

Care of the Environment

The responsible management of resource use and environmental impact is an integral part of our business operation. Power generation faces many environmental challenges. The key issues consist of:

- (a) Energy sources;
- (b) Generation efficiency;
- (c) Climate change;
- (d) Air quality;
- (e) Water sources;
- (f) Material resources;
- (g) Effluent & waste management;
- (h) Public health;
- (i) Noise; and
- (j) Visual & landscape impacts.

Sound management helps to meet these challenges head on to help preserve the natural environment for the current and future generations. The Singapore Green Plan (SGP) 2012 provides a guiding platform for the Company to ensure its actions can contribute positively to the nation's environmental sustainability for the next decade. We have been doing our utmost in minimising CO2 emission and other environmental impacts to the surroundings.

The examples below demonstrate our commitment to the environment.

(a) Greenhouse Gas Abatement

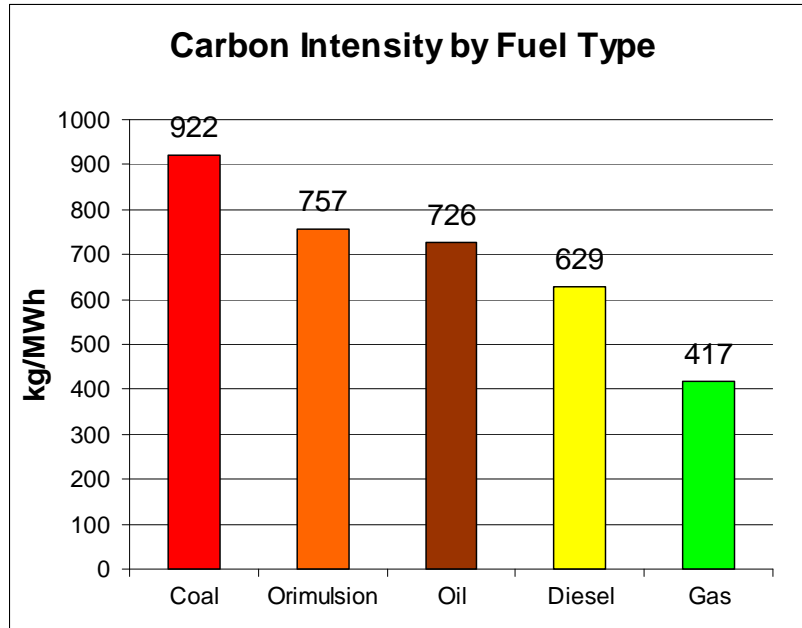
Our Stage I Repowering demonstrates our leadership in reduction of GHG. The achievement was recognised by the Environment Ministry on 28 October 2005 when Senoko received the highest national award of SGP 2012. In the citation, the Ministry noted "Senoko has made caring for the environment its business. The Company pioneered the use of natural gas for electricity generation purposes with the introduction of Malaysian gas in 1992 and this was complemented by the introduction of a second source of natural gas supply from Sumatra in 2003, which also enhanced supply reliability."

Repowering Stage I oil-fired 120MW to environmentally-friendly gas-fired 360MW combined cycle plant, boosting generation efficiency from 36% to a high 50%, reduces carbon intensity from 770 kg CO2/MWh to 400 kg CO2/MWh. The repowering brought about CO2 reduction of up to 2,500,000 tonnes per year, equivalent to the CO2 production from all private vehicles emitted in a year on Singapore roads. This is significant when compared to the total CO2 generation in Singapore of about 38 million tonnes per year. The project cost \$600m and was completed in December 2004, several months ahead of construction schedule.

