13 GREENHOUSE GAS

13.1 ASSESSMENT AND MITIGATION

Issue:

Clarification of the greenhouse gas (GHG) assessment presented in the Draft EIS was requested and additional information was sought on:

- the inclusion of embedded energy (life cycle) emissions sources
- sensitivity analysis of the key variables that influence operational GHG emissions
- energy efficiency opportunities and GHG mitigation commitments
- clarification of the baseline (1990) emission levels and proposed emissions trajectory
- comparison of proposed Olympic Dam emissions to those of other similar operations.

Submissions: 2, 10, 12, 16, 88, 102, 136 and 306

Response:

Embedded energy emissions

There are no legislative requirements to report embedded energy and life cycle emissions (i.e. Scope 3 emissions). However, the calculations provided in Chapter 13 of the Draft EIS did include Scope 3 emissions from some sources, namely those associated with the major fuel and reagent usage proposed for the expanded Olympic Dam operation. In response to the submissions received, additional Scope 3 emission sources have been included and the results are discussed below.

Estimates of greenhouse gas emissions from the proposed expansion were presented in Section 13.2.5 of the Draft EIS for various stages of the project development up to Year 40. The estimates were broken down into those emissions reportable under the National Greenhouse and Energy Reporting (NGER) Act (2007), and those direct and indirect emissions that may be attributed to the expansion but are not currently captured in the NGER Act methodology (see Table 13.1 of the Supplementary EIS).

Table 13.1 Estimated annual greenhouse gas emissions for the proposed expansion

Source	Greenhouse gas emissions (t CO_2-e)			
	Initial development (20 Mtpa)	Intermediate development (40 Mtpa)	Full operating capacity (60 Mtpa)	At closure (Year 40)
NGER Act	2,121,010	2,847,108	3,288,384	3,110,847
Non-NGER	560,953	917,937	1,405,831	1,405,831
Total	**2,681,963**	**3,765,045**	**4,694,215**	**4,516,678**

The NGER-related emissions include Scope 1 and 2 emission sources only. The additional non-NGER-related emissions include:

- Scope 1 sources not included in the NGER Act, specifically:
  - emissions related to metallurgical processing
  - emissions related to acid neutralisation in the tailings storage facility (TSF)
  - emissions associated with the use of explosives

- Scope 3 (life cycle) emissions from the following sources:
  - on-site use of diesel, fuel oil, LPG, natural gas and metallurgical coke
  - off-site generation of electricity
  - material transport diesel.

The guidance on appropriate boundaries for the development of a Scope 3 emissions inventory is general, as is typified by the description in the relevant GHG Australian Standard (AS ISO 14064.1 – 2006 Greenhouse Gases Part 1: Specification with guidance at the organizational level for the quantification and reporting of greenhouse gas emissions and removals), which states: 'The organisation may quantify other indirect GHG emissions based on requirements of the applicable GHG program, internal reporting needs or the intended use for the GHG inventory.'

As companies have discretion over which categories they choose to report, Scope 3 emissions in the Draft EIS were limited to those for which emission factors were provided in the National Greenhouse Accounts (NGA) Factors workbook (November 2008) (DCC2008a), and limited to operations and material transport within Australia.

The GHG Protocol document (World Business Council for Sustainable Development 2004) provides some additional guidance regarding which Scope 3 emission sources may be relevant to include, specifically:

- Scope 3 emissions from a particular source that are large or believed to be large relative to the project's Scope 1 and Scope 2 emissions
- Scope 3 emissions from a particular source that contribute to the project's greenhouse gas risk exposure
- Scope 3 emissions from a particular source that are deemed critical by key stakeholders
- those where the organisation could undertake or influence potential reduction of Scope 3 emissions from a particular source.

Given the above, and in order for the emissions of the proposed expansion to be readily compared to those of other recent major projects in South Australia, the embedded emissions associated with the major project construction materials have been assessed for the Supplementary EIS. Table 13.2 provides the calculations for the new Scope 3 emissions, together with the previously presented Scope 3 emissions associated with fuel and reagent usage.

Table 13.2 Estimated Scope 3 and embedded emissions associated with the proposed expansion

Emissions source	Volume/mass	Greenhouse gas emissions
Additional Scope 3 emissions – Construction materials		
Concrete[1]	715,000 m^3	228,800 t CO_2-e total
Steel[2]	125,000 t	275,000 t CO_2-e total
Piping[3]	2,350,000 m	60,000 t CO_2-e total
Electrical cabling[4]	5,000,000 m	256,250 t CO_2-e total
Previously identified Scope 3 emissions – Operational reagents[1]		
On-site diesel[5]	366,000 kL/a	74,877 t CO_2-e/annum
Fuel oil[6]	14,000 kL/a	2,946 t CO_2-e/annum
Material transport diesel	37,000 kL/a	106,830 t CO_2-e/annum
Electricity	2,573,000 MWh/a	360,220 t CO_2-e/annum
Metallurgical coke	18,300 tpa	11,364 t CO_2-e/annum
Natural gas[6]	45,000 tpa	n.a.
LPG[6]	32,000 kL/a	4,325 t CO_2-e/annum

1 Concrete life cycle GHG emission factor sourced from Flower and Sanjayan 2007.
2 Steel life cycle GHG emission factor sourced from the default value described in National Greenhouse Gas and Energy Reporting (Measurement) Technical Guidelines v1.1 (DCC 2008b).
3 Piping life cycle GHG emission assumes steel pipe work of an average 200 mm diameter and uses the reference from note 2.
4 Electrical cabling life cycle GHG emission factor sourced from US EPA 2005 and Europacable 2009 and assumes all cabling is equivalent to HV cabling.
5 Annual emissions calculated at full operating capacity (60 Mtpa ore throughput) and excluding emissions associated with the existing operation.
6 The expanded processing plant may use natural gas in preference to diesel, fuel oil and LPG, therefore the Scope 3 emissions presented are considered 'worst-case' maximum values, and would reduce if natural gas was used.

