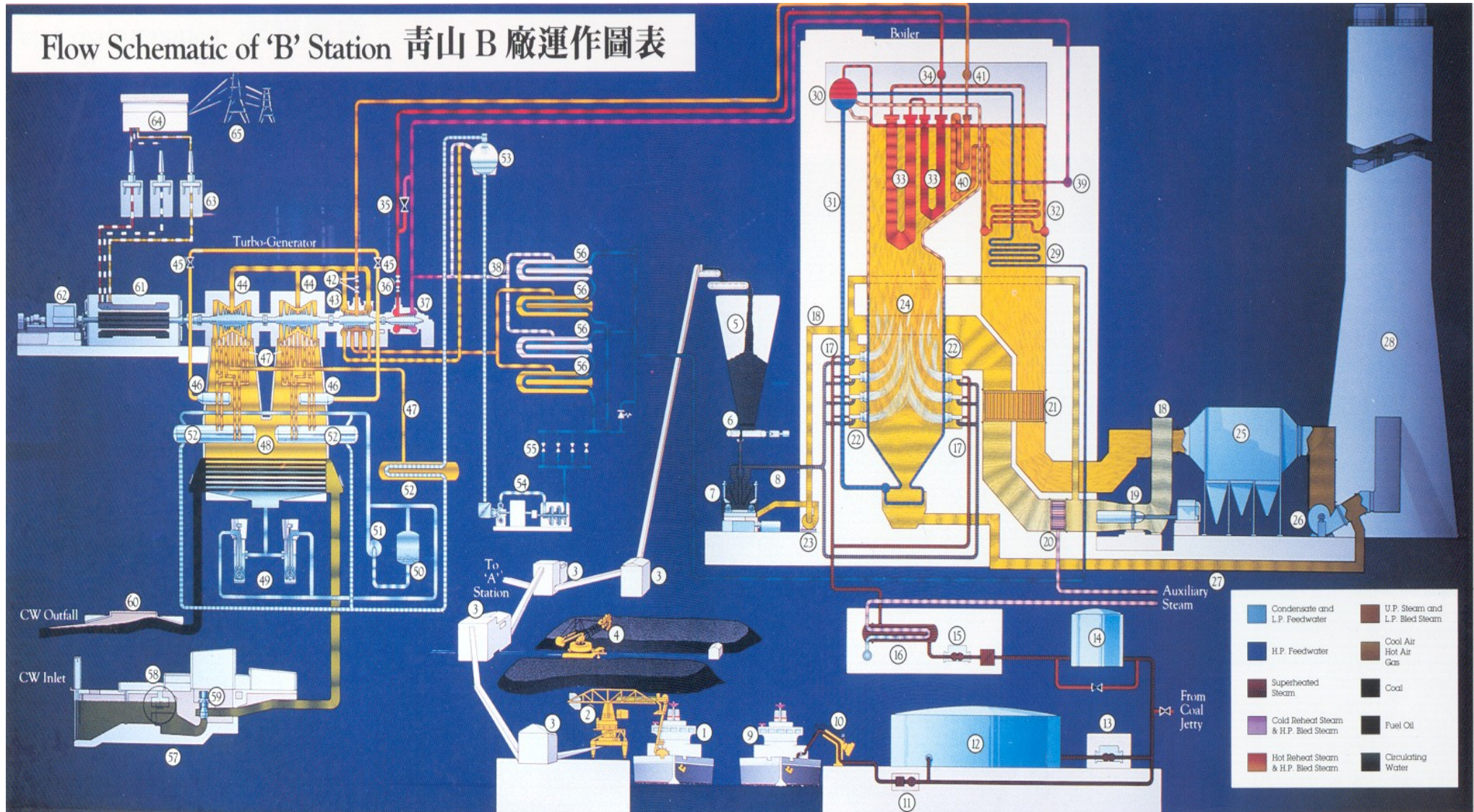
- 1996-2006
- 8x312 MW
- Gas fired units

- 1992
- 3x100 MW
- Diesel oil fired units
- For peak-opping and system operations support

1. We has usage right for 600MW of the Guangzhou Pumped Storage Power Station.
2. We also off-take generation from Daya Bay Nuclear Power Station which provides about one third of electricity use in Hong Kong.

