Pinjarra Alumina Refinery Efficiency Upgrade

Alcoa World Alumina Australia

Greenhouse Gas Management Plan

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EXECUTIVE SUMMARY

The greenhouse effect is a natural phenomenon that warms the earth and enables it to support life (EPA, 2002). The term greenhouse gases typically refers to emissions of carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_x), nitrogen dioxide (NO_2) and some volatile organic compounds (VOCs). Since the pre-industrial era, human activities have significantly increased the atmospheric concentrations of greenhouse gases, particularly emissions of carbon dioxide (CO_2), which is believed to have trapped more heat within the earth's atmosphere leading to climate change. Concern over climate change has lead to an increase in research and reporting from industry.

Purpose

The purpose of this Greenhouse Management Plan is to address the changes to greenhouse gas emissions associated with the Pinjarra Efficiency Upgrade Project. The Environmental Protection Statement (EPS) submitted to the Department of Environment for the Efficiency Upgrade, made commitments to improve energy and reduce greenhouse gas emissions. These commitments were subsequently included within Ministerial Statement 646 (Appendix 1).

Energy Saving Initiatives

A number of key energy saving initiatives will be incorporated into the design of the Efficiency Upgrade to further improve Pinjarra Refinery's overall energy efficiency. The focus is on energy transfer through heat exchange and increasing the rate of yield of alumina through the installation of a new "seed" filtration facility.

Emission Reduction Targets

Alcoa World Alumina recognises greenhouse gas as a global issue and took a corporate leadership position of voluntarily committing to reduce its direct greenhouse gas emissions on a worldwide basis by 25%. The goal has a baseline year of 1990 and is scheduled to be met by 2010. This reduction was irrespective of increase in alumina and/or aluminium production capacity that may be achieved over this period. Alcoa achieved this global goal in 2003; Pinjarra Refinery contributed by reducing its greenhouse gas intensity by almost 6.3% over this period. An additional 3.7% improvement is expected from the Pinjarra Efficiency Upgrade which is predicted to climb to 6.4% with both the Upgrade and Alinta Cogeneration project Unit 1 and to 8.3% with Alinta Cogeneration project Unit 2, making Pinjarra refinery one of the most energy efficient refineries in Australia and throughout the world.

Industry Benchmarking

During the 2004 calendar year Pinjarra refinery operated at an average energy efficiency of 10,600 MJ/t of alumina. In comparison, the world-wide weighted average energy efficiency was 11,644 MJ/t of alumina (International Aluminium Institute IAI, 2000). The Australian average energy efficiency was 11,000 MJ/t alumina determined during the Energy Efficiency Best Practice, study (Australia Aluminium Industry, 2000) commissioned by the Commonwealth Government.

Reporting

Alcoa has voluntarily committed to reducing and reporting on greenhouse emissions. As a member of the Greenhouse Challenge, annual emission inventory progress reports describing, abatement activities and forecasted emissions are provided to the Commonwealth Government. In addition Alcoa Pinjarra has a regulatory reporting requirement to submit to the State Government Department of Environment (DoE) and the Department of Industry and Resources (DoIR) an Annual Environmental Review. This report contains applicable greenhouse gas monitoring data as well as information relating to greenhouse gas emission performance and improvement activities. Alcoa Australia produces an Annual Sustainability Report which details all aspects of environmental, social and economic management of its facilities within Australia. This report includes greenhouse gas management processes, greenhouse gas emission reduction initiatives and provides an update on greenhouse gas emission levels and progress towards achieving its reduction targets. The report is made available to the public through community consultation forums, within various libraries as well as on the Alcoa web site. Alcoa has also signed a Deed of Agreement with the Western Australian Government on efficiency standards for power generation and is participating in the Energy Efficiency Best Practice Program.

Greenhouse gas emission data is expressed as intensity (i.e. the number of tonnes of carbon dioxide per tonne of product) and relates to both direct and indirect emissions. Direct emissions are produced from sources within the boundary of the organisation and as a result of that organisation's activities (AGO 2004). Direct emissions are divided into two components i.e. Scope 1, an organisation's direct emissions as noted above, and Scope 2, an organisation's emissions associated with the generation of electricity, heating/cooling or steam purchased for its own consumption, World Business Council for Sustainable Development (WBCSD 2004). Indirect emissions (Scope 3), are generated in the wider economy and produced by the activities of another organisation (AGO 2004).

Alcoa calculates greenhouse gas emissions according to AGO (AGO 2004), EPA guidance document No. 12 (EPA 2002) and the WBCSD methodology (WBCSD 2004). To summarise; the types and quantity of fuel consumed for each scope are defined. The quantity of each is then multiplied by a carbon dioxide (CO_2) "factor" for that fuel type (The factor is supplied by the AGO and the

calculation results in the number of kilograms of CO_2 for that fuel type). The CO_2 quantities are summed and then divided by the number of tonnes of product produced that year. This provides kilograms of CO_2 per tonne of product i.e. the greenhouse gas intensity for each scope. The relevant scopes are subsequently summed to provide the organisation's greenhouse gas intensity.

The Scopes used for reporting vary according to the reporting purpose. For example, the reporting methodology specified by the Australian Greenhouse Office (AGO) includes scopes 1, 2 and 3 where as WBCSD guidelines only require scopes 1 and 2 as this reduces the potential for double counting CO_2 emissions from raw materials produced by upstream organisations and allows comparison of organisations around the world. These two methodologies can result in two different greenhouse gas intensity numbers for the same organisation.