Total GHG emissions, including the additional and previously reported Scope 3 sources, embedded emissions sources and vegetation clearance sources are summarised in Table 13.3.

Table 13.3 Greenhouse gas footprint for the proposed expanded operation

Source	Once-off emissions	Annual emissions
Construction (embedded) emissions	820,050 t CO_2-e	n.a.
Vegetation clearance (land use change) emissions	920,000 t CO_2-e	n.a.
Operational emissions – full operating capacity of 60 Mtpa ore throughput (all scopes and sources as per the Draft EIS)	n.a.	4,694,215 t CO_2-e/annum
Total	1,740,050 t CO_2-e	4,694,215 t CO_2-e/annum

Life cycle emissions

A high-level assessment of the life cycle greenhouse gas emissions associated with the expanded operation was undertaken using available literature to estimate emissions associated with uranium and copper production, use and disposal.

Uranium
Approximately 9.05 kg of U_3O_8 is required to produce 1 kg of nuclear fuel-grade UO_2 (World Nuclear Association 2008), sufficient to generate approximately 360,000 kWh of electricity. Using the nuclear life cycle information presented in Section 13.2 of the Supplementary EIS, the life cycle greenhouse gas emission for the UOC produced by the combined existing and expanded operation is around 2.63 tonnes of CO_2-e per kilogram of UOC.

Copper
Life cycle emissions for the production of copper wire have been estimated to be around 7.3 tonnes of CO_2-e per tonne of copper wire (US EPA 2005) excluding end use emissions. A study into the emissions associated with the waste management of copper wire indicated that life cycle emissions increased by about 0.033 tonnes of CO_2-e per tonne of copper disposed to landfill, and were reduced by up to 4.6 tonnes of CO_2-e per tonne of copper that was recycled.

Net life cycle emission
As detailed in Section 13.2 of the Supplementary EIS, nuclear electricity is significantly less greenhouse gas intensive than fossil fuel-based electricity generation (65 g of CO_2-e per kWh versus up to 1,175 g of CO_2-e per kWh for brown coal). As a result, using the indicative production rates described in Table 5.1 of the Draft EIS, the net greenhouse gas benefit of the expanded operation would be between 17,000 and 27,000 million tonnes of CO_2-e over the proposed 40-year life of the expanded operation, depending on the country in which the nuclear electricity was generated.

Sensitivity analysis of the key variables that influence greenhouse gas emissions
As presented in Figure 13.4 of the Draft EIS, and reproduced here as Figure 13.1, the primary contributors to the expanded operation's greenhouse gas emissions are the consumption of purchased electricity and on-site diesel, principally for use in the open pit mining fleet (see Figure 13.2 of the Supplementary EIS).

The approach adopted throughout the Draft EIS was to assess realistic worst-case conditions, and as such the electricity and diesel demand, and therefore the calculated GHG emissions, are considered upper boundaries. For example, the electricity consumption used for the GHG calculations was based on maximum, rather than average, demands from all electrical loads. Similarly, the diesel usage was based on the maximum mining fleet numbers (the mining fleet would be the largest consumer of diesel for the proposed expansion). Therefore, in terms of sensitivity analysis, the GHG calculations provided in the Draft EIS and the Supplementary EIS are conservative, and actual emissions are likely to be lower.

It is also noted that the energy efficiency and greenhouse gas mitigation opportunities identified in the Draft EIS have focused on both the 'greening' of electricity and diesel supply, and reducing the demand for electricity and diesel. This is evidenced by commitments made in the Draft EIS, as discussed further below.

Mitigation commitments, energy-efficiency opportunities, emissions trajectory and baseline (1990) greenhouse gas emissions
A number of greenhouse gas abatement measures were provided as commitments in the Draft EIS, specifically:

- constructing an on-site co-generation power station utilising waste heat from the burning of elemental sulphur to provide up to 250 MW of electricity for the expanded operation
- installing solar hot water and solar photovoltaic systems in the new airport, the expanded Roxby Downs and Hiltaba Village
- committing to source renewable energy (35 MW) for the coastal desalination plant via the National Electricity Market (NEM).

