LAND COURT OF QUEENSLAND

REGISTRY: BRISBANE
NUMBER: MRA428-14, EPA429-14
MRA430-14, EPA431-14
MRA432-14, EPA433-14

Applicant:	ADANI MINING PTY LTD
	AND
First Respondent:	LAND SERVICES OF COAST AND COUNTRY INC.
	AND
Second Respondent:	CONSERVATION ACTION TRUST
	AND
Statutory Party:	CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION

AFFIDAVIT OF JEROME GREGORY FAHRER

I, Jerome Gregory Fahrer, Director, ACIL Allen Consulting, 60 Collins Street, Melbourne in the State of Victoria, affirm as follows:

1 I am the Director of ACIL Allen Consulting (formerly Allen Consulting Group). I have held this position since January 1995.

2 I have been engaged by McCullough Robertson, on behalf of the Applicant, to appear as an expert witness in these proceedings in relation to issues raised in the objections to the Applicant's mining lease applications and environmental authority applications for the Carmichael Coal Mine project (**Objections**).

Deponent

Taken by:
Solicitor / Justice of the Peace

Affidavit
Filed on behalf of the Applicants
Form 46 R.431

McCullough Robertson Lawyers
Level 11 Central Plaza Two 66 Eagle Street
BRISBANE QLD 4000
Phone: (07) 3233 8888 Fax: (07) 3229 9949
GPO Box 1855, BRISBANE QLD 4001
Ref: GMR:PWS:TMH:151051-00017

3 My curriculum vitae is attached to the joint expert report referred to below. I refer to my curriculum vitae and say that I have provided expert evidence in relation to a number of matters of dispute relating to resources projects, including:

(a) in the Land and Environment Court of New South Wales, in relation to the Hunter Environment Lobby's appeal against the New South Wales Planning Assessment Commission's approval of Ashton Coal Operations Limited's South East Open Cut coal mine project at Camberwell in the Hunter Valley;

(b) in a commercial arbitration, in relation to a contract dispute as to wholesale gas prices between Origin Energy and AGL Energy.

4 I have previously prepared a joint report, with Roderick Campbell engaged on behalf of the First Respondent, dated 19 December 2014, in relation to issues raised in the Objections within my field of expertise (**Joint Report**).

5 I have been further asked to prepare an individual report in relation to whether from an economic benefit point of view good reason exists to favourably recommend the Application for this mining lease and any issues raised in the Objections within my field of expertise upon which there has not been agreement between experts. Exhibited to my Affidavit and marked '**JGF-1**' is a true copy of my report to McCullough Robertson Lawyers dated 30 January 2015 (**Individual Report**).

Deponent

Taken by:
Solicitor / Justice of the Peace

6 Pursuant to rule 428(3) *Uniform Civil Procedure Rules 1999* (Qld), I confirm that:

(a) the factual matters stated by me in the Joint Report and my Individual Report are, as far as I know, true;

(b) I have made all enquiries considered appropriate;

(c) I genuinely hold the opinions stated by me in the Joint Report and in my Individual Report;

(d) my Individual Report contains reference to all matters that I considered significant; and

(e) I understand my duty to the court and I have complied with this duty.

7 All the facts and circumstances deposed to in this affidavit are within my own knowledge except those stated to be on information and belief. I have, as required, set out the basis and source of my knowledge or information and belief.

Deponent

Person Taking Affidavit:
Solicitor/Justice of the Peace

All the facts affirmed in this affidavit are true to my knowledge and belief except as stated otherwise.

Affirmed by Jerome Gregory Fahrer

at Melbourne

this 30 January 2015

Before me:

A Justice of the Peace/Solicitor

CATHERINE ALEXANDRA ELLIOTT
Arnold Bloch Leibler
Level 21, 333 Collins Street
Melbourne 3000
An Australian Legal Practitioner within the
meaning of the Legal Profession Act 2004

LAND COURT OF QUEENSLAND

REGISTRY: BRISBANE
NUMBER: MRA428-14, EPA429-14
MRA430-14, EPA431-14
MRA432-14, EPA433-14

Applicant:	ADANI MINING PTY LTD
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	AND
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	AND
Statutory Party:	CHIEF EXECUTIVE, DEPARTMENT OF ENVIRONMENT AND HERITAGE PROTECTION

CERTIFICATE OF EXHIBIT

Exhibit '**JGF-1**' to the affidavit of Jerome Gregory Fahrer affirmed 30 January 2015.

Signed:
Deponent

Taken by:
Solicitor / Justice of the Peace /
Commissioner for Declarations

CATHERINE ALEXANDRA ELLIOTT
Arnold Bloch Leibler
Level 21, 333 Collins Street
Melbourne 3000
An Australian Legal Practitioner within the meaning of the Legal Profession Act 200

Certificate of Exhibit
Filed on behalf of the Applicant

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Ref: CEM:GMR:159359-00022

ACIL ALLEN CONSULTING

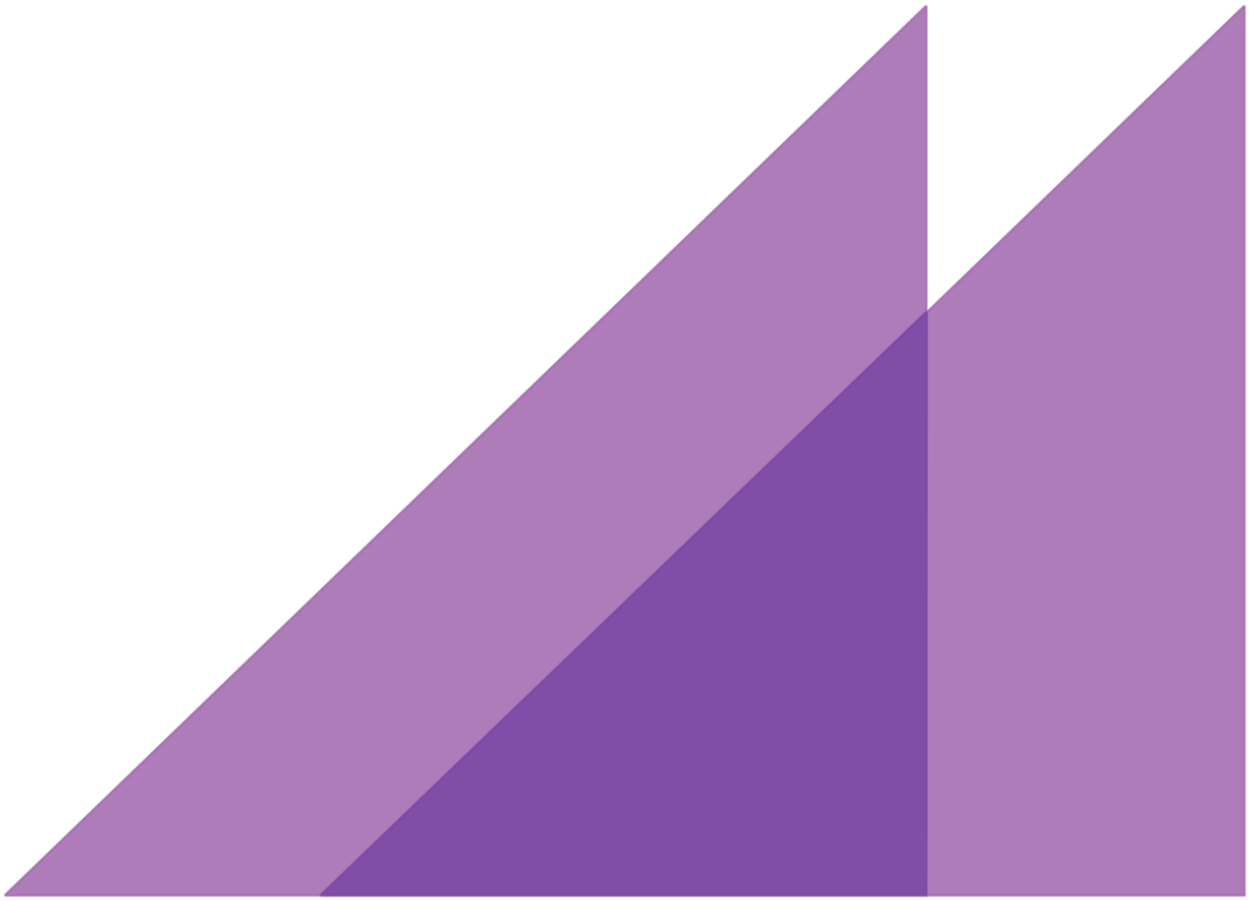
REPORT TO
LAND COURT OF QUEENSLAND

30 JANUARY 2015

CARMICHAEL COAL AND RAIL PROJECT

ECONOMIC ASSESSMENT

EXPERT REPORT BY JEROME FAHRER



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SUGGESTED CITATION FOR THIS REPORT

CARMICHAEL COAL AND RAIL PROJECT:ECONOMIC ASSESSMENT

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List of tables

1 Introduction

1 This report has been prepared by Jerome Fahrer, Director of ACIL Allen Consulting on behalf of the Applicant (Adani Mining Pty Ltd – Adani) in relation to the proceedings in the Queensland Land Court Matter no. MRA428-14, EPA429-14, MRA430-14, EPA431-14, MRA432-14 and EPA433-01.

