Greenhouse Gas Appendix F

Report

Greenhouse Gas Impact Assessment: 5.5 MW Biomass Power Plant

26 FEBRUARY 2009

Prepared for

South East Fibre Exports

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Abbreviations

Abbreviation	Description
AAU	Assigned Amount Units (under the Kyoto Protocol)
AEMO	Australian Electricity Market Operator
AFS	Australian Forestry Standard
CH_4	Methane
CO_2	Carbon Dioxide
CO_2-e	Carbon Dioxide equivalent
CoC	Chain of Custody
CPRS	Carbon Pollution Reduction Scheme
DCC	Department of Climate Change (Federal)
DECCW	NSW Department of Environment, Climate Change and Water
EA	Environmental Assessment
EEO	Energy Efficiency Opportunities
FSC	Forest Stewardship Council
GGAS	NSW Greenhouse Gas Reduction Program
GHG	Greenhouse Gas
GWh	Gigawatt Hours
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardisation
LPG	Liquid Petroleum Gas
MRET	Mandatory Renewable Energy Target
Mt	Million tonnes
MW	Megawatt
MWh	Megawatt Hours
N_2O	Nitrous Oxide
NGA Factors	National Greenhouse Accounts Factors
NGAC	NSW Greenhouse Abatement Certificate
NGERS	National Greenhouse and Energy Reporting System
ORER	Office of the Renewable Energy Regulator
REC	Renewable Energy Certificate
RET	Renewable Energy Target
SEFE	South East Fibre Exports
t	Tonnes
UNFCCC	United Nations Framework Convention on Climate Change

Executive Summary

URS Australia Pty Ltd (URS) has been commissioned by South East Fibre Exports (SEFE) to undertake an assessment of the greenhouse gas (GHG) implications of the proposed 5.5 MW Biomass Power Plant (Power Plant) to be located within the existing Munganno Point mill site at Eden, NSW. This report forms part of the Environmental Assessment (EA) which supports the Project Application which has been lodged.

SEFE generates approximately 35,100 tonnes of wood waste each year, which at present is being disposed (incinerated) in the existing burner or sold as mulch to local markets. SEFE proposes to use the wood waste as fuel for the proposed Power Plant. The Power Plant would have a capacity of around 5.5 MW and would burn approximately 57,700 tonnes of wood waste to produce around 31 GWh of electricity per annum. Wood waste would be drawn primarily from SEFE's current operations with around 22,600 tonnes being obtained from local and regional saw mills. Electricity generated will be used to power existing operations at the mill site with excess provided to the grid.

Under current international accounting rules for energy, carbon dioxide emissions from combustion of biomass is not included in the national greenhouse accounts as they are considered as carbon neutral zero rated. Combustion of biomass also releases very small quantities of non-CO_2 gases. The guidance also indicates that cellulosic or lignocellulosic wastes which have no further economic uses including biomass wastes shall be "zero-rated" for CO_2 emissions, but emissions of CH_4 and N_2O shall be accounted for.

The greenhouse gas inventory for the Power Plant has been based on the accounting and reporting principles detailed within the Greenhouse Gas Protocol[1] (the Protocol). The inventory is based on the methodology detailed in the Protocol and relevant emissions factors in the National Greenhouse Accounts (NGA) Factors, June 2009. The current practice and proposed Power Plant emissions have been calculated on an estimated typical year of plant operation.

Greenhouse emissions were reported broken down into direct emissions (Scope 1), indirect emissions from electricity (Scope 2) and upstream and downstream emissions (selected Scope 3 emissions).

Emissions that fall inside the operational boundary for the greenhouse gas assessment comprised only those which would be modified as part of the proposal, and/or occur at a point beyond which the waste product was initially generated. It has been assumed that the prime site function of generating wood chips for sale will remain unchanged when the Power Plant is built, and hence was not included in the inventory.

Table 1 summarises the estimated emissions associated with the operation of the Power Plant on an annual basis. The greenhouse gas emissions associated with the project are estimated to be **1,314** tonnes carbon dioxide equivalent (CO_2-e) per annum.

[1] World Business Council for Sustainable Development & World Resources Institute (2004), The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard. Revised Edition.

Executive Summary

Table 1 Annual Power Plant Emissions

Emissions Scope		Emissions (tCO_2-e)
Scope 1		1,096
Scope 2		0
Scope 3	Upstream	214
	Downstream	4
	Total	219
Total		**1,314**

The impact that the Power Plant will have on greenhouse gas emissions is a decrease of 7,508 t CO_2-e per annum compared to the current practice, this is largely due to the increased transportation of material involved in the current practice scenario. An additional 1,350 t CO_2-e will be emitted as a result of construction of the Power Plant.

Sent out generation by the Power Plant will be 28 GWh per year (22 GWh sent to the grid and the remainder consumed by the SEFE site). This generation will offset the same quantity of generation per year which would have otherwise been produced from the NSW electricity production pool. The existing NSW grid emissions associated with the production of 28 GWh have been calculated as 24,900 CO_2-e pa, therefore operation of the Power Plant will result in reduction of approximately 23,600 t CO_2-e emissions. The greenhouse emissions intensity of the electricity produced at SEFE will be approximately 41 kg CO_2-e/MWh, a reduction of 849 kg CO_2-e compared to NSW pool electricity generation of 890 kg CO_2-e/MWh.

SEFE will not be required to participate in NGERS and the Carbon Pollution Reduction Scheme (CPRS) in relation to emissions from the Power Plant.

The Office of the Renewable Energy Regulator has confirmed that wood waste generated by SEFE and sawmill residue from third party sawmills would be eligible to create Renewable Energy Certificates (RECs) under this category of wood waste. It is estimated that SEFE would be eligible to generate approximately 26,000 RECs annually.

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Introduction

URS Australia Pty Ltd (URS) has undertaken an assessment of the greenhouse gas implications for the proposed Power Plant (Power Plant) to be located within the existing South East Fibre Exports mill site south of Eden, NSW.

This study forms part of the Environmental Assessment (EA) which supports the Project Application for the proposed facility.

1.1 Project Description

South East Fibre Exports (SEFE) proposes to build a 5.5 MW Wood Waste to Energy (Biomass) facility (Power Plant) at their existing woodchip mill and export facility located in Munganno Point, near Eden NSW, which is approximately 400 km south of Sydney. The Munganno Point mill site is located on the southern shoreline of Twofold Bay and has been in operation for approximately 40 years. The existing facility includes log receival and storage, debarking, chipping and an associated process plant and wharf / ship-loading facility for the export of woodchips.

SEFE generates approximately 35,100 tonnes of wood waste each year, which at present is being disposed (incinerated) in the existing burner or sold as mulch to local markets. SEFE proposes to use the wood waste as fuel for the proposed Power Plant.

The Power Plant would have a capacity of around 5.5 MW and would burn approximately 57,700 tonnes of wood waste to produce around 31 GWh of electricity per annum. Electricity generated will be used at the mill site with excess provided to the grid.

The facility will combust approximately 57,700 tonnes of wood waste per annum. Wood waste would be drawn primarily from SEFE's current operations with around 22,600 tonnes being obtained from local and regional saw mills (**Table 1-1** Wood Waste Fuel Types). SEFE proposes to only use wood waste from its own mill processes and other sawmilling and facilities. No fuel would be sought from municipal landfill or other sources.

Table 1-1 Wood Waste Fuel Types

Fuel Type	Tonnes per annum	Description
Hardwood fines	21,250	This fuel is waste from on-site chipping / screening of hardwood logs which is currently sold to various customers in bulk and generally used for landscaping purposes (i.e. gardening mulch).
Pine bark	9,525	This fuel is waste from on-site contract chipping / screening of plantation softwood logs which is currently sold to a single customer and used for landscaping purposes.
Pine fines	3,300	This waste is generated on-site during the chipping / screening of plantation softwood logs and is currently sold to customers for such purposes as lining hens' cages on poultry farms.
SEFE mill waste (hardwood)	1,060	This fuel is waste from on-site chipping of hardwood logs and is currently disposed of on site in the tepee burner for no energy recovery.

Fuel Type	Tonnes per annum	Description
Hardwood sawmill waste	17,600	This is hardwood sawmilling and screening waste which will be imported from local and regional sawmills with which SEFE already has commercial relationships.
Softwood sawmill waste	5,000	This is waste which will be purchased from a nearby plantation softwood sawmill.

1.2 Current Practice

SEFE sources more than 900,000 tonnes of hardwood and softwood logs each year for processing into woodchips. Approximately 40 percent of the total log intake at the plant comes from NSW State Forests, 50 percent from Victorian state Forests and 10 percent from private property, including SEFE owned plantations. Approximately one third of the total log intake is harvested by contractors directly engaged by SEFE and two thirds is sourced through mill door sales arrangements with VicForests and Forests NSW.