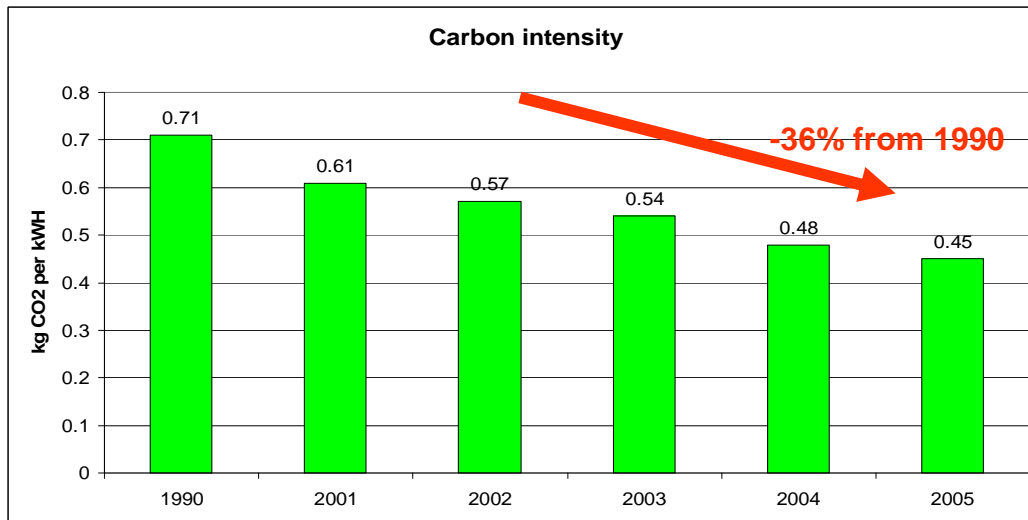


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CO₂ Equivalent for one unit of electricity



Carbon Intensity from positive impact of CCGT



(b) Low NO_x burner

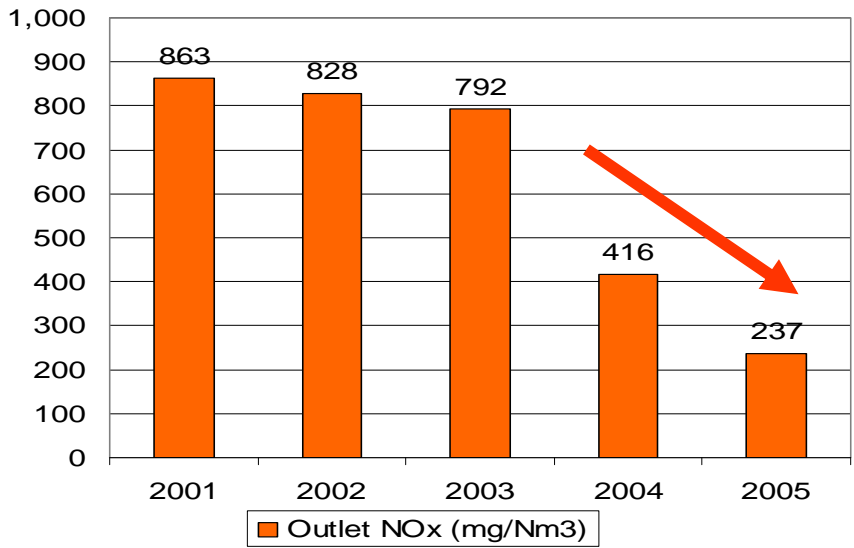
At the life extension shutdown of Siemens V94.2A in 2004-05, the company spent \$16m to retrofit the burner system from hybrid diffusion to pre-mix low NO_x burner, effectively bringing NO_x level to about 200 mg/Nm³ against NEA limit of 700 mg/Nm³.

Low NO_x tangential firing techniques are adopted for all boilers. Water injection system is also installed in our latest combined cycle generating units to control NO_x emissions when the GT is on diesel oil firing.