2 I have been engaged by McCullough Robertson, on behalf of Adani, provide an expert report in the Land Court proceedings.

3 McCullough Robertson has provided me with a letter of instruction, which I have read. It is annexed at Attachment D of this report.

4 I have had no previous involvement in the preparation of materials in support of the proposed Carmichael Coal Mine Project.

5 I am an economist with over 30 years of professional experience, firstly at the Reserve Bank of Australia (1982-1994), where I led the RBA's macroeconomic research, and since 1995 at ACIL Allen Consulting (previously Allen Consulting Group). I have led over 300 major economic consulting projects, with a particular focus on economic evaluation, economic impact, competition and regulation.

6 Annexed at Attachment C is my curriculum vitae.

7 On 19th December 2014 Mr Roderick Campbell (on behalf of the First Respondent, Land Services of Coast and Country Inc) and I (on behalf of the Applicant, Adani Mining Pty Ltd) filed a joint report to the Land Court of Queensland which addressed the Economic Assessment issues raised by Land Services of Coast and Country Inc in its Preliminary Statement of Issues (28 November 2014).

8 The issues discussed in the Joint Report are addressed in this report as follows

- 103 (a),(b) (e): Chapters 4,5,6 and 7
- 103 (c): Chapter 3, paragraph 59 and Chapter 4, paragraph 99
- 103 (d) and 108 (a) (b): section 4.1, paragraphs 87 and 88
- 104, 105(a) (b) (c), 106, 107 (a) (b) (c) (d): Chapter 4 and Attachment A

9 I am instructed by Adani's solicitor Peter Stokes of McCullough Robertson that the Land Court is required to consider whether any good reason has been shown for a recommendation that the application be refused pursuant to section 269(4)(l) of the Mineral Resources Act. Although the Applicant complied with the Terms of Reference (section 5.1) and examined the economic benefits of the project based upon an Input-Output economic model an outcome so produced might be seen as providing an incomplete response to whether good reason has been shown to recommend a refusal of a grant of a mining lease. The report I have prepared examines the question of economic value based on two complementary models in order to answer the question of whether any good reason exists from an economic benefit standpoint to warrant an unfavourable recommendation for the grant of the lease.

10 In preparing this report, I have relied upon the following materials:

- Land Court of Queensland, Applicant: Adani Mining Pty Ltd, Respondents: Land Services of Coast and Country Inc and Conservation Action Trust, Preliminary Identification of Issues, November 28, 2014
- Objection form for a mining lease application to the Department of Natural Resources and mines, lodged by Land Services of Coast and Country Inc, 16 June 2014

and in the order to which they are referred in my report:

- Affidavit of Rajesh Kumar Gupta, 21 November 2014
- Peter B. Dixon and Dale Jorgensen (eds), Handbook of General Equilibrium Modeling, Volumes 1A and 1B, Elsevier, Oxford, 2012
- Queensland Government population projections: http://www.qgso.qld.gov.au/products/reports/qld-govt-pop-proj-lga/index.php
- Deputy Premier, Minister for State Development, Infrastructure and Planning, The Honourable Jeff Seeney, Historic agreements bring jobs to Queensland, Media Statement of 17 November 2014
- Department of Finance, Handbook of Cost-Benefit Analysis, http://www.finance.gov.au/publications/finance-circulars/2006/docs/Handbook_of_CB_analysis.pdf
- Rod Campbell, Richard Dennis and John Quiggin, "Economists on Trial: Economists in the NSW Land and Environment Court, unpublished paper, undated
- William M. Trumbull (1990), "Who Has Standing in Cost-Benefit Analysis?", Journal of Policy Analysis and Management Vol. 9, No. 2 201-218
- Rod Campbell, "Review of Bulga Extension Project Environmental Impact Statement Appendix 18 Economic Impacts", June 2013. http://www.ecolarge.com/wp-content/uploads/2013/09/Ecolarge-Jun-2013-Bulga-extension-submission-FINAL.pdf
- Reserve Bank of Australia, rba.gov.au, Table I1
- Reserve Bank of Australia, Statement on Monetary Policy, November 2011, page 43
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- Richard Cornes and Todd Sandler (1996), The Theory of Externalities, Public Goods and Club Goods, 2nd Edition, Cambridge University Press, Cambridge
- Joseph Farrell , “Information and the Coase Theorem”, Journal of Economic Perspectives 1(2), Fall, 1987
- The Minister for the Environment, the Hon. Greg Hunt MP, media release of 28 July 2014
- Richard W. Tresch, Public Finance: A Normative Theory, Business Publications Inc, Plano Texas
- The Future of Coal: An Interdisciplinary MIT Study (2007) http://web.mit.edu/coal/
- Carmichael Coal Mine and Rail project: Coordinator General’s evaluation report on the environmental impact statement. http://www.dsdip.qld.gov.au/resources/project/carmichael/carmichael-coal-mine-and-rail-cg-report-may2014.pdf
- Adani Mining, http://www.adanimining.com/pdfs/AEIS_Final_Documents/16_Mine_EMP.pdf, http://www.adanimining.com/pdfs/AEIS_Final_Documents/17_EMP_Offsite.pdf, http://www.adanimining.com/pdfs/AEIS_Final_Documents/18_EMP_Rail.pdf,
- Approval Decision by the Minister for the Environment, http://www.environment.gov.au/epbc/notices/assessments/2010/5736/2010-5736-approval-decision.pdf
- GHD, Report for Carmichael Coal Mine and Rail Project Economic Assessment 25215-D-RP-0011 26 September 2012 http://www.adanimining.com/Common/Uploads/EISDocuments/111_EISDoc_Economic%20Assessment.pdf
- Birdlife Australia statement, http://medianet.com.au/releases/release-details?id=806988
- UK Department of Energy & Climate Change, Updated short-term traded carbon values used for UK policy appraisal (2014), https://www.gov.uk/government/publications/updated-short-term-traded-carbon-values-used-for-uk-policy-appraisal-2014
- Garnaut Climate Change Review, http://www.garnautreview.org.au
- GHD, Report for Carmichael Coal Mine and Rail Project Greenhouse Gas Emissions 6 November 2012, http://www.adanimining.com/Common/Uploads/EISDocuments/124_EISDoc_Mine%20Greenhouse%20Gas%20Report_.pdf

- GHD, Carmichael Coal Mine and Rail Project SEIS Report for Economic Assessment, 17 October 2013 http://www.adanimining.com/Common/Uploads/SEISDocuments/44_SEISDoc_Appendix%20E%20-%20Economic%20Assessment%20Report.pdf
- Tim Buckley and Tom Sanzillo, Remote Prospects: A financial analysis of Australia's coal gamble in the Galilee Basin , http://ieefa.org/adani_coal_report/
- Report in the Guardian, http://www.theguardian.com/business/2014/feb/04/bp-deepwater-horizon-bill-rises-profits-fall
- Greenpeace, http://www.greenpeace.org/usa/en/news-and-blogs/news/The-BP-Oil-Spill-One-Year-Later

11 I have read and understood relevant extracts of the Land Court Rules 2010 (Qld) and the Uniform Civil Procedure Rules 1999 (Qld). I acknowledge that I have an overriding duty to assist the Court and state that I have discharged that duty.

I have provided within my report:

(i) details of my relevant qualifications;

(ii) details of material that I relied on in arriving at my opinions; and

(iii) other things as required by the Land Court Rules.

I confirm that:

(i) the factual matters included in the statement are, to the best of my knowledge, true;

(ii) I have made all enquiries I consider appropriate for the purpose of preparing this statement;

(iii) the opinions included in this statement are genuinely held by me;

(iv) this statement contains reference to all matters I consider significant for its purpose;

(v) I have not received or accepted any instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.

If I become aware of any error or any data which impact significantly upon the accuracy of my report, or the evidence that I give, prior to the legal dispute being finally resolved, I shall use my best endeavours to notify those who commissioned my report or called me to give evidence.

I shall use my best endeavours in giving evidence to ensure that my opinions and the data upon which they are based are not misunderstood or misinterpreted by the Land Court.

I have not entered into any arrangement which makes the fees to which I am entitled dependent upon the views I express or the outcome of the case in which my report is used or in which I give evidence.

2 The Carmichael Project and objections to it

2.1 The Carmichael Coal Mine and Rail Project

12 Adani Pty Ltd (Adani) proposes to produce around 40 million tonnes per annum (mtpa) of coal for export to a variety of Asian countries including, *inter alia*, India, China, Korea and Japan.[1]

13 Adani is a fully-owned subsdiary of Adani Group, a vertically integrated energy producer, owning coal mines, rail lines, ports, power stations and electricity networks.

14 The Carmichael mine is to be located in the Galilee Basin, in Queensland, with the coal to be transported by rail to the Port of Abbot Point.

15 This report does not consider the economic impact of any expansion of the port at Abbot Point. My understanding is that this is a separate project subject to different commercial considerations from the Carmichael Project.

16 The Carmichael mine will produce two coal products: Product 1, a low ash/moderate to energy product which will be most suitable for Asian premium export markets, and Product 2, a high ash/lower energy product which will be most suitable for non-premium markets, in particular India.