The greenhouse gas intensity for Alcoa Pinjarra Refinery in 2004 was calculated to be:

Scope	***Australian Greenhouse Office***	***World Business Council for Sustainable Development***
Scope 1	*564 CO_2/t alumina*	*564 CO2/t alumina*
Scope 2	*5 kg CO_2/t alumina*	*5 kg CO2/t alumina*
Scope 3	*78kg CO_2/t alumina*	
Total	***646 kg CO_2/t alumina***	***569 CO_2/t alumina***

Conclusion

This Greenhouse Gas Management Plan has been prepared in accordance with Alcoa's greenhouse management policy, national and international conventions and Ministerial Statement 646 Item 9.

The plan specifically addresses the changes to Greenhouse gas emissions associated with the Pinjarra Efficiency Upgrade Project. The main elements of the plan are:

- *Baseline emissions inventory,*
- *Industry benchmarking,*
- *Emission reduction targets,*
- *Project abatement measures and*
- *Reporting progress.*

1 INTRODUCTION

1.1 GREENHOUSE GAS EMISSIONS

The greenhouse effect is a natural phenomenon that warms the earth and enables it to support life (EPA, 2002). The term greenhouse gas typically refers to emissions of carbon dioxide (CO_2), methane (CH_4), nitrogen oxides (NO_x) and some volatile organic compounds (VOCs). Since the pre-industrial era, human activities have significantly increased the atmospheric concentrations of greenhouse gases, particularly emissions of carbon dioxide. This has trapped more heat within the earth's atmosphere and is believed to be resulting in changed climatic conditions. Concern over climate change has lead to an increase in research and reporting of greenhouse gas emissions from industry.

1.2 ALCOA'S CLIMATE CHANGE POLICY

Alcoa World Alumina believes that available evidence indicates greenhouse gas emissions from human activities affect climate on a global scale. Alcoa manages greenhouse gas emissions on a global scale, by operating consistently within its corporate values and national and local requirements. Alcoa is committed to:

- Continuing to improve energy efficiency in all of its operations; and
- Improving its operations where practicable by implementing best practice technologies to reduce greenhouse gas emissions.

