FINAL REPORT

Greenhouse Gas (GHG) Emissions Forecast and Management Plan

Prepared for

Central West Coal Pty Ltd

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8 December 2008

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Date: 8 December 2008
Reference:
Status: Final Report

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Glossary

ABGR	Australian Building Greenhouse Rating
AC	Alternating Current
AGO	Australian Greenhouse Office
Benchmarking	Process used in management, in which organizations evaluate various aspects of their processes in relation to best practice, usually within their own sector
Bio-sequestration	
BIPV	Building Integrated Photovoltaic systems
CFCs	Chlorofluorocarbons
CO_2	Carbon dioxide
CO_2-e	Carbon dioxide equivalents
CSR	Corporate Social Responsibility
CVRS	Computer Vehicle and Routing Systems
DECC	Department of Environment and Climate Change
DC	Direct Current
ECU	Edith Cowan University
EEO	Energy Efficiency Opportunities Act
FY	Financial Year
GCHP	Ground Coupled Heat Pump
Geo-sequestration	geo-sequestration involves injecting carbon dioxide directly into underground geological formations
GHG emissions	Greenhouse Gas emissions
GJ	Giga Joules (10^{12} Joules)
GSHP	Ground Source Heat Pump
GWP	Global Warming Potential

Glossary

HFC's	Hydrofluorocarbons
HFE's	Hydrofluoroethers
IPCC	Intergovernmental Panel on Climate Change
KPI	Key Performance Indicator
kW	kilo Watt (10^3 watts)
kWh	kilo Watt hours
LPG	Liquefied Petroleum Gas
NGACs	NSW Greenhouse Abatement Certificates
NGA Factors	National Greenhouse Accounts Factors
NGERs	National Greenhouse and Energy Reporting Act
NPAT	Net Profit after Tax
PFC's	Perflurocarbons
PV	Photovoltaic
RECs	Renewable Energy Certificates
SWIS	South West Interconnected System
UNFCCC	United Nations Framework Convention on Climate Change
UV	Ultraviolet
VSD	Variable speed drive
WBCSD	World Business Council for Sustainable Development

Section 1 Introduction

1.1 Purpose and Scope of this document

This greenhouse gas (GHG) emissions forecast and management plan has the following purposes:

- estimate the GHG emissions footprint of the Central West Coal Project;
- document future (planned) abatement initiatives (e.g. energy efficiency) to be implemented at the Central West Coal mine site; and
- identify and determine the feasibility of offsets and abatement opportunities to reduce the Project's GHG liability.

For the described Central West Coal Project, this GHG emissions forecast and management plan will provide the following information:

- a summary of GHG emissions forecasts for the life of the mine site; and
- a list of options to reduce the GHG emissions footprint of the mine site (through abatement and offset options discussed in the report), which will be assessed against the GHG emissions reduction and the cost of the respective abatement options.

1.2 Facility Background

1.2.1 General

Central West Coal Pty Ltd (a wholly owned subsidiary of Aviva Corporation Limited [Aviva]) proposes to develop the Central West Coal Project ("the Project") located near Eneabba, WA (Figure 1-1). The Project will involve the mining of a 60- 75 million tonne (Mt) sub-bituminous coal deposit (the Central West Coal Deposit) as an energy source for the adjacent proposed Coolimba Power Station.

1.2.2 Location

The Central West Coal Project coal deposit is located in the Perth Basin in Western Australia. The project area is near the small town of Eneabba, approximately 250km north of Perth. Refer to Figure 1-1 for details of location.

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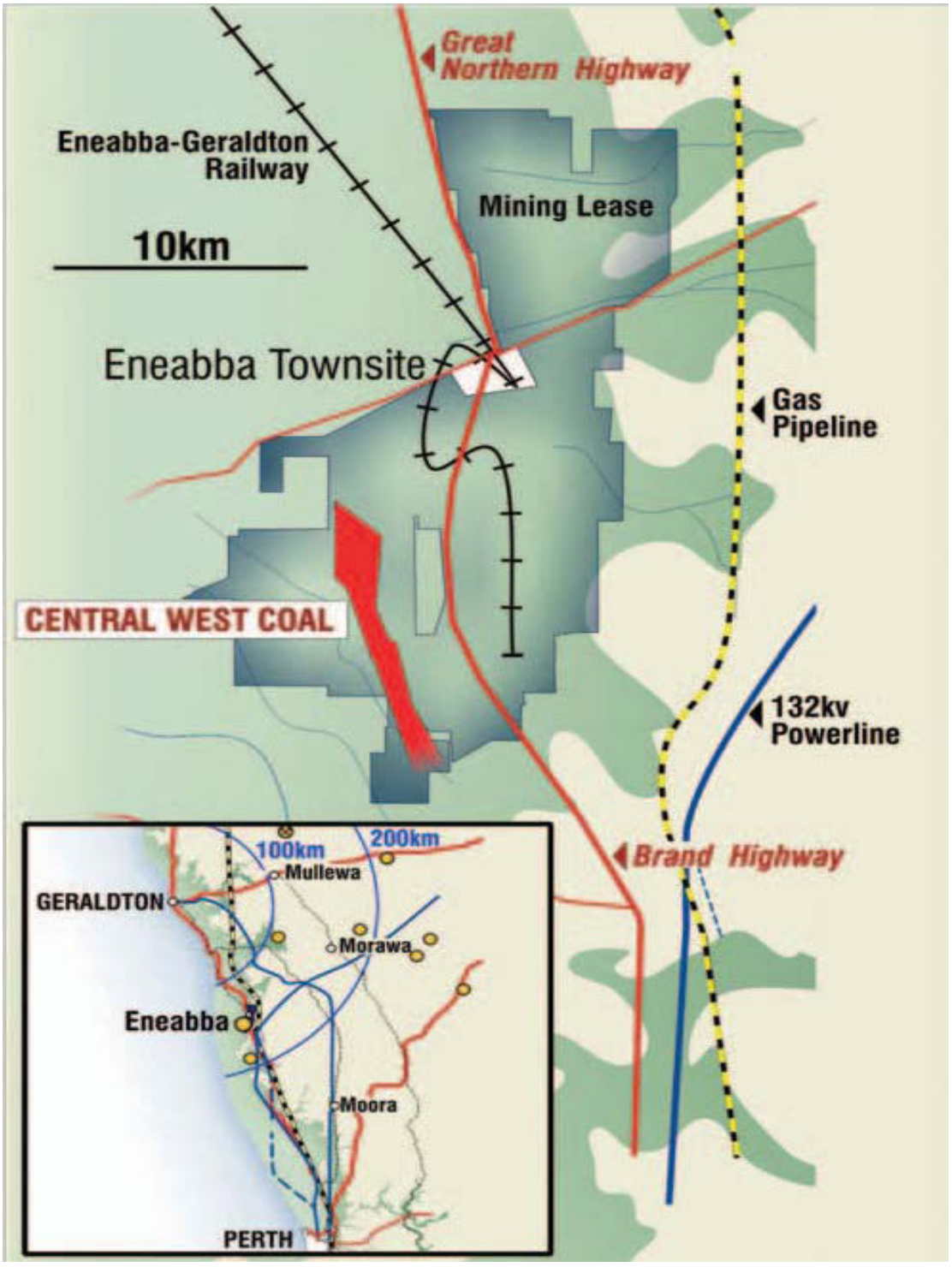

Figure 1-1 Site Location Map

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1.2.3 Process Description

This section describes the main process features of the mining facilities and operation (Refer to Section 3 of PER for detailed description).

Mining will occur progressively and will comprise an open-cut strip mine to extract approximately 2 to 2.5 million tonnes per annum (Mtpa) of sub-bituminous coal. Based on the current estimate of reserves, the anticipated life of the mine is 30 years.

The mine will progress along the ore-body and with a disturbed open area of approximately 75 ha at any one time, with a continual backfill and progressive rehabilitation programme. Vegetation and topsoil will be cleared and stockpiled for use in progressive rehabilitation. Overburden will then be removed by dozer and transported to the waste dump to be used to backfill the pit. The coal will be trucked to the Run of Mine (ROM) area, crushed, screened and stockpiled ready to be conveyed to the power station.

1.3 Emission Sources and Calculation

GHG assessments examine emission sources as a significant part of the assessment. Typically the sources of emissions can be from contributions such as

- **Inputs** - emissions associated with extraction of raw materials and energy consumption. Note that electricity produced from fossil fuels used by the Project will be attributed as indirect emissions to the project. The extent to which the Project is liable for these emissions will depend on the rules of the particular State ,Federal and/or International regulatory regime;
- **Process** - emissions as a result of “coalification” process, chemical processes (e.g. waster water treatment) occurring in the mining and processing operations, at the Project;
- **Outputs** - products and waste produced (e.g. coal processing, GHG emissions from the use of fossil fuels, methane from waste coal oxidation, coal wastes, reject piles);
- **Transport** - including the transportation of raw materials, waste products etc. from the coal mine to the power station;
- **Fugitive losses** – emissions released during mining, crushing or pulverising coal, handling, processing, storage, equipment failure etc.;
- **Vented losses** - direct venting of CO_2 or methane as a result of normal operations (operating practices, onsite utilisation opportunities for methane) and coal fires (gas content of coal), fuel NO_X, thermal NOx, etc.

The following emission sources have been considered when preparing the GHG inventory and forecast for the Project, including:

- **Electricity consumption** – by equipment on the mine site;
- **Fuel consumption** – including LPG and natural gas in equipment and workshop facilities etc;
- **Fleet fuel consumption** – including both contractor and company owned vehicles;
    - Petrol
    - Diesel
    - LPG
- **Stationary/Back up Power Generation** – diesel generators;
- Coal Seam Gas;
- Waste Coal Oxidation (from mining overburden and stock pile); and

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- **Land use and clearing** – any land clearing during the construction phase and life of the Project.

Section 2 Regulations and Protocols

2.1 State Government

In February 2007, the Premier of Western Australia released the Greenhouse and Energy Taskforce "*A Cleaner Energy Future*" report. The Taskforce recommends that **long-term costs and impacts of greenhouse gas emissions need to be "factored into the decision process"** and also recommends that ***"as a general principle, all new stationary energy developments should be liable for the full cost of future GHG emission compliance"*.**

The report encourages the State to "continue its efforts to achieve a national emissions trading scheme, fair to all participants, as a precursor to global trading arrangements". The Taskforce recommends national emissions trading, with prices capped at $25 to $35 per tonne CO_2-e through 2030.

Environmental Protection Authority (EPA) Guidance Notes

WA EPA Guidance Statement #12, "Minimising Greenhouse Gas Emissions", specifically addresses the minimisation of GHG emissions from significant new or expanding operations and requires proponents to clearly indicate in their environmental review documentation of the following:

- GHG emissions inventory and benchmarking;
- Measures to minimise GHG emissions annually and over the life of the project;
- Carbon sequestration e.g. bio-sequestration, geo-sequestration, chemical, soil uptake and reuse; and
- Benefits of reduced GHG emissions on a National or Global scale;

The Guidance Statement also suggests that proponents adequately address/commit to:

- applying best practice to maximise energy efficiency and minimise GHG emissions;
- undertaking comprehensive analysis to identify and implement appropriate offsets; and
- undertaking ongoing programmes to monitor and report emissions and periodically assess opportunities to further reduce GHG emissions over time.