17 While the Carmichael Project is expected to have a life of 60 years, the economic impact analysis and cost benefit analysis reported in this document is for the first phase only, covering the period to 2046-47. In practical terms, for the purposes of this report, truncating the analysis at that point makes no substantial difference, since the present value of benefits, costs and incomes more than 30 years into the future is likely to be small.

18 Anticipating the conclusions of this report, the Carmichael Project will most likely result in very large overall gains in net economic benefit, income and welfare (well-being) for residents of the Mackay, Isaac and Whitsunday (MIW) local government areas, Queensland and Australia.

2.2 Objections to the Carmichael Project

19 Land Services of Coast and Country Inc[2]. has objected to the Project on a variety of grounds. These objections are to be found in three documents: Objection form for a mining lease applcation (Department of Natural Resources and Mines,16 June 2014), Application or amendment application for environmental authority

[1] The figure of 40 mtpa is associated with the bankable feasibility study (BFS) for the Carmichael Project, which is focussed on its first phase of 30 years: In the second phase of the Project, the mine's capacity is expected to increase up to a level of 60 mtpa. The second phase could commence at any point during the 30 year period, or afterwards: Affidavit of Rajesh Kumar Gupta, 21 November 2014.

[2] Another objection has been lodged by the Conservation Action Trust (CAT) of Mumbai, India. This objection is about harms from the transport and burning of coal in India. As discussed in this report, these harms are relevant to a cost benefit analysis of burning coal to generate electricity in India, but not a cost benefit analysis of the mining and transport of coal in Australia. As such, I do not discuss CAT's objection in this report.

(Department of Environment and Natural Protection,16 June 2014) and Preliminary Identification of Issues (Land Court of Queensland, 28 November 2014).

20 In summary, the grounds for objection relevant to this report are

a. the mine will have adverse economic and social impacts on local, regional, state and global economies and communities

b. Application of the *precautionary principle* should lead to the mine not being approved, given the absence of evidence that the mine will not create unacceptable environmental harm

c. the mine will have adverse impacts on groundwater, surface water, biodiversity and climate

d. for a variety of reasons, the Input/Output modelling used in the Environmental Impact Statement is deficient

e. a net economic benefit from the mine has not been been demonstrated.[3]

21 In this report I estimate the economic impact and net economic benefit of the Carmichael Project, using two methods of evaluation: Computable General Equilibrium (CGE) modelling and Cost Benefit Analysis (CBA). In doing so, I take account of the objections made and issues raised by Land Services of Coast and Country Inc.

22 I find that the net economic benefits of the Carmichael Project are likely to be very large.

23 The CGE modelling finds that the net benefits in present value terms, are between $18.6 billion and $22.8 billion while the CBA analysis finds that the net benefits, narrowly defined, are between $12.3 billion and $16.6 billion. More broadly defined, they are between $34.5 billion and $44.3 billion. In all cases, they are more likely to be closer to the larger figure.

2.3 The two types of analysis in this report

24 CGE modelling and CBA are different types of analysis that serve different purposes, though both, in this context, illiuminate the economic effects of the Carmichael Project. They should be thought of as complementary.

25 CGE modelling estimates the economic impact of a project in terms of the economy's overall level of output (or production), as well as output in different industries; employment overall and by industry; impacts on incomes and impacts on different types of spending (consumption, investment, exports and imports). This analysis can be conducted at national, state and regional levels, and over different time periods.

26 Critically, CGE modelling traces through the interlinkages that exist between all industries in the economy, and the effects of changing prices on production investment and consumption, while always taking account of the fact that productive resources in an economy are limited e.g. the the total number of people in jobs

[3] Presumably this means after taking account of the alleged environmental impacts

obviously cannot exceed the total population, and in practice will be around half the total population.

27 However, CGE modelling analyses is limited in that does not take into account non-market effects of economic activity, called externalities, such as pollution, congestion and other spillover effects (which can sometimes be favourable). By definition, externalities are not taken account of when just the forces of demand and supply determine the prices of the goods and services.

28 The primary purpose of CGE modelling is to determine the economic impacts of a project. Such modelling is not designed to make value judgments about whether a project ought to take place, though it is possible, as a by-product of this modelling, to make value judgments about whether residents of a nation, state or region are better off as a result of a project's economic impacts.

29 Cost Benefit Analysis (CBA), on the other hand, is designed to make value judgments about whether a project ought to proceed (where such value judgments implicitly adopt the consequentialist ethics that forms the basis of most welfare economics). It does so by evaluating whether a project creates value (i.e. profit for producers and utility for consumers) in the market for the good that is produced in the project, that is greater than the costs to society of the resources used in the production of the good.

30 Unlike CGE modelling, CBA considers only economic effects in one market, so in that sense it is a more narrow type of analysis. But on the other hand, unlike CGE modelling, CBA does consider externalities, where possible quanyifying their effects, as well as correcting for market prices that are not those that would exist in a competitive market (e.g prices of key inputs that are regulated by governments, or subject to monopoly pricing). In that sense, CBA is a broader type of analysis than CGE.

31 To illustrate the difference between CGE modelling and CBA, consider a hypothetical highway that a government is thinking about building. The construction of such a highway will almost certainly lead to a positive economic impact in its state or region, measured in terms of economic output and employment, as estimated by CGE modelling. This is because of the direct expenditure on the highway and inter-industry effects. But such a highway might or might not pass a CBA. This would depend on whether the benefits, such as the value of the time savings for drivers who use it, exceed the cost of building and maintaining it.

32 In such a hypothetical case, if the CBA does not pass, it would *not* be true that CGE modelling and CBA lead to contradictory conclusions about whether the highway ought to be built, because different questions are asked in each type of analysis. If the question is: "Does the construction and maintenance activity stimulate the economy, leading to higher incomes and employment?", the answer would be 'yes'. If the question is: "Does the highway provide sufficient value for the money spent on its construction and maintenance?", the answer would be 'no'.

33 With the Carmichael Project, this point of nuance does not arise, however, because both the CGE modelling and CBA strongly point to the conclusion that it will have strongly positive economic effects.

3 CGE analysis

3.1 Introduction

34 This chapter presents results of Computable General Equilibrium (CGE) modelling of the economic impacts of the Carmichael coal mine and rail project (the Project) proposed by Adani Mining Pty Ltd (Adani). The model used is the Tasman Global model owned and developed by ACIL Allen Consulting.

35 A CGE model takes account of interactions between industries, the effects of price changes and resource constraints in an economy. As such CGE models provide the most theoretically sound and empirically comprehensive method of evaluating the economic impacts of major projects, 'shocks' to an economy (such as a financial crisis) or policy reforms.

36 In essence, the modelling estimates two future paths over time for the economy; one with, and one without the Project. The impact of the Project at each point in time is the difference between these two paths.

37 A non-technical description of the Tasman Global model is at Attachment A of this report.[4]

38 Results are presented for real output, real income, employment and other economic variables of interest for MIW region (Mackay, Isaacs and Whitsunday local government areas), Queensland and Australia over the period 2014-15 to 2046-47.

39 Data on key inputs for the modelling (projected production volumes, coal prices and production costs) were provided by Adani.

40 The modelling also takes account of the loss of the value of output from agricultural land arising the Project. Data for this aspect of the modelling came from the Project's Environmental Impact Statement.[5]

41 All models contain simplifying assumptions. This is what makes models manageable for analysis. The key simplifying assumption in this instance relates to the Australian labour market. This assumption is that the Project will not reduce any cyclical unemployment (almost equivalently, raise employment) that might occur as a result of a cyclical downturn in the economy over the Project's life.[6]

42 This is a conservative assumption that downplays the economic impact of the Project relative to an alternative assumption that the labour market is, in effect, constantly in a state of significant slack (the assumption at the heart of impact analysis based on Input-Output models).

43 This conservative assumption is more realistic in the context of the analysis of the Project.

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4 For recent, technical, discussions of CGE models and their uses, see Peter B. Dixon and Dale Jorgensen (eds), *Handbook of General Equilibrium Modeling,* Volumes 1A and 1B, Elsevier, Oxford, 2012.

5 http://www.dsdip.qld.gov.au/assessments-and-approvals/carmichael-coal-mine-and-rail-project.html

6 However, the Project does lead to employment modestly increasing in a structural sense, as explained in Chapter 3 of this report.

44 Headline results[7] of the modelling are that over the period 2014-15 to 2046-47 the Project will add in undiscounted terms $61,577 million to Australian real economic output and $42,282 million to Australian real income.. Most of the increase in real output will occur in the MIW region, while most of the increase in real income will occur in the rest of Queensland. The principal reason that the increase in income is less than the increase in output is that Adani is foreign owned, and so the profits (after taxes and royalties) from the Project will not accrue to Australian residents. Nonetheless, despite this foreign ownership, the Project will result in significant real income gains for Australians in general and Queenslanders in particular.[8]

3.2 Measures of macroeconomic impacts

45 One of the most commonly quoted macroeconomic variables at a national level is real GDP, which is a measure of the aggregate output generated by an economy over a given period of time (typically a year). From the expenditure side, GDP is calculated by adding together total private and government consumption, investment and net trade. From the income side, GDP can be calculated as the sum of returns to the primary factors (labour, capital, land and natural resources) employed in the national economy *plus* indirect tax revenue. The regional level equivalent to GDP is Gross Regional Product (GRP) – at the state level it is called GSP (Gross State Product). To reduce the potential confusion with the various acronyms, the term **economic output** has been used in the discussion of the results presented in this report.