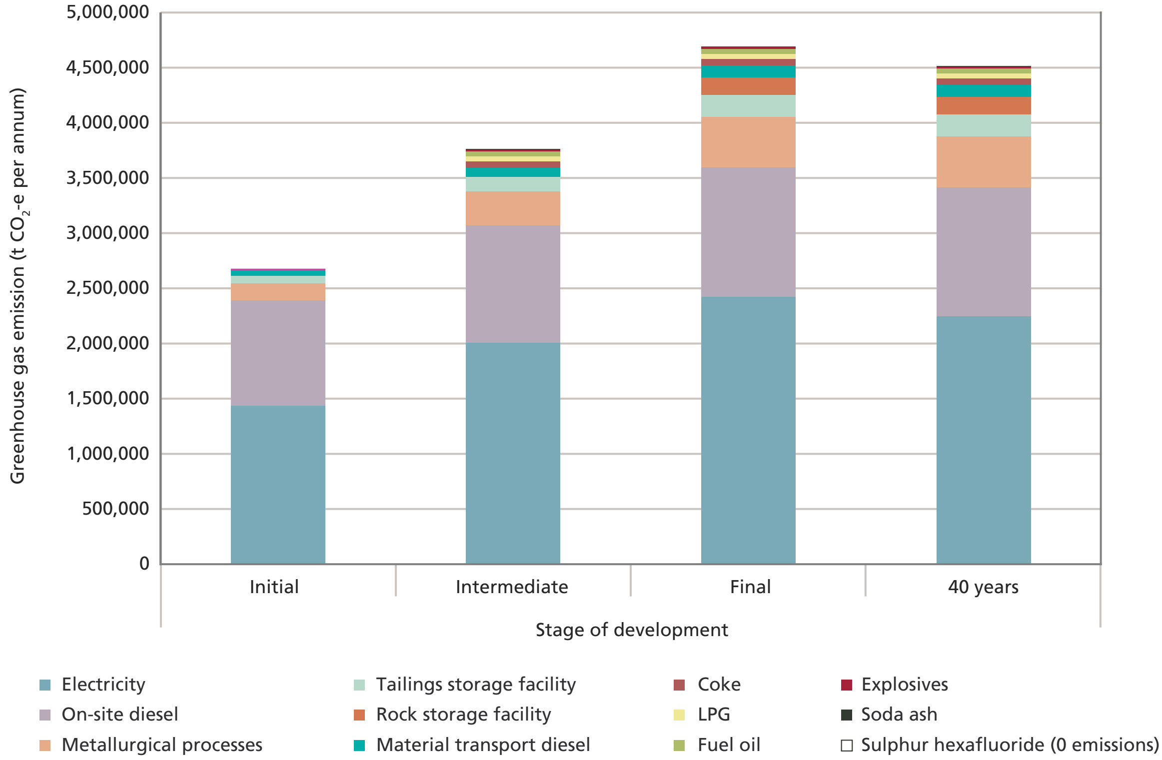


Figure 13.1 Predicted greenhouse gas emission sources for the proposed expanded operation

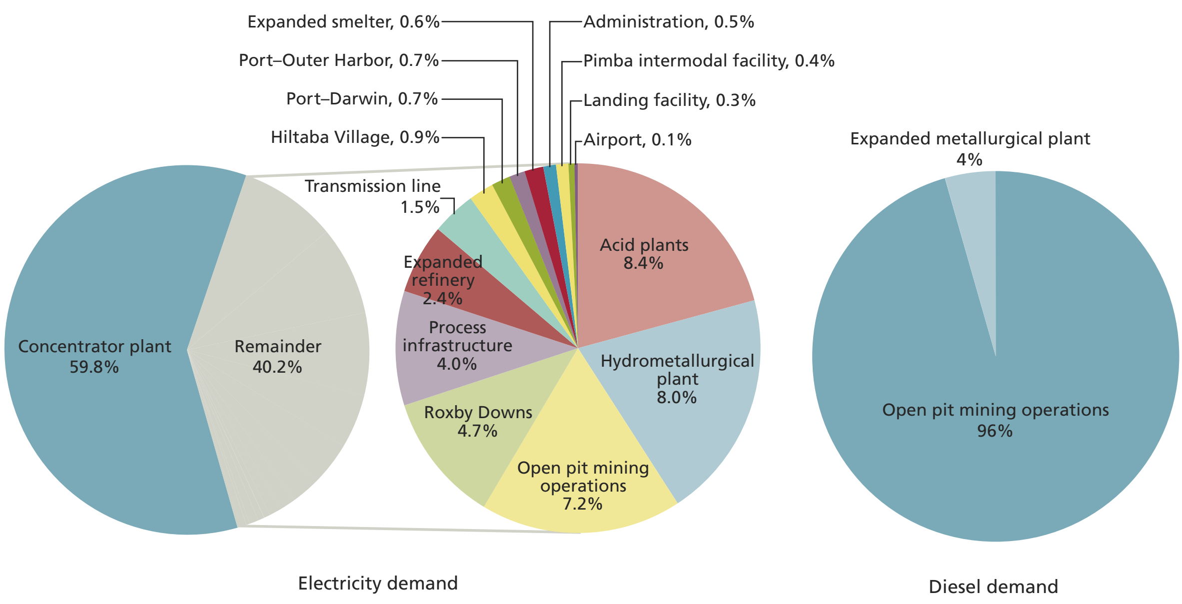


Figure 13.2 Source of electricity and diesel demand for the expanded operation

These were identified as appropriate and achievable commitments that would progress BHP Billiton towards the goal of reducing greenhouse gas emissions (reportable under the National Greenhouse Gas and Energy Reporting (Measurement) Determination (DCC 2008) from the expanded operation to an amount equivalent to at least a 60% reduction (to an amount equal to or less than 40%) of 1990 emissions, by 2050. In 1990, Olympic Dam's greenhouse gas emissions were estimated to be 240,000 t of CO_2-e, the aspirational goal therefore equivalent to around 100,000 t of CO_2-e.

The above-mentioned mitigation measures reduce the estimated electricity demand from approximately 4,400 GWh to approximately 2,450 GWh, saving an equivalent of about 2,100,000 t of CO_2-e per annum.

Since the Draft EIS was published, a further commitment has been made to source renewable electricity (22 MW) from the NEM for the pumping stations between the coastal desalination plant and Olympic Dam. This would reduce electricity demand of the expanded operation by a further 154 GWh per annum, saving about 130,000 t of CO_2-e.