The key aspects of GHG emissions reductions strategy for the Project would include:

- To assess the National (Australian Emissions Trading Scheme (AETS)) and International (Kyoto Protocol, CDM, JI and Emissions Trading) regulatory regime under which the business unit will operate;
- To identify company wide source of liability – implications for the Project, post Australia ratifying the Kyoto Protocol;
- To identify GHG emission abatement opportunities across the mine site;
- To incorporate the concept of GHG emission costs into planning and operations - develop a GHG Emissions Forecast to estimate company wide liability;
- To assess internal emission reduction assets and liabilities using conventional financial and strategic analysis – undertake. Scenario Analysis to estimate difference in GHG emissions from Business as Usual (BAU) Scenario vs. energy efficiency;
- To develop marginal abatement costs curves for all emission abatement opportunities - identify least cost opportunities to reduce GHG emissions;

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- To compare projected internal marginal abatement costs against predicted price trends of tradable carbon instruments, accounting for performance and price uncertainties – sensitivity analysis to include carbon modelling;
- To identify external investment opportunities (e.g. Clean Development Mechanisms (CDM) and Joint Implementation (JI)) with a particular focus on projects that fall within Central West Coal Pty Ltd's core competence and geographic reach; and
- To outline a risk management plan to map the potential consequences of committing to particular strategies.

2.2 Federal Government

2.2.1 Carbon Pollution Reduction Scheme (CPRS)

While the Carbon Pollution Reduction Scheme (CPRS) is not yet legislated, the Federal Government has released two green papers and advised that the legislation will be in effect in 2010. It works by mandating that every organisation with a facility that emits 25 kilotonnes of CO_2-e or more per year must report and purchase a permit for every tonne of CO_2-e it releases.

Permits will be auctioned throughout the year. Where not enough permits are available, or where they are too expensive, some carbon offsets may be supplemented into the scheme; from various forestry projects or from those under Kyoto Protocol's Clean Development Mechanisms (CDMs).

The design of the scheme outlined in the Green Paper[1] provides no scope for voluntary offsets under the scheme and will render programs like the Greenhouse Friendly™ and GreenPower™ ineffective. Table 2-1 provides the timeline the Federal Government has proposed for the introduction of the scheme.

Table 2-1 Timelines for the CPRS

March to June 2008	Phase 1 consultation with stakeholders to inform the development of the Green Paper, including: • ongoing consultation with states and territories through the Council of Australian Governments; • roundtable discussions with peak industry and non-government organisations, with inaugural meetings held on 3 March; • consultation with the agriculture and forestry sectors on the question of their inclusion in the emissions trading scheme and on the timeframe for that inclusion; and • targetted consultations on technical design issues.
July 2008	Public release of the Green Paper on scheme design
July-Sep 2008	Phase 2 consultation on the Green Paper
Dec 2008	Public release of exposure draft of legislative package
Dec 2008 - Feb 2009	Phase 3 consultation on exposure draft legislation package

[1] http://www.climatechange.gov.au/greenpaper/index.html

End 2008	Firm indication by Government of planned medium-term trajectory for the scheme
Mar 2009	Bill introduced into Parliament
Mid-2009	Government aims to achieve passage of bill by Parliament at this time
During 2009	Phase 4 consultation on emissions trading regulations
3rd quarter 2009	Act enters into force; scheme regulator established
2010	Emissions trading scheme will commence

2.2.2 National Greenhouse and Energy Reporting (NGER) Act

The National Greenhouse and Energy Reporting Act was passed in September 2007 establishing a mandatory corporate reporting system for GHG emissions, energy consumption and production. From 1 July 2008, corporations will be required to register and report for the financial year 08/09 if:

- They control a facility that emits 25 kilotonnes or more of greenhouse gases (CO_2-e), or produce or consume 100 terajoules or more of energy; or
- Their corporate group emits 125 kilotonnes or more greenhouse gases (CO_2-e), or produces or consume 500 terajoules or more of energy.

Measurement Methods

The four Methods used for estimating GHG emissions, as stated in the NGER technical guidelines are listed below:

- **Method 1: the National Greenhouse Accounts default method -** specifies the use of designated emission factors in the estimation of emissions. These emission factors are national average factors determined by the Department of Climate Change using the Australian Greenhouse Emissions Information System (AGEIS).
- **Method 2: a facility-specific method using industry sampling and Australian or international standards listed in the Determination or equivalent for analysis** of fuels and raw materials to provide more accurate estimates of emissions at facility level. It is based on existing technical guidelines used by reporters under the Generator Efficiency Standards program.
- **Method 3: a facility-specific method using Australian or international standards listed in the Determination or equivalent standards for both sampling and analysis of fuels and raw materials** – Reporters to comply with Australian or international documentary standards for sampling (of fuels or raw materials) or equivalent as well as documentary standards for the analysis of fuels.
- **Method 4: direct monitoring of emission systems -** two systems for direct emissions monitoring are available including:
  - continuous emissions monitoring (**CEM**); and
  - periodic emissions monitoring (**PEM**).

These approaches enable direct monitoring of greenhouse emissions arising from an activity. This can provide a higher level of accuracy in certain circumstances, depending on the type of emission process although it is more data intensive than other approaches.

Assessment of uncertainty

To standardise the calculation of uncertainty estimates the *GHG Protocol guidance on uncertainty assessment in GHG inventories and calculating statistical parameter uncertainty (September 2003) v1.0 (the protocol)* should be used when estimating uncertainty of emissions.

Uncertainty must be assessed in accordance with protocol so that the range for an emissions estimate encompasses the actual amount of the emissions with 95% confidence. Uncertainty of emissions should be reported at the corporation level – the protocol provides a method for the aggregation of uncertainty across emission sources and facilities. The reporting of uncertainty of emission estimates for individual facilities is not required.

The NGA Emission Factor Ratings framework is designed to provide information on the benefits for improving emission estimation from developing and utilising facility-specific emission factors in preference to the use of NGA default emission factors. Ratings have been allocated to each emission factor method by particular emission source and, in particular, fuel type. The ratings are intended to reflect the level of confidence in the emission factor utilised. They range from 'AAA' (highest confidence) to 'D' (lowest level of confidence).

Selecting measurement method

For an emissions source, **once a method has been selected by a Reporter (e.g. Central West Coal), this selection must be maintained throughout a minimum four year period, unless a method with a higher number is chosen** (*Technical Guidelines*[2]: page 30). For example, if Central West Coal chose Method 2 to measure the CO_2 emissions from processing operations, it would have to continue using Method 2 for the next 4 years. Central West Coal cannot revert to Method 1. However, the *Technical Guidelines* would allow Central West Coal to change to a higher method, in this case, Method 3. Similarly, if Central West Coal chose Method 4 to measure CO_2 and CH_4 from fugitive emissions from deliberate releases from process vents, system upsets and accidents, it cannot revert to Method 1 before 4 years elapses. Conversely, Central West Coal can change to Method 4 within the 4 year period if it starts with Method 1.

Although Method 1 might be practical start with, there is a possibility of overestimating emissions depending on how accurate Central West Coal's estimates the quantities of fuels used/combusted. Hence it is in Central West Coal interest to go to a higher order measurement method as soon as possible.

It is recommended that Central West Coal should initially adopt Method 1 and progressively install GHG emissions measuring devices and metering and monitoring plan to capture more accurate information to report under the higher methods (Methods 2-4) in the future.

2.2.3 Energy Efficiency Opportunities (EEO) Act

The Energy Efficiency Opportunities (EEO) program encourages large energy-using businesses to improve their energy efficiency. It does this by requiring businesses to identify, evaluate and report publicly on cost effective energy savings opportunities. The EEO program is designed to lead to:

- improved identification and uptake of cost-effective energy efficiency opportunities
- improved productivity and reduced greenhouse gas emissions
- greater scrutiny of energy use by large energy consumers

[2] http://www.climatechange.gov.au/reporting/guidelines/index.html

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Participation in the EEO program is mandatory for corporations that use more than 0.5 petajoules (PJ) of energy per year.

2.3 Kyoto Protocol

The Kyoto Protocol is an international agreement linked to the United Nations Framework Convention on Climate Change (UNFCCC), with the objective of reducing GHG emissions that cause anthropogenic climate change. The major feature of the Kyoto Protocol is that it sets binding targets for 37 industrialized countries including Australia and the European community for reducing greenhouse gas (GHG) emissions.

The Kyoto Protocol was adopted in Kyoto, Japan, on 11 December 1997 and entered into force on 16 February 2005. As of June 2008, 182 countries have ratified the protocol. The detailed rules for the implementation of the Protocol were adopted at COP 7 in Marrakesh in 2001, and are called the "Marrakesh Accords."

2.3.1 The Kyoto mechanisms

Under the Treaty, countries must meet their targets primarily through national measures. However, the Kyoto Protocol offers them an additional means of meeting their targets by way of three market-based mechanisms, which include.

- **Emissions Trading**;
- **Clean Development Mechanism (CDM)** - an arrangement under the Kyoto Protocol allowing industrialised countries (Annex 1 countries) with a GHG emissions reduction commitment to invest in projects that reduce GHG emissions in developing countries as an alternative to more expensive emission reductions in their own countries; and
- **Joint Implementation (JI)** - allows a country with an emission reduction or limitation commitment under the Kyoto Protocol (Annex B Party) to earn emission reduction units (ERUs) from an emission-reduction or emission removal project in another Annex B Party, each equivalent to one tonne of CO2, which can be counted towards meeting its Kyoto target.

By the end of the first commitment period of the Kyoto Protocol in 2012, a new international framework needs to have been negotiated and ratified that can deliver the stringent emission reductions as clearly indicated are needed in the Assessment Reports published by the Intergovernmental Panel on Climate Change (IPCC).

COP13 - Bali Conference

The December 2007 Bali UNFCCC conference developed the agenda for the post- Kyoto negotiations. The outcomes agreed at Bali, is that developed countries take on quantitative commitments, while developing countries are to undertake "measurable, reportable and verifiable" mitigation actions. Sectoral approaches to mitigation, incentive mechanisms to reduce tropical deforestation and a broadened CDM are expected to expand the reach of a post-2012 framework. New support mechanisms are likely to be created for adaptation, technology development and diffusion, as well as financing and investment.

Discussions at the Bali UNFCCC conference also expressed a strong international and domestic interest in the establishment of interim targets, in particular the target for 2020. Independent of their effects on the cost of mitigation or climate change, today interim targets for developed countries have become the subject of international negotiation. Developed countries, with the exception of the United States of America have committed themselves under the Kyoto accord to emission limits to be achieved by 2008-2012[3].

[3] Garnaut Report

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2.3.2 Implications of International Negotiations for Australia

Australia has recently committed itself to a reduction in sixty per cent of GHG emissions by 2050 relative to 2000. The European Union committed itself to a reduction target of twenty per cent from 1990 levels by 2020 and 30 per cent provided that other developed countries commit themselves to comparable emission reductions, and to 60-80 per cent reductions by 2050. The US federally is yet to commit to either short- or long-term targets, though recent legislative initiatives suggest that it may soon have long-term targets in place. California has legislated a reduction to 1990 levels by 2020 and eighty per cent reduction below 1990 by 2050.

Australia is legally bound to meet its Kyoto commitments in the first period (2008 – 2012). International negotiations are currently being held to discuss what targets need to be set for the second phase i.e. post 2012. As a result, Central West Coal Pty Ltd need to view the international negotiations carefully, as its GHG emissions may affect the financial viability of the Project.