Within the Woodchip Mill logs are fed by conveyor to a chipper and chips are then screened to remove oversize and undersize wood fragments and fines prior to stockpiling. The woodchips are then stockpiled prior to being delivered to the ship-loading berth for export.

Oversize waste is removed by the log wash ahead of the chipper, stockpiled and then burnt in the incinerator once every three months or so. Fines removed by the screens are stockpiled and sold to external markets as mulch. The waste generation at the current SEFE plant over the last four years averages 29,883 tonnes of hardwood fines, pine bark, hardwood mill waste and pine fines. Typically between 1,144 t and 1,250 t of waste is incinerated each year and between 15,819 t and 23,772 t is transported off-site as garden mulch, primarily to the metropolitan areas of Sydney and Canberra.

SEFE operates a Chain of Custody (CoC) System which is certified to the CoC Standard (AS 4707-2006). This is an inventory control system that tracks the pathway that forest products take from a Defined Forest Area (DFA) or stated source to the final customer.

SEFE, Vic Forests and Forests NSW hold Australian Forestry Standards (AFS) certifications. As a result, approximately 91% of all wood currently received through SEFE's gate is certified. The remainder comes from the residue wood waste obtained from various sawmills.

1.3 Objectives / Scope of Assessment

The scope of this assessment is provided by the Director General's Requirements for the proposal. These stipulate that the EA must include assessment of greenhouse gas and climate change issues, specifically:

- *"The EA must include a comprehensive report on the project's predicted greenhouse gas emissions and mitigation measures.*
- *Emissions should be calculated using an appropriate methodology in accordance with NSW, Australia and international guidelines, be expressed in tonnes of carbon dioxide equivalent (tCO_2-e), and provided as annual emissions for each year of the project.*

1 Introduction

- *In accordance with the Greenhouse Gas Protocol, emissions should be reported broken down by direct emissions; indirect emissions from electricity; upstream and downstream emissions; and emissions from biomass burning and biomass harvesting.*
- *Greenhouse emissions intensity (per unit of production) should be compared before and after the project, and if possible with best practice.*
- *The EA should identify which emissions will be covered by the proposed Carbon Pollution Reduction Scheme (CPRS) and the Renewable Energy Target (RET) scheme."*

The emissions that constitute direct emissions, indirect emissions and upstream and downstream emissions must be determined in order to quantify the predicted greenhouse gas emissions from the proposal. Section 3 provides detail regarding the emissions which form the predicted greenhouse gas inventory for the proposal.

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Greenhouse Gas Policy

2.1 International Policy

The Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC) was signed in 1997 and entered into force in 2005. The Protocol aims to reduce the collective greenhouse gas emissions of developed countries by at least 5 percent below 1990 levels during 2008 – 2012, known as the first commitment period. To achieve this, the Protocol has set binding emissions targets for developed countries.

In December 2007 Australia ratified the Kyoto Protocol, committing to meeting a Kyoto target of 108 percent of 1990 greenhouse emissions by 2008 - 2012. Australia's emissions are expected to reach an average of 107 percent of 1990 levels during the first commitment period. However, this achievement is mainly due to lower than projected transport emissions and the effect of slow growth in electricity generation since late 2007.[2]

The Kyoto Protocol allows for countries to create and acquire Kyoto units called Assigned Amount Units (AAUs) from other countries via three flexibility mechanisms (International Emissions Trading, the Clean Development Mechanism and Joint Implementation). These mechanisms are based on the principle that the benefit to the climate of reducing greenhouse emissions is the same regardless of where they are produced.

The UNFCCC will meet in Copenhagen in December 2009 and attempt to develop a post Kyoto international framework on climate change, which should provide a long term approach for global cooperation on climate change.

In order to meet its Kyoto Protocol target and post Kyoto targets which are yet to be defined, the Government will need to encourage projects that result in creation of Assigned Amount Units, such as renewable energy production, including biomass power plants. Biomass power plants are generally considered as greenhouse neutral as the carbon emitted by the biomass combustion process represents part of the ongoing bio-geochemical carbon cycle.

2.2 Treatment of Biomass and Biomass Waste

Products of the timber industry contain carbon that has been removed from the atmosphere by trees, and is locked up for the duration of the particular timber product. Regenerating or replanting areas and the rapid forest growth continues the cycle of extracting carbon from the atmosphere.

Under current international accounting rules for energy, carbon dioxide emissions from combustion of biomass is not included in the national greenhouse accounts as they are considered zero rated. Combustion of biomass also releases very small quantities of non CO_2 gases. While those gases comprise less than one percent of combustion emissions, international accounting rules require that they be included in national inventories.

The 2006 IPCC Guidelines[3] state that emissions of CO_2 from biomass fuels are estimated and included in the Agriculture, Forestry and other Land Use sector. Therefore emissions from biofuels should not be included in the sectoral totals to avoid double counting, but instead are reported as information items.

[2] Department of Climate Change. August 2009. Tracking to Kyoto and 2020: Australia's Greenhouse Emissions Trends 1990 to 2008 – 2012 and 2020. Commonwealth of Australia.

3 Intergovernmental Panel on Climate Change, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, prepared by the National Greenhouse Gas Inventories Programme Eggleston, H.S., Buendia L., Miwa K., Ngara T. and Tanabe K. (eds). IGES, Japan

With regard to wood waste, the national guidance takes the view that if fuel that would otherwise be flared or heat that would otherwise be wasted is used for electricity generation, then it is considered that the generation does not increase emissions compared to what they would otherwise be.[4] However, where a fuel that would otherwise be vented is burned for generation, or waste material is used for generation, the consideration is more complex. There will be additional combustion emissions, but if the energy output is lower in emissions intensity than the pool coefficient, then there will be greenhouse benefits. The guidance also indicates that cellulosic or lignocellulosic wastes which have no further economic uses including biomass wastes, shall be "zero-rated" for CO_2 emissions, but emissions of CH_4 and N_2O shall be accounted for.

In addition to using a wood waste, the wood waste used in the Power Plant will originate from sustainably harvested forests. Where a generator uses biomass that is not sustainably harvested, or where a portion of biomass used is not sustainably harvested, all emissions from combustion of the non-sustainably harvested biomass must be accounted for, including the CO_2 emissions.

The term 'sustainably harvested biomass' (in relation to sawmill residues) is defined as:

- All sawmill residues from trees that have been taken from forests that are "well managed" and subject to the conditions that no additional trees from a native forest are harvested specifically for biomass.
- The term well managed means the forest has been certified as 'well managed' or sustainably harvested under the Australian Forest Standard or by using an internally recognised process such as the Forest Stewardship Council (FSC).

SEFE operates a Chain of Custody (CoC) System which is certified to the CoC Standard (AS 4707-2006). This is an inventory control system that tracks the pathway that forest products take from a Defined Forest Area (DFA) or stated source to the final customer.

CoC certification is complementary to both SEFE's Environmental Management System (EMS) certified to ISO 14001:2004 and Forest Management Plan certified to Australian Forestry Standard AS 4708-2007 (AFS). It indicates to SEFE's customers that the products purchased come from well managed sustainable forests.

SEFE, Vic Forests and Forests NSW hold Australian Forestry Standards (AFS) certifications. As a result, approximately 91% of all wood currently received through SEFE's gate is certified.

2.3 National Approach to Management of Greenhouse Gas Emissions

Underlying the National Government's Climate Change Policy are three pillars; to reduce Australia's greenhouse gas emissions, to adapt to climate change that cannot be avoided and to help shape a collective international response.

The Government has committed to reducing Australia's carbon pollution to 25 per cent below the 2000 levels by 2020, providing that there is international agreement to stabilise levels of greenhouse gases in the atmosphere at 450 parts per million CO_2 equivalent or lower. If no international agreement is achieved, Australia will reduce its emissions by between five and 15 per cent below 2000 levels by 2020.

[4] Ministry of Energy and Utilities, Greenhouse Gas Emissions from Electricity Supplied in NSW – Workbook, October 2000.

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Emissions Projections released in August 2009 showed that in the absence of the CPRS, Australia's emissions are projected to rise to 120 percent of 2000 levels.[5] The amount of abatement that the CPRS and other new policies need to generate to achieve our national emissions targets represent Australia's "abatement challenge". Under the -5 percent target option this is equal to 138Mt CO_2-e, while under the -25 percent target option the abatement challenge is 249 Mt CO_2-e. Key initiatives to meet the abatement challenge, relevant to the facility, are set out below.

2.3.1 Carbon Pollution Reduction Scheme (CPRS)

The main driver of the Government's plans to reduce greenhouse gas emissions is the CPRS, which will use a cap and trade mechanism to ensure reduction of greenhouse gas emissions by making rights to emit greenhouse gases become scarce, therefore increasing the price of rights. The CPRS caps will be calculated as the difference between the indicative national trajectory and the emissions projections for uncovered sectors. Emitters of greenhouse gases will need to acquire and surrender a permit for every tonne CO_2-e of greenhouse gas that they emit. As well as driving actual emissions reductions, the introduction of a carbon price provides a financial incentive for investment in low emissions technology, such as biomass power plants.