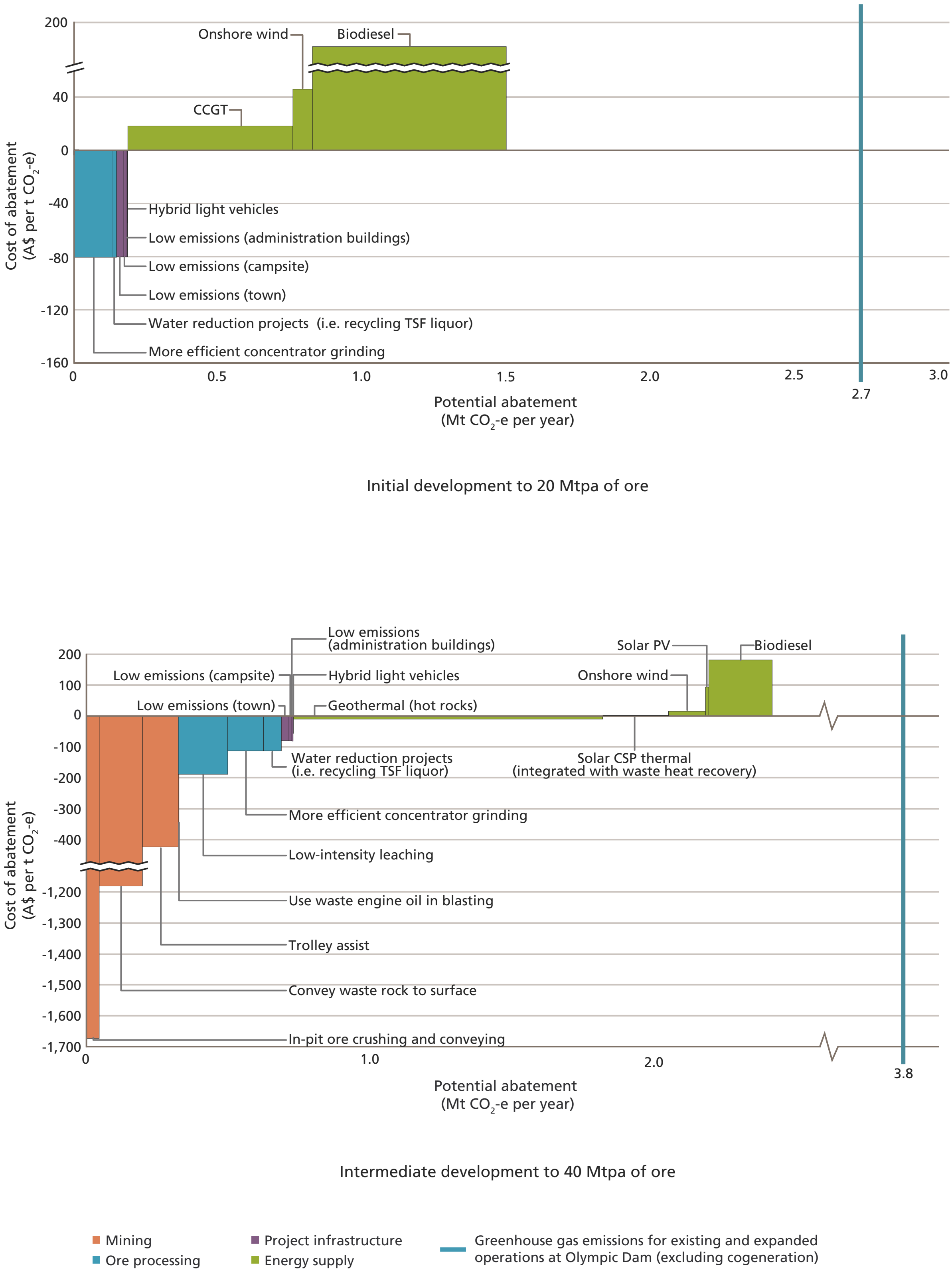
Section 13.2.5 of the Draft EIS provided an overview of other greenhouse abatement measures that would be investigated during detailed design and as the expanded operation developed (refer also to Section L1.6 of Appendix L of the Draft EIS). The abatement potential of these demand and supply-side mitigation measures was described with models developed using McKinsey & Company's carbon reduction methodology, and illustrated in Figures 13.3a and 13.3b of the Supplementary EIS. Firm commitments to implement the identified abatement opportunities cannot be made at this time, as in many cases the proposed mitigation opportunities are unproven at commercial scales or rely on the expanded operation developing beyond a certain scale to be economical. As a consequence, it would not be appropriate to develop emissions trajectories for the expanded operation at this time. A commitment to develop and maintain an Energy and Greenhouse Gas Management Plan was provided in the Draft EIS, and this document would set interim goals, targets and timelines for emissions reduction based on reduction projects that may or may not include those examples identified in Figures 13.3a and 13.3b. The Plan would also identify further greenhouse gas reduction strategies and projects and would establish modelling to project, via an emissions trajectory, the likely reduction pathway from commencement of operations to 2050.

Emissions benchmarking of similar operations

Likewise, it is difficult to compare the expanded operation's estimated greenhouse gas emissions against other, similar, operations; the mining and processing systems vary significantly from one operation to the next, and there are variations in ore grades, recoveries, and the nature and type of the final products. The expanded Olympic Dam operation would be somewhat unusual because it would produce multiple products: a copper concentrate, copper cathode, gold and silver bullion and uranium oxide concentrate.