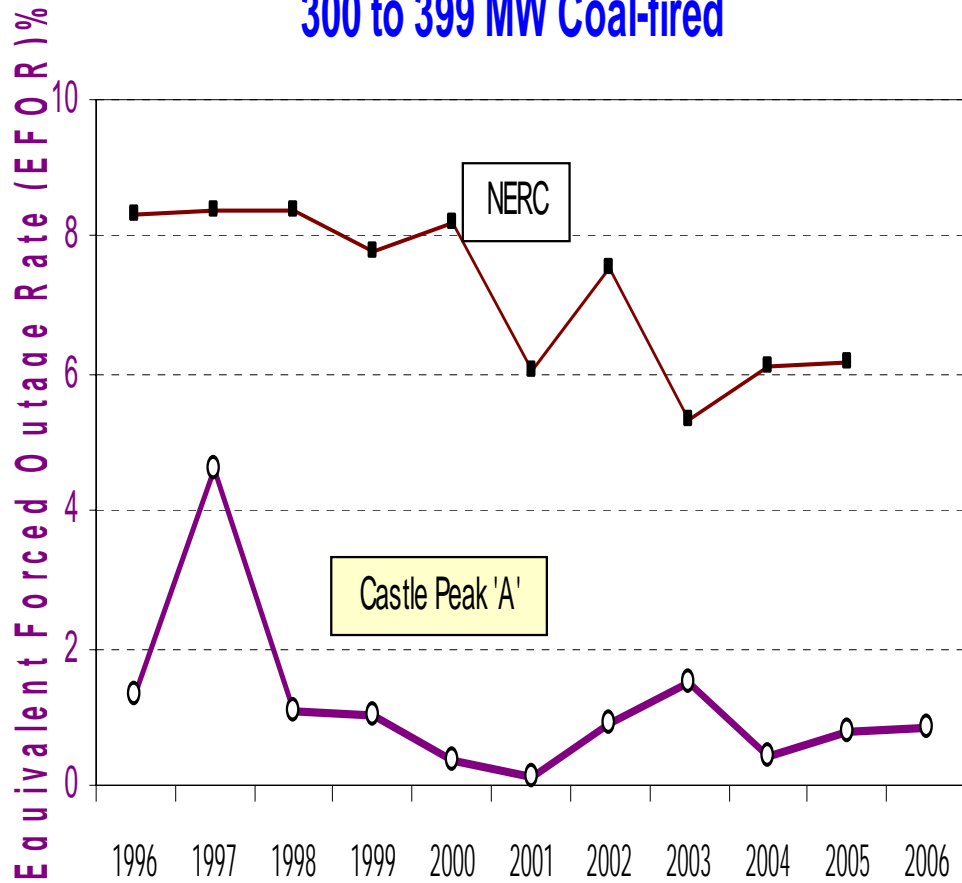
Hong Kong – Significant Emissions Reduction between 1990 and 2006