46 These measures of the real economic output of an economy should be distinguished from measures of the economy's **real income,** which provide a better indication of the economic welfare of the residents of a region. It is possible for real economic output to increase (that is, for GDP to rise) while at the same time real income (economic welfare) declines. In such circumstances people and households would be worse off despite economic growth.

47 In *Tasman Global*, the relevant measure of real income at the national level is Real Gross National Disposable Income as reported by the Australian Bureau of Statistics (ABS).

48 The change in a region's real income as a result of a policy change (often referred to by economists as a policy 'shock') is the change in real economic output *plus* the change in net external income transfers *plus* the change in the region's terms of trade (which measure the change in the purchasing power of the region's exports relative to its imports). As Australians have experienced first-hand in recent years, changes in the terms of trade can have a substantial impact on residents' welfare independently of changes in real economic output.

49 In global CGE models such as *Tasman Global*, the change in real income is equivalent to the change in consumer welfare using the equivalent variation

[7] In the CGE modelling I used a figure of $2200 million for the cost of the rail part of the Project. This figure comes from http://www.dsdip.qld.gov.au/assessments-and-approvals/north-galilee-basin-rail-project.html. After completing the modelling I was advised that the cost is actually $2500 million. The macroeconomic impacts from the CGE modelling that I present in this report are thus underestimated, but not by very much. I used the correct figure of $2500 million in the cost benefit analysis.

[8] Hypothetically, if Australians were to own shares in Adani, they would gain income directly from the Project. However, the net value of income gains would depend on where the money to buy these shares came from: broadly, the options are additional savings or sale of existing Australian-owned assets. In the latter case, the net direct gain would be the income from the Project less the income foregone from the assets that are sold. The net indirect gains would depend on the inter-industry effects of more Australian-resident investment in coal industry vis-à-vis investment in other assets.

measure[9] of welfare change resulting from exogenous shocks. Hence, it is valid to say that the projected change in real income (from *Tasman Global*) is also a projected change in consumer welfare from the Project.

3.3 Real economic output and real income

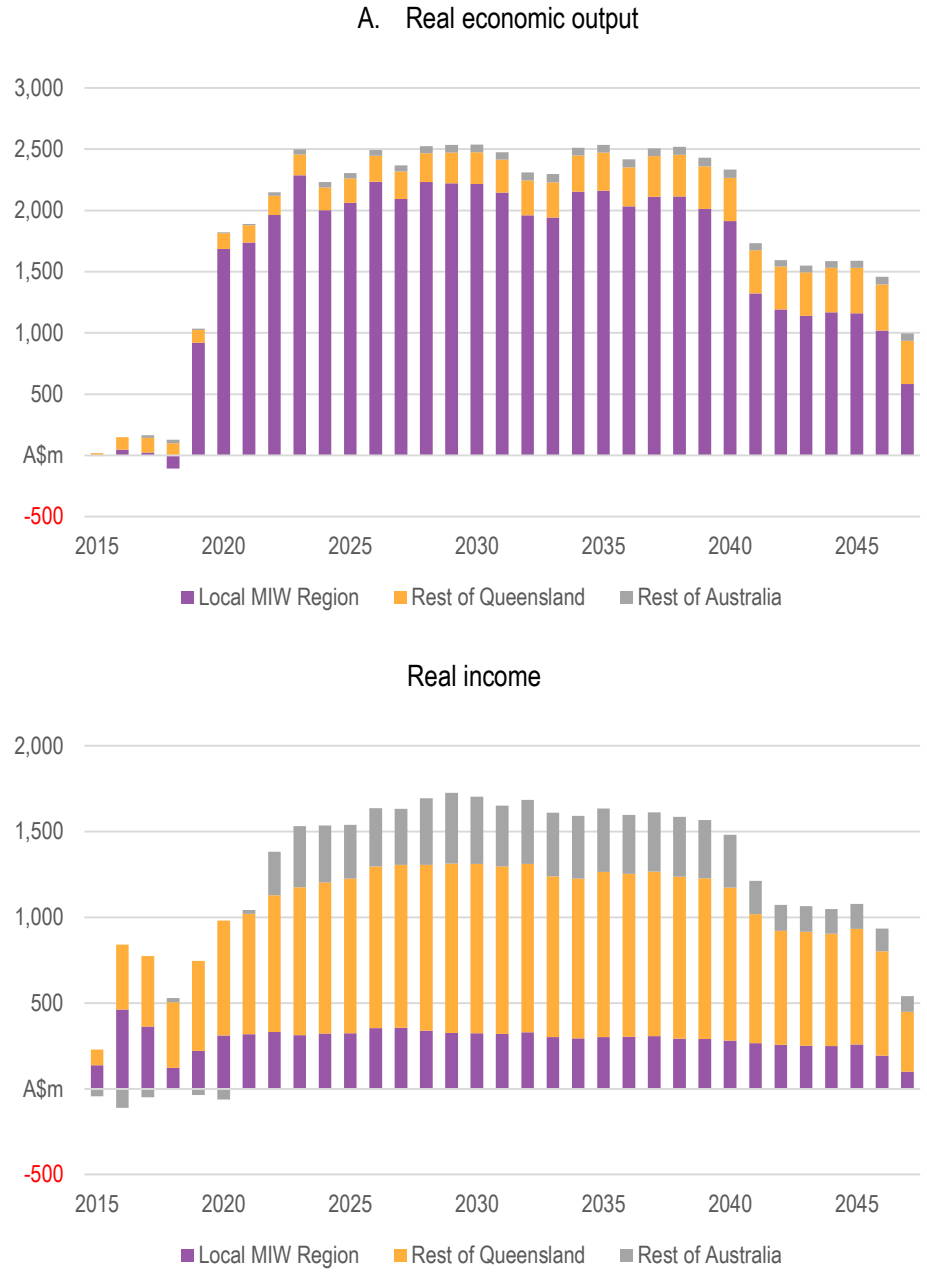
50 Figure 1 shows the change in real economic output and real income in each region for each year of the projection period (AFY2015 to AFY2047) under the Project Case (with the Project) compared to the Reference Case (without the Project). A summary of the projected impacts for all regions are presented in Table 1.

51 The largest changes in aggregate real economic output occur broadly in line with the value of coal production, which begins in 2016-17. This is not surprising as the operations phase is where the key benefits of the Project will be realised – namely, through the monetisation of an otherwise unutilised resource. In contrast, the construction phase of the Project largely increases the demand for scarce factors of production and so has a smaller effect on economic output compared to the size of the investment.

52 However, the additional construction activity associated with the Project has a noticeable effect on the real income of residents in Queensland as there is increased demand for labour and goods and services and this boosts local incomes relative to the Reference Case.

[9] Using the Slutsky measure of income effects not the Hicksian measure.

Figure 1 **Change in economic output and real income as a result of the Project relative to the Reference Case ($, in 2014-15 terms)**



Note: All years are Adani financial years ending 31 March. Local MIW Region includes the Mackay, Isaacs and Whitsunday local government areas.

Source: ACIL Allen Consulting

Table 1 **Projected cumulative change in real economic output and real income in each region as a result of the Project, relative to the Reference Case (in 2014-15 terms)**

	Real economic output			Real income		
	Total (AFY2015 to AFY2047)	NPV (2.8% discount rate)	NPV (4.3% discount rate)	Total (AFY2015 to AFY2047)	NPV (2.8% discount rate)	NPV (4.3% discount rate)
	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m
Local MIW Region	51,749	33,148	26,672	9,585	6,439	5,367
Rest of Queensland	8,275	4,940	3,858	25,328	16,793	13,246
Total Queensland	**60,024**	**38,088**	**30,530**	**34,913**	**22,766**	**18,612**
Rest of Australia	1,553	933	727	7,369	4,516	3,521
Total Australia	**61,577**	**39,021**	**31,256**	**42,282**	**27,282**	**22,133**

Note: NPV = net present value. Real economic output for Queensland is equivalent to real GSP while real economic output at the Australia level is equal to real GDP. Local MIW Region includes the Mackay, Isaacs and Whitsunday local government areas.

Source: ACIL Allen Consulting

53 Table 2 provides a decomposition of the changes in the real economic output changes (top panel) and the real income changes (bottom panel) for each Australian region.

Table 2 **Decomposition of changes in real economic output and real income for each region as a result of the Project, relative to the Reference Case (Total AFY2015 to AFY2047)**

	Local MIW Region	Rest of Queensland	Rest of Australia	Australia
	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m
Real economic output (expenditure side)				
Private consumption	2,785	12,598	5,320	**20,702**
Investment	441	2,894	704	**4,039**
Government consumption	7,127	288	–11	**7,404**
Net trade (to all domestic and foreign regions)	41,397	–7,505	–4,460	**29,432**
– Exports	74,366	–580	–5,519	***68,267***
– Contribution of imports	–32,969	–6,926	1,055	***–38,839***
Real economic output	**51,749**	**8,275**	**1,553**	**61,577**
Real Income				
Real economic output	51,749	8,275	1,553	61,577
Terms of trade	4,446	4,920	2,988	12,354
Net foreign income transfers	–46,610	12,132	2,828	–31,650
Real income	**9,585**	**25,328**	**7,369**	**42,282**

Note: Local MIW Region includes the Mackay, Isaacs and Whitsunday local government areas.

