



Statement by Christopher Dey

**Prepared for
VCAT Works Approval Application
by Dual Gas Pty Ltd**

Integrated Sustainability Analysis (ISA)

The University of Sydney

18 October 2011

I have read the Victorian Civil & Administrative Tribunal (VCAT), Practice Note: PNVCAT 2 - Expert Evidence, and agree to be bound by it.

Declaration:

"I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance which I regard as relevant have to my knowledge been withheld from the Tribunal."



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1 Introduction and background

1.1 Author's qualifications and experience

The author has 14 years of applied research and consulting in energy & greenhouse analysis since completing a PhD in the area of heat transfer. He has a Bachelor of Science (First Class Honours in Physics) from 1992.

1.2 Author's area of expertise

As co-founder of the Integrated Sustainability Analysis (ISA) research group in the School of Physics at the University of Sydney, the author's current research is in the area of sustainability analysis. This area is broad, covering such concepts and techniques as life cycle assessment, full chain greenhouse gas assessment (carbon footprinting), ecological footprinting, industrial ecology, industrial sector studies and triple bottom line analysis and reporting.

The author and ISA group are recognised world leaders in *sustainability science*, which seeks to employ advanced quantitative methods to examine sustainability issues with their inherent spatial and temporal complexity, and their many interdependencies.

To undertake such assessments, the ISA research group employ the technique of generalised input-output analysis. The author and other members of the ISA group have conducted numerous greenhouse, ecological footprint and TBL assessments of organisations, technologies (particularly energy technologies), processes, and populations (at local, state and national level). The author is very familiar with energy technologies (especially in renewable energy) and with the current best practice in TBL and sustainability reporting.

For further information, please see Section 5 for a CV and more background to ISA.

1.3 Origin and purpose of this report

The author was asked by the Environment Defenders Office (Victoria) Pty Ltd to provide an expert opinion on the Triple Bottom Line (TBL) Analysis of the Dual Gas Demonstration Project (DGDP). The TBL Analysis ("SKM TBL Report") was prepared by Sinclair Knight Merz (SKM) at the request of Dual Gas Pty Ltd (Dual Gas). The version of the SKM TBL Report referred to here is indicated as Version 2.10-final (28 March 2011).

The SKM TBL Report set out (see Executive Summary and Section 3) to conduct an analysis consistent with the following principles of environmental protection¹, summarised:

- 1B Principle of integration of economic, social and environmental considerations;
- 1C The precautionary principle;
- 1D Principle of intergenerational equity; and
- 1L Principle of accountability.

¹ Environment Protection Act 1970. Authorised Version No. 175, No. 8056 of 1970, incorporating amendments as at 1 July 2011.

I have interpreted the task of providing an evaluation of the SKM TBL Report in terms of the following criteria:

- 1) how the SKM TBL Report addresses the environment protection principles listed above and the relevance of some of the other principles of environmental protection which were not considered;
- 2) the scope, assumptions and approach of the TBL framework; and
- 3) the comparisons in the report with other electricity generation technologies.

2 Summary

2.1 Overall

The SKM TBL report describes how the environmental protection principles are interpreted, the assumptions behind the approach taken are clear, and it covers what it sets out to cover. In terms of how the report is defined it has no major failings. However, in my view there are some important qualifications to be made on the assumptions and scope of the report.

2.2 Adequacy of the TBL report in addressing the environmental protection principles

The report aims to cover four of the environmental protection principles (EPP), the first being “integration of economic, social and environmental considerations” is the concept of the triple bottom line. *Integration* is the key aspect here, and as with many TBL reports, how well a report achieves this is subjective. In my view the report does not sufficiently integrate the three components of the TBL to address the first EPP. This is discussed further below. The report also does not adequately address across the TBL the two concepts of time scale (eg. intergenerational equity) and full life cycle.

2.3 Scope, assumptions and approach of the TBL framework

The choice of indicators in the TBL framework is reasonable in terms of coverage across the TBL. However, there is in general an emphasis on local and regional impacts, and less emphasis on wider Australian and global impacts. Further, the TBL framework and objectives were developed by SKM and HRL professionals only. A broader, more consultative approach to indicator selection would have been better practice.

The integration of different indicators in TBL reporting is generally approached using a common metric or functional unit (such as electricity output in the case here), and by weighting the different indicators. Weighting can be either qualitatively or quantitatively, or a combination of these. In my view, the indicators are not adequately integrated here as the chosen boundaries (or coverage of the analysis) of each indicator are not fully comparable. In other words, a full life cycle approach is not taken for all indicators.

