



# Energy and Greenhouse Assessment



## Appendix 11





**FINAL**

**GREENHOUSE GAS AND ENERGY  
ASSESSMENT**

**FOR**

**ANVIL HILL PROJECT**

**BY**

**SEE SUSTAINABILITY CONSULTING**

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## Introduction

As part of the environmental assessment for the proposed Anvil Hill Project, Umwelt (Australia) Pty Limited (Umwelt) required a Greenhouse Gas and Energy Assessment to be conducted for the project. The proposed open cut mine will produce up to 10.5 million tonnes per annum and have a project life of 21 years. The main sources of greenhouse gases are direct emissions of CO<sub>2</sub> from the combustion of petroleum products, indirect emissions of CO<sub>2</sub> through the consumption of electricity, methane emitted from the exposed coal seams and direct emissions of CO<sub>2</sub> from explosives.

The Greenhouse Gas and Energy Assessment report for the project has three main sections:

1. An assessment of the energy and greenhouse gas emissions from the proposed Anvil Hill Project in accordance with recognised assessment guidelines;
2. Calculation of energy consumption and greenhouse gas emissions for the proposed Anvil Hill Project for various operational scenarios including maximum annual production, average annual production and the total project;
3. Assessment and identification of where relevant management controls can be utilised to minimise energy use and greenhouse gas emissions and nomination of specific mitigation strategies to achieve this objective.

The greenhouse assessment is based upon the methodologies outlined in:

- NSW Energy and Greenhouse Guidelines (Guidelines) for Environmental Impact Assessment, Sustainable Energy Development Authority and Planning NSW, 2002
- the World Business Council for Sustainable Development (WBCSD) and World Resources Institute (WRI) *Greenhouse Gas Protocol* 2004 (GHG Protocol) and
- the Australian Greenhouse Office (AGO) *Factors and Methods Workbook December 2005 (Workbook)*.

The Greenhouse Gas and Energy Assessment has been prepared using information provided by Umwelt regarding the estimated project annual production schedules, annual electricity consumption, annual diesel consumption, annual explosives consumption and methane gas emissions for the proposed Anvil Hill Project.

## Energy and Greenhouse Emissions for Anvil Hill Project

This section provides an assessment of the energy consumption and greenhouse gas emissions for the proposed Anvil Hill Project.

### Scope of Emissions Inventory

The abovementioned guidelines define three “scopes” of emissions categories for a project:

- **Scope 1** covers *direct* emissions from the combustion of fuels (e.g. diesel) and industrial processes within the boundary of the mining operation
- **Scope 2** covers *indirect* emissions from the mining operation’s consumption of purchased electricity produced by another organisation.
- **Scope 3** includes other *indirect* emissions as a result of the mining operation’s activities that are not from sources owned or controlled by the organisation (for example, product transport on the rail system).

**Direct** emissions are produced from sources within the boundary of an operating mine as a direct result of its activities e.g. combustion of diesel fuels for transportation of product and waste and fugitive emissions of methane. **Indirect** emissions are produced outside the boundary of the mining operation by other organisations but are a direct result of the mining operation’s activities. Indirect emissions mainly result from the generation of electricity consumed by the mining operation. Indirect emissions do not include the emissions generated by the use of the coal produced by the Project.

The term “mining operation’s activities” refers to the activities associated with the proposed Anvil Hill Project that occur within the Project Area.

Scope 3 emissions have not been included in the inventory calculation for the Anvil Hill Project as they are produced by third party organisations outside the Project Area. The World Business Council for Sustainable Development and World Resources Institute *Greenhouse Gas Protocol* 2004 considers the reporting of Scope 3 emissions to be optional. If an organisation believes that Scope 3 emissions are a significant component of the total emissions inventory, these can be reported along with Scope 1 and 2. However, reporting Scope 3 emissions can result in double counting of emissions and can also make comparisons between organisations and/or projects difficult because reporting is voluntary. The Anvil Hill Project has no control over Scope 3 emissions such as those from product transport on the rail system.

An assessment of the Scope 1 and Scope 2 energy and greenhouse gas emissions from the proposed Anvil Hill Project was undertaken over the life of the project from year 1 to year 20. A calculation of the energy consumption and greenhouse gas emissions for the project for various operational scenarios including maximum annual production, average annual production and the total project was also undertaken.

The estimated energy and greenhouse gas emissions for the proposed Anvil Hill Project based on the conceptual production schedule and operational scenarios are shown in **Table 1.1** and **1.2** below.