Source: ACIL Allen Consulting

3.3.1 Real economic output

54 Over the period AFY2015 to AFY2047, the Project is projected to increase the real economic output of:

- *the Local MIW Region* by a cumulative total of $51.7 billion relative to the Reference Case (with a net present value of $26.7 billion, using a 2.8 per cent real discount rate, and $33.1 billion using a 4.3 per cent real discount rate)[10].
- *Queensland* as a whole (i.e. real GSP) by a cumulative total of $60.0 billion relative to the Reference Case (with a net present value of $38.1 billion, using a 2.8 per cent real discount rate, and $30.5 billion, using a 4.3 per cent real discount rate).
- *Australia* as a whole (i.e. real GDP) by a cumulative total of $61.6 billion relative to the Reference Case (with a net present value of $39.0 billion using a 2.8 per cent real discount rate, and $31.3 billion, using a 4.3 per cent real discount rate).

55 To place these projected changes in economic output estimates in perspective, the discounted present values (using a 4.3 per cent discount rate) are equivalent to:

- 10.3 per cent of Queensland's current GSP by a cumulative total of $51.7 billion relative to the Reference Case
- 2.0 per cent of Australia's current GDP.[11]

3.3.2 Real income

56 Real income is a measure of the ability to purchase goods and services, adjusted for inflation. A rise in real income indicates a rise in the capacity for current consumption, but also an increased ability to accumulate wealth in the form of financial and other assets. The change in real income from a project is a measure of the change in welfare of an economy.

57 The extent to which the local residents will benefit from the additional economic output depends on the level of ownership of the capital (including the natural resources) utilised in the business as well as any wealth transfers undertaken by Australian governments as a result of the taxation and royalty revenues generated by the Project

58 Given the assumed high proportion of the potential employees for the Project who will live in the local area (based on employment profiles of current coal producers), a significant amount of the additional personal incomes that are generated as a result of the Project are projected to stay in the Local MIW Region. However, as only a small proportion of the returns to the Project (including royalties and taxes) will accrue to local residents, a significant portion of the wealth generated by the economic activity is transferred outside of the Local MIW Region (primarily to overseas shareholders).

59 The Queensland Government will receive royalties from the Project, but where this additional income will be spent is unknown and for this study was assumed to be spent proportionately to the population in each region of Queensland. Similarly, taxes paid to the Australian Government have been assumed to be spent in each region proportionate to its population.

[10] The derivation of these discount rates is explained in Chapter 4, section 4.4, of this report.

[11] Based on Queensland FY2014 GSP = $296 billion and Australian FY2014 GDP = $1,584 billion (source: ABS Catalogue Number 5220.0, Table 1, released on 2-Dec-2014).

60 Consequently, most of the real income benefit associated with the Project, in absolute terms rather than in per capita terms, is projected to accrue to residents outside of the Local MIW Region.

61 More specifically, over the period AFY2015 to AFY2047, the Project is projected to increase the real income of:

- *the Local MIW Region* by a cumulative total of $9.6 billion, relative to the Reference Case (with a net present value of $6.4 billion using a 2.8 per cent real discount rate and $5.4 billion using a 4.3 per cent real discount rate)
- *Queensland* as a whole by a cumulative total of $34.9 billion, relative to the Reference Case (with a net present value of $22.8 billion using a 2.8 per cent real discount rate and $18.6 billion using a 4.3 per cent real discount rate)
- *Australia* as a whole by a cumulative total of $42.3 billion, relative to the Reference Case (with a net present value of $27.3 billion using a 2.8 per cent real discount rate and $22.1 billion using a 4.3 per cent real discount rate).

62 To place these projected changes in income in perspective, the discounted present values (using a 2.8 per cent discount rate) are equivalent to a one-off increase in the *average* real income of all current residents of the Local MIW Region by around $35,000 per person.

63 This is a noticeable increase in consumer welfare in the context of a single project.

3.4 Employment

64 As well as creating medium term employment in the Queensland economy, monetising the resources from the Project will generate a significant number of short-term jobs related to the construction phase of the Project. In addition to the direct jobs generated on-site, the construction and installation, and production phases will require significant quantities of Queensland sourced goods and services including mining, engineering and management services, some machinery and cement during construction and mining, manufacturing and various business services during operation. Production of these inputs will further increase the demand for labour across the Queensland economy.

65 A key issue when estimating the impact of a project is determining how the labour market will clear.[12] As discussed Attachment A, for this analysis, increases in the demand for labour in the Local MIW Region can be met by three mechanisms: increasing migration from the rest of Australia; increasing participation rates and/or average hours worked; and by reducing the unemployment rate. In the model framework, the first two mechanisms are driven by changes in the real wages paid to workers in the Local MIW Region while the third is a function of the additional labour demand relative to the Reference Case. Given the moderate unemployment rate assumed throughout the projection period, changes in the real wage rate accounts for the majority of the additional labour supply in the policy scenarios relative to the Reference Case.

[12] As with other CGE models, the standard assumption within *Tasman Global* is that all markets clear (i.e. demand equals supply) at the start and end of each time period, including the labour market. CGE models place explicit limits on the availability of factors and the nature of the constraints can greatly change the magnitude and nature of the results. In contrast, most other methods used to assess economic impacts, including I-O multiplier analysis, do not place constraints on the availability of factors. Consequently, these methods tend to overestimate the impacts of a project or policy.

66 Given its importance to the projected impacts, sensitivity of the results to relaxation or tightening of the standard *Tasman Global* labour market assumptions is presented in Section 3.6.

67 It should be noted that this analysis does not assume any change in net foreign migration as a result of the Project.

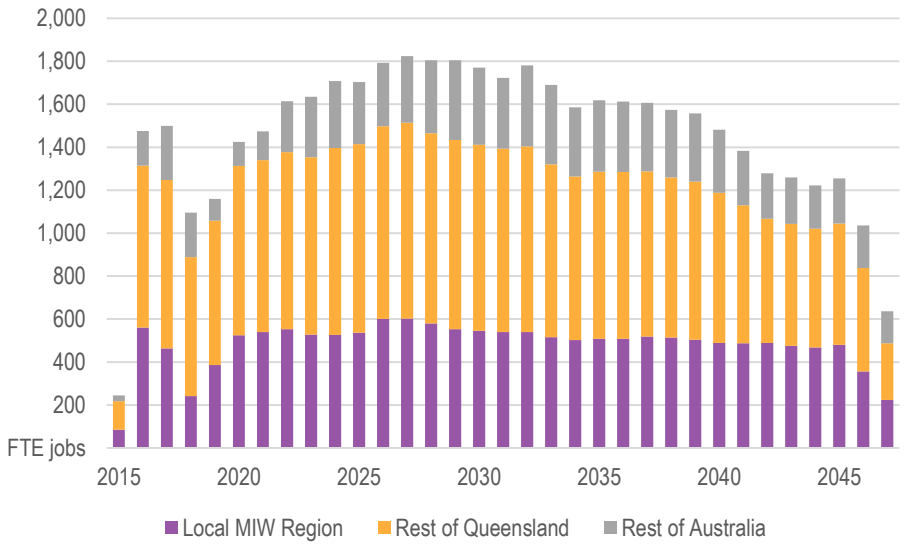
3.4.1 Employment creation

68 Over the life of the Project it is projected that on average around 1,464 employee years of full time equivalent direct and indirect jobs will be created. More specifically, it is projected that the Project will increase employment in:

- the Local MIW Region by 15,943 employee years (average annual increase of 483 FTE jobs)
- Queensland as a whole by 39,796 employee years (average annual increase of 1,206 FTE jobs)
- Australia as a whole by 48,324 employee years (average annual increase of 1,464 FTE jobs).

69 As illustrated in Figure 2, the total additional employment is projected to be broadly constant throughout the projection period, but will experience some variation by region year to year.