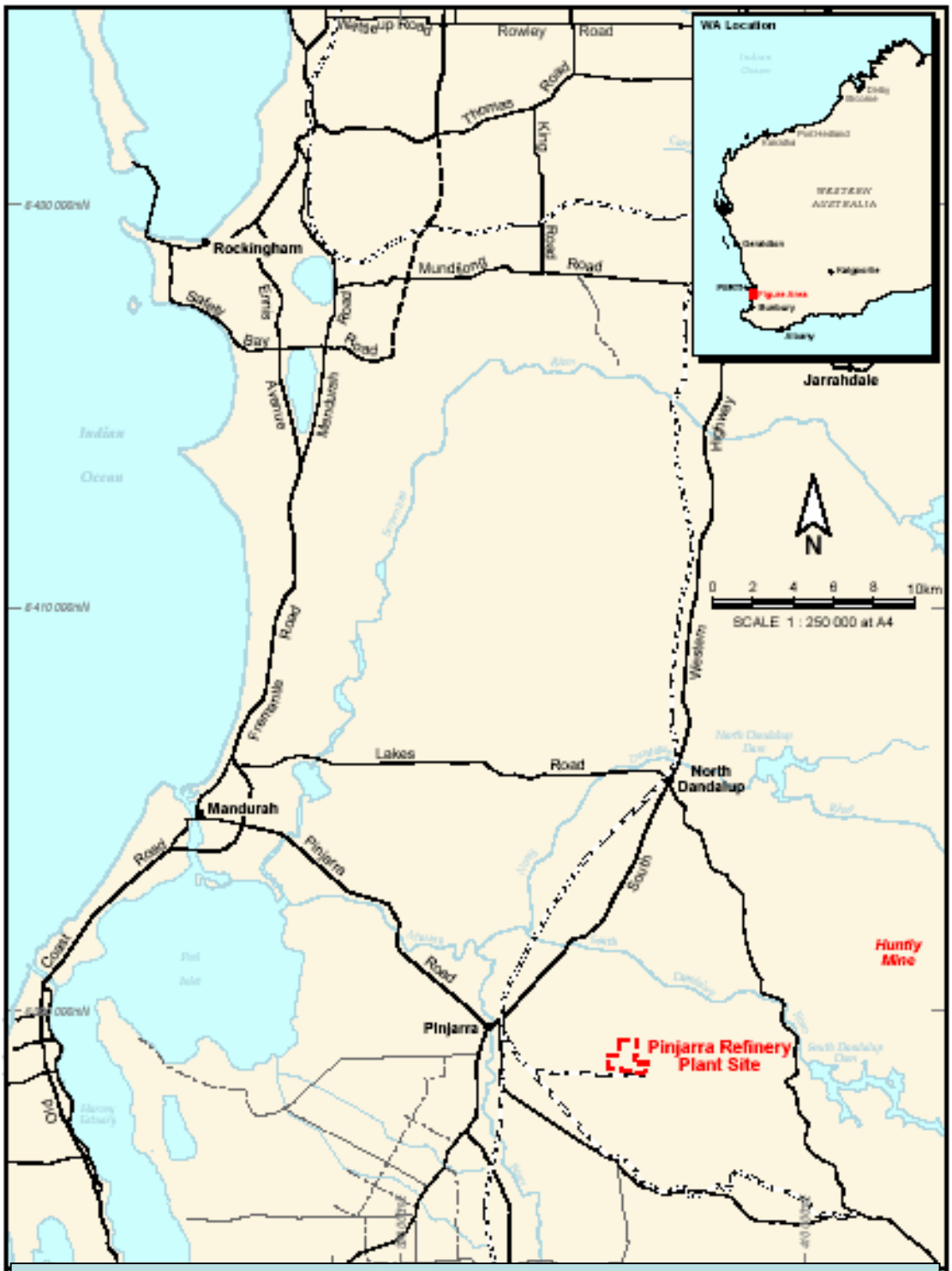
1.3 PURPOSE OF THIS MANAGEMENT PLAN

Within the submission for environmental regulatory approval for the Pinjarra Efficiency Upgrade Alcoa made commitments to achieve reductions in the greenhouse gas emissions intensity and maintain involvement in research and development programs. These commitments were subsequently included within Ministerial Statement 646 item 9 which requested that a Greenhouse Management Plan be created to encompass the changes associated with the Efficiency Upgrade and submitted prior to commissioning of the project. The ministerial conditions also outlined specific elements to address within the plan. Therefore this Greenhouse Gas Management Plan has been prepared in accordance with Alcoa's greenhouse management policy and the relevant Ministerial conditions. Refer to Appendix A for a complete list of these conditions.

Specifically, the purpose of this Greenhouse Management Plan is to:

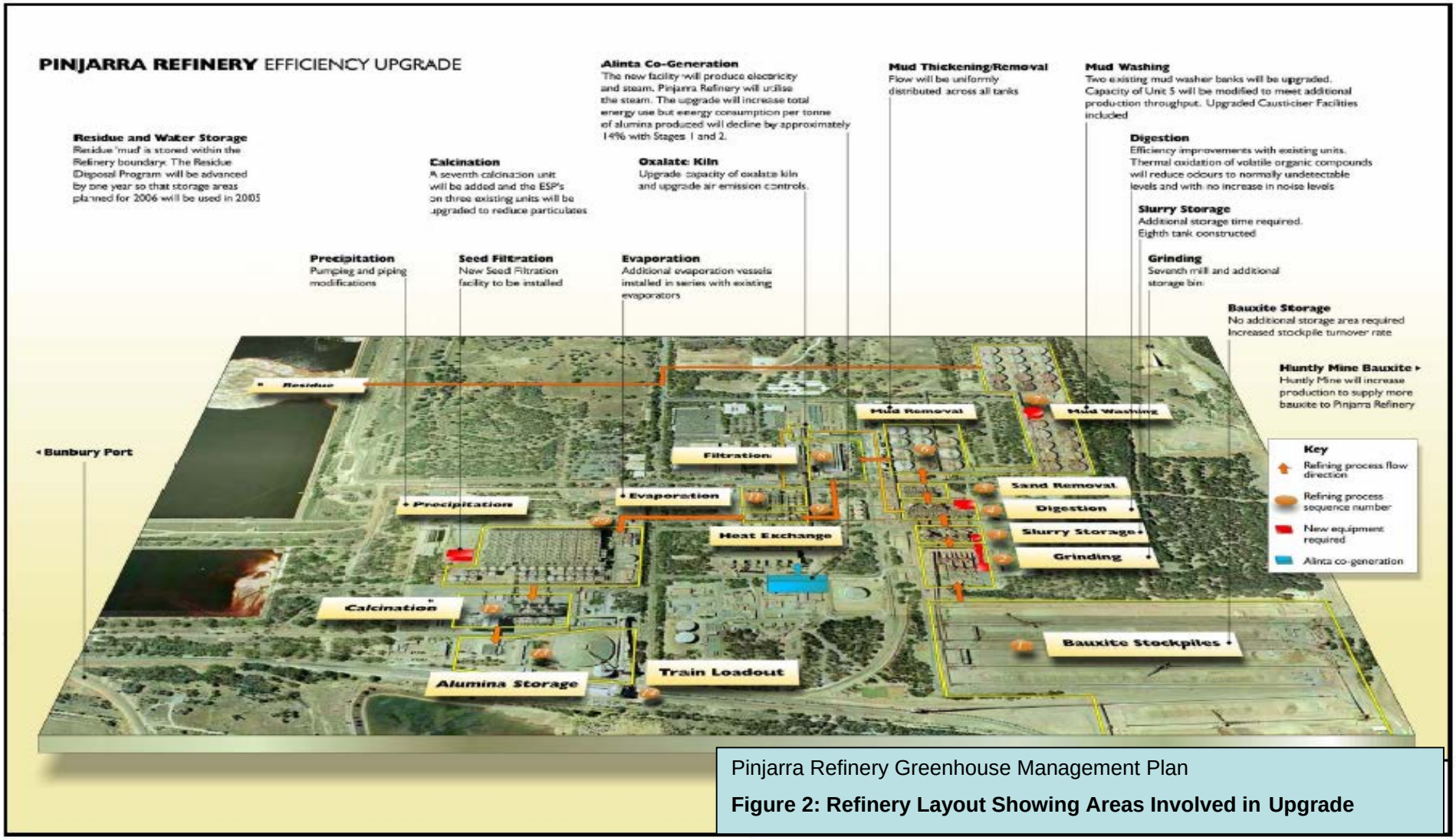
- Ensure that through the use of best practice, the total net greenhouse emissions and/or greenhouse gas emissions per unit of product are minimised; and
- Manage greenhouse gas emissions in accordance with the Framework Convention on Climate Change 1992, which is consistent with the National Greenhouse Strategy and the requirements of the Minister for the Environment.

The location of the refinery within Western Australia is shown in Figure 1 and an overview of the key process areas associated with the Efficiency Upgrade is depicted in Figure 2.