Section 3 Emissions Forecast

3.1 Forecasting Method

The extraction of the coal by open cut mining and its transport to the Coolimba Power Station will require the use of energy and consequent GHG emissions. Furthermore, quantities of methane, trapped in the coal are released when the coal is mined.

In recent years, the Greenhouse Gas Protocol (the Protocol), developed jointly by the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI), has emerged as the de facto working standard for estimating corporate greenhouse gas emissions. The WBCSD explained the context and two part structure of the Protocol as follows:

"The Greenhouse Gas Protocol Initiative's (GHG Protocol) goal is to help businesses better manage their greenhouse gas (GHG) emissions, create a GHG accounting platform to ensure that different trading schemes and other climate related initiatives adopt consistent approaches, and to generally expand GHG accounting capacity around the world.

The GHG Protocol Initiative has developed two documents to facilitate the accounting and reporting of GHG emissions from corporate inventories and GHG reduction projects:

- *The Corporate Accounting and Reporting Standard (Corporate Standard) provides step by step guidance for companies and other organisations to identify, calculate, and report their GHG footprint in a consistent, transparent, and credible manner. The requirements contained in this document provide the backbone for GHG corporate accounting practices around the world.*
- *The GHG Protocol for Project Accounting (Project Protocol) provides specific principles, concepts, and methods for quantifying and reporting GHG reductions—that is, the decreases in GHG emissions or the increases in GHG removals—from climate change mitigation projects."*

A key feature of the GHG Protocol is the approach it takes to setting "operational boundaries" for an emissions inventory. The operation boundary defines what GHG emissions sources are to be included and those to be excluded when reporting the GHG emissions inventory for the Project. The Corporate Accounting and Reporting Standard of the Protocol define the issue in the following terms.

"For effective and innovative GHG management, setting operational boundaries that are comprehensive with respect to direct and indirect emissions will help a company better manage the full spectrum of GHG risks and opportunities that exist along its value chain."

- **Direct GHG emissions** are emissions from sources that are owned or controlled by the company (e.g. from usage of equipment and vehicles for mining process).
- **Indirect GHG emissions** are emissions that are a consequence of the activities of the company but occur at sources owned or controlled by another company (e.g. from purchased electricity).

The Greenhouse Gas Protocol defines three 'scopes' for estimating greenhouse gas emissions:

1. **Scope 1** covers **direct** emissions from sources within the organisation;
2. **Scope 2** covers **indirect** emissions resulting from the consumption of **purchased electricity, steam or heat**; and
3. **Scope 3** includes all other indirect emissions resulting as a consequence of the organisation's activities.

Table 3-1 gives examples of GHG emission sources in coal mining.

Section 3 Emissions Forecast

Table 3-1 Examples of Emission Sources for Coal Mining

Scope 1 Emission Sources	Scope 2 Emission Sources	Scope 3 Emission Sources
Stationary combustion (diesel gensets)	Stationary combustion (consumption of purchased electricity, heat or steam)	Stationary combustion (product use as fuel)
Mobile combustion (mining equipment, transportation of coal)		(transportation of coal / waste, employee business travel, employee commuting)
Fugitive emissions (methane emissions from coal mines and coal pits)		Process emissions (during mining, crushing or pulverising coal, handling, processing, storage, equipment failure, gasification)

The major sources of greenhouse gas emissions from mining operations are:

- consumption of diesel fuel by mining equipment (e.g. dump trucks, dozers, front end loaders);
- consumption of electricity by mining equipment (e.g. dragline); and
- fugitive emissions from exposed coal.

Total lifetime output of raw coal from the Project is between 60 and 75 Mt, based on:

- Average annual output of 2 to 2.5 million tonnes per annum (Mtpa) raw coal, and
- Project operating life of 30 years.

Emissions from each source are calculated by multiplying the quantity of the source material consumed (the activity figure) by the relevant emission factor for that activity. Activity levels and emission factors are shown in the.

In the case of fugitive emissions of methane, the emission factor for methane, measured as kg of methane released per tonne of raw coal mined, is multiplied by the Global Warming Potential (GWP), which equates the greenhouse effect of a given mass of methane with the effect of the same mass of CO_2. The GWP of methane is 21, meaning that methane is 21 times more greenhouse “potent” than CO_2 on a tonne for tonne basis.

3.1.1 Methane Emissions from Coal Mines

Since the coal bed for open cut mines has overburden, which is only a few metres thick, little pressure exists to keep methane in the coal. Hence, coal at surface mines tends to have low methane content. As overburden is removed and the coal seam is exposed during surface mining, methane is emitted directly to the atmosphere. With the exception of a few field studies, methane emissions from surface mines have not been measured or estimated on a mine-specific basis.

The rate at which methane is emitted during post-mining activities depends on the characteristics of the coal and the way it is handled. For instance, the highest releases occur when coal is crushed, sized, and dried. It should be noted that post-mining emissions can continue for months after mining. Post-mining emissions may be estimated by multiplying basin-specific coal production for surface and underground mines by a factor equal to thirty three percent of the average basin-specific in-situ content of the coal.

Section 3 Emissions Forecast

Table 8 on page 21 of the National Greenhouse Accounts (NGA) Factors Workbook, October 2008 lists the emission factors for the production of coal (fugitive) from open cut mines. Note the emission factor for all activities related to the extraction of coal from open cut mines though negligible, has been included in the estimation of GHG emissions from the project.

3.2 Forecast

Forecast CO_2–e emissions of the mining operations (including construction, annual operations during life of mine and decommissioning) are presented Table 3-2 and displayed in Figure 3-1. It should be noted that the estimation of GHG emissions throughout the life of the Project has been based on discussions and data provided by Central West Coal Pty Ltd personnel. URS has made no verification of the authenticity of the data provided.

Based on discussions with Central West Coal Pty Ltd personnel, it was noted that no coal seam gas is present. Hence this has not been included in the GHG emissions estimate in the following table. Evidence of this claim needs to be verified.

Section 3 Emissions Forecast

Table 3-2 Forecast GHG Emissions throughout life of Project

							Fugitive Emissions (t CO_2-e)	
Year	Electricity Usage (kWh)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Fuel Usage (kL)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Low Scenario (2MTpa)	High Scenario (2.5MTpa)
2009	3,945,536	14,204	3,827	972	37,517	2,821		
2010	5,442,483	19,593	5,279	1,167	45,030	3,386		
2011	7,367,078	26,521	7,146	1,586	61,201	4,602	34,000	42,500
2012	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2013	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2014	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2015	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2016	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2017	7,851,943	28,267	7,616	1,718	66,330	4,988	34,000	42,500
2018	8,821,673	31,758	8,557	1,984	76,587	5,759	34,000	42,500
2019	8,821,673	31,758	8,557	1,984	76,587	5,759	34,000	42,500
2020	8,821,673	31,758	8,557	1,984	76,587	5,759	34,000	42,500
2021	8,821,673	31,758	8,557	1,984	76,587	5,759	34,000	42,500
2022			8,557			5,759	34,000	42,500

Section 3 Emissions Forecast

Year	Electricity Usage (kWh)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Fuel Usage (kL)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Fugitive Emissions (t CO_2-e) Low Scenario (2MTpa)	Fugitive Emissions (t CO_2-e) High Scenario (2.5MTpa)
	8,821,673	31,758		1,984	76,587			
2023	9,791,402	35,249	9,498	2,250	86,845	6,531	34,000	42,500
2024	9,791,402	35,249	9,498	2,250	86,845	6,531	34,000	42,500
2025	9,306,537	33,504	9,027	2,117	81,716	6,145	34,000	42,500
2026	9,306,537	33,504	9,027	2,117	81,716	6,145	34,000	42,500
2027	8,336,808	30,013	8,087	1,851	71,458	5,374	34,000	42,500
2028	8,336,808	30,013	8,087	1,851	71,458	5,374	34,000	42,500
2029	8,336,808	30,013	8,087	1,851	71,458	5,374	34,000	42,500
2030	8,336,808	30,013	8,087	1,851	71,458	5,374	34,000	42,500
2031	8,336,808	30,013	8,087	1,851	71,458	5,374	34,000	42,500
2032	9,306,537	33,504	9,027	2,117	81,716	6,145	34,000	42,500
2033	10,761,132	38,740	10,438	2,516	97,103	7,302	34,000	42,500
2034	8,316,908	29,941	8,067	1,863	71,916	5,408	34,000	42,500
2035	8,316,908	29,941	8,067	1,863	71,916	5,408	34,000	42,500
2036	8,316,908	29,941	8,067	1,863	71,916	5,408	34,000	42,500

Section 3 Emissions Forecast

Year	Electricity Usage (kWh)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Fuel Usage (kL)	Energy Use (GJ)	Total Emissions (t CO_2-e)	Fugitive Emissions (t CO_2-e) Low Scenario (2MTpa)	Fugitive Emissions (t CO_2-e) High Scenario (2.5MTpa)
2037	8,316,908	29,941	8,067	1,863	71,916	5,408	34,000	42,500
2038	8,316,908	29,941	8,067	1,863	71,916	5,400	34,000	42,500
Total	**249,507,247**	**868,285**	**233,955**	**54,030**	**2,085,560**	**156,834**	952,000	1,190,000

Section 3 Emissions Forecast

The following assumptions were made in estimating the annual and project life GHG emissions:

- The raw data used for the estimations as provided by Central West Coal from “Fuel and Power Consumption. Xls”;
- The raw data was calculated from costings estimate, as evident from “Fuel and Power Consumption. Xls”. URS was not able to measure the accuracy of the data or the emissions forecasts. It is not clear, whether fuel and electricity use during construction and decommissioning phase of the project has been included. Furthermore, it should also be noted that the year of the costings estimate study is important, as the costs for oil and other resources have since increased significantly;
- The life of mine, annual production figures and other operational aspects of the mine, were taken from the Pre-feasibility Study, prepared by Minserve, dated September 2006. It has been noted that since the study was conducted, project parameters have changed, including change to 24 hours operations. This has not been taken into account for the GHG emissions estimate, provided in

Section 3 Emissions Forecast

- Table 3-2;
- Email from Rob Griffiths on 17/07/2008 is provided as evidence for extrapolating the figures from Minserve on fuel and power usage out to 30 years mine life from the current 25 years. Also the use of 2009 as the first year of operation, rather than 2007.
- Note the emission factor for all production of coal (fugitive) from open cut mines in W.A is 0.017 t CO_2-e/T of raw coal[4] and has been included in the estimation of GHG emissions from the project;
- Note emissions from land use clearing has been deemed to be negligible and hence has not been included in the GHG emissions forecast;
- Based on discussions with Central West Coal Pty Ltd, no stockpiling or overburden occurs onsite, as the Project has a residence time of less than a day. Note, methane emissions from waste coal oxidation has not been included in estimating the GHG emissions forecasts; and
- South West Interconnected System (SWIS) emission factors as found in the National Greenhouse Accounts (NGA) Factors workbook, October 2008, have been used in estimating the GHG emissions from electricity usage.