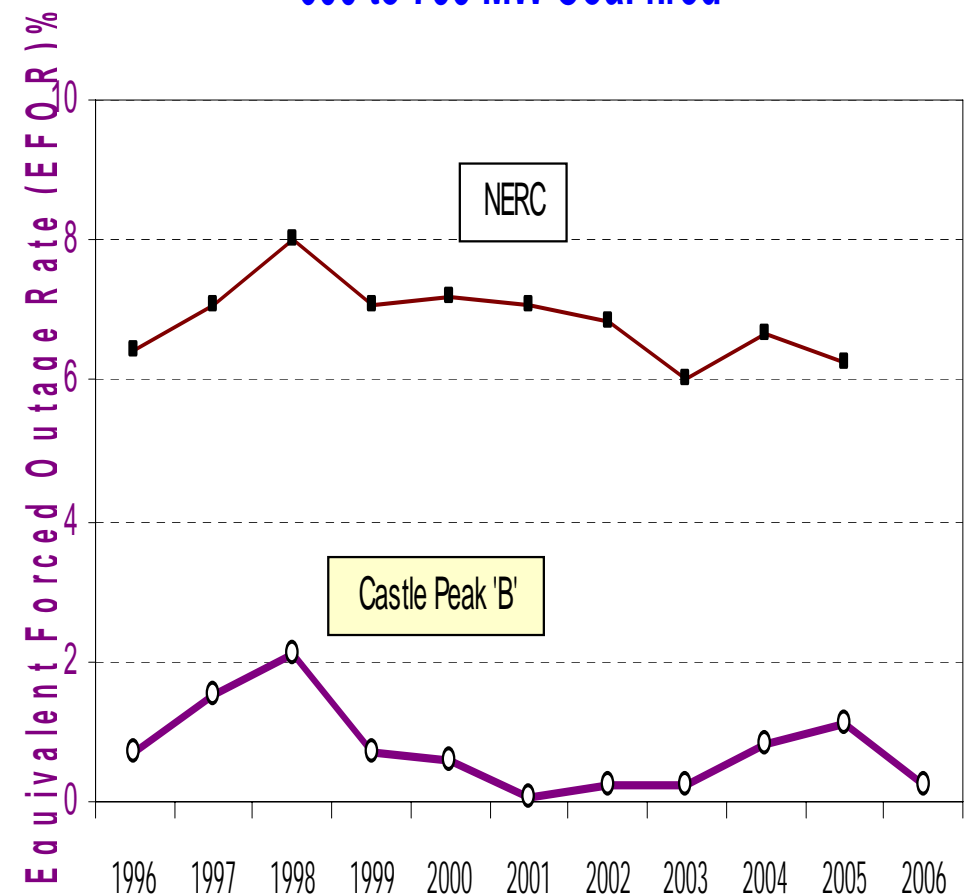


- World leader in 2-shifting units (i.e. shutdown at night and operation in the daytime to meet changing demand)

300 to 399 MW Coal-fired



600 to 799 MW Coal-fired



Source: North American Electric Reliability Corporation (NERC)

Reliability Performance is consistently good but no room for complacent

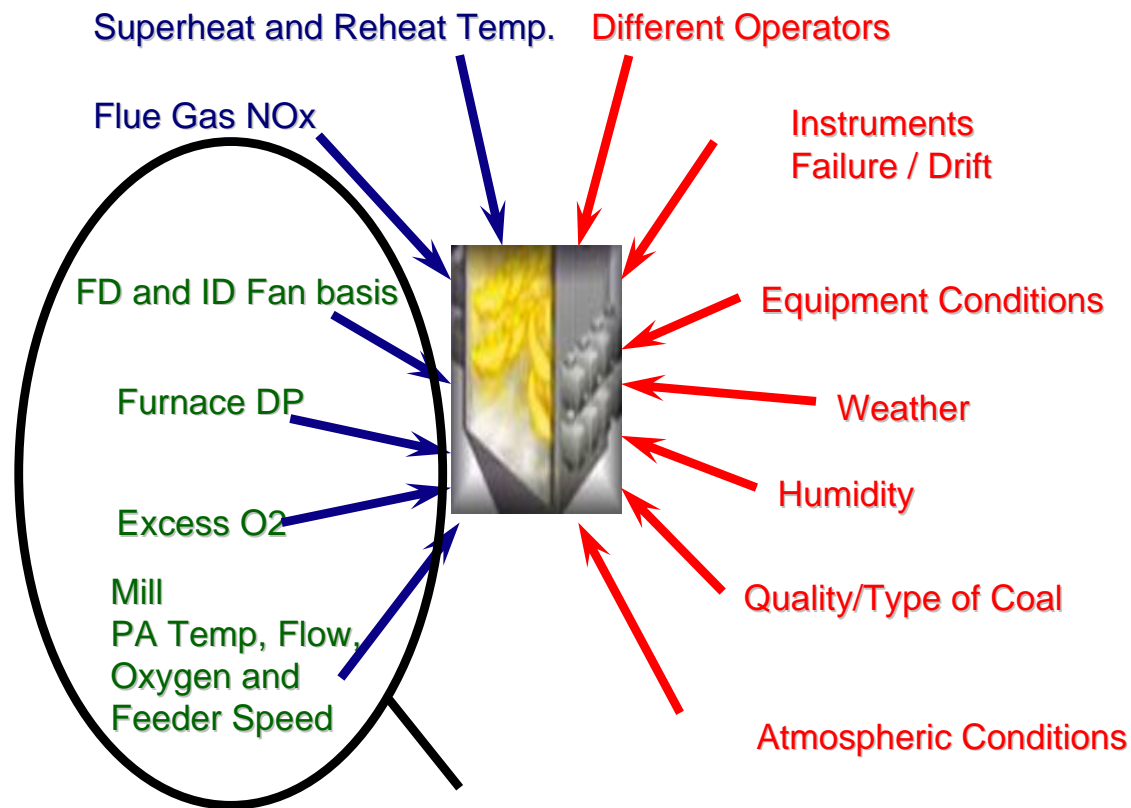
- Adopt Best-Available technologies
 - Replacement of control system with DCS
 - Installation of Boiler Optimisation System (BOS)
- Improve from ‘what you know’
 - Advancement of Efficiency Monitoring System
 - Introduction of Energy Information System
- Doing better with less
 - Unit Start-up Improvement Initiatives

- Boiler control system of CP'B' is a critical system, but facing obsolescence.
- Replacement of the control system with DCS is considered the most cost-effective long term solution to mitigate spare obsolescence problem.
- Contract for upgrading the first unit of CP'B was awarded in April 2001.
- Duration of project – 10 months (from design to installation).
- Outage period for conversion – 90 days.
- Around 7,500 Input/Output signals.