The weighting approach is relatively simple and limited: high, medium and low importance for Victorians. Presumably the weightings for the indicators were done by SKM and HRL staff. Better practice could have included wider consultation, some more quantitative weighting procedure, and sensitivity analysis of the assessments to the weighting choices of different stakeholders. Similarly, the evaluation of the indicators’ “consistency with objectives” (eg. Table 8.1) is limited and subjective, and could have benefitted from broader consultation.

2.4 Comparisons with other generation options

An important assumption is that the electricity produced by DGDP is not comparable with a range of other generation technologies, including renewables. The report states that other technologies are included for context but are not regarded as alternatives, and that it is beyond the report scope to cover them in full TBL detail. Most of the justification for this main assumption is based on current operational aspects of the national electricity market (NEM).

There are three significant points that follow from this:

- Firstly, it is difficult to conclude that the assumption of incomparability with renewable technologies over a 30 year time horizon is valid, and further, that is invalid to compare the DGDP project with electricity generated using natural gas;

- Secondly, if the TBL impacts of other technologies are not being covered thoroughly, then they cannot be used for any form of comparison or context-setting; and
- Thirdly, the incomplete TBL coverage of other technologies, and the questionable argument that there are no other technologies which are comparable on the basis of electricity production, suggests to the reader that there is really only one possible option.

3 Commentary on the SKM TBL Report

3.1 Purpose

The purpose of the report is made clear (Section 1.3) (SKM 2011). Other technologies are also assessed for comparison and to help contextualise the DGDGP:

“It should be noted that these generation technologies are provided for the purpose of context and are not considered as alternative options for the project.”

Whilst this may strictly be true for this demonstration project, in a broader sense, the details of the comparison with other technologies is highly relevant in terms of the long term development of a low emissions electricity generation system. Further, it is stated:

“...electricity produced by the proposed development will not displace renewable energy generation such as wind farms and solar energy power plants and is therefore not considered to be in competition with these forms of renewable energy.”

Again this may be strictly argued presumably on the basis that electricity produced by the DGDGP will not be included in the current Renewable Energy Target² to 2020 and that renewable electricity is currently regarded as non-scheduled in the electricity market. However, well within the lifetime of the DGDGP (of at least 30 years), there may well be general competition within the NEM covering many renewable energy technologies. In this time scale, the DGDGP and similar plants in the future will be competing with renewable electricity technologies.

3.2 Principles of the TBL analysis

The SKM TBL Report set out (see Executive Summary and Section 3) to conduct an analysis consistent with the following principles of environmental protection³:

1B Principle of integration of economic, social and environmental considerations

- (1) Sound environmental practices and procedures should be adopted as a basis for ecologically sustainable development for the benefit of all human beings and the environment.
- (2) This requires the effective integration of economic, social and environmental considerations in decision making processes with the need to improve community well-being and the benefit of future generations.
- (3) The measures adopted should be cost-effective and in proportion to the significance of the environmental problems being addressed.

1C The precautionary principle

- (1) If there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.
- (2) Decision making should be guided by:
 - (a) a careful evaluation to avoid serious or irreversible damage to the environment wherever practicable; and
 - (b) an assessment of the risk-weighted consequences of various options.

² <http://www.climatechange.gov.au/en/government/initiatives/renewable-target/legislation.aspx>

³ Environment Protection Act 1970. Authorised Version No. 175, No. 8056 of 1970, incorporating amendments as at 1 July 2011.

1D Principle of intergenerational equity

The present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations.

1L Principle of accountability

(1) The aspirations of the people of Victoria for environmental quality should drive environmental improvement.

(2) Members of the public should therefore be given:

- (a) access to reliable and relevant information in appropriate forms to facilitate a good understanding of environmental issues;
- (b) opportunities to participate in policy and program development.

Principles 1C, 1D, 1L and particularly 1B, are a sound basis for constructing a triple bottom line assessment framework. However, it would appear that the concept of a full life cycle approach, which is inherent in three other principles of environmental protection from the Environment Protection Act (Principles 1F, 1G and 1H), is also relevant for the TBL assessment of the DGDP.

In practical terms, a full life cycle approach means to ensure that any assessment procedure takes into account the full temporal and supply chain linkage effects of alternatives (in this case, of electricity generation technologies). In conducting TBL assessments, or life cycle assessments in general, great care is required to ensure that a full life cycle approach is achieved, or in other words, that the *boundaries* for the assessments are comparable. The academic literature on this issue is now extensive (eg. (Lenzen and Dey 2000; Ang and Choi 2002; Suh, Lenzen et al. 2003; Murtishaw, Sathaye et al. 2006)).