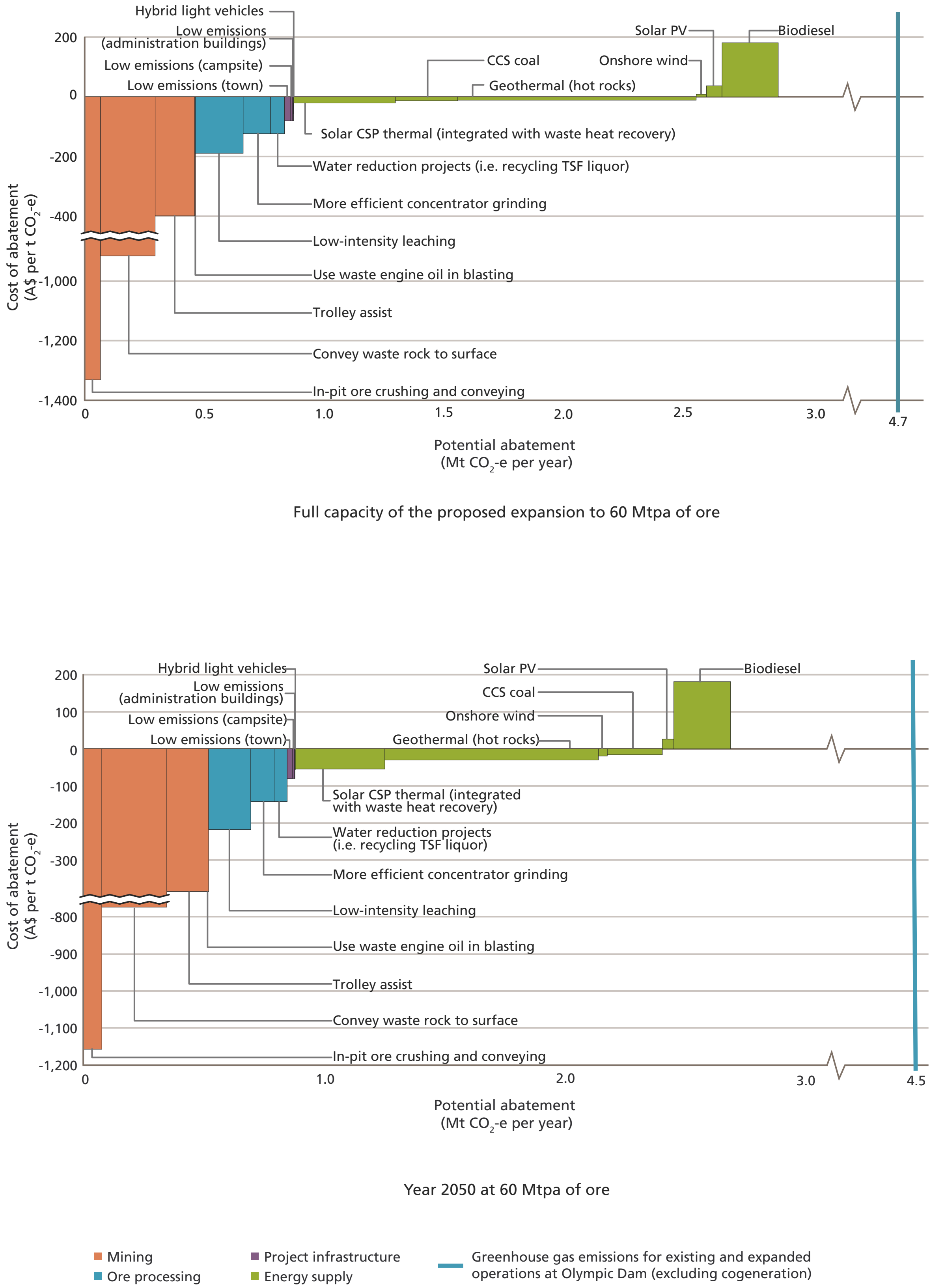
Further differences in the boundaries set for the development of direct and/or indirect greenhouse gas emissions inventories and the emission factors used (based on differences in the make-up of the respective countries' energy supply infrastructure) make such comparisons of little value.

Nevertheless, Figure 13.4 illustrates the publicly reported 2008 greenhouse gas emissions intensity (emissions per tonne of ore processed) from a selection of the largest copper and uranium operations globally, plotted against the projected (NGER Act-compliant) emissions intensity of the expanded operation.



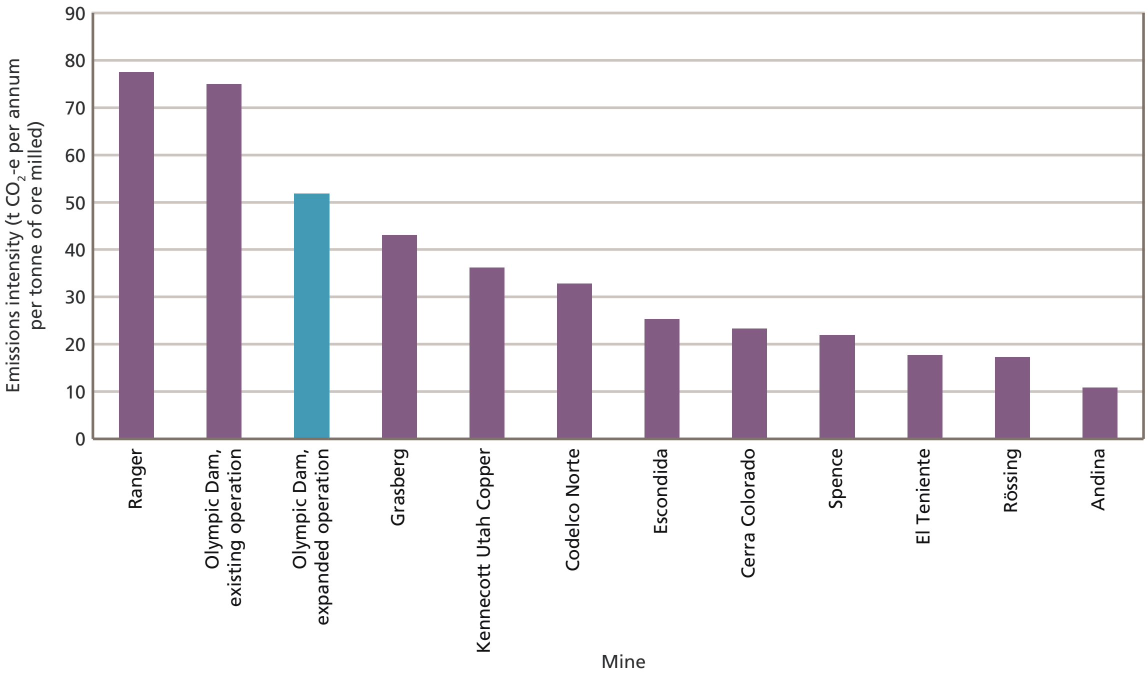
Sources: A cost curve for carbon abatement, McKinsey & Company; BHP Billiton analysis

Figure 13.3a Carbon reduction cost curves for the proposed expansion



Sources: A cost curve for carbon abatement, McKinsey & Company; BHP Billiton analysis

Figure 13.3b Carbon reduction cost curves for the proposed expansion



Source: Multiple references cited, refer to Figure 13.4 in reference list for the various data sources

Figure 13.4 Carbon dioxide emissions

13.2 RENEWABLE ENERGY TARGETS AND THE NUCLEAR FUEL CYCLE

Issue:

Further information was requested regarding the life cycle GHG implications of producing uranium and the life cycle costs of nuclear energy versus traditional fossil fuel and renewable energy sources. In addition, concerns were raised regarding the ability to meet state and federal emissions reduction targets in the context of the increased emissions associated with the proposed expansion. Clarification was sought regarding the potential impacts of the proposed emissions trading scheme (ETS), carbon pollution reduction scheme (CPRS) and the mandatory renewable energy target (MRET) on GHG emissions from an expanded Olympic Dam.