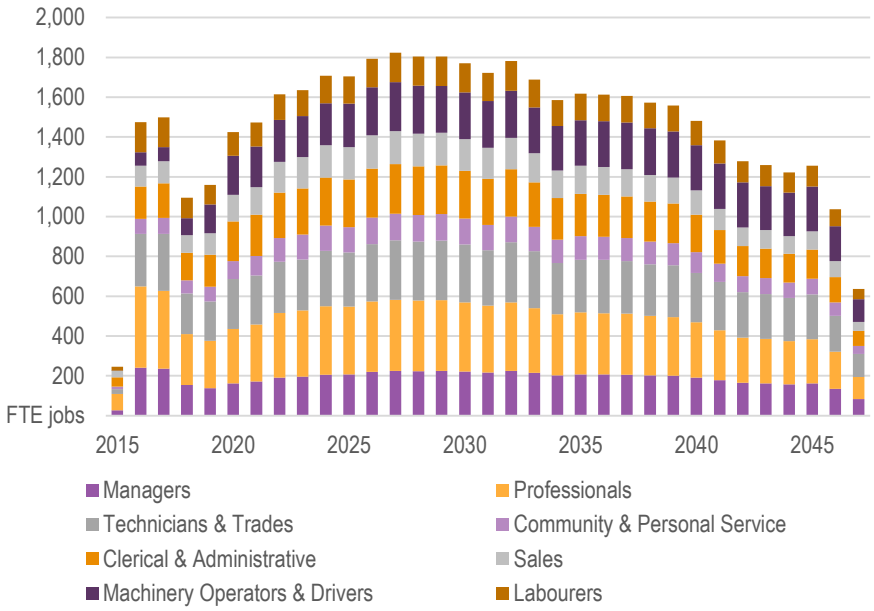
Figure 2 **Projected change in total employment by region, relative to the reference case (Full time equivalent jobs)**



Note: All years are Adani financial years ending 31 March. FTE = Full-time equivalent.
Source: ACIL Allen Consulting

70 Figure 3 shows the broad classifications and numbers of employees stimulated, directly and indirectly, in Australia by the Project over its life. While the data are for Australia as a whole, they largely reflect the high proportion of skilled machinery operators and drivers as well as technical and professional personnel required to operate a project of this type.

Figure 3 **Projected employment by occupation: Australia**



Note: All years are Adani financial years ending 31 March. FTE = Full-time equivalent.
Source: ACIL Allen

71 The occupations shown in Figure 3 are for eight broad occupational groups. These are comprised of more finely detailed occupational groups (97 in total), as set out in Table A2 of Attchment A.

72 Figure 4 shows the decomposition of employment creation by industry arising from the Project. The major "winning" industries are the Project itself and service industries.

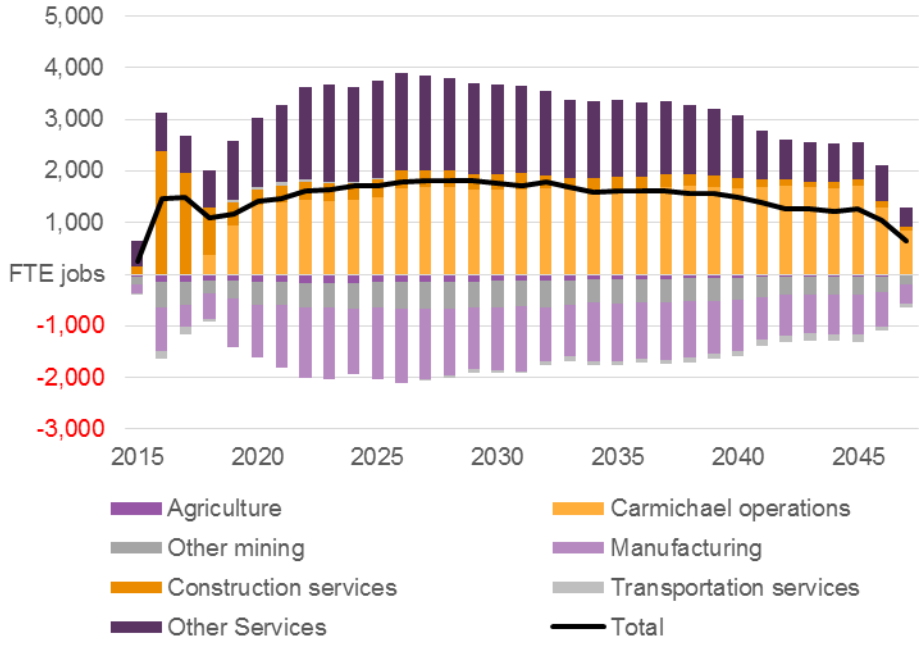
73 Figure 4 also appears to show a loss of jobs, in some industries, especially in manufacturing (up to around 1000 jobs). There is also a small reduction in employment in other mining.

74 However, this does not mean that jobs in manufacturing or other mining will be destroyed as a result of the Project. What it does mean is that jobs in these industries in Australia will grow more slowly with the Project in place than in its absence.

75 The reasons for this are two fold. Firstly, industries that will grow their employment as a result of the Project will employ the same kind of occupations as would otherwise be employed in manufacturing and other mining. Second, the exports from the Project will cause a small appreciation of the exchange rate which will have a negative effect on trade-exposed industries, such as in the manufacturing sector.

76 To repeat, the "loss" of employment in certain industries resulting from the project does not mean that people will be fired from their jobs. Typically, what will happen is a fitter and turner, after completing her apprenticeship in 2030, will be employed by Adani instead of working for a manufacturing company, which would happen if the Project did not go ahead.

Figure 4 **Projected employment by industry: Australia**



Note: All years are Adani financial years ending 31 March. FTE = Full-time equivalent.
Source: ACIL Allen

3.5 Real Wages

77 Figure 5 shows the impact of the Project on real wages. Over most of its life, the Project lifts real wages in the local MIW region by 1.5 – 2.0 per cent above what they would be absent the Project. Considering that the Project's operations will directly employ fewer than 2000 people, this is a large number in a region with a population currently of 180,000 and which is projected by the Queensland Government to be between 250,000 and 307,000 in 2031.[13] The higher average real wage in the region is due to two effects. First, mine workers are highly paid, and this effect will push up the average wage for the region. Second, the increased economic activity in the region which results from the Project will lead to a more buoyant labour market with higher average wages being paid to employees throughout the region's economy.

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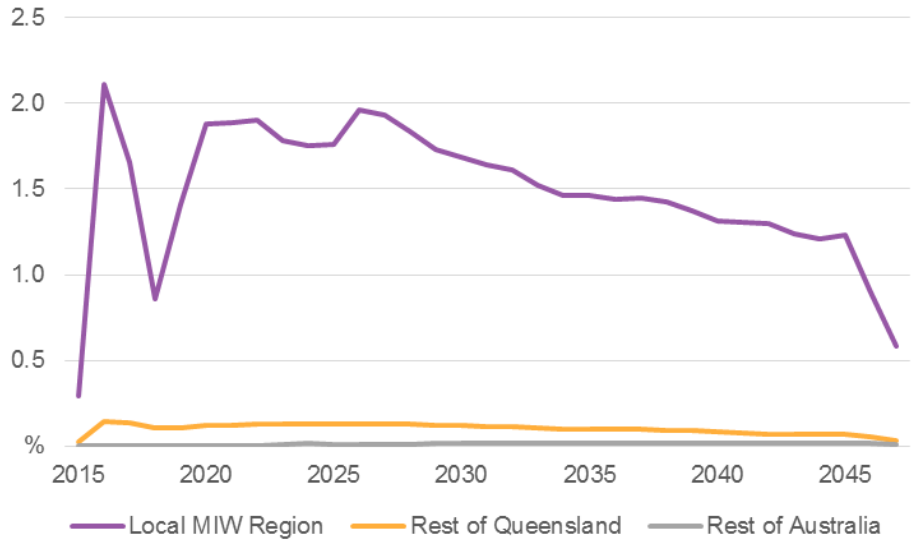
[13] http://www.qgso.qld.gov.au/products/reports/qld-govt-pop-proj-lga/index.php

Figure 5 **Real wage impacts (per cent above Reference Case)**



Source: ACIL Allen

3.6 Sensitivity analysis

78 This section analyses the sensitivity of the modelled impacts to two alternative labour market assumption:

a. Fully constrained labour market where, nationally, no additional jobs are allowed to be created relative to the Reference Case (but people move between regions)
b. Unconstrained labour market, where the supply of labour (at the Reference Case wage rates) is fully responsive to demand.

3.6.1 Labour market sensitivity

79 This section examines the sensitivity of the projected economic impacts of the Project to two extreme labour market environments, namely, a fully constrained scenario and an unconstrained labour market scenario.

80 In the fully constrained labour market scenario it is assumed that, nationally, there will not be any additional people employed as a result of the additional labour demand generated by the Project, nor will any workers choose to work longer hours in response to increasing wages relative to the Reference Case. This is an extreme and unrealistic assumption, but one that generates a floor to the projected economic impacts of the Project (all else equal).

81 The opposite extreme is modelled in the Unconstrained Scenario where it is assumed that there is an 'unlimited' pool of labour available to meet any additional labour demand generated by the Project, relative to the Reference Case. Note, this does **not** mean that there is an infinite supply of labour, rather that all **additional** labour demands generated by the Project (at the Reference Case wage rates) can be met without needing to crowd out employment from other industries. With the exception of the availability of other factors of production, this assumption is the

same as those obtained from using the upper level estimates from input-output employment multipliers[14]

82 The results are presented in Table 3 and Table 4. It can be seen that in the Unconstrained Case output, income and particularly employment effects from the Project are much larger than in the other two cases. However, the Unconstrained Case is not realistic, for it effectively assumes labour market conditions associated with a deep recession, but lasting for over 30 years. The most realistic case is the Project Case.