In May 2009 the Government announced that obligations under the CPRS would be phased in from July 2011 and that a one year fixed period will be introduced whereby permits will cost $10 per tonne in 2011 – 2012. The threshold for participation in the CPRS is 25,000 tonnes CO_2-e and will be based on direct (Scope 1) emissions only and emissions from stationary energy will be covered from the CPRS commencement.

According to the White Paper[6] the CPRS will cover around 75 percent of Australia's emissions, covering emissions from the stationary energy, transport, fugitive, industrial processes, waste and forestry sectors, will be included under the CPRS. The CPRS does not include emissions from agriculture and deforestation.

Emissions relevant to the facility and obligations for reporting those emissions under the CPRS are described below:

- Emissions from domestic combustion of products containing fossil fuels will be applied to entities with a facility that has direct (Scope 1) emissions of 25,000 tCO_2-e a year or more.
- Transport emissions.
- Scheme obligations for emissions from the combustion of petroleum products will apply to upstream suppliers of liquid fuels.
- Scheme obligations for emissions from domestic combustion of natural gas, LPG and synthetic fuels will apply to entities that first supply LPG for use in the market (except certain large users).
- Landfill facilities are responsible for waste under the Scheme.
- Scheme obligations for waste water and waste incineration facilities will apply to entities with a facility that has direct (Scope 1) emissions of 25,000 tonnes of CO_2-e a year or more.

The CPRS White Paper states that CPRS obligations would not apply to emissions from combustion of biomass for energy; they would be receive a zero rating. Emissions from deforestation will also not be included in the CPRS, despite being included under Kyoto Protocol rules.

[5] Department of Climate Change. August 2009. Tracking to Kyoto and 2020: Australia's Greenhouse Emissions Trends 1990 to 2008 – 2012 and 2020. Commonwealth of Australia.
[6] Commonwealth of Australia, Carbon Pollution Reduction Scheme: Australia's Low Pollution Future, White Paper, Vol 1, December 2008.

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Electricity generators will be required to use National Greenhouse and Energy Report System Methods 2 – 4 for estimating and reporting carbon dioxide emissions that are covered under the CPRS as they already use a higher order emissions calculation method under the Generator Efficiency Standards program.

SEFE will not be required to participate in the CPRS in relation to emissions relating to the Power Plant.

2.3.2 National Greenhouse and Energy Reporting System (NGERS)

The introduction of NGERS has made greenhouse gas and energy reporting mandatory for corporations that meet certain corporate and/or facility thresholds. When a controlling corporation's group meets the facility or corporate group threshold, the controlling corporation must apply for registration and report its GHG emissions and energy data to the Commonwealth government. Corporations are required to report greenhouse gas emissions, energy production and energy consumption under NGERS if they exceed any of the three facility thresholds:

- GHG emissions of 25 kilotonnes of CO_2-e
- Energy production of 100 terajoules
- Energy consumption of 100 terajoules.

NGERS will underpin the CPRS, providing the primary source of emissions data on which obligations under the Scheme will be based.

Alone, the Power Plant does not meet the NGERS reporting threshold, given that emissions originating from the proposed Power Plant have been estimated as substantially below 25,000 t CO_2-e per annum.

2.3.3 Renewable Energy Target (RET)

The Office of the Renewable Energy Regulator (ORER) is the statutory authority established to administer the Government's *Renewable Energy (Electricity) Act 2000* and the *Renewable Energy (Electricity) Regulations 2001*. The policy that underpins the Act and Regulations is commonly referred to as the Mandatory Renewable Energy Target (MRET) scheme. The objectives of the MRET are to encourage the additional generation of electricity from renewable resources, reduce emissions of greenhouse emissions and ensure that renewable energy sources are ecologically sustainable.

The MRET is a market-based measure that encourages renewable energy deployment by creating an obligation for electricity retailers and large users to purchase Renewable Energy Certificates (RECs) that are created by renewable energy generators. Under the scheme a legal liability is placed on wholesale purchasers of electricity to proportionately contribute towards the generation of an additional 9,500 GWh of renewable energy per year by 2010. All retailers and large buyers are required to maintain the 9,500 GWh of new renewables between 2010 and 2020 to provide investment certainty up to 2010.

Demand is created by legally obliging parties who buy wholesale electricity to source an increasing percentage of their electricity purchases from renewable-based generation, or pay a penalty of $65 per MWh of shortfall. A supply incentive is created by enabling an extra revenue stream to be earned for generating this additional renewable-based electricity. This revenue stream, which is additional to the price a generator would receive for the electricity, is achieved by creating a tradeable REC.

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The measure provides that one REC may be created for each MWh of electricity generated by accredited power stations using eligible renewable energy sources. As at December 2008, a total of 37,111,281 RECs had been created in the REC registry for the generation years. RECs created by wood waste generators account for 2.4 percent of this total (892,384 RECs).[7]

In 2008 the Federal Government committed to introducing an expanded Renewable Energy Target (RET) scheme to subsume the MRET scheme and ensure that 20 percent of Australia's electricity supply is provided by renewable energy by 2020.

Key attributes of the RET include:

- ensuring at least 20 percent of Australia's electricity supply is generated from renewable sources by 2020, by maintaining 15,000 GWh of existing renewable energy capacity as well as providing 45,000 GWh of additional generation, to make a total of 60,000 GWh of renewable energy;
- maintaining the same eligibility criteria as in the current MRET scheme and retaining the eligibility of all renewable energy projects that have been approved under existing state-based schemes; and
- phasing out the RET between 2020 and 2030 as the proposed CPRS matures and carbon prices become sufficient to ensure the RET is no longer required.

Renewable energy sources eligible under the MRET and RET are defined under the *Renewable Energy Act 2000*. The list of eligible renewable energy sources includes wood waste. Wood waste may comprise:

- Wood waste from the eradication of non-native woody weeds;
- A manufactured wood product or by-product from a manufacturing process;
- Waste products from the construction of buildings or furniture;
- Sawmill residue;
- Wastes from harvesting native forests; or
- Wastes from harvesting plantations.

Regulation 8 (1) (b) establishes the following eligibility criteria for the second category (a manufactured wood product or by-product from a manufacturing process).

The wood waste must be:

(b) a manufactured wood product or by-product from a manufacturing process.

Wood waste generated by SEFE and sawmill residue from third party sawmills would be eligible to create RECs under this category of wood waste. This has been confirmed by the Office of the Renewable Energy Regulator.

The RECs can then be sold on the market administered by the ORER. The number of RECs that can be created by a new power station is calculated as follows[8]:

[7] Office of the Renewable Energy Regulator. Increasing Australia's Renewable Energy Generation. Annual Report 2008.Commonwealth of Australia 2009.
[8] Office of the Renewable Energy Regulator. Fact Sheet: Information for Applicants who Intend to Apply for Accreditation of a Power Station. Updated March 2009.

The REC eligibility of a power station is calculated as follows:

REC eligibility = TLEG – FSL – AUX – [(DLEG) x (1 – (MLF))]

Where

TLEG is amount of electricity in MWh generated at the generator terminals in a year

FSL is the fossil fuel component

AUX is auxiliary losses relating to electricity consumed internally within a power station to generate electricity (not including electricity consumed in manufacturing or production process)

DLEG is the amount of electricity sent out to the grid from the generator each year

MLF is the marginal loss factor calculated for each power station by AEMO

Using the above formula, SEFE's proposed Power Plant would be eligible to generate approximately **26,831** RECs annually.[9]

2.3.4 Energy Efficiency Opportunities (EEO)

The EEO program encourages large energy using businesses to improve their energy efficiency. It does this by requiring businesses to identify, evaluate and report publicy on cost effective energy saving opportunities. Participation in EEO is mandatory for corporations that use more than 0.5 PJ of energy per year (approximately equal to 139,000 MWh). The proposed Power Plant will not be required to participate in EEO.

2.4 State Approach to Management of Greenhouse Gas Emissions

The NSW Greenhouse Plan[10] was released in November 2005. The plan provides the NSW strategic approach to combating climate change in NSW. The Plan set emission reduction targets of a 60 percent cut in greenhouse emissions by 2050 and a return to year 2000 greenhouse emission levels in NSW by 2025. These targets would mean net NSW CO_2-e emissions of 155.5 million tonnes in 2025 and 62.2 million tonnes in 2050.

The plan recognised energy as the largest and one of the fastest growing greenhouse gas emission generators in NSW and considers reducing emissions from electricity generation as a priority and provided various initiatives to reduce emissions from electricity generators. The NSW state government is currently in the process of developing a Climate Action Plan which will revise the NSW Greenhouse Plan and give greater attention to adapting to the impacts of climate change.