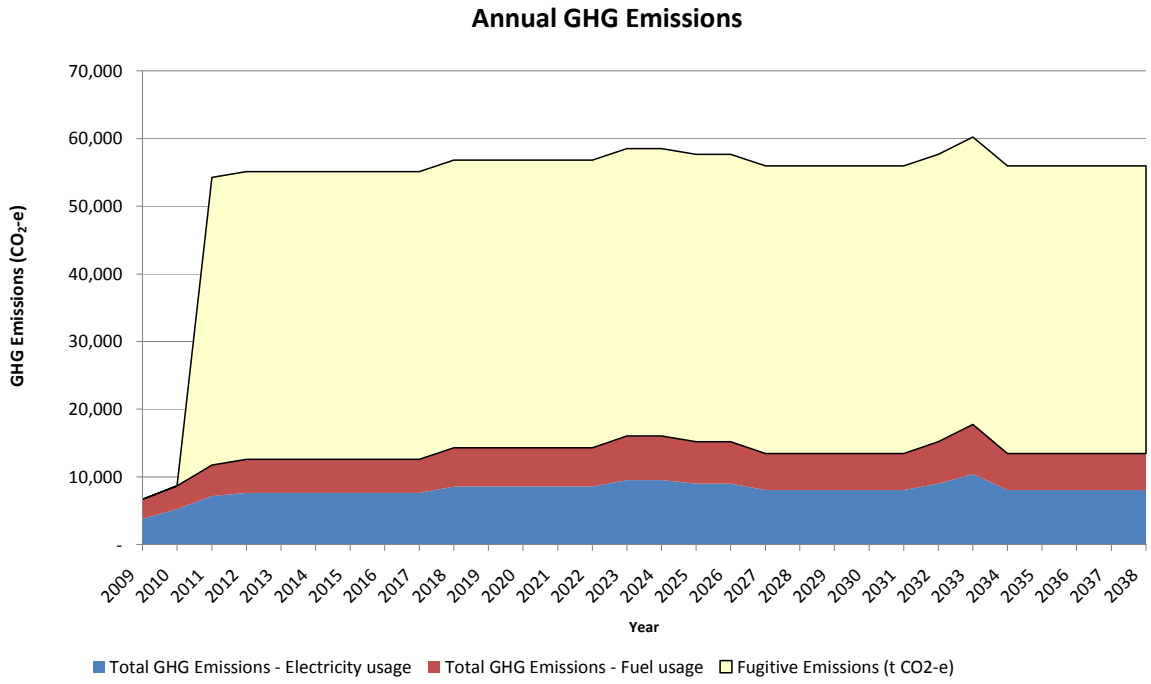

Figure 3-1 Forecast GHG Emissions during Project Life

[4] Table 8, page 21, National Greenhouse and Accounts (NGA) Factors, October 2008

Section 3 Emissions Forecast

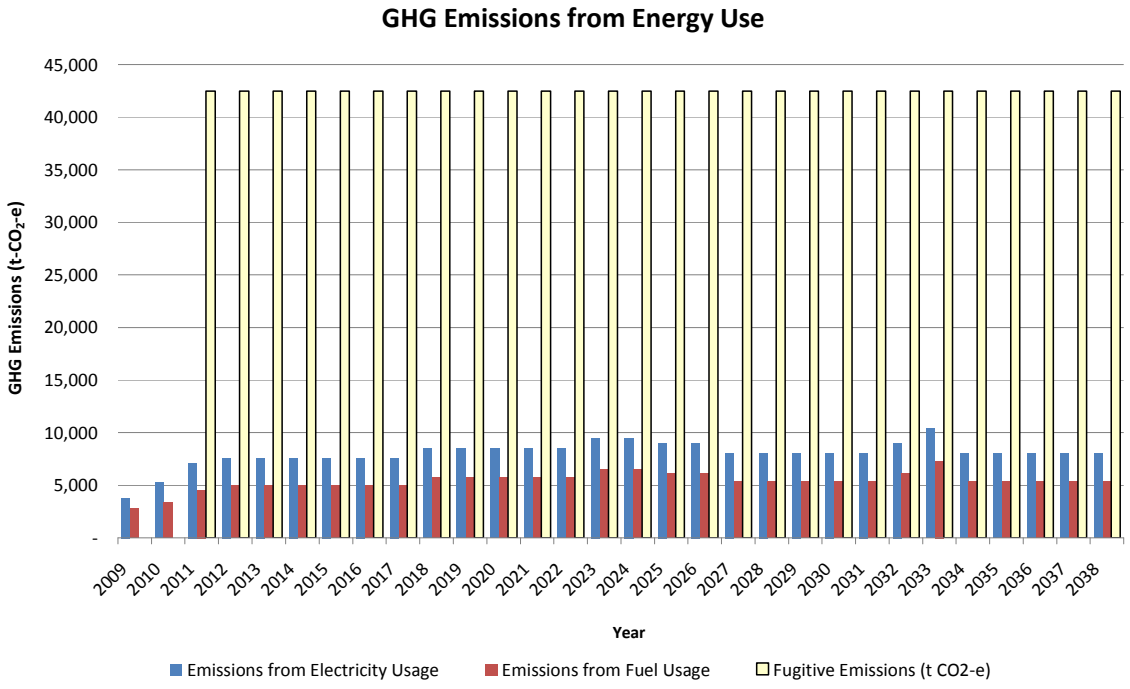

Figure 3-2 GHG Emissions from Energy Use

Figure 3-1 shows the total annual GHG emissions throughout the 30 year life of the project. Figure 3-2 shows the relative of GHG emissions from electricity use and on-site fuel consumption. It should be noted that for the estimation of GHG emissions, emission factors for electricity are the default standard of the SWIS system, from the National Greenhouse Accounts (NGA) Factors workbook, 2008.

Table 3-3 Direct Greenhouse Gas Emissions from Mining operations

Emission Source	Unit	Activity Level over Project Life	Total GHG Emissions (t CO_2-e)
Electricity	kWh	249,507,247	233,955
Diesel	kL	54,030	156,834
Fugitive Emissions			952,000 (Low) - 1,190,000 (High)
Total Emissions			1,580,789
Average Annual Emissions			52,693
kg CO_2-e/tonne of coal produced[5]		21.08 – 22.38	

Interpretation of these figures quoted in Table 3-3, should take account of the following qualifications.

- The full fuel cycle factor, provided in the NGA Factors workbook, October 2008, has been for estimating the total GHG emissions from energy use;

[5] Mining to extract approximately 2 to 2.5 million tonnes per annum (Mtpa) of sub-bituminous coal, over 30 years

Section 3 Emissions Forecast

- The emission factor for electricity is determined by the mix of power stations supplying the SWIS network. However, the mine site will source its power from Coolimba Power Plant. Actual life time GHG emissions from operation of the mine will need to be accurately estimated, once the emission factor for the power station has been determined; and
- The emission factor for fugitive methane emissions in the NGA Factors workbook is for all open cut coal mines and is based at a limited set of field measurements made at a small number of mines and is subject to very high uncertainty. In practice, emissions will vary widely from mine to mine and over time at an individual mine, depending on characteristics of the coal being mined.

Section 4 Benchmarking

4.1 Comparison with Australia's National Emissions

The most recent available data on Australia's national GHG emissions are contained in "The Australian Government's Initial Report under the Kyoto Protocol". Following the Guidelines for compiling national emissions inventories, developed by the Intergovernmental Panel on Climate Change and used by all States Parties to the United Nations Framework Convention on Climate Change, national inventories include only emissions occurring within the boundaries of the nation. Australia's sectoral emissions based on data contained in '*Australia's National Inventory Report: 2005 Revised edition*' is set out in Table 4-1.

Table 4-1 Australia's greenhouse gas emissions[6]

Sector	Gigagrams	t CO_2-e
Energy	286,799.12	286,799,120
Industrial Processes and Solvents	25,297.21	25,297,210
Agriculture	87,648.17	87,648,170
Waste	17,536.94	17,536,940
Land Use Change (Deforestation)	136,492.36	136,492,360
Base year emissions estimate	**553,773.80**	**553,773,800**

The total GHG emissions from the mining, transport and use of coal from the project are estimated to be approximately 1,580,789 t CO_2-e (refer Table 3-3).

4.2 Comparison with West Australia's Emissions

GHG emissions were 66.6Mt CO_2-e in Western Australia in 2005.

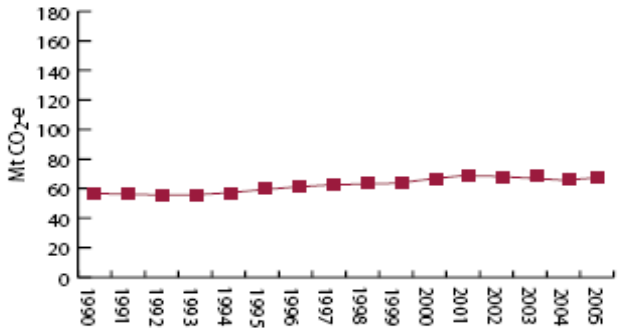

Figure 4-1 GHG Emissions in WA, 1990 – 2005[7]

[6] http://www.greenhouse.gov.au/inventory/publications/pubs/unfccc-report.pdf

Section 4 Benchmarking

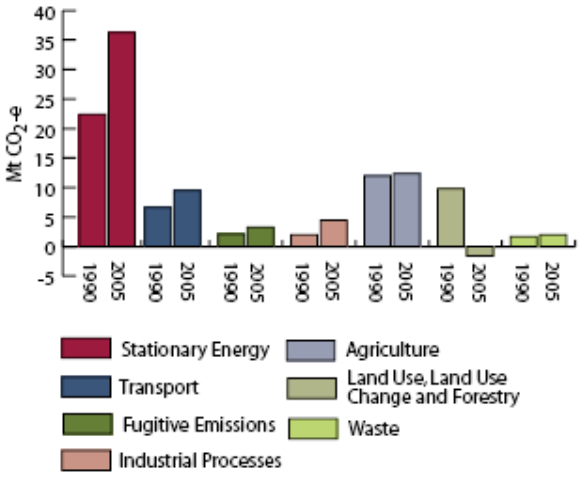

Figure 4-2 Emissions by Sector, 2005 in Western Australia[8]

[7] State and Territory Greenhouse Gas Inventories 2005

[8] State and Territory Greenhouse Gas Inventories 2005

Section 5 Abatement and Offset Options

Sections 5 and 6 outline the various abatement and offsetting opportunities currently available in the market, which can be used to reduce either part or all the GHG emissions generated by the Project. Please note the following definitions

- **Abatement Project** – projects such as energy efficiency projects, implemented within the Project's boundary, that result in a reduction of GHG emissions from BAU;
- **Offset Project** – projects such a renewable energy, tree plantation etc., that result in partial or complete reduction of GHG emissions;

It is recommended that the Project proponents undertake a detailed feasibility analysis, regularly update its knowledge of climate change legislation and monitor carbon prices to identify a portfolio of options to help meet its GHG emissions commitments as per the state, federal and international legislation.

5.1 Development of Corporate Strategy towards Emissions Reductions

In developing a corporate strategy towards emissions reductions, Central West Coal Pty Ltd will need to have a thorough knowledge of current climate change legislation and how such policy may impact its operations. As the policy landscape concerning Climate Change, GHG emissions and Emissions Trading change frequently changes, it is recommended that Central West Coal Pty Ltd have an intimate understanding of policy is required both at the National and International level, for the current situation and for likely future developments.

Companies, such as Central West Coal Pty Ltd that are exposed to climate change legislation need to understand what options and technologies are available for reducing emissions liabilities. Such methods might include internal action, offsetting mechanisms and emissions trading.