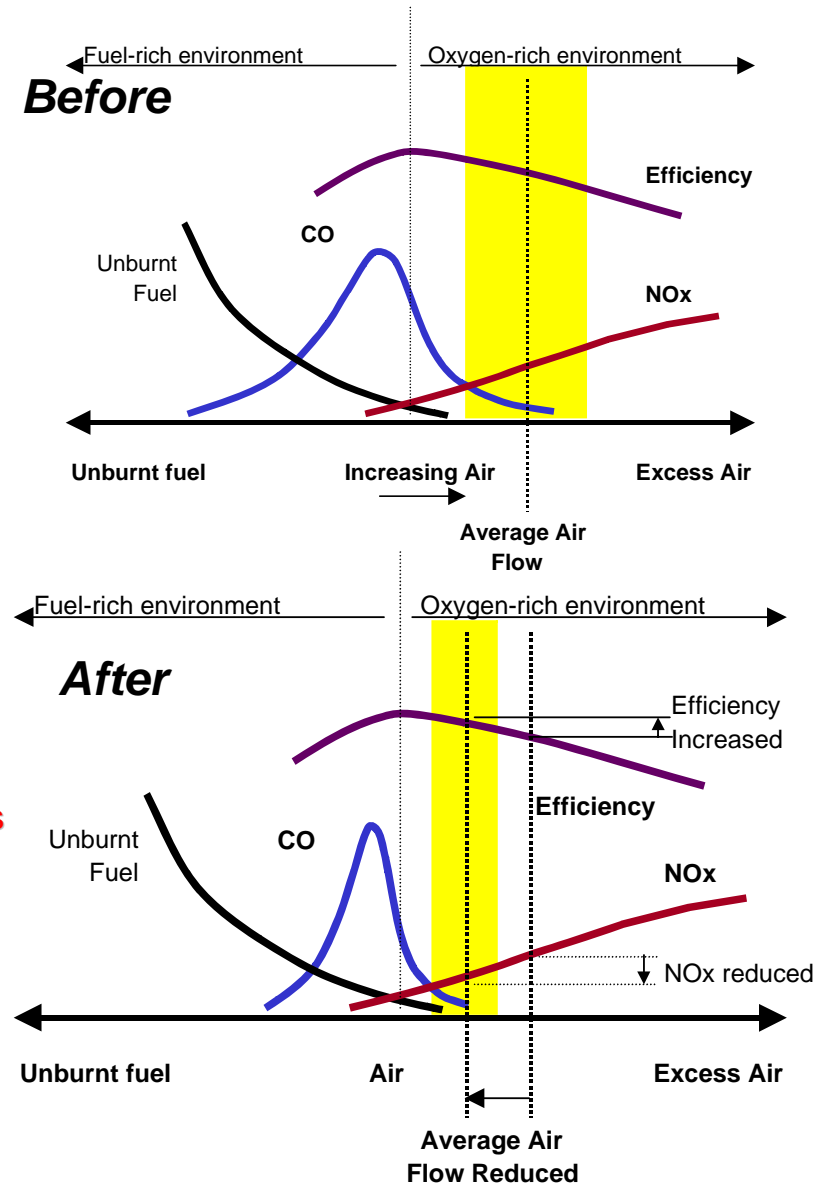


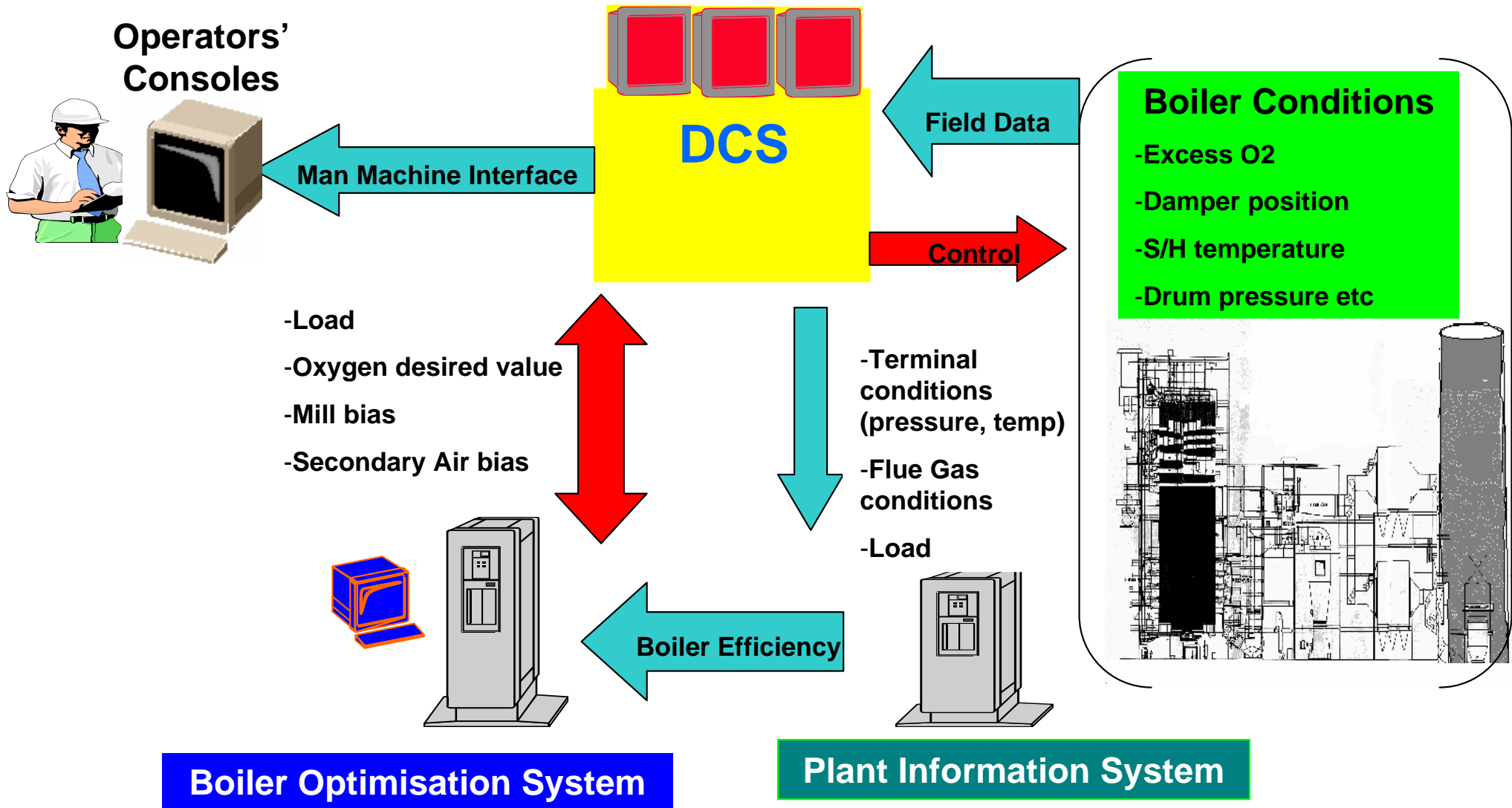
Four units at CP'B' have installed DCS and the systems work satisfactory

Boiler Optimisation is a top-down process to determine what the set points should be on boiler to achieve optimum combustion