State initiatives than are relevant to SEFE are discussed below.

2.4.1 NSW Greenhouse Gas Reduction Program

The GGAS aims to reduce greenhouse gas emissions associated with the production and use of electricity by using project-based activities to offset the production of greenhouse gas emissions. GGAS establishes annual statewide greenhouse gas reduction targets and then require individual

[9] Based on TLEG of 31,000 MWh, AUX of 3072.3 MWh and 21,928 MWh dispatched to the NSW pool. Assumes MLF of 0.95
[10] NSW Greenhouse Office, NSW Greenhouse Plan, November 2005.

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electricity retailers to meet mandatory benchmarks based on the size of their share of the electricity market.

The facility may be eligible to participate as an Abatement Certificate Provider under the Generation Rule of the GGAS, which allows electricity generators to create abatement certificates (NSW Greenhouse Abatement Certificate, or NGACs) for electricity generated at an emissions intensity lower than that of the designated NSW pool coefficient. If this was the case, it would be classed as a Category D generating system and would be able to generate NGACs for each MWh generated. Abatement certificates can then be supplied to retailers on the market who are required to surrender NGACs on the basis of their share of the NSW electricity market.

The proponent notes that the GGAS is likely to be subsumed by the CPRS by the time the facility is operational.

3

Greenhouse Gas Assessment Methodology

3.1 Accounting and Reporting Principles

The greenhouse gas inventory for the Power Plant is based on the accounting and reporting principles detailed within the Greenhouse Gas Protocol (the Protocol).[11] The Protocol was first established in 1998 to develop internationally accepted accounting and reporting standards for greenhouse gas emissions from companies. The main principles are as follows:

- **Relevance**: The inventory must contain the information that both internal and external users need for their decision making.
- **Completeness**: All relevant emissions sources within the inventory boundary need to be accounted for so that a comprehensive and meaningful inventory is compiled.
- **Consistency**: The consistent application of accounting approaches, inventory boundary and calculation methodologies is essential to producing comparable GHG emissions over time.
- **Transparency**: Address all relevant issues in a factual and coherent manner, based on a clear audit trail. Disclose any relevant assumptions and make appropriate references to the accounting and calculation methodologies and data sources used.
- **Accuracy**: Data should be sufficiently precise to enable intended users to make decisions with reasonable assurance that the reported information is credible.

The greenhouse gas emission inventory for the Project is based on the methodology detailed in the Protocol and relevant emission factors in the National Greenhouse Account (NGA) Factors June 2009, the Methodology for the Estimation of Greenhouse Gas Emissions and Sinks 2006 – Energy (Stationary Sources) and the relevant Intergovernmental Panel on Climate Change (IPCC) Good Practice Guidance.[12]

3.2 Reporting Boundaries

3.2.1 Inventory Operational Boundaries

The Director-General's Requirements for the environmental assessment require that, in accordance with the Greenhouse Gas Protocol, emissions should be reported broken down by: direct emissions; indirect emissions from electricity; upstream and downstream emissions; and emissions from biomass burning.

The Protocol defines direct and indirect emissions through the concept of emission "scopes" in order to help delineate direct and indirect emission sources, improve transparency and provide utility for different types of organisations.

- **Scope 1** (Direct Greenhouse Emissions): Direct emissions occur from sources that are owned or controlled by the company, for example emissions from combustion in owned or controlled boilers, furnaces and vehicles. This does not include CO_2 emissions from the combustion of biomass, which should be reported separately.
- **Scope 2** (Electricity Indirect Emissions): Scope 2 accounts for the greenhouse emissions from the generation of purchased electricity consumed by the company. Purchased electricity is defined as

[11] World Business Council for Sustainable Development & World Resources Institute (2004), The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.
[12] IPCC, Good Practice Guidance and uncertainty management in National Greenhouse Gas Inventories.

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electricity that is purchased or otherwise brought into the organisational boundary of the company. Scope 2 emissions physically occur at the facility where the electricity is generated.

- **Scope 3**: Scope 3 emissions are a consequence of the activities of the company, but occur from sources not owned or controlled by the company. Examples of scope 3 activities are extraction and production of purchased materials; the use of sold products and services.

Emissions that fall inside the operational boundary for the greenhouse gas assessment comprised only those which would be modified as part of the proposal, and/or occur at a point beyond which the waste product was initially generated. The prime site function of generating wood chips for sale will remain unchanged when the Power Plant is built, and hence is not included in the inventory.

The following Scope 1 and Scope 2 emissions fall within the operational Power Plant Greenhouse Gas Inventory:

- Combustion of biomass for electricity generation (CH_4 and N_2O emissions only. CO_2 are emissions considered to have a neutral impact) (Scope 1).
- Combustion of supplementary fuel oils to aid biomass combustion at start-up (Scope 1).
- Increase in use of fossil fuels on site for operational or maintenance purposes (predominately due to increase in use of one front loader) (Scope 1).
- Emissions from construction vehicles and plant operating on the site (Scope 1).

In accordance with the Director-General's Requirements upstream and downstream (Scope 3) emissions have been evaluated. These processes are further described in Section 4.1.2:

- Wood waste combustion at third party sawmills;
- Composting of wood waste generated at third party sawmills;
- Transport emissions associated with the distribution of wood waste from third party sawmills to SEFE;
- Transport of wood waste from third party sawmills sold as landscaping to market;
- Disposal of ash waste generated by third party sawmills;
- Extraction and distribution of distillate fuel used at SEFE to fire the Power Plant;
- Composting of wood waste generated at SEFE;
- Distribution of mulch from SEFE to the end-use locations;
- Disposal of ash generated at SEFE; and
- Emissions produced through the manufacture and transport of plant, materials and equipment to be installed at the site (construction emissions).

The following emissions fall outside the operational Power Plant Greenhouse Gas Inventory boundary as they are considered to be the same for the current site practice and proposed use, or likely to comprise incidental emissions:

- The emissions associated with timber product manufacture, such as harvesting the plantations and the milling of the timber, are not considered as part of those arising from the fuel supply to the proposed Power Plant as there would be no change in emissions compared to the current practice.
- Transport of biomass fuels to the Power Plant, except where additional fuels are brought to the site from other sawmills.
- Site electricity drawn from the NSW Electricity Grid, which remains unchanged from the current practice scenario, with the exception of the parasitic load on the Power Plant.

3.2.2 Materiality

Materiality' is a term that has been defined in a number of sources. For example, ISO 14064.1-2006[13] provides the following definition:

"**Materiality** – concept that individual or an aggregate of actual errors, omissions and misrepresentations in the GHG assertion that could affect the decisions of the intended users"

ISO 14064 also states that acceptable materiality is determined by the validator, verifier or GHG program, based on the agreed level of assurance. Most definitions of materiality adopt a similar approach and are non-prescriptive, usually leaving the assessment of materiality to the judgement of a verifier.

In practice and as the Greenhouse Gas Protocol[14] states; as a rule of thumb, an error is considered to be materiality misleading if its value exceeds five percent of the total inventory.

All emissions that are within the organisational boundary are included in the inventory unless they are excluded on materiality grounds or data was otherwise unavailable at the time of preparing the greenhouse gas assessment.

The following emissions are not included in the inventory on the basis of materiality:

- Employee travel emissions produced by six additional employees during the operational phase of the plant.
- Employee travel emissions produced by 40 personnel during the construction period.
- Emissions associated with decommissioning. See Section 4.1.1 for discussion.

3.3 Calculation Approaches

The greenhouse emissions inventory for the Project is based on the methodology detailed in the Greenhouse Gas Protocol and relevant emission factors in the National Greenhouse Accounts (NGA) Factors and the relevant IPCC Good Practice Guidance. The NGA Factors methodology is consistent with the National Greenhouse and Energy Reporting System, Method of Measurement 1.

A spreadsheet model has been specifically developed for the Project and uses data sources and emission factors detailed below in order to calculate current practice and project emissions for an average year of operation according to the Protocol.

For accounting purposes, URS has assumed that the disposal of wood waste at other sawmills that will supply wood waste to the proposed Power Plant is not a limiting factor and that logging will not increase as a result of disposal of waste to SEFE.

The NGA Factors approach was developed for national greenhouse inventory accounting purposes, but also forms the basis of accounting practices for NGERS. In line with international greenhouse gas emission accounting approaches, the NGA factors method does not take into consideration the carbon dioxide emissions from either combustion or decomposition of biomass. Under the current practice at the site, the majority of wood waste generated is sold for landscaping mulch and this would provide reduced greenhouse gas emissions when compared to combustion of the wood waste as some of the carbon mass would be sequestered into the soil as carbon. Given the uncertainty regarding the estimation of long term soil carbon sequestration from recycled organic materials such as mulch, an

[13] Australian Standard, 'Greenhouse Gases Part 1: Specification with guidance at the organization level for quantification and reporting of greenhouse gas emissions and removals'
[14] 'The Greenhouse Gas Protocol – A Corporate Accounting and Reporting Standard', Revised Edition, WBCSD and WRI

estimation of potential soil carbon sequestration from the mulch product has not been included in the greenhouse gas inventory for the project. Whilst the reduction in greenhouse gas emissions has not been quantified, the true emissions would be reduced in comparison to the results of the inventory.