5.1.1 Suggested Strategy

Establishment of Operational Boundaries

Depending on the nature of the mining operations (e.g. owner operated, contractor etc.), it is necessary to define which of the GHG emissions sources are relevant for reporting purposes. These boundaries may be defined by the national reporting system or according to the preference of Central West Coal. Boundaries include defining issues associated with ownership and control of processes, but having a wider boundary than that defined by the national reporting system may actually allow the Project a broader range of internal abatement options.

It is recommended that Central West Coal review all new and existing contracts with sub-contractors to determine emissions liability under the **'operational control'** philosophy adopted by the NGERS regulations. Furthermore, all contracts either with existing and/or new sub-contractors should clearly identify the party that has the GHG emissions liability under the **'operational control'** philosophy, to avoid future litigation.

Calculation of Actual GHG Emissions Inventory

Having defined its boundaries, Central West Coal will need to estimate its actual GHG emissions inventory. One important aspect of this is the identification and isolation of the typical production and utilisation variables that best track the Central West Coal's GHG emissions so that the impact of changes in these variables can be monitored.

Determine Emission Liabilities and Reduction Requirements

The difference between the target emissions determined by the specific regulatory regime and the actual emissions produced by the Project are the emissions liabilities that Central West Coal Pty Ltd is subject

to. However, the target itself cannot be determined until the national legislation concerning the Australian Emission Trading System (AETS) has been determined.

Monitoring and Reporting

An emissions monitoring and reporting system is essential for Central West Coal to optimise its carbon management position and reduce its emissions liabilities. Such systems facilitate the management and control of emission targets, achieve transparency and verifiability of emissions reporting and liabilities.

Taking a standard approach to the methodology will help ensure that reliable results are consistently made over time. A monitoring and reporting system would include the following features:

- Ability to estimate direct and indirect emissions;
- Consistent recording form year to year;
- Identification of energy sources and associated GHG emissions by business operation;
- Ability to aggregate data in a variety of ways;
- Include agreed conversion factors (e.g. emission intensity of black coal);
- Report energy consumed in internationally agreed units;
- Linked to accounting records; and
- Ability to chart progress against economic variables.

In line with the NGERs Act, Central West Coal will have to measure and report the GHG emissions it is responsible for. Hence when developing a metering and monitoring strategy, it is advised that Central West Coal take emissions monitoring into consideration. The four Methods for estimating GHG emissions, as per the NGER technical guidelines has been described in section 2.2.2) of this document.

5.2 Potential Abatement Opportunities

5.2.1 Procurement Policy

Critical to any energy management program is the successful integration of energy efficiency into the design and procurement processes. Energy efficiency measures are most cost effective when implemented at the design/procurement stage, with retrofitting usually more costly and disruptive.

An effective procurement strategy for energy efficiency involves:

- Including minimum efficiency standards for direct purchases;
- Including minimum efficiency standards in requests for tender documents;
- Evaluating tenders based on the life cycle cost of the equipment. Essentially, this is minimising the sum of upfront capital cost, maintenance costs and operating costs (energy) over the expected life of the equipment item; and
- Evaluating suppliers, based on their sustainability policy.

There are three types of procurement guidelines that could be applied to the Project:

- **ENERGY STAR** - Equipment specifications that cover individual items (e.g. motors, pumps, etc);
- **Minimal Energy Performance Standards (MEPS)** - Design standards that cover the entire installation (e.g. processing plant etc); and
- Requirements/standards for suppliers.

These guidelines specify minimum standards in requests for tender documents. Energy efficiency is then part of a range of criteria used to evaluate tenders.

As part of introducing triple bottom line consideration into the Project's decision making process all new capital works (new projects and asset replacement) in excess of $100,000 should undergo a formal review process which includes Life Cycle Analysis (LCA) costing as part of the financial impact statement (FIS) process.

5.2.2 Minimal Energy Performance Standards (MEPS)

Motors and pumps are significant consumers of energy within mining facilities. Maximising the efficiency of motors and pumps can therefore deliver significant energy (and hence GHG) savings. The practice for the procurement of conventional motors within the Project should utilise the Federal Government's Minimal Energy Performance Standards (MEPS) program and High Efficiency Motors (HEMs). MEPS is a regulatory tool used to increase the average efficiency of a product class. MEPS regulations remove from sale the least energy efficient models on the market and have become a powerful tool in reducing energy usage in Australia[9].

MEPS does not extend to regulating non-standard motors (such as those used in submersible pumps, geared motors etc). It is recommended that within Central West Coal, when purchasing non-standard motors larger than 100kW they be high efficiency motors and where possible the use of VSDs be preferred.

It is recommended that a 'Motor Selection Panel' be developed to pre-qualify non-standard motors below 132kW. This panel should consist of a list of suppliers that meet the required efficiency standards and would function to govern the procurement and refurbishment of new and existing motors, so as to ensure a standard of efficiency is maintained throughout the entire Central West Coal Project.

In addition to energy cost savings, it is also anticipated that the changes to motor procurement policy will increase productivity through reduced project management time associated with tasks. It is not possible to provide sufficient estimate of the savings from this initiative as data such as operating efficiency, motor ratings and operating hours for motors within the Project are not readily available at the time of preparing the GHG emissions forecasts.

5.2.3 Other Equipment

Central West Coal will purchase a range of equipment that could be subject to efficiency standards at the procurement stage. These include:

- Vehicles;
- Equipment (SAG and Ball mills, crushers, conveyors etc.);
- Office equipment (computers, photocopiers etc); and
- Lighting.

The MEPS scheme is being expanded to include a range of energy consuming devices such as compressors and lighting. Where possible, purchasing guidelines should be brought into line with these standards. Although the total effect of efficiency improvements of these devices is difficult to estimate, it will assist in improving the awareness of energy efficiency across the entire Central West Coal Project.

[9] http://www.energyrating.gov.au/meps1.html

Contractor procurement policies

Certain equipment used within the Project will be purchased by contractors. It recommended that the contracts used by Central West Coal Pty Ltd, include energy efficiency criteria in procurement and operation of equipment.

Supplier's environmental sustainability policies

Currently there is no evaluation of suppliers based on the environmental sustainability of their businesses. Similar to the existing requirement for the Project's contractors to abide by occupational health and safety regulations, it is recommended that environmental sustainability also become a key focus area in the procurement process.

5.2.4 Fuel Switching

Vehicle Fleets

Petrol to LPG

Conversion of vehicle fleets from conventional unleaded petrol (ULP) to Liquid Petroleum Gas (LPG) is a common method for GHG emissions reduction within the transport sector. Typically, savings in GHG emissions of up to 15% are realistically achieved through LPG conversion technologies.

Vehicle Fleets - Diesel to Alternative Fuels

Alternative fuels, also known as non-conventional fuels, are materials or substances that can be used as a fuel, other than conventional fuels. Examples of alternative fuels include biodiesel, chemically stored electricity in batteries and fuel cells, hydrogen, vegetable oil and other biomass sources.

In WA, the alternative fuels market is in its infancy. It is recommended that the Project, consider the option of converting mineral diesel-powered vehicles to bio-diesel, subject to availability and costs. No modifications to the engine are required in the conversion to alternative fuels. However, the use of bio-diesel may soften and degrade certain types of elastomers and natural rubbers that can exist in some fuel hoses and pump seals and as such these should be replaced.

The Emission Factor for alternative fuels is dependant on feedstock and production; however several trials have revealed an average CO_2-e emission reduction of approximately 80% compared to that of fossil diesel.

Vehicle Fleets - Diesel to CNG

Current technologies are available that allow for the conversion of diesel engines to run on Compressed Natural Gas (CNG) or on LPG. At present they are only suitable for stationary diesel generators as well as heavy vehicles such as buses and trucks. Heavy vehicles located in regional areas may have limited access to CNG refuelling facilities. As a result the emissions reduction from the replacement of fossil diesel fuel with CNG should be considered for fleet vehicles or stationary diesel generators, depending on availability of a reliable supplier.

Stationary Diesel Generators

Similarly to transport diesel, there is an opportunity to convert all stationary diesel generators (used for power generation, remote lighting, water and wastewater pumping) to alternative fuels.

5.2.5 Renewable Energy

Renewable energy is defined as any energy source that is inexhaustible, such as the sun, wind, wave or geothermal. Use of renewable energy avoids GHG emissions produced from conventional fossil fuelled

generation, during their operation. The following section presents a brief overview of the renewable energy market and generation technologies available.

Generation Costs

The technology that harnesses renewable energy is in many cases well developed and commercially available. However, capital costs are generally high, which has presented a significant barrier to these technologies competing with fossil fuel based power generation. The Commonwealth Government's Mandatory Renewable Energy Target (MRET) initiative has placed a legal liability on electricity wholesalers Australia-wide to purchase additional electricity each year from renewable energy sources. The current MRET is set at 9,500GWh (or 2%) of electricity generated by 2010. Renewable Energy Certificates (RECs) are used to demonstrate compliance with the MRET and can be acquired through contracts with renewable energy generators or by trading them. The value of 1 REC is equivalent to purchasing 1 MWh of renewable energy.

The MRET program has resulted in technologies that can utilise landfill gas, biomass (with feedstock from waste sources) and wind energy becoming increasingly competitive as the RECs produced have helped to offset the relative high capital costs of renewable energy generation. Wave and solar powered generation costs are significantly higher than other renewable sources and 3-5 times higher than black coal.

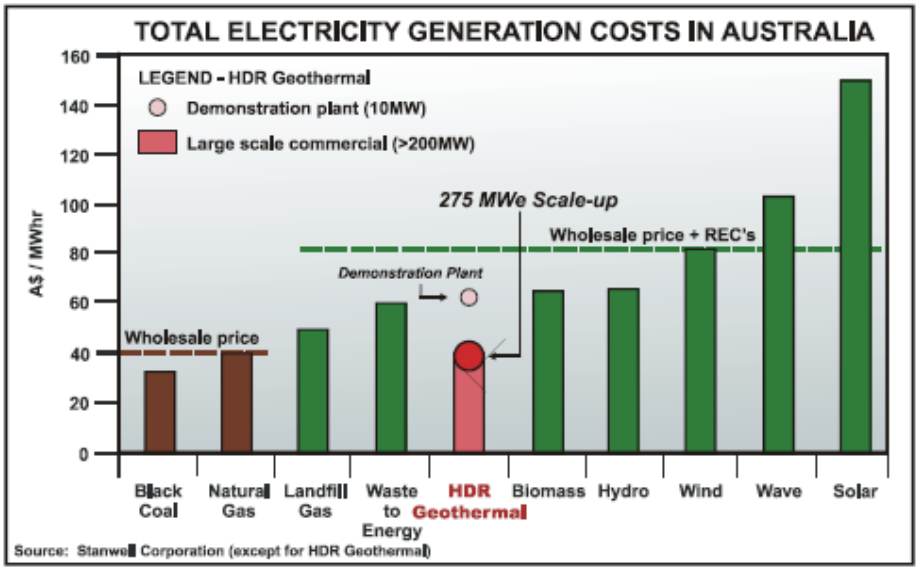

Figure 5-1 Comparison of Electricity Generating Costs in Australia[10]

Generating Renewable Energy

The cost of generation of renewable energy varies depending on the technology and the resource used. More specific to the requirements of the Project's GHG reduction strategy is to determine the relative costs of GHG emission reductions, relative to the various renewable energy technologies available.

[10] Quarterly Report, Geodynamics Ltd, March 2003.