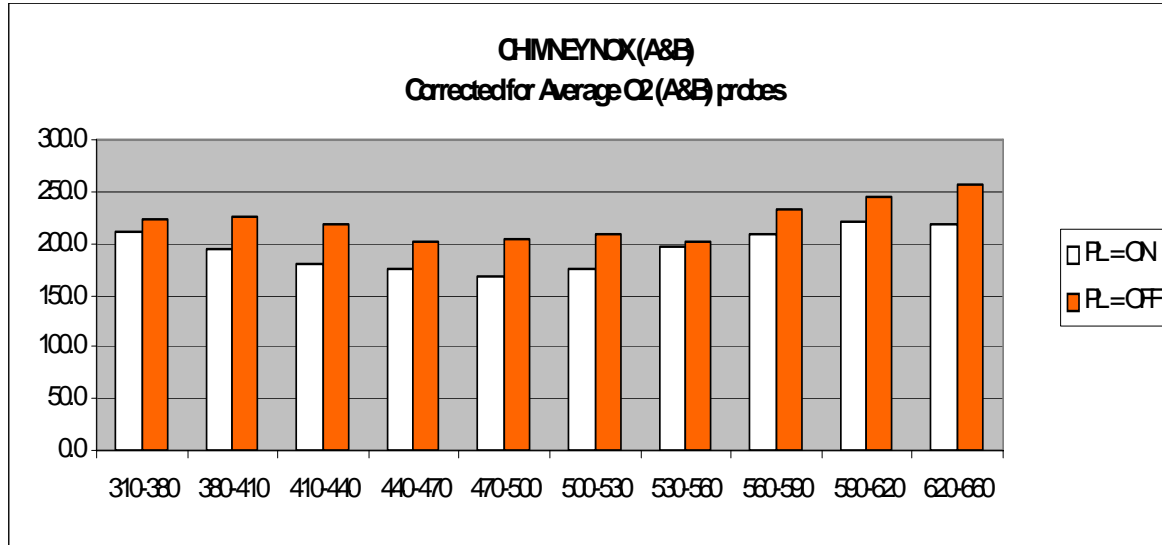


BOS changes their set points and Bias using Artificial Intelligent



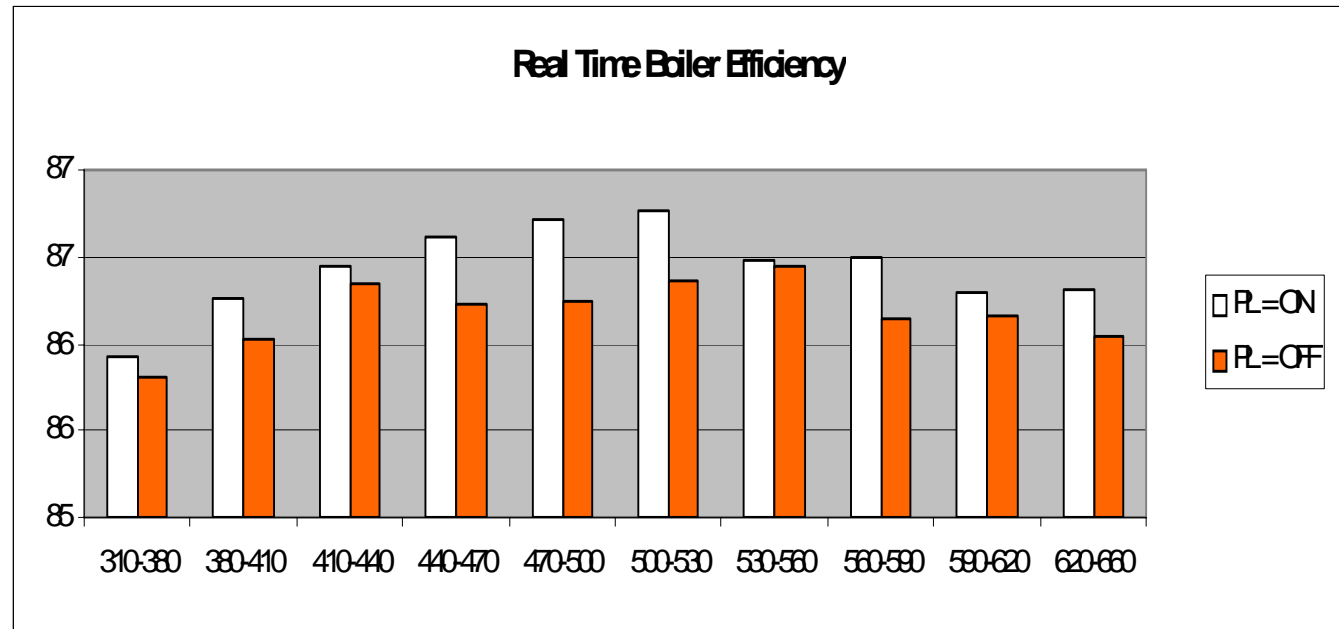
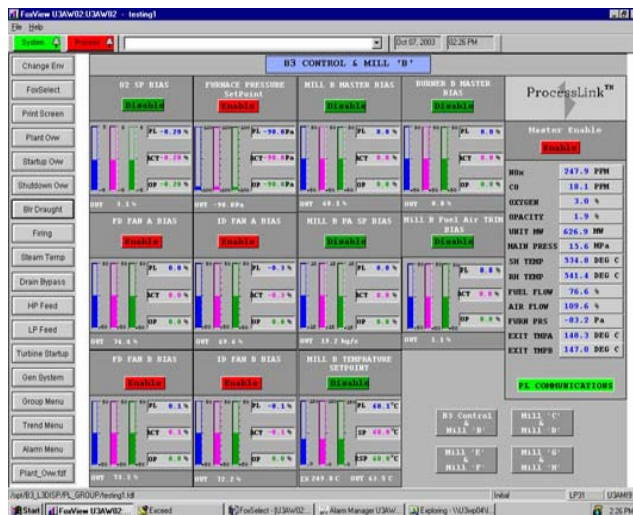


BOS is not a standalone system!
Interface with the existing DCS is essential



- An average of 11.8% NOx reduction.
- An average of 0.25 % Boiler efficiency Gain.

