

# Katestone Environmental

**NEWGEN POWER STATION  
NEERABUP**

**GREENHOUSE GAS  
ABATEMENT PROGRAMME  
(GGAP)**

**March 2008**

**FINAL**

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## **1. Element/issue**

Emission of greenhouse gases to the atmosphere as a result of the operation of the power station.

## **2. Objective**

The objectives of this GGAP are:

- (1) Ensure that the plant is designed and operated in a manner which achieves reductions in "greenhouse gas" emissions as far as is practicable;
- (2) Provide for ongoing "greenhouse gas" emissions reductions over time;
- (3) Ensure that the total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product from the project are minimised; and
- (4) Manage "greenhouse gas" emissions in accordance with the *Framework Convention on Climate Change 1992*, and consistent with the contemporary National Greenhouse Strategy as updated from time to time.

## **3. Current Status**

Greenhouse gases such as carbon dioxide have been implicated in gradual global climatic changes. Greenhouse gases affect the balance between incoming solar energy and losses due to radiation from the earth and atmosphere. Pollutants of importance to greenhouse warming and associated with power generating activities are water vapour (H<sub>2</sub>O), nitrous oxide (N<sub>2</sub>O), carbon dioxide (CO<sub>2</sub>) and methane (CH<sub>4</sub>). Indirect greenhouse gases such as carbon monoxide (CO), nitrogen oxides other than N<sub>2</sub>O and non-methane volatile organic compounds (NMVOCs) do not have a strong radiative forcing effect in themselves, but influence atmospheric concentrations of the direct greenhouse gases.

Water vapour is the major contributor to the greenhouse effect but is not normally considered in inventories because human output is negligible compared to the day-to-day precipitation cycle. Carbon dioxide is the next most significant greenhouse gas and the major anthropogenic contribution.

The NewGen Power Station is an emitter of carbon dioxide and to a much lesser extent, nitrous oxide and methane.

## **4. Potential emissions**

The assessment of greenhouse gas emissions has been undertaken in accordance with the EPA's *Guidance for the Assessment of Environmental Factors, No 12, Minimising Greenhouse Gas Emissions*, the AGO's Factors and Methods Workbook and the AGO's Generator Efficiency Standards.

CO<sub>2</sub> will be produced during the operations of the NewGen Power Station and is also associated with transport of materials to and from the site. Emissions of greenhouse gases from the power station have been estimated to be initially 0.7 million tonnes per year (CO<sub>2</sub> equivalent). With an average degradation factor of 0.3% per year, the total greenhouse gas emissions from the plant will be about 0.77 million tonnes per year (CO<sub>2</sub> equivalent) in the 30<sup>th</sup> year of operation.

## **5. Program to minimise greenhouse gas emissions**

NewGen Power will implement the following “no regrets measures<sup>1</sup>” that are consistent with the AGO's Generator Efficiency Standards to minimise greenhouse gas emissions:

- Minimise/reduce energy use through the following:
  - Routine monitoring of plant efficiency; and
  - Operate plant at optimum efficiency in accordance with manufacturer's operation and maintenance.
- Implement a routine preventative maintenance and cleaning regime to maintain operation of the power station at optimal efficiency.
- Implement a "continuous improvement approach" so that advances in technology and potential operational improvements of plant performance are adopted where practicable.
- NewGen Power will become a member of the Greenhouse Challenge Plus Program.

NewGen Power will implement the following “beyond no regrets measures<sup>2</sup>” that are consistent with the AGO's Generator Efficiency Standards to minimise greenhouse gas emissions:

- Annual auditing of greenhouse gas emissions;
- Fund energy efficient programs in conjunction with Synergy, including the employment of a Greenhouse Program Officer; and
- Undertake an annual review of state of the art mitigation measures to identify advances in technology and potential operational improvements of plant performance that are relevant for open-cycle gas-turbines. Investigate the feasibility of implementing these technological or operational improvements at the NewGen Power Station.