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Average NO_x Emission



Conversion of GT11-21 to pre-mix low-NO_x burners & commissioning of CCP4-5

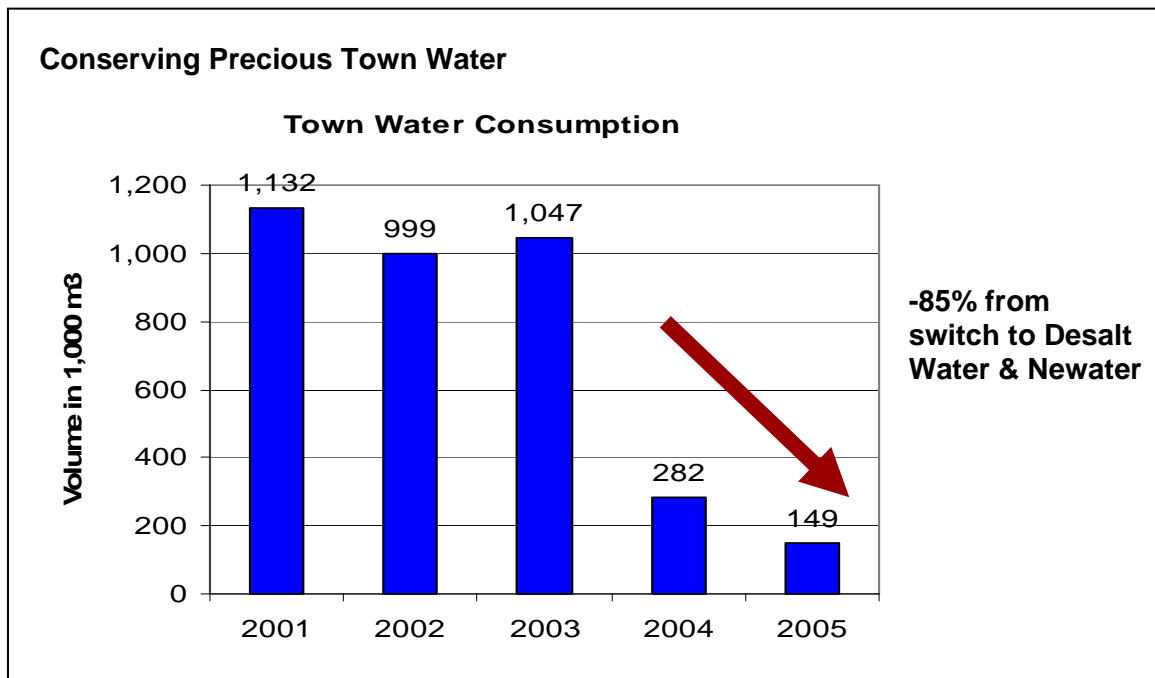
NEA statutory limit (from 2004) = 700 mg/Nm³

(c) Desalination Plant

Water is a precious resource and is vital to power generation process. We recognise Singapore's need for sustainable water sources. As such, the Company switched to NEWater in December 2003 to replace PUB Town Water. This resulted in a 66% reduction in monthly town water usage.

Taking advantage of our vicinity to the Straits of Johor, Senoko achieved water self sufficiency by constructing 2,400m³/day desalination plant to supply boiler feedwater. The Company monitors the water usage to ensure maximum use with minimum waste.

In addition, rain water is collected and used for station washing.