In terms of Australian emissions reporting requirements, although the NGER guidelines do not include Scope 3 (supply chain emissions), recent international reporting best practice is increasingly recognising the importance of supply chain contributions. Techniques to do this are now in new standards, such as the recently released final version of the GHG Protocol Standards for Product and Value Chain GHG assessments⁴. The issue of common boundaries can be generalised to apply to all indicators in a TBL framework, not just emissions.

3.3 Rationale, development and scope of the TBL framework

Section 3.2 of the SKM TBL Report outlines the approach to constructing the TBL Framework: elements of the Global Reporting Initiative (GRI) approach to Sustainability Reporting, adapted and combined with multi-criteria assessment (MCA). The SKM TBL Report well qualifies the assumptions and limitations behind this choice.

The selection of TBL indicators from the suite of indicators in the GRI guidelines is quite reasonable (Section 4 Appendix A of the SKM TBL Report) and well documented.

There are several critical aspects of the TBL framework chosen:

- 1) The GRI guidelines specify a boundary selection approach based on control or influence of an organisation, and hence do not deal with the complexities of supply chains.
- 2) The indicators and weightings were chosen by SKM and HRL professionals (Section 3.3). Better TBL practice would generally involve consultation with a wider number of stakeholders on these two important aspects. Stakeholder inclusiveness is an important report guiding principle, as for example included in the Global Reporting Initiative Sustainability Reporting Guidelines.

⁴ www.ghgprotocol.org, launch of final versions on 4 October 2011.

- 3) Any MCA approach is highly dependent on the weighting choices which are employed to allow the comparison and aggregation of often very different indicators for different options. The weightings were chosen on the perceived importance to Victorians of each of the indicators. It is arguable that this is a limited scope to consider weightings given that some of the impacts from the DGDP are much broader than in Victoria alone. Some more transparency of the choice of weightings would be desirable.
- 4) The approach to determine Consistency with objectives (for example the three consistency levels shown in Table 8.1), particularly when the stated objectives are qualitative, can be considered subjective and relatively simple. For qualitative indicators this appraisal process could be made more robust by conducting further consultation.
- 5) Although it is stated in Section 3.4 that “... this TBL covers the whole life cycle of the plant (design, construction, commissioning, operation and decommissioning phases) ...” it is not clear how this is actually undertaken, and here *whole life cycle* is being used to mean within the immediate control of the DGDP.
- 6) The exclusion of aspects associated with the provision of natural gas and coal, with plant manufacture in China, and with the transmission and pipe line infrastructure is a limitation of the analysis. It is a limitation because it does not satisfy the full life cycle criterion: that all electricity generation options will have the same boundary for the comparison of their TBL performance.

3.4 Specific comments

- Section 5.1.3.2 Indirect Emissions: there does not appear to be a comprehensive coverage of indirect emissions from all options, though this could be regarded as falling out of the stated scope of the report.
- Greenhouse gas intensity (GGI) can incorporate full life cycle emissions over the life of a plant (tonnes per MWh). It is unclear why this performance metric cannot be used to look at total lifetime emissions of all generation options.
- Section 5.1.4 Displacement of Alternative Generation Sources: “... the DGDP and other base load coal and natural gas fired power stations will not displace any renewable generation such as wind and solar.” Whilst this may be true now (see Section 3.1 above), it is not certain that there will be no displacement of renewable emissions electricity options by the DGDP in the future. As the contribution of renewable electricity to the NEM increases to 20% by 2020, as it is targeted to do, the market operating rules may change.
- Australian content of direct and indirect employment creation would appear to be a useful additional indicator.
- Projected capital costs for different technologies (Fig 7-1) should be updated based on latest available information, and included some projections of future costs. In general the relativities between the costs of electricity from DGDP technology compared with other technologies will be likely to change significantly even in the short term. Solar thermal and Solar PV installed costs continue to fall steadily.
- Although the information presented about the other technologies appears to be accurate, the incomplete TBL coverage of the other technologies (though stated in the assumptions) appears to the reader to be suggesting that in fact there are no other electricity generation technologies that are viable compared to the DGDP.

4 References

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- Lenzen, M. and C. J. Dey (2000). "Truncation error in embodied energy analyses of basic iron and steel products." Energy **25**(6): 577-585.
- Murtishaw, S., J. Sathaye, et al. (2006). "Spatial boundaries and temporal periods for setting greenhouse gas performance standards." Energy Policy **34**(12): 1378-1388.
- SKM (2011). Dual Gas Demonstration Project Triple Bottom Line Analysis (Version 2.10-final).
- Suh, S., M. Lenzen, et al. (2003). "System Boundary Selection in Life-Cycle Inventories Using Hybrid Approaches." Environmental Science & Technology **38**(3): 657-664.