Section 5 Abatement and Offset Options

The following presents an overview of the current renewable energy generating technologies and opportunities that may exist for Central West Coal.

Wind Power

Wind power is an established generating technology and has grown exponentially throughout the world in the last ten years. Western Australia is currently experiencing significant growth, with wind generation capacity increasing from 30MW to approximately 200MW within the last five years.

Further installation of large wind farms, may pose issues to the stability of the electricity network as a result of intermittent generation causing voltage and frequency fluctuations. However, studies show that the South West Interconnected System (SWIS) can readily accept a wind capacity of 500MW assuming wind farm diversity, forecasting and power limiting strategies are employed. This suggests an additional 300MW as reasonable development potential for the future.

A report prepared for the Ministerial Council on Energy concluded that electricity from wind costs between $60 and $80 per megawatt hour (MWh), compared to $31 to $40/MWh for coal and $37 to $44/MWh for natural gas[11]. With an approximate wind farm capital cost of $2m/MW installed, significant expenditure would be required for Central West Coal Pty Ltd to make major reductions to their corporate emissions.

Solar Power

The option for solar photovoltaic (PV) generation is becoming more realistic as efficiencies improve and the cost of cells decreases. Currently (as Figure 5-1 suggests) PV is the most expensive of renewable energy technologies at approximately 5 times the cost of coal powered generation. However, it can be commercially competitive in niche applications such as remote, off-grid generation and requires minimal maintenance.

Due to the extensive use of diesel powered pumping in remote locations, an opportunity exists for Central West Coal to abate emissions through the replacement/supplement of this generation with PV power. Up to 50% of the renewable component for such installations is available through the State Government's Renewable Remote Power Generation Programme (RRPGP).

The potential for replacing diesel plant with PV generation is dependant on existing infrastructure, generator ratings and duty cycles. The availability of this information is currently limited which has made it difficult to provide estimations of potential savings.

Several emerging PV related technologies such as the Sliver Technology, Liquid Solar Array[12] (LSA) might present GHG emission abatement opportunities for Central West Coal in the future. Investigations have revealed that the technology is still in the developmental stage. However, with the potential for the technology to be eligible for government funding, Central West Coal Pty Ltd may choose to partner with such solar firms to bring the technology to the next stage of development/commercialisation.

Solar thermal electricity has been successfully demonstrated on a large scale in California over the last 15 years. Essentially this technology uses a large expanse of mirrors or concentrators to concentrate solar energy onto absorbers that in turn generate steam to power turbines. An Australian development, the Compact Linear Fresnel Reflector (CLFR)[13] uses a series of parallel mirrors to focus light onto an absorber surface positioned about 8 metres above the mirrors. Stage 1 has been completed at the Liddell power station in the Hunter Valley in New South Wales. Steam produced by the system is fed to the power station's boiler feedwater pre-heater, thereby reducing coal consumption. The inventors of this

[11] Wind Farms: the facts and fallacies

[12] http://www.sunengy.com/images/LiquidSolarArrayDraft4US.pdf

[13] http://www.physics.usyd.edu.au/app/research/solar/clfr.html

technology have suggested that further developments may result in cost effective direct electricity generation and capability to power desalination plants.

Wave Power

Wave power is still at a developmental stage around the world. Pilot plants of both onshore and offshore systems do exist both overseas and in Australia. One local development is the CETO wave energy converter developed by Seapower Pacific Pty Ltd that is currently being tested off the coast of Fremantle. The system sits on the sea bed and converts wave energy to deliver high pressure water to shore for desalination or electricity generation[14].

Predicted generation costs of wave power are over $100/MWh (compared with $80/MWh for wind generation) however the lack of commercial size generation plant means that there is limited reliable information as to what true costs will be. Given the level of development, wave power has not proven to be commercially feasible within Australia. However as technologies such as the CETO develop, and renewable targets increase, wave generation may present a feasible option for Central West Coal Pty Ltd.

Energy from Biomass

Landfill gas, produced from the anaerobic decomposition of commercial, industrial and domestic wastes, is currently used in a number of power stations within the Perth metropolitan area. The total installed capacity of these stations is around 24MW.

Biogas, produced from the decomposition of sewerage, is used in the Water Corporation's Woodman Point wastewater treatment plant. This plant generates approximately 6GWh of electricity per year. Two 600 kW reciprocating engine generator sets, fuelled by the biogas, provide electricity for use on site with the excess exported to the grid. Waste heat from the engines is also recovered and used for optimising digester temperature.

Bagasse, the cane residue from sugar production, is combusted at the Ord Sugar Mill at Kununurra in the Kimberley to produce steam to run a 6 MW cogeneration plant.

5.2.6 Carbon Capture using Algal Biomass

Global Aquaculture Limited [GAL] has developed a patented process that can sequester large quantities of CO_2 flue gas by algal photosynthesis in a cost effective manner. The GAL process is a form of post combustion capture where the flue gases leaving a power station are cooled then fed into a CO_2 absorber. By passing exhausted gases through an absorbing solution of algae the CO_2 is captured and sequestered naturally.

Global Aquaculture's Project applies a dual layer biomass sequestration process and a pyrolysis process that has been developed to produce a charcoal-like by-product and synthetic gas (containing mainly Hydrogen and CO_2) from various streams of on-site grown biomass, and if economically viable, also those coming from both farm animal husbandry, cropping waste, and forestry sources.

Local algal species, suited to climatic, and ecological conditions, along with speed of reproduction, are used for inoculate, breeder, and grow out facilities. These facilities will be charged via carbonation systems, with post plant flue gas. Algae within the system are capable of absorbing twice their dry weight of carbon during their growth cycles, these are then dried using exhaust gas feed drum dryers, with the product then being used totally for pyrolysis. Additional streams of nutrients are developed using biomass digester.

In the pyrolysis system, a portion of the hydrogen is used to create ammonia where economical, onsite ammonia producing by-product, or ammonia is purchased leaving hydrogen for fuel utilisation. The

[14] http://www.ceto.com.au/home.php

ammonia is then combined with the char and CO_2 at atmospheric pressure and ambient temperature to form a nitrogen-enriched char. The char materials produced in this process contain a significant amount of non-decomposable carbons such as the elementary carbons that can be stored in soil as sequestered Carbon.

Approximately 70-80 per cent of the CO_2 from flue gas is captured by the absorber. The clean flue gas is released into the atmosphere. The biomass produced may be carbonised and used elsewhere or directed to an alternate pathway and produce slow release fertilisers.

5.2.7 Fly Ash Cement

CO_2 emissions in cement manufacturing are caused mainly in clinker manufacturing which causes about 1 tCO_2/t-clinker. Central West Coal should engage in discussions with local cement manufacturers to sell the fly ash, which can be used in the cement making process. By using the admixture, the clinker content and hence CO_2 emissions from the cement production process can be reduced. This project can be a significant source of emission reductions and has the potential to generate carbon credits for Central West Coal Pty Ltd. It is recommended that Central West Coal Pty Ltd investigate this option further.

Section 6 Availability of Offsets

The Project has the capacity to abate 70-80% of the total GHG emissions produced from the Coolimba Power Station. However, Central West Coal may have to look to other companies that can create offsets through sequestration, energy efficiency projects, low emission energy production processes and broader market mechanisms, to reduce its emissions profile.

The trade of these offsets allows for efficient investment in cost effective offset projects and investors reaching their emissions goals. The emergence of a number of carbon offset schemes where verification and monitoring standards are regulated by scheme administrators has created a number of markets for the trade of carbon offsets. Schemes often impose emission targets for participant's based on allowable emissions and energy saving targets, failure to comply can mean penalties or loss of endorsement.

There are a wide range of offset actions that reduce emissions, and all have particular issues which purchasers should be aware of. Broad categories for offsets are:

- **Bio-sequestration** - The most popular form of offsets in the voluntary market at present relate to bio-sequestration (e.g. forestry projects). Trees soak up carbon and thus can reduce the quantity of greenhouse gases in the atmosphere. The quality and aims of bio-sequestration offset products vary widely and not all of these products meet the strict requirements necessary to be verified against offset standards. The permanence of these products requires particular attention, however when appropriately planned, these plantations can have co-benefits, such as counteracting salinity and improving biodiversity.
- **Energy efficiency** - A number of options for energy efficiency offset products are available, ranging from major upgrades of manufacturing processes to distribution of energy efficient products. As identified in a report by RMIT's Global Sustainability Institute, "energy efficiency offset products have some perceived risks relating to the accuracy and reliability of baseline measurement and changes over time in energy use." However, these projects can also have co-benefits of education and long-term behaviour change.
- **Renewable energy** - Renewable energy offsets can include wind, solar, biomass and other renewable energy sources, which help reduce reliance on fossil fuel sources. However there are questions over whether renewable energy offset products meet additionality criteria in more stringent offset standards.
- **Greenhouse gas avoidance, capture and destruction projects** - Outside of bio-sequestration, energy efficiency and renewable energy, there is a broad range of offset projects which attempt to reduce greenhouse gas emissions through avoidance, capture and/or destruction of emissions. These are usually located on industrial sites and can range from capture and/or flaring of landfill gases to destruction of HFCs in large industrial processes. These often target the less common, but more potent greenhouse gases, such as methane, HFCs, etc. While these offset products are available in Australia, they are presently less common than other types of offset products described above.

6.1 Issues associated with Offsets

EPA Victoria's Carbon Management Principles suggest that business first look at opportunities to avoid and reduce their own emissions before considering offsets in order to optimise financial and environmental outcomes.

Following is a brief explanation of each of the key considerations in selecting offsets:

- Additionality;
- Permanence;
- Leakage;
- Double counting;
- Timing of emissions reductions;

Section 6 Availability of Offsets

- Monitoring and verification; and
- Co-benefits.

Additionality

Additionality is a key concept in evaluating whether or not an offset project leads to real and measurable greenhouse gas reductions. To be regarded as a valid offset, a project must be proven to be 'additional' to what would have occurred anyway. For example, a routine upgrade of equipment or changes in response to a regulatory requirement cannot be regarded as additional.

Translating the concept of additionality into practice requires establishing 'tests' of additionality. Typically these tests address the following types of additionality:

- ***Financial Additionality -*** the project needs to go beyond business as usual (BAU) commercial practice. A standard test for this is if the project is financially viable without the offset funding.
- ***Regulatory Additionality -*** the project needs to go beyond existing legal requirements.
- ***Environmental Additionality -*** the emission reductions cannot be counted toward another emission reduction scheme or commitment.

Permanence

Some emission reductions may not be secure or may involve a range of risks. For example, this can occur with carbon bio-sequestration (e.g. forestry) projects where risks from fire or pest infestation are high or where carbon offset credits are sold in advance and the project never eventuates. Offset providers should offer some form of guarantee that purchased credits will be maintained, or customers will be compensated if the project doesn't deliver the expected emissions reductions.

Leakage

Changes in emissions that take place beyond the boundary of the project but are attributable to the project activity are called emissions 'leakage'. New and/or additional emissions occurring off-site need to be quantified and taken into account in assessing the emissions reductions achieved. For example, if a forestry project limits logging in one area, the possibility that deforestation will occur elsewhere should be considered. Offset providers should also consider emissions from project operations (e.g. electricity use, transportation of materials, etc.) that could increase emissions relative to the project baseline.

Leakage should be explicitly addressed in calculation of the net emissions reductions achieved by a project.