Pinjarra Refinery Greenhouse Management Plan

Figure 1: Regional Location Map



Pinjarra Refinery Greenhouse Management Plan

Figure 2: Refinery Layout Showing Areas Involved in Upgrade

2 EMISSION REDUCTION TARGETS

2.1 ALCOA WORLD ALUMINA GREENHOUSE TARGETS

In line with Alcoa's Greenhouse Policy, Alcoa World Alumina took a corporate leadership position by voluntarily committing to reduce its direct greenhouse gas emissions on a worldwide basis by 25%. This goal is estimated from a baseline year of 1990 and is scheduled to be met by 2010. The reduction was irrespective of increase in alumina and/or aluminium production capacity that may be achieved over this period. Alcoa achieved this global goal in 2003 and continues to voluntarily research and where practicable implement greenhouse gas reduction initiatives.

Alcoa World Alumina, Australia (Alcoa) has been a signatory to the voluntary Greenhouse Challenge through the Australia Alumina Council since 1996 and Pinjarra Refinery has been a member since 1997. Signatories to the Greenhouse Challenge are committed to reducing greenhouse emissions, providing annual progress reports to the Commonwealth Government along with proposed actions to assist in reducing future emissions. This is consistent with Action 2.1.5 of the Western Australian Greenhouse Strategy (DoE 2004) which encourages organisations to report greenhouse gas emissions and develop reduction strategies.

2.2 PINJARRA REFINERY GREENHOUSE TARGETS

Since 1996 Pinjarra refinery has consistently reduced its greenhouse gas intensity through process changes to improve the yield of alumina, and improvements to the heat exchange efficiency. Pinjarra refinery made a significant contribution towards achieving the global 2010 target by improving the efficiency of it operations by 6.3% since 1990. The overall improvement is expected to climb to 12% with the Pinjarra Efficiency Upgrade and Alinta Cogeneration Unit 1 and 14% with Alinta Cogeneration project Unit 2.

2.3 PINJARRA EFFICIENCY UPGRADE GREENHOUSE TARGETS

At Pinjarra, alumina production capacity will be increased to approximately 4.2 million tonnes per annum through the Pinjarra Efficiency Upgrade Project and will incorporate a number of key energy saving initiatives. The focus will be on energy transfer through heat exchange and increasing the rate of yield of alumina through the installation of a new "seed" filtration facility. The Pinjarra Efficiency Upgrade is expected to provide a 3.7% improvement in greenhouse gas intensity for the refinery operations and 8.3% when combined with Alinta Cogeneration. Reducing greenhouse intensity is a key focus for Alcoa's growth projects.

3 GREENHOUSE GAS EMISSION INVENTORY

3.1 ESTIMATING EMISSIONS

Alcoa has used the internationally recognised reporting protocol from the World Business Council for Sustainable Development (WBCSD) methodology for calculating greenhouse gas emissions since 2003. The calculation methods are similar to those of the AGO other than inclusion of Scope 3. WBCSD do not require upstream indirect emissions (Scope 3) as this improves consistency of reporting, reduces the potential for double counting and allows for comparison across more organisations.

The greenhouse gas emission calculation relies upon multiplying the amount of energy consumed by an emission "factor" which is specific to fuel type. For Pinjarra refinery, the AGO advised emission factors have been used for natural gas, i.e. 52.7 kg of CO_2/GJ direct emissions (scope 1 and 2) and 7.3 kg of CO_2/GJ from indirect emissions upstream (scope 3) for a total of 60.0 kg of CO_2 per GJ of energy (See Figure 3). Using the WBCSD method the 2004 emissions factor for natural gas used by Pinjarra refinery is 52.7 kg of CO_2/GJ.

The AGO emission factors are based on state or national averages and are updated annually to reflect changing information on Australia's emission sources; such as the composition of the fuel mix used to produce electricity. Therefore, changes in estimated emissions can occur from year to year depending on the reliability of the factor that has been derived and made available by the AGO. http://www.greenhouse.gov.au/workbook/index.html (Example: Figure 4, year 2002)

The national greenhouse gas emission inventory also considers carbon sinks where greenhouse gases are removed from the atmosphere, for example carbon sequestration by trees and soil. For example the emissions associated with clearing and soil carbon loss at the mines are expected to be partially off-set by the mine rehabilitation program.

For the purposes of benchmarking within the same type of industry, greenhouse gas emissions are presented as greenhouse gas intensity (i.e. greenhouse gas emission per unit of product). This allows emissions produced within Australia to be compared internationally. The most significant greenhouse gas contribution from the refinery arises from the release of carbon dioxide which is a direct result of combustion activities. Carbon Dioxide is the main substance emitted and quantities of other greenhouse gases, such as NO_x and VOCs, are considered to be negligible in comparison.

3.2 PINJARRA'S BASELINE INVENTORY

The trend in Pinjarra Refinery's greenhouse gas intensity since 1990 is depicted in Figure 4 and demonstrates Alcoa's continued achievement in reducing emissions. This decrease has been a result of incremental improvements in the refinery's energy efficiency. The increase in early to mid 1990s was due primarily to the installation of an Alumina Leach Drying (ALD) process to improve product quality.

In 2004 the total estimated greenhouse gas emissions for Pinjarra Refinery were 2.01 Mt of CO_2 (Scope 1 and 2) which equates to 569 kg of CO_2/t alumina and 0.27 Mt of CO_2 which equates to 78 kg of CO_2/t alumina (Scope 3).

3.3 PREDICTED EFFICIENCY UPGRADE INVENTORY

Due to additional steam, electricity and natural gas required for the Efficiency Upgrade, preliminary designs indicated a potential increase in net greenhouse gas emissions. Energy saving initiatives were subsequently incorporated into the design (refer to Section 4.1).