There are several greenhouse gases including carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) that are relevant to the Project. In order to simplify inventory accounting, carbon dioxide equivalents (CO_2-e) is used. This accounts for the various greenhouse warming potentials of non CO_2 gases, which is a measure of the amount of infrared radiation captured by a gas in comparison to an equivalent mass of CO_2, over a fixed lifetime. Following this convention, greenhouse inventories in this report are expressed as mass of CO_2-e released.

3.3.1 Emission Factors

Direct measurement of greenhouse emissions at the emission source will give the most accurate and precise assessment of emissions. This is not typically feasible in development projects, so emission factors remove the need for site specific testing of emissions. They are a factor expressed as the amount of greenhouse gas emissions per unit of activity, which can be used to determine inventories for a site.

Emission factors can be identified from various sources, including international, national and state guidance. The majority of emission factors used in this report have been sourced from the Department of Climate Change NGA Factors Workbook, June 2009. The emission factors used are described in Section 4 of this report.

The moisture content of the biomass material used as fuel has been established as 40 percent calculated on the basis of wet tonne weight. In accordance with the NGA technical guidelines, the fuel supply can be classified as, and the emission factor applied for, green and air dried wood, which is defined as having a moisture content of more than 20 percent on a wet basis and is combusted to produce heat or electricity.

4

Greenhouse Gas Inventory

This section estimates the greenhouse gas emissions associated with the Power Plant and provides a comparison to current practice emissions and emissions that would be associated with generation of electricity by the NSW electricity generation pool.

4.1 Project Emissions

Greenhouse gas emissions have been estimated for the construction and operation of the Power Plant. Estimated greenhouse gas emissions from the project have been compared to emissions generated by the current practice. For the purposes of this comparison it has been assumed that the volume of wood waste material processed by SEFE on an annual basis will be the same as that consumed by the proposed Power Plant, although in practice the volumes processed over the last four years are slightly lower than the volumes that will be burnt.

4.1.1 Construction / Decommissioning Phase Emissions

Construction

Greenhouse gas emissions associated with construction have been estimated using data in equipment specifications provided by SEFE. The majority of construction materials would comprise concrete and steel. Estimations of greenhouse gas emissions are provided in **Table 4-1**. Where quantities have not been provided, estimations have been made based on URS experience. The assumptions made are detailed in **Table 4-1**.

Table 4-1 Summary of Emissions – Construction Phase

Source	Description	Emissions (t CO_2-e)
Emissions derived from embodied energy of plant materials	Plant materials including concrete foundations and slab, turbine and condenser, boiler, ESP, stack and structure, sea water delivery system. Assumes that the boiler, ESP, stack and structure will comprise 200t of material. Concrete being readymix concrete and steel being tinplate steel processed at Port Kembla, NSW.	1,315
Delivery of concrete	Assumes a truck capacity of 15t and that delivery will be from 40km distance	8.5
Delivery of other materials	Assumes that delivery of other materials will be in 20 loads from 420km distance	26.6
Total		**1,350**

The emissions associated with the construction stage will be offset by the greenhouse gas emissions savings within the first month of the plant's operation due to the emissions avoided due to reduced generation of electricity being required by the NSW electricity generation pool (see Section 4.1.5).

Decommissioning

Emissions would be associated with decommissioning the plant and removing it from the site at the end of its life. Options for the plant at this time have not been assessed. Due to uncertainties as to the

fate of the plant, the timing of the works and the market for recycled materials, it is not possible to quantify greenhouse gas emissions associated with decommissioning, although typical greenhouse gas sources would include fuel use in mobile plant, trucks transporting waste materials offsite and crushing plant used to break up concrete foundations, and waste processing. It is likely that emissions associated with decommissioning would not be material in the context of the whole of life emissions of the project. As such, no assessment of the emissions associated with the end of life phase of the project has been made.

4.1.2 Operational Emissions

Operational emissions are described according to scope on an annual basis for each year of operation of the plant.

Direct Emissions (Scope 1)

Direct emissions from the project and current practice will be associated with the following elements.

Wood waste combustion at SEFE

The current practice at SEFE is to dispose of the larger SEFE mill wood waste in an onsite incinerator. Typically, between 1,144 t and 1,250 t of waste is currently incinerated each year. During the operation of the Power Plant SEFE will incinerate 35,100 t (all of the wood waste processed). As described in Section 2.2, national guidance indicates that if fuel that would otherwise be wasted, such as wood waste, is used for electricity generated, then it is considered that the generation does not increase emissions compared to what they would otherwise be and results in emissions reductions compared to fossil fuel generation. Therefore carbon emissions have not been accounted for in this assessment. However, combustion of biomass does produce small quantities of CH_4 and N_2O, which are accounted for. Combustion of wood waste on site currently results in the emission of 19 t CO_2-e and will result in approximately 767 t CO_2-e for each year of operation of the Power Plant.

Combustion of transport fuels for on site vehicles, specifically the operation of the front end loader

Diesel oil will be consumed by on site vehicles, primarily by a front end loader which will operate on the site. Currently, the front end loader is used for 1,500 hours per annum. During the operation of the Power Plant it is estimated that use of the front end loader will increase to approximately 2,700 hours per annum. It is estimated that diesel consumption by the front end loader is at the rate of 0.02 kL per hour. Combustion of diesel by operation of the front end loader currently accounts for approximately 81 tonnes CO_2-e and will account for approximately 146 t CO_2-e for each year of the life of the project.

Combustion of fuel oil for boiler start up

The Power Plant will be restarted approximately four times per year. It is estimated that the plant will consume approximately 50 L of fuel oil per start up with a total fuel consumption of 0.2 kL. Combustion of fuel oil during start up will account for approximately 0.5 t CO_2-e per annum.

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Table 4-2 Scope 1 emissions associated with the Power Plant and current wood waste disposal practice

Emission Source	Current Practice t CO_2-e	Power Plant t CO_2-e
Wood waste combustion at SEFE	19	767
Combustion of transport fuels	81	146
Combustion of fuel oil	-	0.5
Total	**100**	**913**

Indirect Emissions (Scope 2)

Scope 2 emissions account for the greenhouse emissions from the generation of purchased electricity consumed. The facility's current annual electricity consumption is 6 GWh. This will not increase as a result of the operation of the Power Plant. However, the parasitic load of the Power Plant itself will be approximately 550kW. When calculating the total power exported to the electricity grid, this power consumption has been subtracted from the generator output. Hence electricity consumption associated with Scope 2 emissions has been addressed in the forecast of electricity sent out. Electricity consumption during times at which the plant is non-operational is considered to be below the materiality threshold.

Indirect emissions relating to purchased electricity for the remainder of the SEFE facility (approximately 6 GWh) are not included as part of this assessment, as the consumption of purchased electricity will remain the same for the current practice and proposed Power Plant scenarios. The avoided Scope 2 emissions from purchased electricity are addressed under Avoided Emissions (see Section 4.1.5).

The assessment assumes that there will be no increase in electricity consumption for the operation of the shredder, which may be required for processing some of the wood waste received from other mills before it can be used as fuel in the Power Plant.

Upstream and downstream emissions (Scope 3)

In accordance with the Director-General's Requirements upstream and downstream emissions have been evaluated. The paragraphs below contain a description of Scope 3 activities which have been identified as constituting upstream and downstream emissions for both the proposed Power Plant and the current practice. **Table 4-3** provides a summary of upstream and downstream emissions. The total upstream and downstream emissions are 8,549 t CO_2-e pa for the current practice and 227 t CO_2-e for the proposed Power Plant. The higher emissions for the current practice are due to increased transport emissions in the current practice scenarios and the main disposal activity (combustion of biomass) in the proposal scenario being included elsewhere in the inventory (Scope 1).