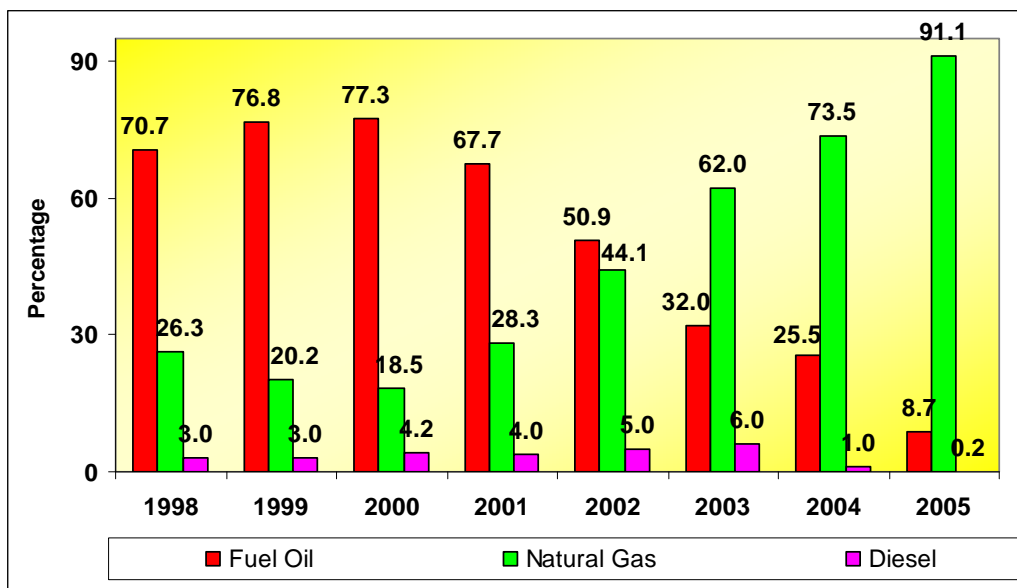


(d) Ultra-Low Sulphur Diesel (ULSD)

The new regulation of 0.005% sulphur diesel would come into force from October 2006. By being proactive, the Company took the proactive steps of disposing of the existing stock. Diesel Tanks No. 2 and No. 3 with non-ULSD were completely de-sludged using vacuum pump and mop-cleaned on 23 June 2006. Diesel Tank No.2 was then half-filled with ULSD of 0.002% sulphur on 26-June. This is better than the statutory limit of 0.005% sulphur. The company is the first GenCo to dispose off non-ULSD and replenish with the cleaner ULSD to reduce PM2.5 particulate in the air under SGP 2012 environmental protection requirement.

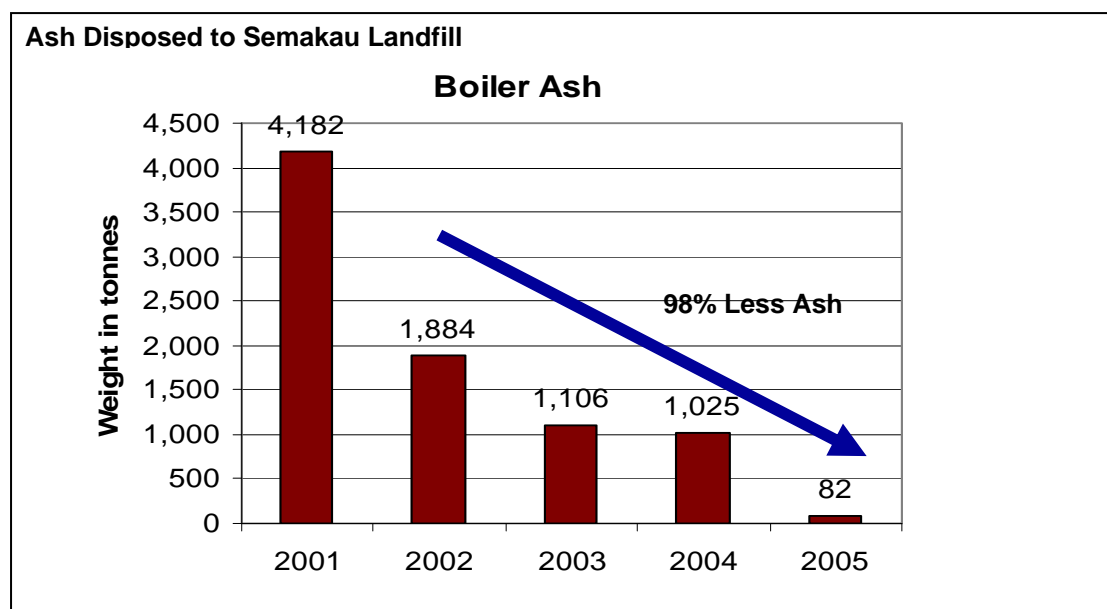
(e) Air Pollution Control

Over 90% of our generation comes from the natural gas-fired combined cycle power plant with practically zero emission of SO₂. All the conventional thermal boilers are capable of firing natural gas as well as fuel oil.



(f) Electrostatic Precipitator

Electrostatic precipitators (EP) are used to clean the furnace gas before it is discharged from the chimney stack. Each boiler of the conventional thermal generating units is equipped with an electrostatic precipitator which extracts over 90% of the ash from the flue gas before emission. Regular tests on the EP performance and chimney emissions are carried out in accordance with international standards. Closed circuit colour television and opacity meters are installed to provide continuous surveillance over the chimney flue gas. Regular source emission tests are carried out to ensure that the flue gas emissions of our generating units are acceptable.