Completion of the Efficiency Upgrade and the first unit of Alinta Cogeneration Project is expected in 2006. It is anticipated that the greenhouse gas intensity will reduce to approximately 533 kg CO_2/t alumina representing an improvement of 6.3% compared to 2004 and almost 12% compared to 1990.

When the second unit of the Alinta Cogeneration Project (ENVIRON, 2002, 2003a) is completed further energy savings will be achieved at the Pinjarra refinery resulting in the greenhouse gas intensity reducing to approximately 507 CO_2/t alumina (Scope 1 and Scope 2). The combined effect of the Efficiency Upgrade and the Alinta Cogeneration Project will equate to an annual saving in greenhouse gas emissions of approximately 10% relative to the 2004 baseline, and approximately 14% relative to the 1990 baseline.

Table 1 below shows the intensity and total tonnes CO_2 for Pinjarra Refinery, Pre Efficiency Upgrade (2004) and Estimated for Post Efficiency Upgrade (2006) (Includes 2 Alinta Cogeneration Units and is calculated against forecast production rates). Figures for the AGO and WBCSD greenhouse gas intensity are shown.

The results show a significant reduction in Greenhouse gas intensity and a slight rise in total tonnes of CO_2. This is in line with the increased production and is primarily due to the seventh Calciner unit.

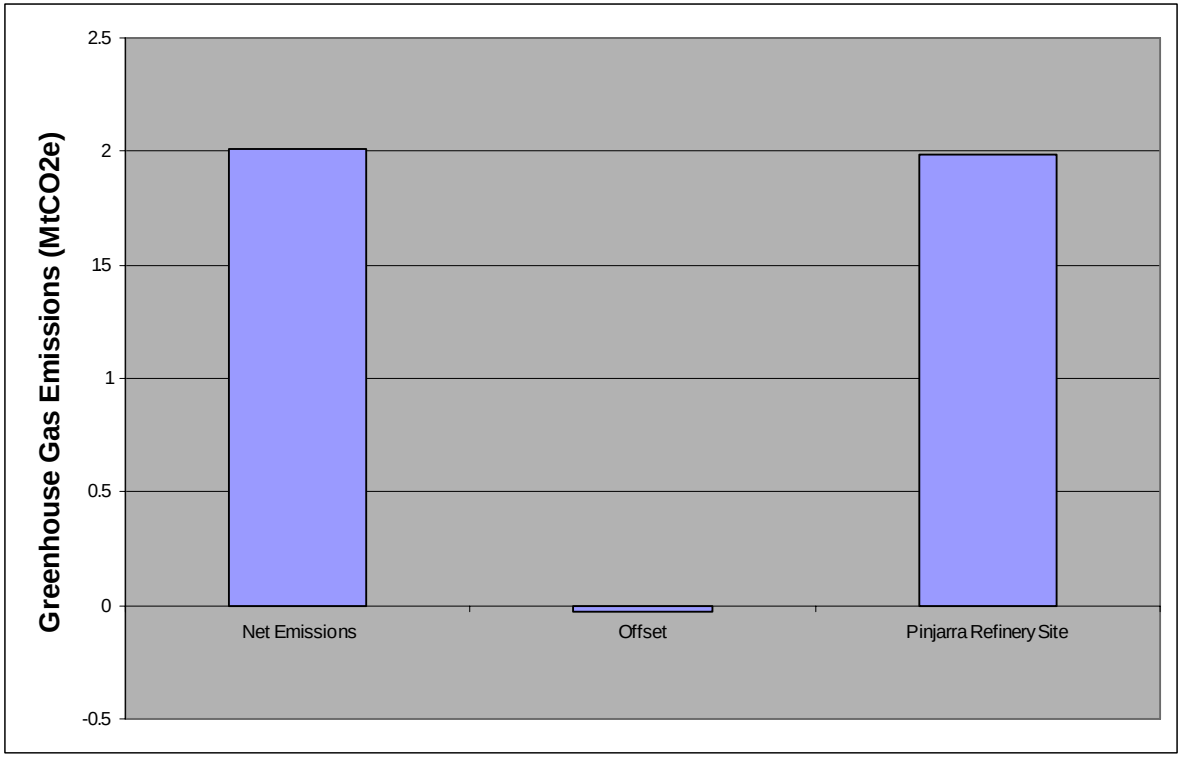
Table 1: Energy Saving Initiatives

AGO Method Scope 1, 2 & 3	2004 CO_2/t alumina	2006 *Estimated* e.CO_2/t / Al	Intensity Comparison to 2004 (%)	Intensity Comparison to 1990 (%)	2004 Mt CO_2	2006 Mt CO_2 *Estimated*
Scope 1	**564**	**517**				
Scope 2	**5**	**5**				
Scope 3	**78**	**72**				
AGO	**646**	**594**				
WBCSD	**569**	**522**	**-8.3%**	**-14%**	**2.01**	**2.28**

Table 2 below shows the greenhouse gas intensity for Pinjarra Refinery, Pre Efficiency Upgrade (2004) compared to other Alcoa refineries for 2004. Figures for the AGO and WBCSD greenhouse gas intensity are also shown.