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Table 4-3 Scope 3 (upstream and downstream) Greenhouse Gas emissions

Emissions Source	Current Practice t CO_2-e	Power Plant t CO_2-e
Upstream		
Wood waste combustion at third party sawmills	244	0
Composting of wood waste generated at third party sawmills	1,921	0
Transport of wood waste sold as landscaping materials to market	480	0
Transport emissions associated with the distribution of wood waste from third party sawmills to SEFE	0	212
Disposal of ash waste generated by third party sawmills	0.1	0
Extraction and distribution of distillate fuel used at SEFE	6	11
Total Upstream Emissions	**2,651**	**223**
Downstream		
Composting of wood waste generated at SEFE	4,522	0
Distribution of mulch from SEFE to market	1,376	0
Disposal of ash generated at SEFE	0	4
Total Downstream Emissions	**5,898**	**4**
Total Scope 3		
Total upstream and downstream emissions	8,549	227

Although the current practice appears to be associated with higher emissions than the proposed power plant due to transport emissions and combustion of biomass, this assessment does not consider carbon dioxide emissions from either the combustion or decomposition of biomass (as discussed in Section 3.3). Given the uncertainty regarding the estimation of long term soil carbon sequestration from recycled organic materials such as mulch, URS has not quantified this reduction in greenhouse gas emissions. Therefore, the approach does not reflect the reduced greenhouse gas emissions that would result from mulching when compared to combustion of biomass due to some of the carbon mass being sequestered into the soil making comparison between the current practice and proposed power plant difficult.

Upstream

Wood waste combustion at third party sawmills (current practice)

Approximately 22,600 tonnes of wood waste for the proposed Power Plant will be imported from other hardwood and softwood sawmills. Currently, approximately 30 percent of the wood waste generated by third party sawmills from which SEFE will source material is disposed of by incineration at the sawmill site and a further 20 percent is disposed of by incineration and generation of process heat for food processing. An additional 7,000 tonnes is received from SEFE by a third party facility for combustion and generation of process heat. Greenhouse gas emissions from wood waste combustion at third party sawmills account for 244 tCO_2-e.

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Mulching and transport of wood waste generated at third party sawmills (current practice)

Approximately 50 percent (11,300 t) of the wood waste generated at third party sawmills is currently sold as mulch for landscaping in the Canberra, Sydney and Wollongong metropolitan areas. For the purposes of this assessment it has been assumed that emission factors for CH_4 and N_2O for composting as provided in the NGA Factors, June 2009, will be appropriate for the final treatment of waste material removed offsite for processing as mulch, which may be used for landscaping purposes. Composting is described in the 2006 IPCC Guidelines for National Greenhouse Gas Inventories as an aerobic process which results in a large fraction of the degradable organic carbon being converted to carbon dioxide. CH_4 is formed in anaerobic sections of the compost, but is oxidised to a large extent in the aerobic sections of the compost. Using published emission factors for composting will likely provide an overestimate of emissions associated with mulch for landscaping, as anaerobic sections of the material, and therefore methane emissions will be minimised. Composting of waste generated at third party sawmills currently generates of 1,921 t CO_2-e.

Based on information received from SEFE regarding the likely location of the third party sawmills, it has been assumed that the sawmills are located an average of 335km away from the market depots. On this basis, wood waste transport from third party sawmills to market currently accounts for 480 t CO_2-e.

Transport emissions associated with the distribution of wood waste from third party sawmills to SEFE (Power Plant)

The operation of the Power Plant will require that approximately 22,600 t of wood waste will be transported from third party sawmills to the SEFE Power Plant. Based on preliminary supply information provided by SEFE, three sawmills will be involved in the supply of wood waste to SEFE for fuelling the Power Plant. One of these mills is local and assumed to be located 35km away and the other two are approximately 100km from SEFE. The number of loads per annum have been calculated as approximately 900 based on a load capacity of 25 t of material. Emissions from the transport of wood waste from third party sawmills to SEFE are calculated to be 212 tCO_2-e.

Transport of ash waste generated by third party sawmills (current practice)

One of the three sawmills that will supply SEFE with wood waste disposes of the waste via incineration, which in turn produces ash waste which needs to be disposed of offsite. For the purposes of this assessment, it has been assumed that the current practice with regard to ash disposal at the third party sawmill is to an onsite landfill. The ash contents of the wood waste material (hardwood fines, pine bark, hardwood mill waste, pine fines and softwood mill waste) were provided by SEFE, with the average ash content of material being 0.7%. On this basis combustion of diesel fuels for transport of waste ash from the third party site currently accounts for only 0.1 t CO_2-e per annum.

Extraction and distribution of distillate fuel used at SEFE (current practice and Power Plant)

Scope 3 emissions from the extraction and distribution of diesel fuel and fuel oils used at the SEFE facility, have been calculated as 6 t CO_2-e for current practice and 11 t CO_2-e for the proposed practice. This takes into consideration only the operation of the front loader and fuel oil used during start-up of the Power Plant. Other fuel combustion emissions will remain unchanged.

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Downstream

Distribution of mulch from SEFE to market and mulching of wood waste (current practice)

Under current practice, 76 percent, or 26,600 t of wood waste is composted and provided as landscaping material. Distribution of the mulch material to the market currently produces 1,376 t CO_2-e per annum, based on 60 percent of the mulch being transported to the Sydney / Wollongong area and the remainder sent to Canberra. Emissions from composting have been calculated using the same methodology as composting of wood waste generated at third party sawmills. Emissions are estimated to be 4,522 t CO_2-e

Transport of ash generated at SEFE to (current practice and Power Plant)

Emissions from transport of waste ash have been calculated on the basis of 90 percent being spread on plantations approximately 85km away and 10 percent being provided to landfill in close proximity to the SEFE site. Emissions associated with the current practice are estimated to be 0.11 t CO_2-e, this will increase slightly to 4.3 t CO_2-e per annum during the operation of the Power Plant.

4.1.3 Best Practice Management of Wood Waste

The Director-General's requirements require that the greenhouse emissions intensity of the Power Plant be compared with best practice, if possible. The UK Environment Agency[15] notes that for waste feedstocks such as wood waste, where there are a number of potential alternative uses for the wood apart from disposal to landfill and combustion for electricity generation. Clean wood waste can also be composted to produce mulch, but GHG emissions associated with this route may be low. It is considered that a mulch disposal scenario would be the best practice wood waste processing method in terms of reduction of greenhouse gas emissions. Given that the current practice at the SEFE facility is predominantly to sell waste as mulch material (approximately 76%), current practice is considered to be very close to best practice and therefore a comparison between the Power Plant and a best practice mulch disposal scenario has not been made as part of this assessment.

4.1.4 Summary of project emissions

Table 4-4 summarises the component emissions associated with the operation of the Power Plant on an annual basis. The greenhouse gas emissions associated with the project are estimated to be **1,140** tonnes CO_2-e per annum. This represents a decrease compared to current practice emissions by 7,508 tonnes CO_2-e when carbon sequestered into the soil or body tissues following the decomposition of mulch is not included in the greenhouse gas inventory for the current practice scenario.

[15] Environment Agency. Minimising greenhouse gas emissions from biomass energy generation. April 2009.

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Table 4-4 Summary of project emissions

Emissions Source		Power Plant t CO_2-e	Current Practice t CO_2-e
Scope 1		913	100
Scope 2		0	0
Scope 3	Upstream	223	2,651
	Downstream[16]	4	5,898
	Total	227	8,549
Annual emissions during operation		1,140	8,648
Change in emissions from current practice		-7,508	

The Director-General's Requirements for the Environmental Assessment state that the "*Greenhouse emissions intensity (per unit of production) should be compared before and after the project, and if possible, with best practice".* Whilst it is not possible to compare the emissions intensity per unit of production with best practice, as there is no energy production in the current practice scenario, the emissions intensity per tonne of wood waste processed is comparable. Using the NGA factors methodology, the emissions intensity of the current practice is 0.15 t CO_2-e per tonne of wood waste processed (including wood waste processed at the SEFE facility and at third party sites). The emissions intensity for the proposed plant is 0.02 t CO_2-e per tonne of wood waste processed using the same methodology.

The low greenhouse gas emissions associated with the project are accounted for by the good practice activities innate within the Power Plant proposal design. In particular:

- More than 90% of the biomass fuel originates from sustainably managed forests as defined by the Australian Forestry Standards. The remaining proportion is waste originating from other sawmills that would be generated regardless of whether the Power Plant was in operation or not.
- The transport of biomass will be minimised as most of the fuel would comprise waste already available at SEFE. Therefore emissions associated with transport would also be minimised. Transporting fuels very long distances is known to reduce the emissions savings made by using biomass fuels compared with natural gas by between 15 and 50 percent.[17]
- Wood waste will be the fuel source for the Power Plant. It generally produces lower emissions in terms of intensity than other biomass feedstock, in part due to the absence of energy needed to process the fuel prior to use in the Power Plant and absence of the need for nitrogenous fertilisers to the crop.[18]
- The Power Plant would result in a reduction of transmission losses, which have not been quantified in this assessment (see Section 4.1.7).

[16] Does not include reduced CO2 emissions due to current mulching practice
[17] Environment Agency (UK). Minimising greenhouse gas emissions from biomass energy generation, April 2009. pg 8
[18] Environment Agency (UK). Minimising greenhouse gas emissions from biomass energy generation, April 2009. pg 3-4

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4.1.5 Avoided Emissions

Sent out generation by the Power Plant will be 28 GWh per year (22 GWh sent to the grid and the remainder consumed by the SEFE site). This generation will offset the same quantity of generation per year which would have otherwise been produced from the NSW electricity production pool.