Submissions: 1, 2, 7, 8, 10, 11, 12, 13, 16, 24, 27, 35, 37, 38, 42, 43, 44, 46, 50, 52, 65, 92, 97, 99, 102, 104, 110, 112, 114, 116, 125, 133, 136, 141, 146, 147, 149, 159, 161, 177, 180, 185, 196, 204, 205, 206, 214, 216, 218, 222, 224, 241, 245, 247, 248, 249, 254, 255, 258, 266, 287, 288, 289, 296, 299, 303, 304, 306, 309, 311, 315, 317, 326, 328, 331, 335, 336, 337, 343, 351, 353, 359, 360, 361, 363, 369, 371, 379 and 389

Response:

Nuclear life cycle emissions

Details of the nuclear fuel cycle were presented in Section 2 of Appendix E3 of the Draft EIS, and are summarised here in Figure 13.5. Studies of nuclear fuel life cycle greenhouse gas emissions have shown that the generation of nuclear electricity produces about 65 g of CO_2-e per KWh of electricity generation (Sovacool 2008; Lenzen 2008). This emissions intensity is about 10 to 15 times less than that of fossil fuel electricity generation and at the higher end of the range of renewable electricity generation emission intensities.

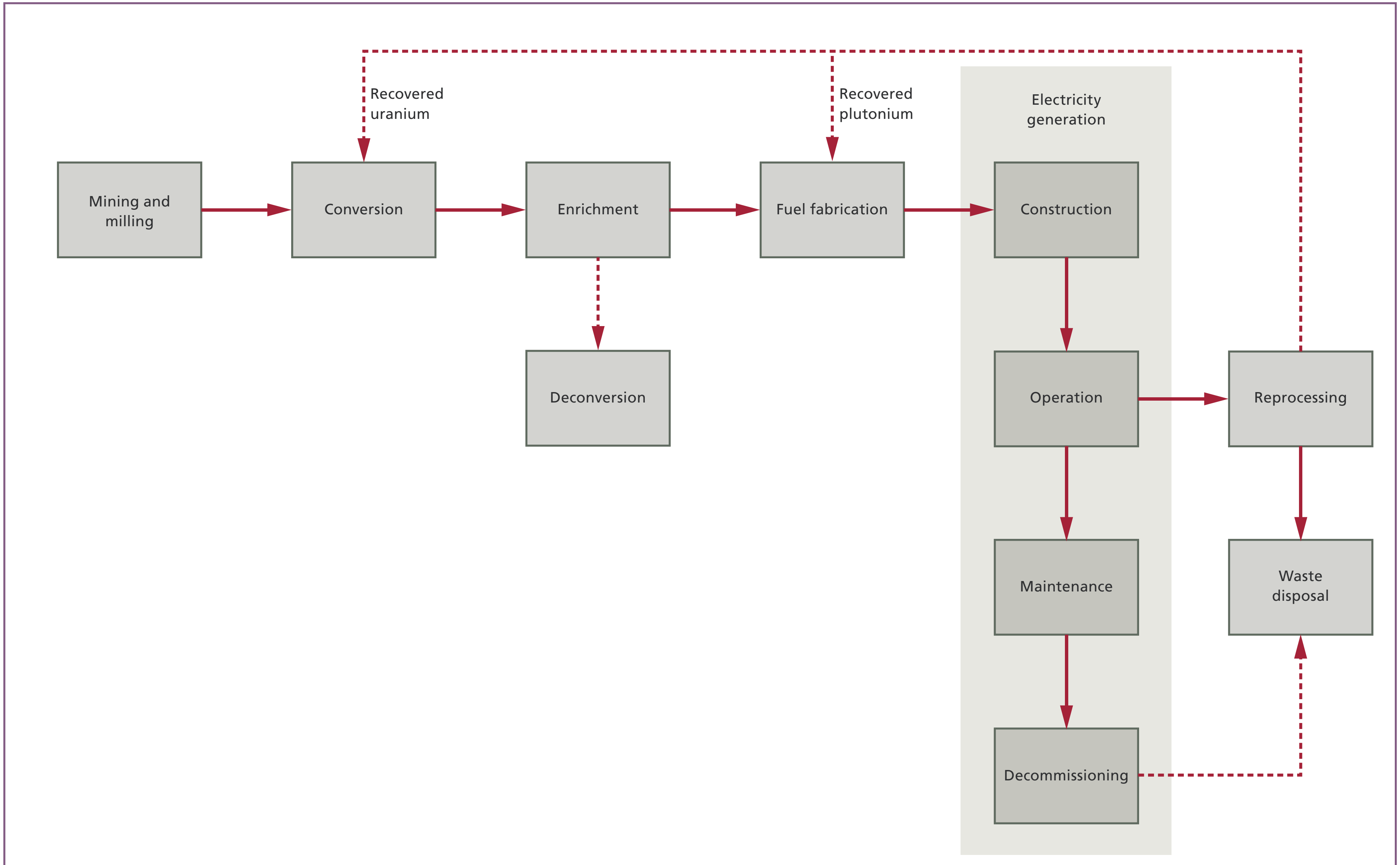


Figure 13.5 The nuclear fuel cycle

An extensive analysis of the life cycle greenhouse gas emissions of electricity-generating technologies has been undertaken (Sovacool 2008; Lenzen 2008). These studies highlighted the various aspects of the nuclear fuel cycle that have the greatest influence on life cycle greenhouse gas emissions. Specifically these are:

- the grade of the uranium ore mined
- the method of enrichment
- the conversion rate of the nuclear fuel cycle (i.e. the amount of fuel recycling)
- the source (fossil, renewable or nuclear) of electricity used for the enrichment phase and the overall greenhouse gas intensity of the electricity mix in the countries where fuel cycle activities are undertaken.

Sovacool (2008) undertook a literature review of 19 previous nuclear life cycle emission analyses from more than 60 nuclear power stations. The results of this study are presented in Table 13.4.