Table 2: Greenhouse Gas Intensity Comparison to Other Refineries

AGO Method Scope 1, 2 & 3	Pinjarra 2004 CO_2/t alumina	Kwinana 2004 CO_2/t alumina	Wagerup 2004 CO_2/t alumina
Scope 1	**564**	**652**	**567**
Scope 2	**5**	**5**	**1**
Scope 3	**78**	**90**	**78**
AGO	**646**	**747**	**646**
WBCSD	**569**	**657**	**567**



Pinjarra Refinery Site		%	%
Natural Gas Combustion Stationary Sources	Power house boilers	68	
	Calciners	31	
	Oxalate kiln	0	
	Alumina Leach Dryer	1	
			96
Diesel Combustion - Stationary Sources (i.e. power house boilers)			3
Organic Combustion (i.e oxalate kiln)			0
Other fuels combustion - Stationary			0
Petrol / Diesel Combustion (i.e. all on road vehicles			0
Process Emissions (i.e. non combustion emissions from the Alumoina Leach			0
SEC power			1
			100%

Offset		%
Causticisation		69
Residue Surface Carbonation		17
Residue Surface Carbonation		14
		100

Notes:

1. **Does not include raw materials and product transportation to and from the Pinjarra refinery, but does include motor vehicle use on the refinery site.**
2. **Total Greenhouse Gas Emissions reported using the WBCSD method (Scope 1 and 2)**

Figure 3
Summary of the Pinjarra Refinery 2004 Greenhouse Gas Emissions Inventory (Scope 1 and 2).

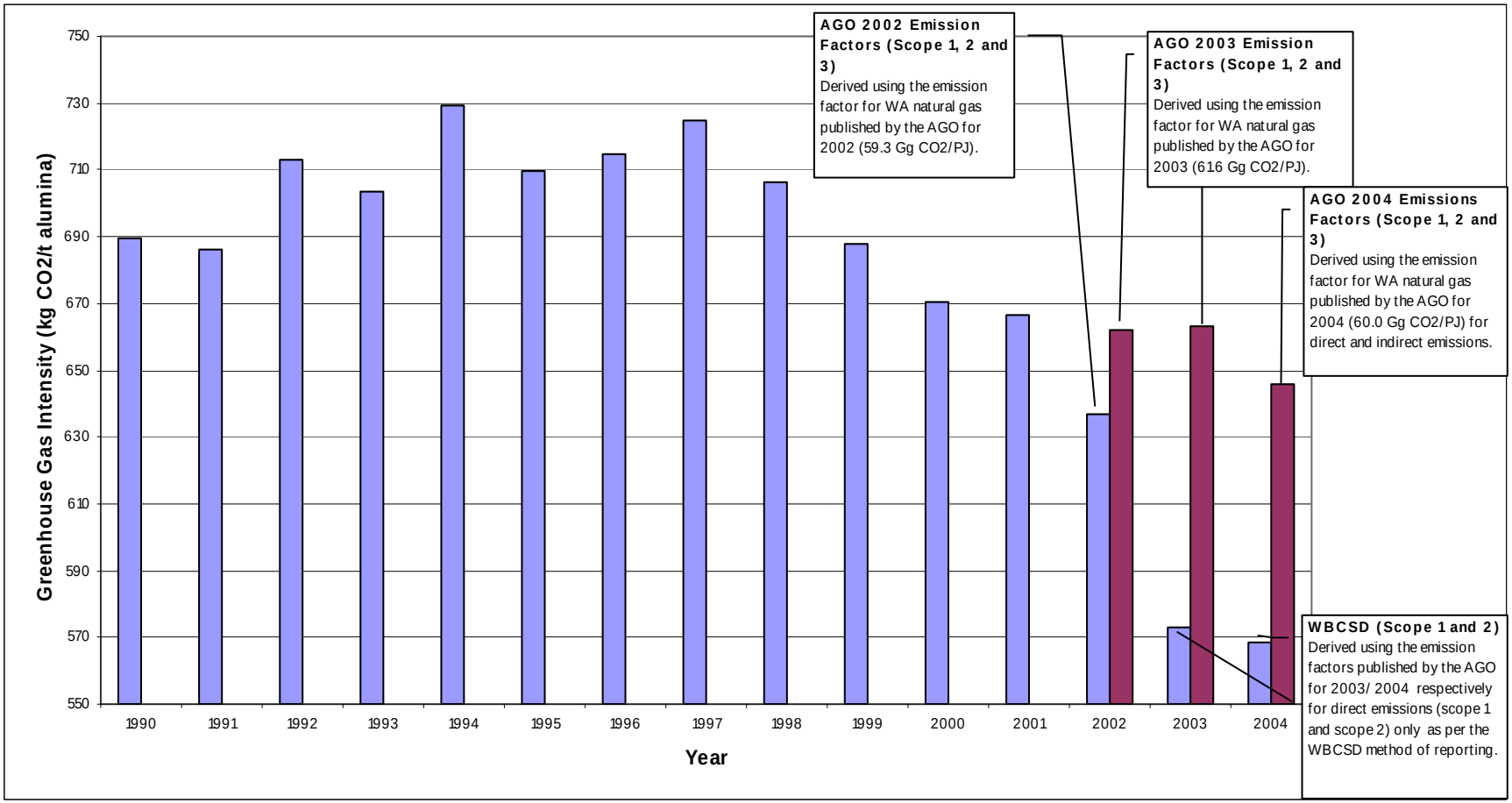


Figure 4
Trend in Greenhouse Gas Intensity to the Pinjarra Refinery – 1990 to 2004.

4 ENERGY SAVING INITIATIVES

The Pinjarra Refinery has already achieved favourable reductions in green house gas intensity (from the baseline emissions in 1990). Further energy saving initiatives (as part of the Pinjarra Upgrade) are discussed below. As the refinery has already achieved favourable reductions in greenhouse gas intensity, this will place limitations on further improvements once the Upgrade is complete and ultimately on further reductions in greenhouse gas intensity in the near future. Further significant reductions are unlikely again until future upgrades leading to efficiency improvements are undertaken.

Alcoa is currently registered in the Energy Efficiency Opportunity Program (Energy Efficiency Opportunity Act, 2006) and will be completing a full energy assessment and public report of Pinjarra Refinery.