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<sup>1</sup> "no regrets" measures are those which can be implemented by a proponent and which are effectively cost-neutral.

<sup>2</sup> "beyond no regrets" measures are those which can be implemented by a proponent and which involve additional costs that are not expected to be recovered.

## 6. Greenhouse gas efficiency

The AGO has published a guideline for the application of Generator Efficiency Standards, measured in terms of greenhouse intensity. This guideline includes the recommended practice for determining best practice greenhouse efficiency for existing and new fossil fuel based power plants (i.e. electricity generation plant or combined heat and power plant). For power stations and other combustion plant, the efficiency with which useful energy can be generated from fuel is an important indicator of the relative importance of a carbon dioxide source. One means of reducing carbon dioxide emissions is to increase the efficiency of fuel conversion or adopt technology that is more efficient at converting fuel into electricity.

Open cycle gas turbines (OCGT) are amongst the most greenhouse efficient fossil fuelled power generation technology currently available. OCGTs are widely used throughout the world as a response to abate greenhouse gas production from power generation. OCGT technology can achieve relatively low emissions of greenhouse gases because it utilises natural gas, a fuel that has the least carbon intensity of the fossil fuels.

The NewGen Neerabup Gas-Fired Power Station is configured to deliver 330 MW of peak and shoulder load capability. The efficiency of the NewGen Neerabup Gas-Fired Power Station is presented in Table 1 and is compared to the AGO guidelines.

For a small portion of the year (approximately 770 hours) the NewGen Neerabup Gas-Fired Power Station will operate with water injection. This will reduce the power station efficiency.

**Table 1: Efficiency of NewGen Neerabup Gas-Fired Power Station (% Higher Heating Value (HHV) Basis)**

Plant	Output MW	Efficiency HHV at 25°C and 60% Relative Humidity (HHV)
NewGen Neerabup OCGT	330	30.4%/29.0% <sup>1</sup>
AGO Generator Efficiency Standards OCGT		33.1%
Note <sup>1</sup> Efficiency reduced for about 770 hours per year whilst water injection occurs		

The predicted greenhouse gas intensity of the NewGen Power Station is compared in Table 2 with Western Power's average performance in 2005.

**Table 2: Comparison of predicted greenhouse gas intensity of NewGen Neerabup Gas-Fired Power Station with Western Power's average intensity in 2005 and best practice levels.**

Source of emissions	Greenhouse gas intensity (tonnes CO <sub>2e</sub> /MWh)
NewGen Neerabup Power Station	0.65 <sup>1</sup>
Western Power Corporation 2005 (including abatement actions) <sup>2</sup>	0.9
AGO Generator Efficiency Standards OCGT with WA Gas	0.57
Note <sup>1</sup> Total intensity operating with water injection	

## 7. Greenhouse gas offsets

NewGen has considered the feasibility of implementing greenhouse gas offsets and has determined that they are not required as the emissions from the plant are relatively low for OCGT technology.

## **8. Monitoring and reporting**

Greenhouse gas emissions will be monitored in accordance with the requirements of the Australian Greenhouse Office. In particular, the following information will be recorded and reported:

- Fuel types.
- Fuel usage (PJ for gas, tonnes for other fuels).
- Plant capacity (MW).
- Capacity factor (%).
- Output factor (%).
- MWh generated (monthly).
- MWh sent-out (monthly).
- MWh imported (monthly).
- Sent-out thermal efficiency (monthly).
- Average annual greenhouse intensity (kg CO<sub>2</sub>-e/MWh) based on monthly averages.

An annual report will be prepared that summarises greenhouse gas emissions in accordance with the AGO's requirements specified in the Generator Efficiency Standards and the Greenhouse Challenge Plus programme.

## **9. Auditing**

Annual audits will be conducted to assess compliance with this Greenhouse Gas Abatement Programme.