Table 13.4 Emissions intensity of the nuclear fuel cycle (Sovacool 2008)

Emissions	Emissions intensity (g CO_2-e per kWh of generated electricity)					
	Front-end[1]	Construction[2]	Operation[3]	Back-end[4]	Decommissioning[5]	Total
Minimum	0.58	0.27	0.1	0.4	0.01	1.36
Maximum	118	35	40	40.75	54.5	288.25
Mean	25.09	8.2	11.58	9.2	12.01	66.08

[1] Front-end – Mining, milling, conversion, enrichment, fuel fabrication, and transport.
[2] Construction – All materials and energy inputs for building the power station.
[3] Operation – All energy needs for maintenance, cooling and fuel cycles and back-up generators.
[4] Back-end – Fuel processing, conditioning, reprocessing, interim and permanent storage.
[5] Decommissioning – Deconstruction of the facility and land reclamation.

A similar study undertaken by Lenzen (2008) on behalf of the Australian Government concluded that the greenhouse gas intensity of nuclear power was around 60 g CO_2-e per kWh of generated electricity (ranging between 10–130 g CO_2-e per kWh) for light water reactors, and around 65 g CO_2-e per kWh (ranging between 10–120 g CO_2-e per kWh) for heavy water reactors.
The greenhouse gas intensity of nuclear power is lower than that of any fossil-fuelled power technology.

The results of the above-mentioned nuclear fuel life cycle emissions analysis are compared to other forms of electricity-generation technologies in Table 13.5 and illustrated in Figure 13.6, which shows both international greenhouse gas intensities and those in an Australian context (with study ranges in brackets).

Table 13.5 Greenhouse gas emissions intensity of electricity generation technologies

Electricity technology	Greenhouse gas intensity (g CO_2-e/kWh)	
	International	Australian
Offshore wind[1]	9	n.a.
Onshore wind[1]	10	21 (13–40)
Biogas[1]	11	n.a.
Hydroelectric (run-of-river)[1]	13	15 (6.5–44)
Solar thermal[1]	13	n.a.
Biomass[1]	28	n.a.
Solar PV[2]	32	106 (53–217)
Geothermal[1]	38	n.a.
Nuclear[3]	66	65 (10–130)
Natural gas (combined cycle)[4]	443	577 (491–655)
Natural gas (open cycle)	n.a.	751 (627–891)
Fuel cell[4]	664	n.a.
Diesel[4]	778	n.a.
Heavy oil[4]	778	n.a.
Black coal (supercritical)	n.a.	863 (774–1046)
Black coal (new subcritical)	n.a.	941 (843–1,171)
Black coal (scrubbed)[4]	960	n.a.
Black coal (unscrubbed)[4]	1,050	n.a.
Brown coal (new subcritical)	n.a.	1,175 (1,011–1,506)

1 Sourced from Pehnt 2006.
2 Sourced from Fthenakis & Kim 2008.
3 Sourced from Sovacool 2008.
4 Sourced from Gagnon et al. 2002.

It can be seen from the data in Table 13.5 that the nuclear fuel cycle emits less greenhouse gas than any fossil fuel technology, and emissions are similar to, though at the upper range of, the renewable electricity generation technologies.

Effect of the proposed expansion on state and federal emissions reduction targets

Section 13.2.2 of the Draft EIS outlined the various international, national and state-based schemes for the abatement of greenhouse gas emissions that were in place at the time of publication. Some of these have changed significantly since publication, most notably the postponement of the national emissions trading scheme (the Carbon Pollution Reduction Scheme (CPRS)) and an increase in the South Australian target for renewable energy generation. The commitments contained in the Draft EIS align broadly with both the South Australian and Australian greenhouse gas reduction targets and, as a result, it is not expected that the development of the proposed expansion would significantly affect the ability of the Australian or the South Australian governments to meet the legislated emissions reduction targets. The current Australian and South Australian targets are summarised in Table 13.6.

Table 13.6 Summary of South Australian and Australian Government greenhouse gas targets

Jurisdiction	Scheme	Target	Timeframe
Australian	Enhanced Renewable Energy Target	20% of electricity to be generated by renewable sources	2020
South Australian	*Climate Change and Greenhouse Emissions Reduction Act (2007)*	Reduction in greenhouse gas emissions within the state by at least 60% to an amount that is equal to or less than 40% of 1990 levels	2050
		Increase the proportion of renewable electricity generated so that it comprises at least 20% of electricity generated in the state	2014
		Increase the proportion of renewable electricity consumed so that it comprises at least 20% of electricity consumed in the state	2014
		Increase the proportion of renewable electricity generated so that it comprises at least 33% of electricity generated in the state[1]	2020

[1] Announced by the South Australian Premier on 2 June 2009, but not yet formally incorporated into the *Climate Change and Greenhouse Emissions Reduction Act (2007)*.

Subject to government and company approvals, the expanded operation may be in pre-mine and pre-stripping phases by the initial 2014 target, with little, if any, additional electricity use associated with the proposed expanded operation. On this basis, it is considered that South Australia's 2014 target would not apply to the expanded operation.

The 2020 state target is significantly more stringent than the equivalent national target (33% generation from renewables versus 20%), however the proposed expanded operation would aim to progress toward this target through the following commitments (as detailed in Section 13.2.5 of the Draft EIS, and further in Section 13.1 of this document):

- the construction of an on-site co-generation power station utilising waste heat from the burning of elemental sulphur to provide up to 250 MW of electricity for the expanded operation
- the installation of solar hot water and solar photovoltaic systems in the new airport, the expanded Roxby Downs and Hiltaba Village
- a commitment to source renewable energy (35 MW) for the coastal desalination plant via the National Electricity Market (NEM)
- a commitment to source renewable electricity (22 MW) from the NEM for the pumping stations between the coastal desalination plant and Olympic Dam.