The availability of an additional 28 GWh supply from a renewable biomass source reduces the need for supply from fossil fuel sources such as coal, gas or a combination of these and can reduce the carbon intensity of electricity supplied to the NSW grid. This translates to a net greenhouse benefit where a low greenhouse emission energy supply displaces higher greenhouse emission intensity forms of electricity generation.

To gain an indication of the net greenhouse gas benefit of electricity supply from biomass relative to the existing supply to the NSW grid, the existing emissions for a comparable supply of 28 GWh have been calculated using the published National Greenhouse Accounts Factor for consumption of purchased electricity by end users in NSW and ACT of 0.89 kg CO_2-e/kWh (**Table 4-5**). The factor of 0.89 reflects the emissions from a mix of predominately coal and gas and to a lesser extent of renewable energy sources. The actual emission savings through implementation of the Power Plant depend on the type of generation displaced and are greatest for displacement of coal fired electricity generation.

Whilst the emissions intensities are commonly compared to the NSW GGAS Pool Coefficient, it is considered that the National Greenhouse Accounts (NGA) factors Scope 2 emission factor of 890 kg CO_2-e/MWh provides a more relevant basis for comparison. The NSW Pool Coefficient only includes a subset of electricity generators, and does not include the full suite of Scope 3 emissions associated with fuel combustion.

The existing NSW grid emissions associated with the production of 28 GWh have been calculated as 25 kilotonnes CO_2-e pa, therefore operation of the Power Plant will result in abatement of approximately 23.8 kt CO_2-e emissions as shown in **Table 4-5.** The emissions intensity associated with electricity production by the proposed power plant is 41 kg CO_2-e/MWh. This is a decrease of 849 kg CO2-e/MWh when compared to the NSW average of 890 kg CO_2-e/MWh.

Table 4-5 Annual Avoided Emissions

Avoided Emissions	Units	Quantity
Electricity (sent out generation)	GWh	28
NSW grid average electricity generation intensity	kg CO_2-e/MWh	890[19]
SEFE electricity generation emissions intensity	kg CO_2-e/MWh	41
Emissions for the same electricity production produced by NSW Pool	t CO_2-e	24,900
SEFE generation emissions	t CO_2-e	1,140
Avoided Emissions	t CO_2-e	23,780

[19] Department of Climate Change, National Greenhouse Accounts (NGA) Factors, June 2009

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4.1.6 Greenhouse Gas Intensity Performance

The proposed Power Plant results in electricity production at a lower greenhouse intensity than the existing NSW average. **Table 4-6** shows the emissions intensity of the proposed Power Plant against the emission intensities for a range of generator types in NSW.

When performing comparisons it should be noted that the data presented in **Table 4-6** represent the instantaneous emissions intensity of each technology type operating at its peak efficiency and does not include fuel consumption associated with start-up and shutdown of the plant.

Table 4-6 Emissions Intensity of Various Generator Types[20]

Generator Type	Emissions Intensity kg CO_2-e / MWh
SEFE Biomass Power Plant	41
Open Cycle Gas-Fired Turbine	~600 – 700
Combined Cycle Gas Turbine	~400 – 500
Coal-Fired – Best Existing Australian Plant	830
Coal Fired World's Best Practice	~ 800 – 810

4.1.7 Transmission Losses

Electricity generated by the proposal is likely to encounter more efficient transmission than does electricity which is currently supplied to the region. Within a transmission network, losses occur along power lines and in transformers and depending upon location, are in the order of 5 to 10% of the power provided by generators. Whilst not quantified in this assessment, the following factors are likely to result in reduced transmission losses comparative to those existing:

- The proposal would be located at the end of a transmission line on which there is minimal existing power generation. The nearest existing generator is understood to be Brown Mountain Hydro, which has a generating capacity of 5 MW, which is small in comparison to consumption in the region. This means that electricity provided to the grid by SEFE is likely to displace load flows which currently originate beyond Cooma.
- A proportion of the power generated will be used on the SEFE site for (existing) wood processing operations not associated with the power plant. This power will pass from the power plant to the existing substation bus at a Voltage of 11kV.

Figure 4-1[21] shows a transmission network diagram for the region which includes the Edrom substation which is located at the SEFE site.

[20] NSW Government. Energy Direction Green Paper. 2004
[21] Source Country Energy http://www.countryenergy.com.au

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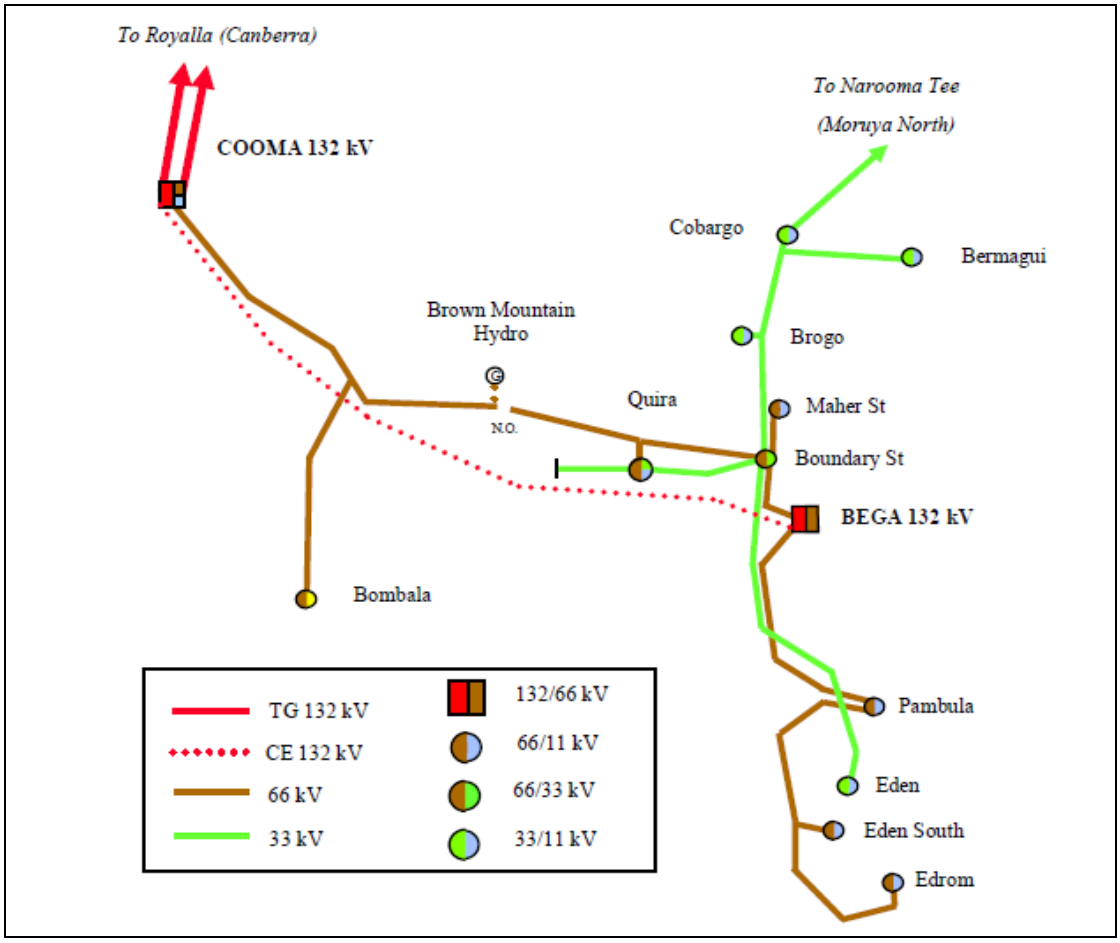
Figure 4-1 Transmission Network Diagram for the SEFE Region



4.2 Comparison to National and NSW Greenhouse Gas Inventories

The National Greenhouse Gas Inventory 2007 (Department of Climate Change, 2009)[22] is the latest available national account of Australia's greenhouse gas emissions. Australia's net direct greenhouse gas emissions across all sectors totalled 597.2 $MtCO_2$-e in 2007, with the stationary energy sector being responsible for 291.7 Mt CO_2-e.

According to the National Greenhouse Gas Inventory, NSW net direct greenhouse gas emissions were estimated to be 162.7 Mt CO_2-e. Stationary energy sources were estimated to account for 79.4 Mt CO_2-e of NSW emissions, equating to approximately 49% of total NSW greenhouse gas emissions. The electricity supply industry therefore has an important role to play in reducing Australia's greenhouse gas emission industry. The greenhouse emissions that will be generated by the Power Plant will be insignificant in comparison to national and state total and stationary energy sector emissions, however operation of the plant will lead to a minor reduction in these inventories.