Double counting

Double counting can happen when two or more businesses claim the same emissions reduction. This can happen if an offset is sold to two or more entities, or when an entity upstream of the project unknowingly claims the reduction as its own (e.g. an electricity generator). The establishment of protocols and the use of an offsets registry can ensure offsets are adequately accounted for.

Timing of emissions reductions

Some offset providers generate and sell credits from their projects on an annual basis while others forecast credits over the life of their projects and bundle them into one sale.

Counting on emissions reductions to occur over the lifetime of a project presents several risks. Regulatory requirements could make some offset projects obsolete in the future – like implementing energy efficiency technologies that may be mandated by government in the future, and thus no longer satisfy 'additionality' (see above). In addition, something could also happen to the project in the future; the benefits of an afforestation project could be put at risk by bush fire, or an energy-efficient technology could break and get replaced with a less-efficient model, or the project may even change scope during operation.

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Proper monitoring and verification and commitments from the offset provider to secure replacement credits if the project does not deliver anticipated emissions reductions could mitigate these risks.

Offset purchasers should also be aware that future emissions reductions might not have the same impact on climate change as current emissions reductions. Some companies may wish to ensure that the impact of their operations are neutralised in 'real time'.

Monitoring and verification

To ensure that the emissions reductions claimed by the project have actually taken place, the emissions should be verified, in line with a recognised verification standard. The verifier should evaluate the project based on an explicit set of criteria that minimise the risk of false emission reduction claims. This should include the ongoing monitoring of the project to ensure that claimed outcomes have eventuated.

Co-benefits

Although the primary goal of carbon credits is to offset greenhouse gases, projects may provide secondary benefits such as reductions of other pollutants, increase in habitats for biodiversity or education benefits from the installation of new energy efficient technologies. Co-benefits range between projects and may be an important factor for a purchasing decision.

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Table 6-1 Carbon Offset Providers in Australia

Name	Website	Costs ($/tonne)	Accredited
Climate Friendly	http://www.climatefriendly.com/		GS (part), GP
Green Fleet	http://www.greenfleet.com.au/	10.00	GF
CO_2 Australia	http://www.co2australia.com.au/	16.00	GGAS, GF
Carbon Planet	http://www.carbonplanet.com/home/	23.00	GGAS
Easy Being Green	http://www.easybeinggreen.com.au/categories.asp?cID=109&fromhome=true	18.50	GGAS, GF
Origin Energy	http://www.originenergy.com.au/carbon/		GF
Elementree	http://www.elementree.com.au/	10.00	
Carbon Reduction Institute	http://www.noco2.com.au/		GS
Greenhouse Friendly	http://www.greenhouse.gov.au/greenhousefriendly/		GF
Carbon Smart	http://www.carbonsmart.com.au/Default.aspx		GGAS
Australian Carbon Traders	http://www.australiancarbontraders.com/		
Carbon Neutral	http://www.carbonneutral.com.au/	15.00	
BP Global Choice	http://www.bp.com/subsection.do?categoryId=9012553&contentId=7024333		GF
Carbon Pool	http://www.carbonpool.com/	10.00	GF
Greenhouse Balanced	http://greenhousebalanced.com.au/	11.00	GF
Neco	http://www.neco.com.au/img/business/business.html		GGAS
Project Andromeda	http://www.projectandromeda.com/network.html		GF
Men of the Trees	http://www.menofthetrees.com.au/		
Generation Green	http://www.bendigobank.com.au/generationgreen/	11.00	

GS (Gold Standard) - To qualify for the Gold Standard, CDM projects must be either renewable energy generation or energy efficiency; must meet more rigorous criteria to establish that emissions reductions are additional to business-as-usual; and must demonstrate that the project is sustainable within its host community.
GGAS (NSW Scheme) - The NSW Greenhouse Gas Reduction Scheme (GGAS) commenced on 1 January 2003 and is one of the first mandatory greenhouse gas emissions trading schemes in the world

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GP (Green Power) - A national accreditation program that sets environmental and reporting standards for renewable electricity products offered by energy suppliers
GF (Greenhouse Friendly) - Greenhouse Friendly™ is a program run by the Australian Greenhouse Office. Australian businesses can market greenhouse neutral products or services, deliver greenhouse gas abatement and give Australian consumers greater purchasing choice.

Table 6-2 Advantages and Disadvantages of Offset Sources[15]

Offset	Description	Advantages	Disadvantages
Purchase Carbon Offsets to an agreed standard eg NGAC, CDM, JI, CCX, GHF	Purchase Credits from Brokers or suppliers with independent verification of carbon accounting and auditing. Can be sourced from any or all of the offset options. Range of standards and eligibility criteria give a good range of choice and prices.	• Ready made credits. • Can select a range of offset sources.	• Can be seen to be paying to pollute. • Standards and price vary greatly
Renewable Energy Certificates (RECs)	Regulated and government backed scheme where generation of renewable energy creates certificates that can be transferred.	• Ready regulated markets. • Supports clean and developing technologies. • Best for reducing electricity emissions.	• Can be seen as double counting. • Not available in some schemes. • Caution to be shown if offsets mandatory. • Competitive Market. •
Forestry (conservation)	Re-afforestation and afforestation projects that reinstate native vegetation for the purpose of creating additional environmental outcomes as well as carbon sequestration. Multiple providers with multiple standards. These are generally permanent non harvest projects with a mix of species often planted on private land. Highest value credits. Have an underlying property right that allows the creation and	• Can generate excellent marketing opportunities. • Helps create pathways for adaptation to climate change. • Additional environmental benefits. • Social benefits for landholders. • Australia is well placed to	• Often expensive, varying standards and price, maintenance obligation. • Caution should be given to standards applied. • Some concerns over maintenance periods. • Relatively expensive.

[15] http://www.envlaw.com.au/newlands9.pdf

	transfer of forestry rights.	measure and monitor sequestration activity. • Only proven technology to remove carbon dioxide from the atmosphere.	
Forestry (commercial)	Commercial (harvest) projects that guarantee the ongoing maintenance of vegetation on site. Multiple providers with multiple standards. Many providers claim additional environmental outcomes although not as strong as conservation based projects. Highest value credits have an underlying property right that allows the creation and transfer of forestry rights.	• Only proven technology to remove carbon dioxide from the atmosphere. •	• Often expensive, varying standards and price, maintenance obligation • Caution should be given to standards applied. • Some concerns over maintenance periods. • Relatively expensive. • Concerns over leakage – pushes problem elsewhere.
Avoided Deforestation	By protecting at risk remnant vegetation providers reduce the amount of emissions being released into the atmosphere. Generally backed by a long term conservation covenant. Very good for protecting vulnerable and threatened vegetation communities. Standards and prices can vary and avoided deforestation is not recognised in many schemes.	• Relatively inexpensive (if acceptable). • Protect native vegetation. • Good PR possibilities. • Limited market supply. • Reduces deforestation, an important contributor to climate change	• Concerns over leakage – pushes problem elsewhere. • Not currently in Kyoto mechanism. • Caution should be given to standards applied. • Some concerns over maintenance periods. • Prices vary. • Concerns over Additionality.
Soil Carbon Sequestration	By changing land management to increase the amount of carbon stored in the soil, offsets can be generated. Not recognised in many schemes but the push is on to have it recognised. A typical project sees the change from traditional land management to minimum or no tillage systems providing ongoing production improvements and soil carbon storage.	• High potential sequestration rates. • Lots of available areas. • Relatively inexpensive.	• Permeance concerns – soil is a volatile pool, can restrict land management options, difficult to accurately measure and monitor. • No set standards (CCX has a voluntary standard) • No legislation in Australia (except WA) to create underlying property right for transfer of carbon (WA only under eligible forests).

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Fossil Fuel replacement/reduction Purchase Bio diesel Ethanol Blended Fuel	Fuel additives such as bio-diesel and ethanol allow for a blending of fossil fuels with renewable fuels. Considerations must be given to the cost of purchasing and transporting fuel blends as well as leakage and change in land management to produce fuel.	• Has additional benefits such as reducing other pollutants. • Supports developing technologies. • Can lead to less dependency on fossil fuel.	• Inefficient, leakage concerns, limited application to many industrial process • Can mean modifying fleet and/or supply chain. • Known to void some machinery warranties.
Bio generation	Through the establishment and sustainable harvest of plantations (especially Mallee species) to feed gasification plants.	• Creates ongoing sustainable energy supply. • Technology constantly improving. • Reduce emissions form sale or use of clean energy. • Carbon sequestered in forest resource. • Provides local labour. • Can be done anywhere on national grid.	• Often expensive to establish. • Varying standards and price. • Maintenance obligation.
Methane Capture and Destruction – Livestock	Although called methane capture and destruction from livestock, projects can include modifications to feed supplies to reduce methane production in ruminants. Also includes capitalising on animal waste treatment processes that captures methane and converts to electricity.	• Due to high GWP of methane it is an efficient method of reducing emissions.	• Some concerns over additionality.
Methane Capture and Destruction – Coal Seam	Captures methane emissions from coal seams and either destroys (flaring) or converts to electricity generation. Specific analysis of individual mining operations needs to be investigated.	• Due to high GWP of methane it is an efficient method of reducing emissions.	• Some concerns over additionality in operating mines.
Methane Capture and Destruction - Landfill	By sealing landfills, methane from decomposing organic matter can be destroyed	• Monitoring and calculations easy.	• Some concerns over Additionality. •

	(flaring) or converted to electricity generation.	• Can turn methane to energy. • Due to high GWP of methane it is an efficient method of reducing emissions.	
Destruction of Industrial Gasses	Through chemical and industrial processes greenhouse gasses can be restricted from entering the atmosphere. Can be expensive to establish but also provide an ongoing source of offsets.	• Easy to measure and monitor.	• Limited supply. • Concerns over some projects Additionality.
Geo Sequestration	Gasses emitted from generation or industrial process are captured, compressed and then injected into underground storages such as depleted gas and oil wells. This can increase yields from such reserves.	• Potential to be cost effective method. • Potential to store vast amounts of carbon.	• Often limited suitable geology near operations (not know specifically for Newmans). • Unproven/effectiveness unknown.

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Table 6-3 Targeted emissions offsets summary table

Emission Source	Offset Option
Coal Seam Methane	Purchase from or invest in methane destruction projects
Consumption of Electricity	Purchase of Green Energy Investment in green energy production facilities
Fuel Consumption	Utilisation of Alternative fuel

Matching GHG emissions with offset

Due to the long lead time of some offset projects (such as forestry), it is possible that the mine will initially be a net emitter of gasses and, as the sequestration project develops, it will 'catch up' to the emissions. Hence, if the Project does consider forestry offsets, it is recommended that it start looking for possible suppliers of forestry credits to account for this lag time. Other projects that involve substantial infrastructure development and/or contractual arrangements may not deliver offsets until the construction of the mine occurs. Should this be the case there will need to be a guarantee on delivering the offsets and clear understanding of the responsibilities of the parties to any agreement should a project fail.

It may be ideal to have a mixture of projects that will lead to an emission balance. This may mean purchasing offsets in the first stage of operations whilst investing in a sequestration or methane destruction project to offset later year's emissions.

6.2 Emissions Trading

Currently there is no formal carbon market in Western Australia. Emissions trading schemes exist in NSW (GGAS scheme) and internationally and some schemes include credits for carbon sequestered in trees (bio-sequestration). However there is limited trade occurring on the Australian Climate Exchange and the Australian governments planned schedule for a nation emissions trading system will only commence in 2010.