BOS Display at CCR



- In CPB, thermal performance is monitored by on-line Generation Efficiency Monitoring System (GEMS).
- A project was initiated to migrate to OSISoft Plant Information (PI) System, with enhanced indicators of highlight.
- A user-friendly tool for economic justification for replacement of deteriorated plant equipment. (e.g. gas airheater element replacement)
 - On-line display the 'cost of Heat' per unit electricity of generation
 - Highlight under-performing area to allow informed decision

B4 Overview

- CPPS Overview
- CPB Terminal
- B1 Overview
- B2 Overview
- B3 Overview
- B4 Chemistry
- B4 Fuel
- B4 Heat Rate
- B4 Cylinder
- B4 Condenser
- B4 BFP
- B4 Sootblowing
- B4 Energy Saving

Terminal Condition		RT Value	RT Target
Unit Active Load	(MW)	651	-- --
Unit Reactive Load	(MVar)	98	-- --
Unit Auxiliary Work	(MW)	36.8	36.0
TSV Pressure	(MPa)	15.4 15.3	-- --
TSV Temperature	(deg C)	539 541	538
IPSV Temperature	(deg C)	539 537	538
IPSV Temperature	(deg C)	542 547	538
IPSV Temperature	(deg C)	539 545	
Final Feedwater Pressure	(MPa)	19.7	-- --
Final Feedwater Temperature	(deg C)	243	252
Condenser Vacuum	(kPa)	5.3 5.2	4.9
CW Inlet Temperature	(deg C)	19.1 19.2	-- --
CW Outlet Temperature	(deg C)	27.1 27.6	29.0
CW Outlet Temperature	(deg C)	27.3 28.3	
FD Fan Inlet Temperature	(deg C)	22 22	-- --
Flue Gas Temperature	(deg C)	141 0	116
Economiser Excess Oxygen	(%)	0.0 2.9	3.2
Chimney CO	(ppm)	10	50
Carbon in Ash (Last Day)	(%)	Shutdown	0.0
Station Work	(MW)	2.0	2.7

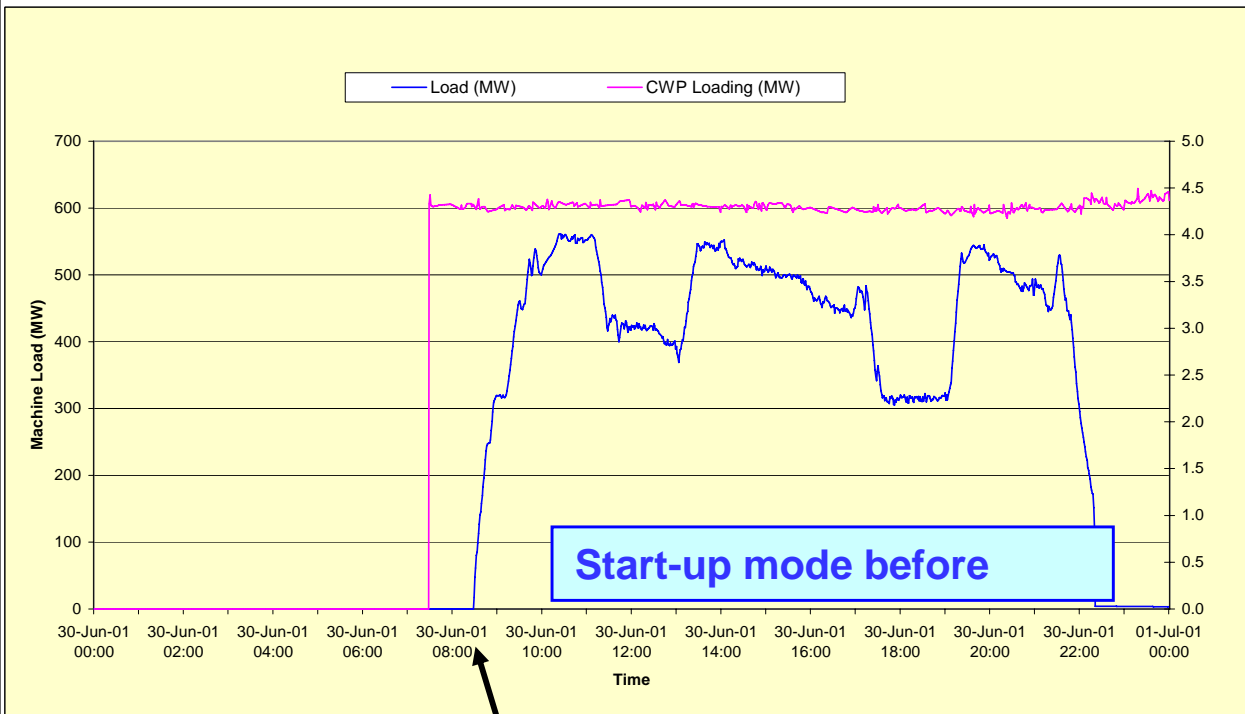
Efficiency and Loss		RT Value	Comparison
Generation Cost	(HK\$/MWH)	81.6	
Efficiency			(0) (100)
Boiler	(%)	86.4	
Turbine	(%)	44.7	
Generation	(%)	38.6	
Sent-Out	(%)	36.4	
Performance Factor	(%)	98.8	
Loss			(-1000) (0) (1000)
TSV Temp	(HK\$/hr)	-15	
IPSV Temp	(HK\$/hr)	-67	
Cond CW Flow	(HK\$/hr)	-71	
Cond CW Vacuum	(HK\$/hr)	123	
Final Feed Temp	(HK\$/hr)	166	
System Make-Up	(HK\$/hr)	-96	
Flue Gas Temp	(HK\$/hr)	702	
Excess Oxygen	(HK\$/hr)	-64	
Chimney CO	(HK\$/hr)	-10	
Carbon in Ash	(HK\$/hr)	-85	
Aux Work	(HK\$/hr)	61	
Total	(HK\$/hr)	645	