The timelines associated with achieving the full operating capacity for the expanded operation are subject to government and company approvals. However, a conservative assessment has been undertaken assuming that full operating capacity broadly aligns with the 2020 GHG target timeline set by the South Australian Government. Using this indicative timeframe, the above-mentioned commitments reduce the electricity demand for the proposed operation from around 4,400 GWh per annum to approximately 2,450 GWh, a reduction of about 45% over a business-as-usual scenario. It is noted that co-generated electricity from waste heat generated on-site could be considered low-emission rather than renewable generation, and that as a proportion of the balance of externally supplied electricity, approximately 14.2%, would be supplied from renewable sources under contract from the NEM.

BHP Billiton has established a goal of matching the South Australian Government greenhouse gas emissions reduction target for 2050, and has detailed in Section 13.2.5 of the Draft EIS and Section L1.6 of Appendix L to the Draft EIS how this may be achieved using supply and demand-side emissions-abatement technologies. Further opportunities to increase the proportion of renewable electricity used in the expanded operation and reduce electricity demand would be investigated during detailed design, and documented in the proposed Olympic Dam Greenhouse Gas and Energy Management Plan.

Effect of an emissions trading scheme on greenhouse gas emissions

The greenhouse gas emissions inventory presented in the Draft EIS and expanded in Section 13.1 of this chapter are based on a conservative worst-case assessment, and do not include the potential effects of an emissions trading scheme should the Australian Government develop such a scheme in the future. BHP Billiton would comply with the relevant requirements of such a scheme, and its effect on the viability of particular greenhouse gas abatement projects, and hence the projected emissions trajectory for the expanded operation would be detailed in the Greenhouse Gas and Energy Management Plan.

Issue:

It was suggested that BHP Billiton formulate an international agreement to reduce the risk of carbon leakage.

Submission: 2

Response:

Carbon leakage may be defined as a net increase in GHG emissions as a result of a developer choosing to relocate production to another country that has less strict carbon reduction policies. This situation was identified in the Garnaut Climate Change Review (Garnaut 2008) as having the potential to result in adverse environmental and economic effects and presents a significant obstacle to the development of domestic mitigation policies in countries around the world, especially in the case of emissions-intensive, trade-exposed (EITE) industries. This is a consequence of the distortion in prices that may occur if industries in Australia were subject to an emissions trading scheme or carbon tax system in the absence of a similar system in the countries of trade competitors.

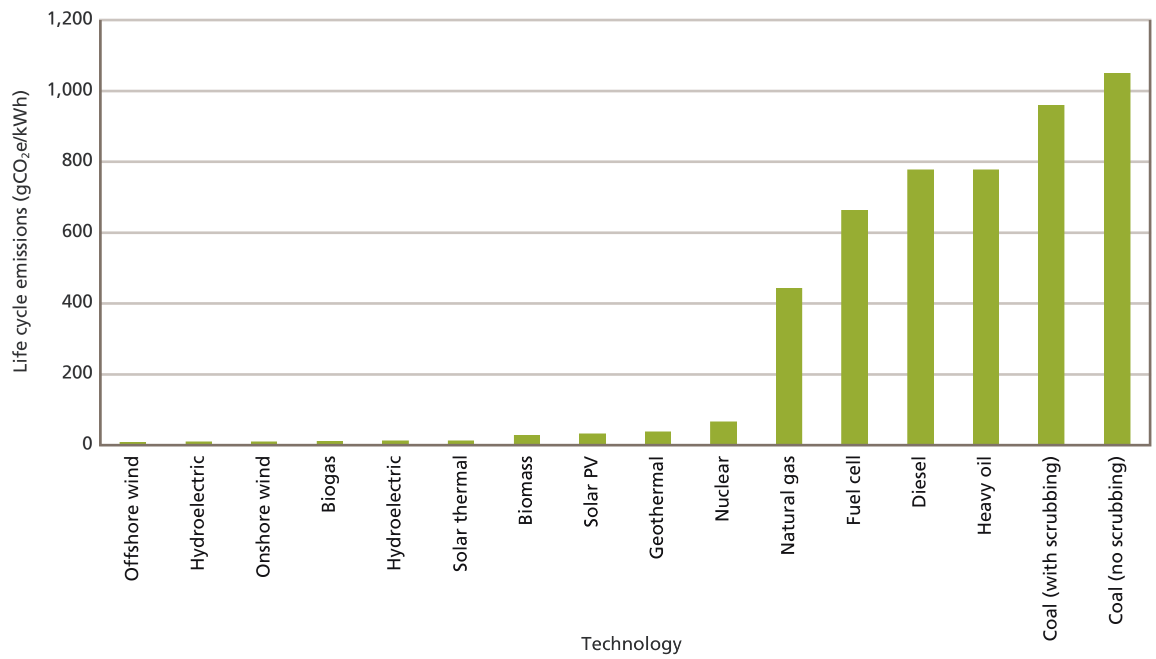
The Garnaut Review identified three options to address the potential for carbon leakage. In order of preference, these are:

- a comprehensive global agreement on mitigation, under which all major emitters have national limits
- effective sectoral climate change agreements for EITE industries, placing particular industries on a more or less level playing field
- domestic assistance measures for Australia's most exposed industries.

The Garnaut Review states that alongside the negotiation of a global agreement, the negotiation of sectoral agreements in priority areas for Australia (including metals, natural gas, cement and sheep and cattle products) should be an urgent international policy priority for the Australian Government.

BHP Billiton recognises that climate change is a global issue and, through its company-wide Climate Change Position, seeks to implement actions that aim to stabilise concentrations at levels guided by the research of the United Nations Intergovernmental Panel on Climate Change.

Sectoral agreements can play a role in avoiding unnecessary carbon leakage in an international GHG mitigation scheme if they cover a critical mass of global production and are legally binding under international law with appropriate enforcement and verification measures. BHP Billiton would support the Australian Government in formulating an international sectoral agreement, and would welcome the opportunity to provide advice and comments to government in cooperation with national and international industry associations.



Source: Pehnt 2006, Fthenakis & Kim 2008, Sovacool 2008 and Gagnon 2002

Figure 13.6 Nuclear life cycle GHG emissions