**Table 1.1 Anvil Hill Project Energy Usage Estimate Year 1 - Year 21 (Scope 1 & 2)**

<b>Year</b>	<b>Year 2</b>	<b>Year 5</b>	<b>Year 10</b>	<b>Year 15</b>	<b>Year 20</b>	<b>Project Total</b>	<b>Average Annual</b>	<b>Project Maximum</b>	<b>Maximum Annual</b>
<b>ROM Production T</b>	3,200,000	10,500,000	8,499,993	7,000,022	3,917,011	140,116,795	7,005,840	157,000,000	10,500,000
<b>Saleable Production T</b>	2,432,000	7,980,000	6,459,995	5,320,017	2,976,928	106,488,764	5,324,438	119,315,142	7,980,000
<b>Energy Content Saleable GJ</b>	58,039,105	190,440,781	154,166,225	126,960,918	71,043,678	2,541,328,800	127,066,440	2,847,427,227	190,440,781
<b>Diesel kL</b>	13,984	27,899	27,845	26,884	22,796	487,552	24,378	546,276	27,899
<b>Explosives T</b>	6,571	17,042	17,000	17,345	13,789	302,645	15,132	339,098	17,042
<b>Methane kg</b>	831,240	2,727,506	2,207,980	1,818,343	1,017,493	36,397,091	1,819,855	40,781,055	2,727,506
<b>Electricity kWh</b>	33,371,434	109,499,998	88,642,785	73,000,227	40,848,827	1,461,218,005	73,060,900	1,637,219,053	109,499,998
<b>Diesel GJ</b>	539,782	1,076,913	1,074,804	1,037,731	879,943	18,819,497	940,975	21,086,271	1,076,913
<b>% of Total</b>	81.8%	73.2%	77.1%	79.8%	85.7%	78.2%	78.2%	78.2%	73.2%
<b>Electricity GJ</b>	120,137	394,200	319,114	262,801	147,056	5,260,385	263,019	5,893,989	394,200
<b>% of Total</b>	18.2%	26.8%	22.9%	20.2%	14.3%	21.8%	21.8%	21.8%	26.8%
<b>Total GJ</b>	659,919	1,471,113	1,393,918	1,300,531	1,026,998	24,079,882	1,203,994	26,980,259	1,471,113
<b>GJ/T ROM</b>	0.206	0.140	0.164	0.186	0.262	0.172	0.172	0.172	0.140
<b>GJ/T Saleable</b>	0.271	0.184	0.216	0.244	0.345	0.226	0.226	0.226	0.184
<b>GJ Energy Consumed / GJ Energy Sold</b>	0.011	0.008	0.009	0.010	0.014	0.009	0.009	0.009	0.008

**Table 1.2 Anvil Hill Project Greenhouse Gas Emissions Estimate Year 1 - Year 21 (Scope 1 & 2)**

Year	Year 2	Year 5	Year 10	Year 15	Year 20	Project Total	Average Annual	Project Maximum	Maximum Annual
<b>ROM Production T</b>	3,200,000	10,500,000	8,499,993	7,000,022	3,917,011	140,116,795	7,005,840	157,000,000	10,500,000
<b>Saleable Production T</b>	2,432,000	7,980,000	6,459,995	5,320,017	2,976,928	106,488,764	5,324,438	119,315,142	7,980,000
<b>Diesel kL</b>	13,984	27,899	27,845	26,884	22,796	487,552	24,378	546,276	27,899
<b>Explosives T</b>	6,571	17,042	17,000	17,345	13,789	302,645	15,132	339,098	17,042
<b>Methane kg</b>	831,240	2,727,506	2,207,980	1,818,343	1,017,493	36,397,091	1,819,855	40,781,055	2,727,506
<b>Electricity kWh</b>	33,371,434	109,499,998	88,642,785	73,000,227	40,848,827	1,461,218,005	73,060,900	1,637,219,053	109,499,998
<b>Diesel TCO<sub>2</sub>e</b>	37,757	75,328	75,181	72,587	61,550	1,316,390	65,819	1,474,946	75,328
<b>% of Total</b>	44.9%	33.2%	37.9%	41.6%	51.6%	39.3%	39.3%	39.3%	33.2%
<b>Explosives TCO<sub>2</sub>e</b>	1,099	2,851	2,844	2,902	2,307	50,633	2,532	56,731	2,851
<b>% of Total</b>	1.3%	1.3%	1.4%	1.7%	1.9%	1.5%	1.5%	1.5%	1.3%
<b>Methane TCO<sub>2</sub>e</b>	17,456	57,278	46,368	38,185	21,367	764,339	38,217	856,402	57,278
<b>% of Total</b>	20.7%	25.2%	23.4%	21.9%	17.9%	22.8%	22.8%	22.8%	25.2%
<b>Electricity TCO<sub>2</sub>e</b>	27,865	91,432	74,017	60,955	34,109	1,220,117	61,006	1,367,078	91,432
<b>% of Total</b>	33.1%	40.3%	37.3%	34.9%	28.6%	36.4%	36.4%	36.4%	40.3%
<b>Total TCO<sub>2</sub>e</b>	84,177	226,889	198,409	174,630	119,333	3,351,478	167,574	3,755,158	226,889
<b>TCO<sub>2</sub>e /T ROM</b>	0.026	0.022	0.023	0.025	0.030	0.024	0.024	0.024	0.022
<b>TCO<sub>2</sub>e /T Saleable</b>	0.035	0.028	0.031	0.033	0.040	0.031	0.031	0.031	0.028
<b>Total TCO<sub>2</sub>e Excl. CH<sub>4</sub></b>	66,721	169,612	152,041	136,444	97,966	2,587,139	129,357	2,898,756	169,612
<b>TCO<sub>2</sub>e /T ROM Ex. CH<sub>4</sub></b>	0.021	0.016	0.018	0.019	0.025	0.018	0.018	0.018	0.016
<b>TCO<sub>2</sub>e /T Saleable Ex. CH<sub>4</sub></b>	0.027	0.021	0.024	0.026	0.033	0.024	0.024	0.024	0.021