(g) Noise Control

The Company recognises the importance of noise control and has placed special emphasis in planning against noise to protect working personnel from long exposure and transmission to immediate vicinity of the power station.

Wherever possible, noise equipment such as quiet transformers, motors and fans are used. Equipment inspection and noise measurements are carried out at the manufacturers' workshop and after installation on site to ensure that the noise emission limits laid down by the Company are met. Where additional noise reduction is needed, acoustic louvers and enclosures, silencers, sound absorptive linings and barriers are used.

Regular in-plant noise surveys for plant equipment are carried out to ensure that there is no unacceptable deterioration in noise emissions and to provide recommendations for maintenance to reduce noise where necessary.

(h) Water Pollution Control

The water treatment plants at CCP1-2 & CCP3-5, and the Desalination Plant adjacent to the jetty has received official waiver. Plant washing water and ash handling water from Stage II/III boiler & EP may have high suspended solid concentrations. The waste water is directed into a settling lagoon for neutralisation until it is fit for discharge.

We consistently tested water samples collected at the discharge drains and settling lagoon on a monthly basis. The analysis is done by accredited independent laboratories. The oil-free discharge, permissible effluent and the total solid in the suspension were within legal limits. Based on the manual samples collected, the results were within the limits defined in NEA's Code of Practice for Pollution Control for effluent discharge into waterway. This 3rd-party independent due-diligence testing confirmed our legal compliance with the environmental laws.

(i) Energy Efficiency

In 2004/05, the ceiling for the Turbine Hall was installed with high pressure mercury fittings. Each fitting has 400W HPMV lamp. With no reduction in brightness, this initiative resulted in a 50% reduction in energy usage and fittings and an annual saving of about \$40,000.

We take every opportunity to improve our energy efficiency through upgrading of lighting systems within the plant. One of the Senoko staff was recognised as an iconic energy saving superman at MEWR SGP 2012 road show to the Singapore heartland. The Company premises are currently undergoing renovation. Every opportunity is taken during the renovation to replace the lighting to energy saving gadgets which last longer and give out more lux.

(j) Reduce, Re-use & Recycle

Responding to the call in SGP 2012 to increase recycling activities, we have plant-wide waste reduction, re-use and recycling programs. The Company engages all employees and most business partners in these programs. Our diverse recycle materials include:

- (i) Toner/printer cartridges, paper, metal, cans, bottles, electronics and electrical equipment and waste oil are identified as re-cycleable. The Company began a segregate-and-collect system across the plant, and is actively monitoring the progress.
- (ii) The Company has also adopted a policy of replacing old fire-extinguishing medium Halon 1301 with non-ozone depleting alternative once the medium in



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the bottle has been consumed. About 90% of Halon 1301 in the power station has been replaced.

- (iii) At Senoko's 230kV and 66kV Switch Houses which contain transmission-related Extra High Voltage (EHV) Gas-Insulated Switchgear (GIS), SF6 gas recovery equipment is deployed whenever SF6 in GIS chamber has to be replaced. In-situ gas monitoring devices and an alarm system to detect minute leaks are designed into the equipment and installed at every GIS to address the concern of unnoticed accidental release of green house gas.

(k) Public Health

We encourage litter-free environment across the whole power station and when hosting outdoor corporate activities. The staff canteen was renovated at a cost of \$500k to bring the canteen up to the latest NEA environmental standard requirement. Staff and contractors are more aware of Litter-Free campaign and develop more hygiene habits and practices. Site work areas are cleaner and working personnel are more cheerful in the canteen. It also helps to prevent and control vector-borne diseases.

(l) Flora & Fauna

Despite the very constrained nature of the site at Senoko, there is a major effort to reserve 10~15% of space to greenery to conserve flora and fauna. The healthy growth of fruit trees, tropical palms, shrubs and flowers are an excellent indicator of the surrounding air quality. The flora adds considerably to the aesthetic quality of the site.



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