## **10. Review and revision**

This Greenhouse Gas Abatement Programme will be reviewed on an annual basis to ensure that it reflects relevant aspects of operation management and maintenance and complies with regulatory requirements. Available technology for mitigating greenhouse gas emissions from OCGT will be reviewed on an annual basis and adopted where practicable (see Section 5).

## **11. Emission targets**

The potential emissions provided in Section 4 are estimates based on 2628 hours of operation in the year. Total emissions are not considered a good comparative indicator of greenhouse performance over time. Accordingly, emission targets have been set on a per unit of production basis.

Greenhouse gas emission targets for the NewGen Neerabup Gas-Fired Power Station are given in Table 3. The targets will be achieved through the implementation of the actions identified in Section 5 of this Greenhouse Gas Abatement Programme. Over a 30-year timeframe, the target reduction in greenhouse gas emissions is 1.48%.

Table 3: Greenhouse gas emission targets.

End of Year	Approved (tCO <sub>2</sub> e/MW hr)	Target GHG (tCO <sub>2</sub> e/MW hr)	Target change (%)	End of Year	Approved (tCO <sub>2</sub> e/MW hr)	Target GHG (tCO <sub>2</sub> e/MW hr)	Target change (%)
1	0.653	0.652	-0.05	16	0.683	0.677	-0.79
2	0.655	0.654	-0.10	17	0.685	0.679	-0.84
3	0.657	0.656	-0.15	18	0.687	0.681	-0.89
4	0.659	0.657	-0.20	19	0.689	0.682	-0.94
5	0.661	0.659	-0.25	20	0.691	0.684	-0.99
6	0.663	0.661	-0.30	21	0.693	0.686	-1.04
7	0.665	0.662	-0.35	22	0.695	0.688	-1.09
8	0.667	0.664	-0.40	23	0.697	0.689	-1.14
9	0.669	0.666	-0.45	24	0.699	0.691	-1.19
10	0.671	0.667	-0.50	25	0.701	0.693	-1.24
11	0.673	0.669	-0.55	26	0.704	0.694	-1.29
12	0.675	0.671	-0.60	27	0.706	0.696	-1.34
13	0.677	0.672	-0.65	28	0.708	0.698	-1.39
14	0.679	0.674	-0.70	29	0.710	0.700	-1.44
15	0.681	0.676	-0.75	30	0.712	0.701	-1.48

## 12. Greenhouse Challenge Plus

NewGen will become a member of the Commonwealth Government's Greenhouse Challenge Plus programme.

## 13. Greenhouse Gas Abatement Programme availability

The Greenhouse Gas Abatement Programme will be made publicly available by the following means:

- Free copies of the GGAP, when approved by the DEC for release, will be provided to – the DEC library (2 copies), City of Wanneroo public libraries (2 copies), and JS Battye library (2 copies);
- The GGAP will be posted on the NewGen Power website [www.newgenpower.com.au](http://www.newgenpower.com.au); and
- DEC will be requested to advertise the availability of the GGAP in the “West Australian” newspaper.

During the impact assessment phase comments were received from the following stakeholders:

- Department of Environment and Conservation (DEC);
- EPA;
- Western Australian Planning Commission (WAPC);
- Department of Water (DoW);
- Department for Planning and Infrastructure (DPI);
- Local Member Dianne Guise;
- City of Wanneroo;
- Western Power Corporation;
- Conservation Council of Western Australia Inc;
- Forest Products Commission; and
- Residents and Landowners.



## 14. Compliance review

Table 4 is a summary of sections of the Greenhouse Gas Abatement Programme that address the Minister for the Environment's conditions of approval.