Table 3 **Labour market sensitivity analysis – macroeconomic impacts**

	Real economic output (total)			Real income		
	Project Case	Fully Constrained	Unconstrained	Project Case	Fully Constrained	Unconstrained
	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m	2014-15 A$m
Local MIW Region	51,749	51,316	58,421	9,585	9,386	12,114
Rest of Queensland	8,275	7,554	19,285	25,328	24,759	34,554
Total Queensland	**60,024**	**58,870**	**77,706**	**34,913**	**34,144**	**46,668**
Rest of Australia	1,553	–3,044	3,089	7,369	3,040	10,604
Total Australia	**61,577**	**55,826**	**80,795**	**42,282**	**37,184**	**57,272**

Note: NPV = net present value. Real economic output for Queensland is equivalent to real GSP while real economic output at the Australia level is equal to real GDP.

Source: ACIL Allen Consulting

Table 4 **Labour market sensitivity analysis – employment impacts**

	Project Case	Fully Constrained	Unconstrained
	Employee years	Employee years	Employee years
Local MIW Region	15,943	13,327	63,963
Rest of Queensland	23,852	13,091	145,935
Total Queensland	**39,796**	**26,418**	**209,899**
Rest of Australia	8,528	-26,418	40,569
Total Australia	**48,324**	**0**	**250,468**

Note: An employee year is employment of one full time equivalent (FTE) person for one year or, say, one 0.5 FTE person for two years.

Source: ACIL Allen Consulting

[14] More specifically, the Type 2A employment multipliers which include the direct, production induced and consumption induced effects.

4 Cost Benefit Analysis

4.1 The principles of Cost Benefit Analysis

83 Cost Benefit Analysis (CBA) is a method of economic analysis whose primary objective is to determine whether a proposed project is economically efficient, relative to the alternative of not doing the project.

84 If the present value of a project's benefits exceeds the present value of its costs, then the project is worth doing, in the sense that is *allocatively efficient*. That is, the project resources that are utilised in the project (land, labour, capital, technology), in the present case the production of coal from a mine, are being put to their highest-value use. In this sense, a CBA provides a measure of the economic well-being, or welfare, created by a project.

85 A CBA provides a means of determining whether a project should go ahead, from a social point of view. However, a CBA says nothing about whether or to what extent a project will be privately profitable, when the proponent is a private business, as is the case for the Carmichael Project.

86 Neither does a CBA say anything about whether a private proponent of a project should invest in that project, from that proponent's point of view. That decision is the outcome of a very different analysis. For example, the financing cost of a project is typically important in a private business case analysis but plays no part in a CBA.

87 The Queensland Government, as part of its *Galilee Basin Development Strategy,* has announced that it will take a "short-term, financial stake" in the Galilee Basin infrastructure, with the first such investment being in the rail line used to transport coal from the Carmichael mine to the Port of Abbot Point.[15]

88 My understanding is that this decision by the Queensland Government will have no bearing on the cost of the rail line, and therefore no bearing on the CBA. What matters in a CBA is the total resource cost of a project, not who pays for it.[16]

89 CBA is what economists refer to as a *partial equilibrium* analysis, which means that the benefits and costs are those that arise directly from the project, in the market in which the outputs of the project are bought and sold.

90 It is not conceptually correct to count in a project's CBA the benefits and costs that arise in other markets, even if they are 'caused' (indirectly) by the project. For example, in the case of Carmichael Project, the coal to be mined will be thermal coal to be used in the production of electricity by the buyers of the coal (including Adani's parent company for its own power stations). The cost of any environmental damage of the related greenhouse gas (GHG) emissions should be counted in a CBA of the electricity production that will use the coal from the Carmichael Project[17],

[15] Deputy Premier, Minister for State Development, Infrastructure and Planning, The Honourable Jeff Seeney, *Historic agreements bring jobs to Queensland*, Media Statement of 17 November 2014.

[16] The outcome of a CBA does not determine whether the Queensland Government's decision to invest in Galilee Basin infrastructure is good policy. That would depend on factors such as what the Government's policy objectives are, and whether the policy is the best feasible way of achieving those objectives.

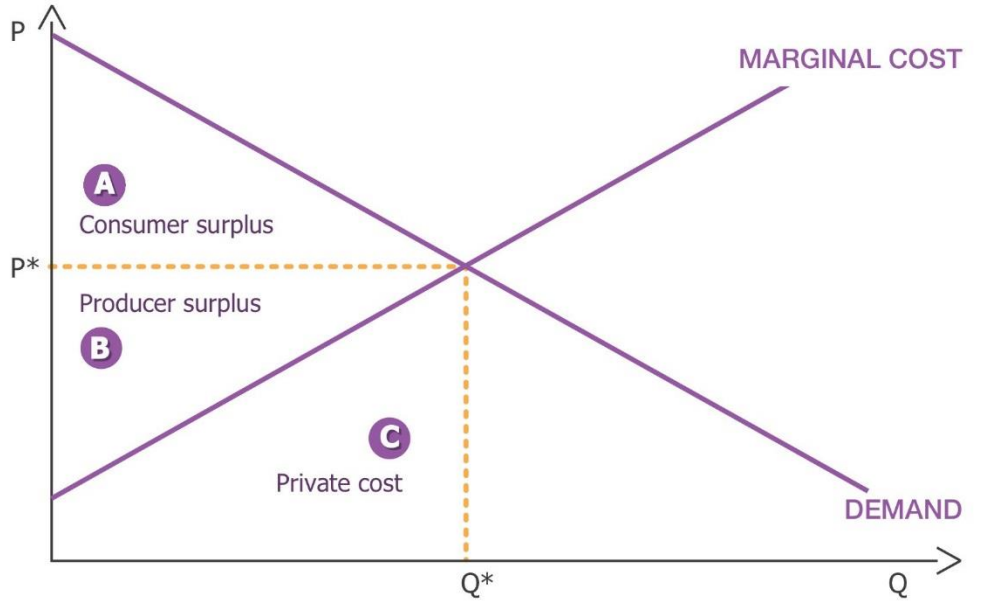
[17] Together with the other costs of the electricity production as well as its benefits.

but not in the CBA of the Carmichael Project itself.[18] It is however correct to include in the Carmichael Project CBA the environmental cost of the GHGs emitted during the mining and rail transport of the coal.

91 The *Handbook of Cost-Benefit Analysis*, published by the Department of Finance and Administration in January 2006, shows at page 20 that at a conceptual level, the benefits in a CBA are amounts (in dollar terms) which are known as *consumer surplus* and *producer surplus*. The costs are the opportunity costs of the resources that are used up in the project, i.e. their value in their next-best alternative use. Costs can be categorised as those internal to the project (such as capital expenditures and operating costs) and external costs (the costs of negative externalities from the Project, such as effects on the value of agricultural land).

92 The concepts consumer surplus and producer surplus are illustrated in Figure 3 below.

Figure 6 **Producer surplus and consumer surplus**



Source:

93 Figure 3 illustrates, conceptually, the market for the good which is the output of the project that is subject to the CBA. On the horizontal axis, labelled Q, is measured the amount of the good that is produced, bought and sold. On the vertical axis, labelled P, is measured (in dollars) the price of the good and the cost of producing it. The line labelled Marginal Cost (MC) represents the cost of producing each additional unit of output. It is drawn with an upward slope on the assumption that each additional unit of output is increasingly costly to produce. The line labelled Demand represents the willingness to pay of the buyers of the good. It is drawn with a downward slope on the assumption that the more units that buyers purchase of

[18] Similarly, it is strictly incorrect to count the GHGs emitted in the generation of electricity that is used to power the Project. Rather they should be counted in a CBA of domestic electricity generation. However, to maintain consistency with the Queensland Coordinator's evaluation report on the Project, I include the cost of these GHGs in the analysis. This is a conservative approach that leads to an overstatement of the overall social costs of the Project.

the good, the less they are willing to pay for further units.[19] This is a ubiquitous assumption in economic analysis.[20] Both lines are drawn as straight lines for expositional convenience, but this need not be so in practice. They are commonly referred to in economic analysis as the demand and MC functions.

94 The intersection of the Demand and MC functions, at the price labelled P* and amount of good labelled Q* represents the equilibrium in the market, where both buyers and sellers agree to the amount of the good to be transacted, and the price.

95 Consumer surplus, shown as the triangle labelled A, represents the benefit to the buyers of the good. It is a benefit because it is (the sum of) the difference between what buyers are willing to pay for each unit of the good that they buy (as represented by the demand function) and what they actually pay, P*.

96 Producer Surplus, shown as the triangle B, analogously represents the difference between the price that sellers receive for each unit of the good produced and the cost of producing that unit. Producer Surplus can be thought of as a measure of profit of the enterprise that produces the good, although it is not typically equal to the accounting profit.

97 Together, consumer surplus and producer surplus (the areas A+B in Figure 3) represent the private benefit of the project.

98 The private cost of the project is represented by the area C. But this is not the total cost. Additionally, there may exist costs due to negative externalities, such as damage to the environment, and costs which governments may incur to facilitate the project. The social costs of the project, which are those which should be used in a CBA are the sum of private costs, externality costs and public expenditures.[21]

99 There are benefits which are additional to the private benefits. Typically, a project will pay taxes to governments (such as royalties in the case of a mining project). These should properly be counted as benefits of the project provided they have not already been counted in the Producer Surplus. A project could also have externality benefits, which would add to its social value.