4.1 EFFICIENCY UPGRADE

A number of key energy saving initiatives will be incorporated into the design of the equipment to be installed as part of the Efficiency Upgrade and existing Greenhouse Action Plan to further improve the Pinjarra refinery's overall energy efficiency, including:

- The installation of a new "seed" filtration facility will increase the yield of alumina allowing an increase in production at low incremental energy use
- Re-use blow-off vapour steam from digestion via the 35J vapour line (causticisation) will optimise heat-exchange recovery and provide approximately 0.3 GJ/t of alumina energy saving.
- Improve acid wash effectiveness by automation of the evaporation wash system thereby increasing the efficiency of heat recovery,

4.2 ALINTA COGENERATION PROJECT

Efficiency gains will be achieved via the Pinjarra Efficiency Upgrade and via a cogeneration agreement between Alinta gas and Alcoa. As well as providing power to the main grid via an internal combustion power plant located immediately adjacent to the Alcoa site, Alinta is to provide Alcoa a specified amount of electricity and steam. This is an excellent example of industrial synergy where the waste from one industry is used as a raw material in the next resulting in this instance in less greenhouse gas emissions.

5 ALUMINA INDUSTRY GREENHOUSE GAS EFFICIENCY BENCHMARKS

The Australian alumina industry is relatively efficient in comparison with other countries. According to estimates from the International Aluminium Institute (IAI) the Australian industry has one of the lowest energy consumption rates per tonne of alumina production in the world. A comparison of the energy efficiency of the Pinjarra Refinery against other alumina industrial regions for 2003 is detailed in Table 2 below (the latest figures provided by the International Alumina Institute at the time of preparing this report).

Table 3: Energy Efficiency Statistics for the Alumina Industry

Region	Energy Used per Alumina Produced (MJ/tonne of alumina)
Africa and South Asia*	14,536
Europe*	12,312
Latin America*	11,112
East Asia # and Australia*	11,745
Australia	*11,000*
North America*	10,927
Pinjarra Refinery	*10,600*
World-wide Weighted Average	11,644

Source: International Aluminium Institute Statistics Report (IAI, 2004) *

Notes: # Normally includes China, Japan and South Korea. Reports only received from Japan in 2003.

A study into Energy Efficiency Best Practice in the Australian aluminium industry was commissioned in 2000 by the Commonwealth Government (DoISR, 2000). The study surveyed all six alumina refineries in operation in Australia at the time, and found that the average energy consumption was approximately 11,000 MJ/t of alumina produced with Pinjarra Refinery's energy efficiency being 10,600 MJ/t. After the Efficiency Upgrade and the Alinta Cogeneration Project are fully operational, the energy efficiency of Pinjarra refinery will be further improved. Publicly reported greenhouse gas emission information for the existing and proposed alumina refineries throughout Australia indicates that Pinjarra refinery has the lowest greenhouse gas intensity within the Australian alumina industry.

6 EXISTING GREENHOUSE ABATEMENT MEASURES

6.1 ALUMINIUM LIFE CYCLE ASSESMENT

Life Cycle Assessment (LCA) is a scientific tool for the evaluation of environmental effects of products and services through the complete life cycle; known as "cradle to grave" This includes consideration of extraction of raw material, processing (i.e. refining and smelting), fabrication, transportation, use, recycling and ultimately disposal. (Environ, 2003). A comprehensive LCA has been conducted by Alcoa for aluminium production.

Aluminium itself contributes to reducing greenhouse emissions through the energy efficiencies it gains from its lightness and recyclability. For example, the increasing use of aluminium in the automotive industry is producing vehicles which are significantly lighter than traditional steel vehicles and use less fuel.

6.2 ESTABLISHEMENT AND MAINTENANCE OF PERENNIAL VEGETATION

Alcoa supports landscape restoration projects under the Alcoa Landcare Project and related community partnerships. In addition Alcoa supports ecological restoration and conservation projects such as the current sponsorship of the Alcoa Jarrah-Tuart Restoration Project at Kings Park Botanic Garden, WWF Australia's Woodland Watch, Greening Australia's Living Landscapes projects and wetland creation and development on its sites in WA.

6.3 RENEWABLE FUELS

Action 2.1.15 of the Western Australian Greenhouse Strategy states that the Western Australian government will continue to support the use of renewable energy and the development of renewable energy technologies throughout the state. Alcoa supports renewable energy demonstration projects such as the wind turbine installation at Fairbridge Village. Alcoa has also conducted feasibility studies on the use of mine clearing wood residue for power generation or biofuel.

6.4 OTHER ENERGY EFFICIENCY ACHIEVEMENTS IN WESTERN AUSTRALIA

In the ten years prior to 2005, Alcoa imported minor quantities of electrical power from the grid and generated the remainder onsite at a steam turbine power plant via the combustion of natural gas. Incremental efficiency improvements have been implemented during this time. These were in the form of increases in plant utilisation and minor plant modifications.

7 RESEARCH AND DEVELOPMENT

Alcoa spends more than $23 million on research and development in Australia each year to ensure that its alumina refineries are among the most efficient in the world and can achieve ongoing reductions in the future. One of Alcoa's research and development programs with the potential to deliver significant greenhouse gas emission benefits is residue carbonation. The residue carbonation process developed by Alcoa involves the direct injection of carbon dioxide into the residue slurry, generated as a by-product of the Bayer alumina refining process. The carbon dioxide is acidic so neutralises the alkaline components of the slurry to form various carbonate (CO_3^{2-}) compounds. Carbonates are chemically stable and hence the process acts as a greenhouse gas emission sink. Residue carbonation has the potential to save approximately 35 kg CO_2/t of bauxite residue.