**Table 4: Compliance Review - Minister for the Environment Approval and Schedule 2, EPA Specifications for the content of the Greenhouse Gas Abatement Programme**

Condition number	Condition Text	GGAP Section
<b>10</b>	<b>Greenhouse Gas Abatement</b>	
10-1	<p>Prior to commencement of ground-disturbing activities, the proponent shall submit, for approval by the CEO, a Greenhouse Gas Abatement Programme, prepared on advice of the Environmental Protection Authority as set out in Schedule 2, which sets out measures and processes to:</p> <ul style="list-style-type: none"> <li>• ensure that the plant is designed and operated in a manner which achieves reductions in "greenhouse gas" emissions as far as practicable</li> <li>• provide for ongoing "greenhouse gas" emissions reductions over time;</li> <li>• ensure that the total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product from the project are minimised; and</li> <li>• manage "greenhouse gas" emissions in accordance with the <i>Framework Convention on Climate Change 1992</i>, and consistent with the contemporary National Greenhouse Strategy as updated from time to time.</li> </ul>	2, 5, 6, 9, 10, 11, 12
		5, 8, 11
		2, 5, 6, 9, 11
		2
10-2	The proponent shall implement the Greenhouse Gas Abatement Programme required by condition 10-1 unless modifications are approved by the CEO.	All
10-3	Prior to commencement of ground-disturbing activities, the proponent shall make the Greenhouse Gas Abatement Programme required by condition 10-1 publicly available in a manner approved by the CEO.	13
<b>Schedule 2</b>	<b>Specifications for the content of the Greenhouse Gas Abatement Programme</b>	
(1)	calculation of the "greenhouse gas" emissions associated with the proposal;	6, 8, 11
(2)	specific measures to minimise the total net "greenhouse gas" emissions and/or the "greenhouse gas" emissions per unit of product associated with the proposal using a combination of "no regrets" and "beyond no regrets" measures;	5
(3)	consideration of the implementation of "greenhouse gas" offset strategies;	7
(4)	estimation of the "greenhouse gas" efficiency of the project (per unit of product and/or other agreed performance indicators) and comparison with the efficiencies of other comparable projects producing a similar product, both within Australia and overseas;	6
(5)	implementation of thermal efficiency design and operating goals consistent with the Australian Greenhouse Office Technical Efficiency guidelines in design and operational management;	2, 5, 6, 8, 9, 11, 12
(6)	actions for the monitoring, regular auditing and annual reporting of "greenhouse gas" emissions and emission reduction strategies;	8, 9, 10, 11
(7)	a target set by the proponent for the progressive reduction of total net "greenhouse gas" emissions and/or "greenhouse gas" emissions per unit of product and as a percentage of total emissions over time, and annual reporting of progress made in achieving this target. Consideration should be given to the use of renewable energy sources such as solar, wind or hydro power;	11
(8)	a program to achieve reduction in "greenhouse gas" emissions, consistent with the target referred to in (7) above;	5
(9)	<p>entry, whether on a project-specific basis, company-wide arrangement or within an industrial grouping, as appropriate, into the Commonwealth Government's "Greenhouse Challenge" voluntary cooperative agreement program, which includes:</p> <ol style="list-style-type: none"> <li>1. an inventory of emissions;</li> <li>2. opportunities for abating "greenhouse gas" emissions in the organisation;</li> <li>3. a "greenhouse gas" mitigation action plan;</li> <li>4. regular monitoring and reporting of performance;</li> <li>5. independent performance verification</li> </ol>	12
(10)	review of practices and available technology;	5, 10
(11)	"continuous improvement approach" so that advances in technology and potential operational improvements of plant performance are adopted.	5, 10

## **15. References**

Australian Greenhouse Office 2006, Technical Guidelines: Generator Efficiency Standards.

Katestone Environmental 2007, Air Quality Assessment of the Proposed NewGen 330 MW Gas-Fired Power Station, Report from Katestone Environmental to ERM Power Pty Ltd, July 2007.

Western Power (2005), Annual Report 2005, Western Power Corporation.

## **16. Acknowledgements**

This document has been prepared for NewGen Power by Katestone Environmental Pty Ltd.