## Energy Consumption

**Table 1.1** above shows that proposed Anvil Hill Project estimated energy usage is dominated by diesel usage at 78% with the remaining 22% consisting of electrical energy. This is due to the reliance on diesel powered mining equipment, with no plan to use a dragline or electric shovels. Typically, electricity consumption for ancillary activities is dominated by the Coal Preparation Plant (CPP) with a minor contribution from the workshop, bath house and administration office.

The energy indices for the mining operation are 0.172 GJ per tonne of ROM coal mined and 0.226 GJ per tonne of saleable coal. The index for GJ/tonne of saleable coal of 0.226 is less than the Australian open cut black coal mining industry average of 0.29 GJ/tonne. (AGSO, 2000) The net energy consumption figures of 0.009 GJ/GJ for the proposed Anvil Hill Project is comparable with the Australian open cut black coal mining industry average of 0.010 GJ/GJ (AGSO, 2000).

## Greenhouse Emissions

**Table 1.2** above shows the proposed Anvil Hill Project estimated greenhouse gas emissions associated with energy consumption plus those methane emissions from the coal seam. The Scope 1 and 2 annual average greenhouse emissions for the mining operation are dominated by energy use with diesel at 39% and electricity at 36%. Emissions from methane make up 23% of the total and explosive use at 2% makes up the remainder of the inventory. The average annual greenhouse emissions for the mining operation are estimated at 167,574 TCO<sub>2</sub>e. The greenhouse indices for the mining operation are 0.024 TCO<sub>2</sub>e/tonne of ROM coal mined and 0.031 TCO<sub>2</sub>e/tonne of saleable coal. The greenhouse index of 0.031 TCO<sub>2</sub>e/tonne of saleable coal is less than the Australian open cut black coal mining industry average of 0.05 TCO<sub>2</sub>e/tonne of saleable coal. (AGSO, 2000)

The levels of methane contained in the coal seams to be mined by the Anvil Hill Project were taken from actual bore hole samples collected in 2005. Total gas content from the samples is quite low ranging from 0.30-0.72 m<sup>3</sup>/tonne. Gas composition from the samples shows that methane levels range from 78.5%-94.5% of the gas content. The gas content and methane composition results from each seam to be mined have been used in estimating the total methane emissions from the Anvil Hill Project.

Emissions from methane vary significantly between mines and by excluding these a more accurate comparison can be made of greenhouse emissions from energy. This also allows the Anvil Hill Project to focus on emissions from energy use over which it has control. Excluding methane the average annual greenhouse emissions from the mining operation are 129,357 TCO<sub>2</sub>e. The greenhouse indices for the mining operation excluding methane are 0.018 TCO<sub>2</sub>e/tonne of ROM coal mined and 0.024 TCO<sub>2</sub>e/tonne of saleable coal. Excluding methane the greenhouse index of 0.024 TCO<sub>2</sub>e/tonne of saleable coal is equivalent to the Australian open cut black coal mining industry average (excluding methane) of 0.024 TCO<sub>2</sub>e/tonne of saleable coal. (AGSO, 2000)



## **Greenhouse Mitigation Strategies**

Centennial Hunter Pty Limited (Centennial) will assess and implement where possible energy and greenhouse management initiatives during the project design, operation and decommissioning. Some of the opportunities for improving energy efficiency and reducing greenhouse emissions from the Anvil Hill Project are discussed below.

Due to the nature of open cut coal mining and the low levels of methane contained in the coal seams to be mined, the Anvil Hill Project has no means of capturing and combusting methane. An underground mining operation may pre drain methane from the coal seams prior to mining and thus has access to a low volume high methane concentrations source of gas. Alternatively an underground mining operation will remove methane via the ventilation system and have access to a high volume low methane concentration source of gas. An open cut mining operation does not have such opportunities available and so its greenhouse mitigation measures are largely focused upon energy management and energy efficiency.

Centennial is therefore assessing the viability of the following energy and greenhouse mitigation measures for the Anvil Hill Project:

- Energy management
- Energy efficiency in the mining fleet
- Energy efficiency in stationary equipment
- Energy efficiency in mining processes and coal preparation
- The use of some proportion of biodiesel in the mining fleet
- Electric boosted solar hot water and
- Small scale planting for carbon sequestration

The objective of these measures is to seek further opportunities to reduce greenhouse gas emissions.

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