Combustion of natural gas in the powerhouse boilers contributes approximately two thirds of the net greenhouse gas emissions from the Pinjarra refinery with the remaining third from the calciners. Therefore research and development work into energy efficiency is primarily focused on these areas. Other combustion sources within the refinery contribute less than 2% to overall emissions.

8 MONITORING AND REPORTING PROGRESS

Alcoa maintains a comprehensive greenhouse gas emissions inventory that covers all of its operations. The emissions inventory data are derived using the estimation techniques recommended by the National Greenhouse Gas Inventory Committee, and also reported in accordance with the internationally recognised reporting protocol of the World Business Council for Sustainable Development/ World Resources Institute. The inventory data is reviewed on a regular basis to assess progress towards achieving the voluntary targets in greenhouse gas intensity established by Alcoa, and to assist in identifying opportunities for further reductions in greenhouse gas emissions.

As a signatory to the Commonwealth Government's Greenhouse Challenge Program, Alcoa submits ongoing progress reports of its emission inventory, abatement activities and forecasted emissions to the Australian Greenhouse Office (AGO). Alcoa also reports its greenhouse gas emissions in the Annual Environmental Review prepared for each of the refineries and is submitted to the DEC and the DoCEP as part of its regulatory reporting requirements. Information on Alcoa's greenhouse gas emissions and progress towards achieving its reduction targets are made available to the public in its annual Sustainability reports.

9 DEVELOPMENT OF THIS PLAN

In accordance with Ministerial Statement 646, Alcoa will provide a copy of this plan to the DEC Audit branch and provide a summary of the greenhouse gas emissions and intensity data to the DEC and DoIR within the Annual Environmental Report.

9.1 DEVELOPMENT OF MANAGEMENT PLAN

The following summary describes the milestones for development of this management plan:

July 2005	Summary presented to the Pinjarra Community Consultation Network (CCN)
August 2005	Detailed summary and discussion with the Environmental Improvement Plan (EIP) group for the Pinjarra Efficiency Upgrade
Q1 2007	Copy provided to Air Quality Management Branch of DEC

9.2 PUBLICATION

In accordance with the Ministerial Statement, following submission to the audit branch of the DEC the plan will be made publicly available to the wider community and general public. Alcoa will then request the DEC to advertise the availability of the plan for public comment within their weekly DEC / EPA advertisement found within each Monday's edition of 'The West Australian'. In addition Alcoa will also advertise within the locally available Coastal Times. Hardcopies of the plan will be available in government and local libraries as summarised below.

Table 4 Locations for viewing hardcopies of the plan.

Location	Address	Copies Available
DEC library	Westralia Square Level 8, 141 St Georges Terrace Perth WA 6000 Tel: +61-8-9222 7010	2 hardcopies
Battye Library	Battye Library. Located inside the Alexander Library Building, Cultural Centre, Perth WA 6000	2 hardcopies
Murray Shire Library	Located at the corner of Pinjarra Rd & Forrest St. Opening hours between 9.00am - 6.00pm Monday to Friday and 9.00am to 12.00pm on Saturdays.	2 hardcopies

9.3 CONCLUSION

Alcoa will continue to focus on reducing greenhouse gas emissions from its worldwide operations. Major improvements at individual sites become feasible when combined with major projects such as the Pinjarra Efficiency Upgrade. Ongoing efficiency improvements will continue to be investigated on an environmental, social and economic basis and where applicable implemented in the intervening years.

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Appendix A

Ministerial Conditions

This Greenhouse Gas Management Plan has been developed in accordance with the following Ministerial conditions related to greenhouse gas emissions management of the Pinjarra Refinery Efficiency Upgrade project:

9.1 Prior to commissioning, the proponent shall prepare a Greenhouse Gas Emissions Management Plan to: ensure that through the use of best practice, the total net greenhouse emissions and/or greenhouse gas emissions per unit of product are minimised; and manage greenhouse gas emissions in accordance with the Framework Convention on Climate Change 1992, and consistent with the National Greenhouse Strategy, to the requirements of the Minister for the Environment on advice from the EPA.

This plan shall include:

1. *Calculation of the greenhouse gas emissions associated with the proposal, as advised by the EPA (Note: current requirement are set out in an EPA guidance document).*

2. *Estimation of the greenhouse gas efficiency of the project (per unit of product and/or other agreed performance indicator) and comparison with the efficiencies of other comparable projects producing a similar product, both within Australia and overseas.*

3. *Actions for the monitoring and annual reporting of greenhouse gas emissions and emissions reductions strategies.*

4. *A target set by the proponent for the reduction of total net greenhouse gas emissions and/or greenhouse gas emissions per unit of production and as a percentage of the total emissions over time, and annual reporting of progress made in achieving this target. Consideration should be given to a contribution from renewable energy sources such as solar, wind or hydro or conversion to cleaner energy sources (fuel swapping); and*

5. *Consideration by the proponent of 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. Components of the agreement program include:*

    a. *An inventory of emissions;*
    b. *Opportunities for abating greenhouse gas emissions in the organisation;*
    c. *Greenhouse gas mitigation action plan;*
    d. *Regular monitoring and reporting of performance; and*
    e. *Independent performance verification.*

9.2 The proponent shall implement the Greenhouse Gas Emissions Management Plan required by condition 9.1, to the requirements of the Minister for the Environment on advice of the EPA.

9.3 Prior to commissioning, the proponent shall make the Greenhouse Gas Emissions Management Plant required by Condition 9.1 publicly available, to the requirements of the Minister for the Environment on advice of the EPA.