5 CV for Christopher Dey and ISA credentials

Skills, qualifications and experience

Christopher Dey has fourteen years experience in energy analysis, renewable energy technologies, greenhouse gas analysis and TBL accounting. During the past six years Dr Dey has been instrumental in the development of three major sustainability (TBL) accounting software tools, multiple assessments for State and Australian governments (including on TBL issues), and three online sustainability tools developed for the Australian Government.

He has conducted numerous sustainability related research and consultancy projects with State and Federal governments (including the UK Government) as well as with organisations from multinational organizations to SMEs and NGOs. His most recent large-scale project is working with the Water Services Association of Australia (WSAA) to develop an Excel-based tool to account for the ecological footprint of the water sector. The tool will be used throughout the water industry.

Dr Dey has a decade of research contributing to the development of life cycle assessment (LCA) methodology and numerous reports to business and industry. Some highlights include as co-author of a report on life-cycle analysis of non-nuclear power for the Department of Prime Minister and Cabinet, 2006; co-developer of reporting methodology for TBL LCA of all sectors of the Australian economy (report called *Balancing Act*) incorporating full on-site and indirect effects across ten distinct indicators, and numerous conference presentations and academic publications. Eg.

Dey C. and R. Wood (2008). Emissions intensities for the CPRS Green Paper.

Foran, B., M. Lenzen, et al. (2005). *Balancing Act - A Triple Bottom Line Account of the Australian Economy*. Canberra, ACT, Australia, CSIRO Resource Futures and The University of Sydney.

Foran, B., M. Lenzen, et al. (2005). "Integrating sustainable chain management with triple bottom line reporting." *Ecological Economics* 52(2): 143-157.

Lenzen, M., C. Dey, et al. (2006). Input-Output-Analysis and Triple Bottom Line Accounting – a new software for business and government. 2nd International Conference on Quantified Eco-Efficiency for Sustainability, Egmond aan Zee, Netherlands.

Lenzen, M., C. Dey, et al. (2006). Triple-Bottom-Line Accounting of Society, Economy and Environment – a new life-cycle software for business. 5th Australian Conference on Life-Cycle Assessment, Melbourne.

Lenzen, M., C. Dey, et al. (2006). Life-Cycle Energy Balance and Greenhouse Gas Emissions of Nuclear Energy in Australia. Department of Prime Minister and Cabinet commissioned study for the UMPNER (Nuclear) Enquiry, ISA, The University of Sydney.

ISA (Dey, Lenzen and Murray) were winners of the 2011 Eureka Prize for Innovative Solutions to Climate Change.

Integrated Sustainability Analysis at the University of Sydney

The ISA group at the University of Sydney was formed in 2002 building on research conducted over the previous five years. It has a respected national and international profile for its work in sustainability analysis. It has undertaken a range of activities for business, industry, community and government in countries around the world as well as in Australia. This includes extensive work for the UK government (Defra). ISA's role ranges from advising governments on aspects of policy to supporting community groups and non-government organisations in their activities. ISA has prepared numerous Scope 1 & 2 (and Scope 3) greenhouse gas emissions assessments for organisations from SMEs to multi-nationals and major public organisations.

ISA's research is also highly regarded in the academic sphere. It has a global reputation for methodological advances in life cycle analysis as well as for practical application of its methodology in business and industry (a list of academic publications can be found at <http://www.isa.org.usyd.edu.au/publications/paper.shtml#Journal>)

In 2005 the Australian Government launched Balancing Act: a triple bottom line analysis of the Australian economy a report for which ISA and the CSIRO had been commissioned. Balancing Act provides an overview of the Australian economy using a set of ten environmental, social, and financial indicators (Balancing Act can be found at <http://www.isa.org.usyd.edu.au/publications/index.shtml>)

2004-6 the NSW Environmental Trust awarded ISA a grant to develop a world-first software solution for accounting for the Triple Bottom Line (BL3).

In 2008, ISA was commissioned by the Department of Prime Minister and Cabinet to produce greenhouse emissions assessments for 100 Australian industry sectors, which were included in the CPRS Green Paper Appendix D.

2009-10 ISA invited by WRI to participate in development of new GHG Protocol for scope 3 accounting (for example of contribution see

http://www.isa.org.usyd.edu.au/education/documents/20090220_ISA-USyd_Pain-Free-Scope-3v_www-version.pdf)

In 2009 ISA was awarded the NSW Green Globe award for its work in the field of sustainability.