The WA Government is currently working with the other states and territories to develop a national emissions trading scheme. Draft papers for the national scheme have proposed that bio-sequestration be included, but considerable development is needed on the design of the proposed scheme. For further information on the national emissions trading system go to http://www.emissionstrading.nsw.gov.au/

Individuals and businesses in WA undertake voluntary purchases of carbon offset products. In addition, since 2006, the Western Australian Government has offset the government's passenger vehicle fleet emissions, by buying a range of carbon offset products. Apart from lowering the environmental impacts of the government fleet, this process provides government agencies with crucial information on the emerging market in offset products, which is used to inform other buyers about credible offset products.

A range of carbon accounting methodologies and standards have been developed, and buyers should seek specialist advice prior to entering into any commercial arrangements. However, items to consider in any commercial arrangement should include:

- Registration of carbon agreements on land title using the Forestry Rights Act, 2003;
- Additionality and permanence of the offset;
- Eligible definitions of "forest", "reforestation" and "afforestation" under the Kyoto Protocol; and
- Carbon accounting in harvested wood products.

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Carbon Offset Markets

There are several key markets operating for the trade of carbon offsets.

Kyoto Markets

Countries that have ratified the Kyoto Protocol are legally bound to meet national targets for greenhouse gas emissions. The targets were designed for industrialized nations (Annex 1 countries) to limit the concentration of atmospheric pollutants to a level that would avoid an unacceptable level of climate change. This meant a reduction in emissions for most developed countries. Countries were given allowances for emissions and are able to increase emissions if they can balance them with offsets from either the Joint Implementation (JI) or the Clean Development Mechanism (CDM).

Current Price – price dependant on the type of project and project location

European Union Emissions Trading Scheme

The European Union Emissions Trading (EU–ETS) is a cap and trade approach where allocations have been made to industrialised countries. If countries exceed their emissions targets, they will be fined for each tonne of CO_2-e they exceed there allocation. The over allocation of emissions for phase 1 (2005 – 2008), resulted in prices for credits falling from around €30 euro/tonne CO_2-e to €4.25euro/tonne in December 2007[16]. Phase 2 (2008-2012) is expected to have tighter allocations and according to market analysts this will cause an increase in the price back to around the €30/tonne CO_2-e mark. Global carbon credit trade rose to $60 billion in 2007, from $33 billion the previous year. Total traded volume in the global market reached 2.7 billion tons of greenhouse emissions reductions in 2007, a 64 percent jump in the same period.

Current Price € 17.25 as on 14/11/08 ($33.17[17] AUD) per tonne of CO_2-e.

New South Wales Greenhouse Gas Abatement Scheme (GGAS)

The GGAS is a cap and trade approach administered by the Independent Pricing and Regulatory Tribunal and is considered to be one of the earliest emissions trading systems in the world. Under the GGAS large energy users and large energy produces (known as benchmark participants) are bound by legislation to a maximum per capita emission in tonnes CO_2-e. Penalties for non compliance include either a fine payment or source a similar number of NGAC(s) (New South Wales Greenhouse Gas Abatement Certificate) to offset their surplus emissions. This scheme, has led to the development of a number of offset projects in New South Wales. Benchmark participants must offset their emission with offsets that have been generated in the same (accrediting period) (year).

Current Price (Spot Market): $10(AUD) per tonne of CO_2-e.

Chicago Climate Exchange (CCX)

The Chicago Climate Exchange (CCX) is a voluntary greenhouse gas registry. The self regulated membership have entered binding agreements to reduce their greenhouse gas emission by 4% rising to 6% by 2010 from a baseline set between 1998 through to 2001. Carbon Financial Instruments (offsets) are traded through the registry to help balance members emissions.

Current Price $1.10 US as on 14/11/08 ($ 1.69 AUD[18]) per tonne of CO_2-e.

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[16] http://uk.reuters.com/article/oilRpt/idUKL0882989920070108

[17] AU$1= 0.52 €

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Australian Climate Exchange (ACX)

The Australian Climate Exchange (ACX) is the first carbon exchange in Australia. The first emissions commodity listed on the ACX are the Australian Government accredited Greenhouse Friendly approved abatement known commonly as Voluntary Emission Reductions (VERs).

Current Price $8.75 (AUD) per tonne of CO_2-e[19].

The following table has been created to show the approximate costs associated with purchasing offsets.

Table 6-4 Summary of offset prices with annual and total costs

Market	Price/tonne of CO2-e (AUD)	Annual Offset Cost (AUD)	Total Offset Cost (AUD*10^6)	Costs per tonne of Coal Mined Annually (AUD)	
				2 Mtpa	2.5 Mtpa
Kyoto (CDM/JI)					
EU-ETS	33.17	1,747,825	52.43	0.74	0.70
GGAS	10	526,930	15.81	0.22	0.21
CCX	1.1	57,962	1.74	0.02	0.02
ACX	8.75	461,063	13.83	0.20	0.18
CPRS (estimate $20)	20	1,053,859	31.62	0.45	0.42

It should be noted that the prices quoted are as on dates mentioned above. It is very likely that as the availability of offsets become scarce, the price would increase substantially. Furthermore, the costs associated with penalties for non-compliance will also increase in the future. The figures quoted above are based on per tonne of CO_2-e offset, however, as the annual GHG emissions generated by the project is in the order of million tonnes, it is recommended that Central West Coal Pty Ltd obtain Expressions of Interest (EOI) from offset providers. This would ensure the ability of the market to provide the necessary offsets for the project life and also help Central West Coal Pty Ltd negotiate discounts on prices.

[18] AU$1 = US$0.65

[19] Price dependant on project type and location

Section 7 Funding Opportunities

The State and Federal Governments are currently offering several funding programs aimed at promoting renewable energy and energy/water efficiency technologies with strong synergies for greenhouse gas emissions abatement. The following lists the current funding programs that may have potential to provide significant capital for GHG abatement initiatives.

7.1 Low Emissions Technology Demonstration Fund (LETDF)

This Fund has been developed by the Australian Greenhouse Office (AGO) to support the commercial demonstration of new technologies that will effectively deliver large-scale GHG emission reductions to the energy sector. Projects eligible to receive part of the $500m of funding available will be those that present innovative energy supply technologies in both renewable and fossil fuel sources, as well as energy efficiency in both the stationary and transport sectors.

To be eligible technologies have to demonstrate a potential to be commercially available by 2030 and be able to reduce the energy sector's greenhouse gas signature by at least 2%. As a result of these criteria it is unexpected that this fund will be applicable to Central West Coal.

Application Forms are not available online. Ph: 13 28 46 or hotline@ausindustry.gov.au

7.2 Renewable Energy Development Initiative (REDI)

The REDI program, developed by the Australian Government's AusIndustry division is offering grants of $50,000 to $5m for the development of new renewable energy technologies. In order to be eligible for funding, the technology is required to be at the early stages of commercialisation and have a strong emission-reduction potential.

Similar to the LEDTF program, utilising this grant would require Central West Coal to work with a suitable candidate that already has a new renewable technology in the development stages that would benefit both parties. For Central West Coal to directly benefit from such developments (in terms of GHG emissions abatement) it is envisaged that Central West Coal would enter a contract with the renewable energy provider to purchase this energy. There may also be a requirement for Central West Coal to provide a proportion of the capital cost of the project so as to safeguard the purchasing agreement.

Enquiry Forms are available from: http://www.ausindustry.gov.au

Potential Technologies

- CETO Wave Energy Converter - Seapower Pacific Pty Ltd. For further information see: http://www.seapowerpacific.com.
- Liquid Solar Array – commercialisation is not expected in the near future.
- Solar Air Conditioning – Minimal developments within Australia. GHG emissions from air conditioning represent a very small percentage of Central West Coal's total emissions, and would not be feasible to pursue at this stage.

7.3 Solar Cities

Solar Cities is a $75m initiative to be implemented by the AGO over the next 8 years. The program aims to demonstrate the ability to create sustainable urban developments through the application of solar technologies, smart metering and energy efficient practice.

The Cities of Perth and Kalgoorlie-Boulder have recently been short-listed as potential candidates to host the Solar Cities Program with final selections made in July 2006.

Potential Technologies

Several new solar energy technologies exist that may be of benefit to Central West Coal, such as:

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- Sustainable Technologies Australia's (STA) dye sensitised solar cells (array on Leederville office).
- Solar Air Conditioning (not yet commercially available in Australia).
- Solar concentrating troughs (potential to drive absorption cooling process).
- PhotoVoltaic-Thermal (PVT) combi-panels (produce both electrical and thermal energy).

7.4 Renewable Remote Power Generation Programme (RRPGP)

RRPGP is a sub-programme of the 'Low Emissions Technology Abatement' initiative which supports the uptake of cost effective abatement opportunities incorporating low emissions technologies. Specifically the RRPG Programme funds a range of initiatives including $4.8m towards the displacement of remote diesel-powered water pumping through the use of renewable energy technologies. Applications for renewable energy stream are ongoing and are being accepted now.

7.5 Sustainable Energy Development Office Grants Program

The Sustainable Energy Development Office (SEDO) Grants Program provides funding for innovative renewable energy and energy efficiency projects in Western Australia[20]. The Committee's primary goal is to reduce greenhouse gas emission associated with energy use by increasing:

- the efficiency of energy use; and
- the use of renewable energy.

Projects typically funded by the Committee include:

- research and development of new sustainable energy technologies;
- feasibility studies investigating the viability of innovative sustainable energy projects;
- education and training projects that increase understanding and adoption of sustainable energy practices; and
- projects that demonstrate the viability of emerging sustainable energy technologies.
- Funds are allocated twice-yearly via a competitive grant application process. Grants usually range from $10,000 to $50,000.

7.6 The Australian Water Fund

The Federal Coalition announced a series of new water-related policies prior to the November 2004 federal election. The most significant of these policies included establishment of the Australian Water Fund (AWF), a $2 billion program over 2 years[21].

The objective of the Australian Water Fund is to assist projects that:

- improve river flows;
- encourage improvements and efficiency to on-farm water use;
- desalinate water for use in cities and towns;

[20] http://www1.sedo.energy.wa.gov.au/

[21] http://www.nwc.gov.au/agwf/index.cfm

- recycle and reuse stormwater and 'grey' water;
- provide more efficient storage facilities, such as underground aquifers;
- provide alternatives to ocean outfalls and the better management of sewerage in our coastal cities and towns;
- lead to improvements in irrigation infrastructure; and
- develop water efficient housing design.

The AWF consists of 3 key elements with the majority of the funding ($1.6 billion) intended for large capital infrastructure projects under the 'WaterSmart Australia' program over the next 5 years.

7.7 Water Smart Australia Program

The Water Smart Australia Program was developed by the National Water Commission in 2005 to target large-scale projects that will make a significant contribution to the sustainable management of Australia's water resources. Projects eligible for funding include those that improve river flows, sustain groundwater aquifer levels, recycle and reuse stormwater and wastewater from sewage. A minimum of $1m is expected for each project.

Potential opportunities exist for Central West Coal through recycling of water and wastewater initiatives and improved management of water resources. Additional to this, carbon sequestration opportunities may exist through re-vegetation projects.

Application information is available at: http://www.nwc.gov.au/water_fund/how_to_apply.cfm

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