Emission	Opacity (%)	SOx (ppm)	NOx (ppm)	CW dT (degC)
	13	128	258 222	0.0

Estimated Fuel Flow (kg/s)	Coal	Oil	Gas
	74.2	0.0	-- --

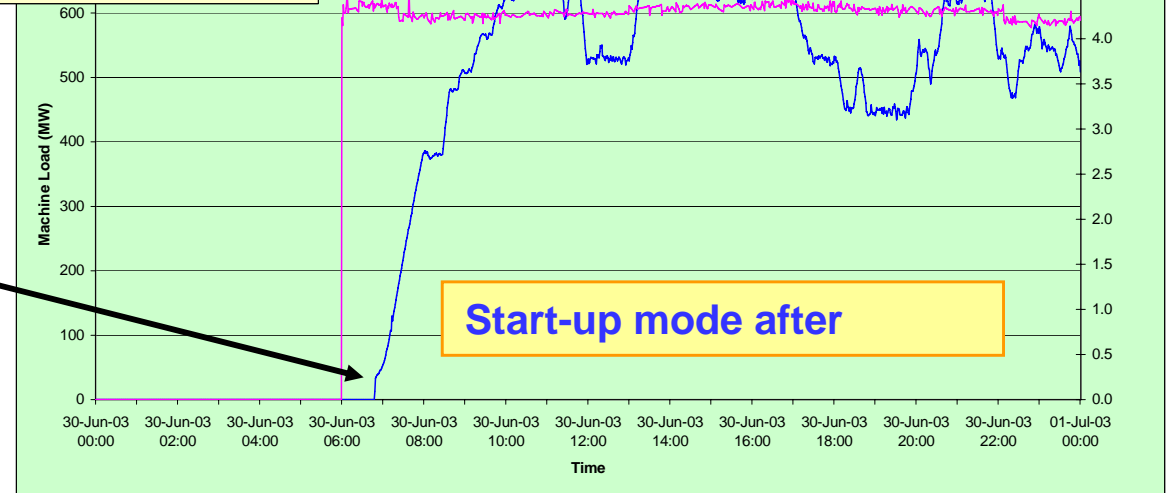
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Purpose : Energy Saving



**Reduction in auxiliary power consumption for a unit start-up
=> ~ 2 MWh
=> 2000 x 100W light bulbs for 10 hours**

Reduction in main cooling water pump by 15~20 min, during start-up.





In order to further reduce emissions, we will

- Increase use of ultra-low sulphur coal
- Install additional Emissions Control Equipment (FGD & SCR) at the Castle Peak B Power Station
- Bring in liquefied natural gas (LNG) to replace depleting Yacheng gas field, ensuring reliable and adequate supply of natural gas for generation



Q & A