[22] Commonwealth of Australia. Australian National Greenhouse Accounts National Inventory by Economic Sector 2007.

4 Greenhouse Gas Inventory

Table 4-7 Comparison of Project Emissions with Australian and State Emissions

	Total Emissions	Contribution by Project	Emissions reduction by Project
	Mt CO_2-e	%	%
Total Australian Emissions	597.2	0.0002	0.0040
Australia Stationary Energy	205.9	0.0006	0.0115
Total NSW emissions	160.7	0.0007	0.0148
NSW Stationary Energy	47.1	0.0024	0.505

4.3 Mitigation Measures

The greenhouse gas assessment indicates that although the Power Plant will lead to increased greenhouse gas emissions compared to the current practice, avoided emissions due to electricity production from renewable source will result in an overall reduction in emissions. Given the above, further mitigation measures, including offsets have not been considered as part of this assessment.

In order to minimise greenhouse emissions during construction, energy efficient materials will be used during construction and wastage will be minimised. Emissions will also be minimised during operation by minimising the use of fuel oils for start-up as well as optimising plant efficiency in terms of fuel handling, combustion efficiency and auxiliary energy.

5

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Limitations

URS Australia Pty Ltd (URS) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of South East Fibre Exports Pty Ltd (SEFE) and only those third parties who have been authorised in writing by URS to rely on the report. It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the Proposal dated 22 April 2009.

The methodology adopted and sources of information used by URS are outlined in this report. URS has made no independent verification of this information beyond the agreed scope of works and URS assumes no responsibility for any inaccuracies or omissions. No indications were found during our investigations that information contained in this report as provided to URS was false.

This report was prepared between July and February 2010 and is based on the conditions encountered and information reviewed at the time of preparation. URS disclaims responsibility for any changes that may have occurred after this time.

This report should be read in full. No responsibility is accepted for use of any part of this report in any other context or for any other purpose or by third parties. This report does not purport to give legal advice. Legal advice can only be given by qualified legal practitioners.

A

Appendix A Greenhouse Gas Inventory

Material quantities

			Current	Proposed
SEFE site	Woodwaste generated	t	35000	35000
	Woodwaste combusted	%	4%	100%
		t	1400	35000
	Woodwaste taken to third party for use in process heat	t	20%	0%
			7000	0
	Woodwaste mulched and distributed offsite	%	76%	0%
		t	26600	0
	Woodwaste combusted (imported)	t	0	22600
	Total woodwaste combusted onsite		1400	57600
		t		
	Ash generated	t	10	403
Third party sites	Woodwaste generated		22600	22600
	Woodwaste combusted onsite (incl. for process heat)	%	50%	0%
		t	11300	0
	Woodwaste mulched and distributed offsite	%	50%	0%
		t	11300	0
	Ash generated	t	79	0
Totals	Total woodwaste combusted	t	19700	57600
	Total woodwaste mulched	t	37900	0

Hauling Distances

			Distance	Fraction of Total
Ash Disposal	SEFE to ash disposal site	km	85	
	Third party mills to plantation disposal site	km	85	
	Third party mills to landfill disposal site	km	5	100%
	Weighted average	km	5	
Mulch distribution	SEFE to Sydney market	km	470	60%
	SEFE to Canberra market	km	315	40%
	Weighted average	km	408	
	Third party mills to mulch market	km	335	
Importation of woodwaste	Local mill to SEFE	km	35	40%
	Other mills to SEFE	km	100	60%
	Weighted average	km	74	

Scope 1 Emissions

			Current	Proposed
Woodwaste combustion	Amount combusted on site	t	1400	57600
	Emission factor	tCO_2-e/t wood	0.013	0.013
	Emissions	**tCO_2-e**	**19**	**767**
Distillate combustion (Mobile)	FEL operation	hrs	1500	2700
		kL/hr	0.02	0.02
		kL	30	54
	Emission factor	tCO_2-e/kL distillate	2.70	2.70
	Emissions	**tCO_2-e**	**81**	**146**
Distillate combustion (Stationary)	Starts per year	-	-	4
	Boiler start-up fuel	kL/start	-	0.05
		kL	0	0.2
	Emission factor	tCO_2-e/kL distillate	2.68	2.68
	Emissions	**tCO_2-e**	**0**	**0.5**
TOTAL SCOPE 1			**100**	**913**

Scope 2 Emissions

	Current	Proposed
TOTAL SCOPE 2	**0**	**0**

Scope 3 (Upstream) Emissions

			Current	Proposed
Woodwaste combustion at other sawmills	Amount of woodwaste combusted	t	18300	0
	Emission factor	tCO_2-e/t wood	0.013	0.013
	Emissions	**tCO_2-e**	**244**	**0**
Woodwaste composting at other sawmills	Amount of woodwaste composted	t	11300	0
	Emission factor	tCO_2-e/t wood	0.17	0.17
	Emissions	**tCO_2-e**	**1921**	**0**
Distribution of mulch from other sawmills to Market	Amount of mulch distributed	t	11300	0
	Truck capacity	t	25	25
	Number of loads	-	452	0
	Distance to destination	km	335	335
	Distance travelled	km	302840	0
	Emission factor	tCO_2-e/km	0.002	0.002
	Emissions	**tCO_2-e**	**480**	**0**
Distribution of mulch from other sawmills to SEFE	Amount of mulch distributed	t	0	22600
	Truck capacity	t	25	25
	Number of loads	-	0	904
	Distance to destination	km	74	74
	Distance travelled	km	0	133792
	Emission factor	tCO_2-e/km	0.002	0.002
	Emissions	**tCO_2-e**	**0**	**212**
Disposal of ash from other sawmills	Amount of ash disposed	t	79	0
	Truck capacity	t	25	25
	Number of loads	-	3	0
	Distance to destination	km	5	335
	Distance travelled	km	32	0
	Emission factor	tCO_2-e/km	0.002	0.002
	Emissions	**tCO_2-e**	**0.1**	**0**
Extraction and distribution of distillate fuel used at SEFE	**Amount of distillate combusted onsite**	**kL**	**30**	**54**
fuel used at SEFE	Emission factor	tCO_2-e/km	0.205	0.205
	Emissions	**tCO_2-e**	**6**	**11**
TOTAL SCOPE 3 (UPSTREAM)			**2651**	**223**

Scope 3 (Downstream) Emissions

			Current	Proposed
Woodwaste composting of material from SEFE	Amount of woodwaste composted	t	26600	0
	Emission factor	tCO_2-e/t wood	0.17	0.17
	Emissions	**tCO_2-e**	**4522**	**0**
Distribution of mulch from SEFE to market	Amount of mulch distributed	t	26600	0
	Truck capacity	t	25	25
	Number of loads	-	1064	0
	Distance to destination	km	408	335
	Distance travelled	km	868224	0
	Emission factor	tCO_2-e/km	0.002	0.002
	Emissions	**tCO_2-e**	**1376**	**0**
Disposal of ash from SEFE	Amount of ash disposed	t	10	403
	Truck capacity	t	25	25
	Number of loads	-	0.4	16
	Distance to destination	km	85	85
	Distance travelled	km	67	2742
	Emission factor	tCO_2-e/km	0.002	0.002
	Emissions	**tCO_2-e**	**0.11**	**4.3**
TOTAL SCOPE 3 (UPSTREAM)			**5898**	**4**

Avoided Emissions

			Current	Proposed
Displacement of existing generation	Electricity exported to grid	MWh	0	27930
	NSW grid average electricity generation intensity	tCO_2-e/MWh	0.89	0.89
	Emissions for the same electricity produced elsewhere	tCO_2-e	0	24858
	Displaced emissions	**tCO_2-e**	0	-24858

Construction and Decommissioning Emissions

Proposed

Emissions derived from embodied energy of plant materials	**Concrete**	**Emission Factor**	**Material Quantity (t)**	**tCO_2-e**
	Foundations and slab	0.126	1000	126
	Steel			
	Turbine and condenser	3.01	70	211
	Boiler, ESP, stack and structure	3.01	200	602
	Sea water delivery system (piping)	3.01	125	376
	Emissions		**tCO_2-e**	**1315**
Delivery of concrete	Amount of concrete delivered		t	1000
	Truck capacity		t	15
	Number of loads		-	67
	Distance to destination		km	40
	Distance travelled		km	5333
	Emission factor		tCO_2-e/km	0.002
	Emissions		**tCO_2-e**	**8.5**
Delivery of materials	Number of loads		-	20
	Distance to destination		km	420
	Distance travelled		km	16800
	Emission factor		tCO_2-e/km	0.002
	Emissions		**tCO_2-e**	**26.6**
TOTAL CONSTRUCTION EMISSIONS				**1350**
	Plant life		years	30
TOTAL CONSTRUCTION EMISSIONS (ANNUALISED)				**45**

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