100 Externalities, by definition, are costs and benefits which are not reflected in any market prices. Spillover effects from a project which are reflected in market prices are not externalities. For example, suppose that a project increases demand for skilled workers such that the wage received in the labour market by those workers rises. This is a spillover from that project, but it is not an externality, and does not need to be separately accounted for in a CBA.

4.2 How should consumer surplus be estimated?

101 In CBAs of mining projects, consumer surplus is sometimes not counted as a benefit.

102 For example, the NSW Government *Guidelines for the use of Cost Benefit Analysis in Mining and Coal Seam Gas Proposals* (November 2012) state that the net

[19] Equivalently, a downward sloping demand curve indicates that the lower the price of a good, the more they are willing to buy.

[20] Strictly, this is not an assumption, but is derived from an optimisation problem where consumers are hypothetically compensated for the effects of price changes on their purchasing power. But this is a technicality of no import here.

[21] Public expenditures in this context means direct payments to the Project, not benefits that the Project receives from government policies generally.

benefits of a mining project should be measured as gross mining revenues, less production and related costs, less public expenditures, less environmental costs, plus other economic effects (which could be positive or negative).

103 In terms of Figure 6, abstracting from externalities and public expenditures, gross mining revenues are represented by the rectangle formed by the sum of the areas B+C, or equivalently, by Q* units of production sold at a price of P*. This means that, according to the NSW Government Guidelines, the net benefits of a project are revenues (B+C) minus costs (C) i.e. the area marked as B.

104 The area marked as B is Producer Surplus.

105 In other words, the net benefits (benefits minus costs) of a mining project, according to the NSW Government Guidelines, ignore consumer surplus entirely.[22] This is in contrast to advice from the Australian Government's Department of Finance and Administation, which states that consumer surplus is a benefit to be counted.[23]

106 It is understandable why the NSW Government Guidelines should adopt this approach. Gross mining revenue is relatively easy to calculate from a project's business plan or financial statements, while Consumer Surplus must be estimated.

107 In particular, the size of the consumer surplus depends on the slope of the demand curve. If the slope is steep, then consumer surplus is relatively large; if the slope is flat, then consumer surplus is relatively small.

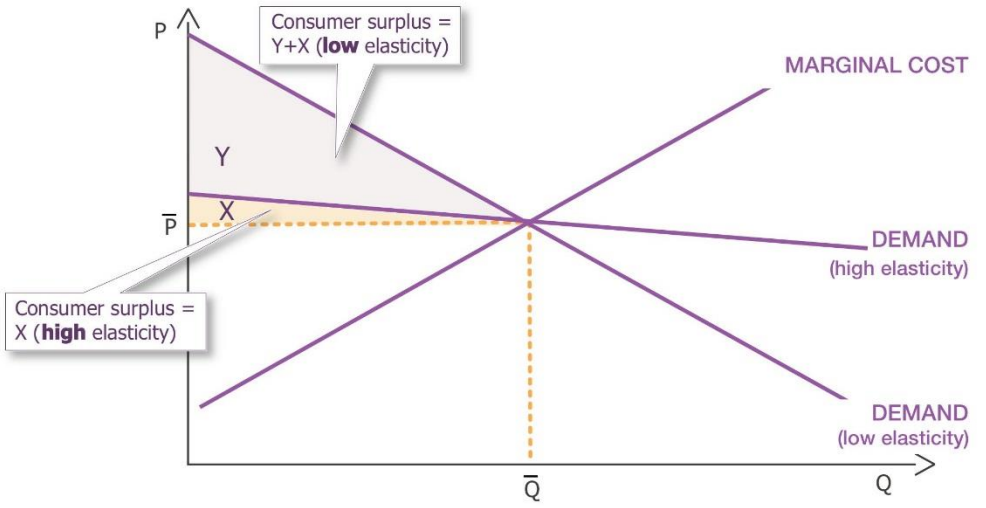
108 The slope of the demand curve depends on the price elasticity of demand i.e. the responsiveness of demand to a change in price, where this elasticity is defined as the percentage decrease (increase) in demand to a percentage increase (decrease) in price. A demand curve with a large elasticity will have a flat slope, and *vice versa*.

109 This is illustrated below in Figure 7 below, where two demand curves are drawn, one with a steep slope (low elasticity) and one with a flat slope (high elasticity).

[22] Strictly speaking, in economic theory, consumer surplus refers to a benefit gained by consumers (individuals and households). The buyers of minerals are more likely to be businesses, who use those inputs in their production processes.. However, businesses still benefit when they purchase their inputs for less than they are prepared to pay for them

[23] Handbook of Cost Benefit Analysis, page 20.

Figure 7 **Consumer surplus with high and low price elasticity of demand**



Source:

110 Consumer curplus with the high elasticity demand curve is represented by the area X, while consumer surplus for the low elasticity demand curve is represented by the area X+Y. Thus CS corresponding to demand functions with low elasticity will be relatively large.

111 To estimate the consumer surplus associated with the Project therefore requires an estimate of the price elasticity of demand for coal.

112 The most up-to-date estimate, as far as I am aware, of the price elasticity of demand for Australian coal is, in absolute terms, 0.3.

113 This was the estimate used by three economists who appeared for the Bulga Milbrodale Progress Association opposing the extension of the Warkworth open cut coal mine in the NSW Hunter Valley: Rod Campbell (the economic expert for Land Services of Coast and Country Inc in these proceedings) and two co-authors.[24] This estimate implies a very steep demand curve, and hence a very large consumer surplus accruing to buyers of coal.

114 If the elasticity of demand for Australian coal were larger, that is, buyers of coal were more sensitive to changes in prices, then the estimated consumer surplus would be smaller. It is likely that over the life of the Carmichael Project, buyers of thermal coal, who will use it to generate electricity, will become more price-sensitive, as alternative methods of electricity generation become more widespread, and as GHGs are taxed and/or regulated.

115 Accordingly, in the estimates of benefits and costs presented in Chapter 6, I use a larger price elasticity, equal to one, representing a more-than tripling of price sensitivity by coal buyers. The estimated consumer surplus, while much smaller than that estimated using the price elasticity preferred by Campbell et. al,, nevertheless remains very large.

[24] Rod Campbell, Richard Dennis and John Quiggin, "Economists on Trial: Economists in the NSW Land and Environment Court, unpublished paper, undated. The origins of this elasticity estimate are an unpublished paper written in 1991 by two economists from the then Australian Bureau of Agricultural and Resource Economics.

4.3 Whose costs and benefits should be counted?

116 The question of whose costs and benefits should be counted in a CBA is often posed as "Who has standing?"

117 According to a widely-cited paper in the field by William N.Trumbull[25], this comes down to whose preferences and welfare should be counted in the analysis; for example, whether the welfare of future generations should be counted in a CBA of a long-lived investment, or whether the welfare of criminals should count in a CBA of a criminal justice program aimed at reducing crime.

118 Of particular relevance to a CBA of the Project is whether the benefits that accrue to non-Australians (especially the shareholders of Adani, which at present is entirely foreign-owned) should be counted in the analysis.

119 According to Trumbull, it makes no logical sense to stop the analysis at national borders, just as it makes no logical sense to stop the analysis at local borders. For example, if a factory pollutes a river and this affects people downstream in a neighbouring locality then clearly a CBA of the factory's activities should include the costs to all the people affected.

120 According to a report written in 2013 by Rod Campbell, the economic expert witness for Land Services of Coast and Country Inc in these proceedings, the benefits of an Australian mining project that accrue to non-Australians should not be counted in a CBA, for the reason that they are not Australians. Rather, the only benefits that should be counted are royalties and taxes paid to Australian governments by foreign-owned mining companies.[26]

121 This is a value judgement, not economic reasoning. It is no more or less valid than any other value judgement (in the sense that the conclusions follow from the premises), but it is not economics.

122 As shown in the CGE analysis reported in Chapter 3, the Project will generate considerable real income gains to residents of Australia, Queensland and the MIW region. These gains will arise because of the investment made by Adani.

123 The argument that only financial benefits that a country or region gains from foreign investment in mining are royalties and other taxes is thus shown to be false.

124 This does not mean that the fact that the Project will take place in Australia is irrelevant. For example, the Project will be subject to a host of national and Queensland laws and regulations, such as those affecting landholders and the Project's environmental impacts, and these will have a bearing on the Project's costs.

125 In general, including in the case of the Carmichael Project, foreign investment expands the size of the economy, and brings with it technology, management expertise and other benefits that would otherwise be absent. However, foreign companies, including Adani, will only invest in a country (or a region) if the returns

[25] William M. Trumbull (1990), "Who Has Standing in Cost-Benefit Analysis?", *Journal of Policy Analysis and Management* Vol. 9, No. 2 201-218,

[26] Rod Campbell, "Review of Bulga Extension Project Environmental Impact Statement Appendix 18 Economic Impacts", June 2013. http://www.ecolarge.com/wp-content/uploads/2013/09/Ecolarge-Jun-2013-Bulga-extension-submission-FINAL.pdf

from that investment are sufficiently high relative to the associated risks and relative to the risk/return calculus on investment opportunities elsewhere.

126 It is thus entirely appropriate for the producer surplus (a measure of the profits from the Project) to be counted in a calculus of the Project's benefts against its costs.

127 Moreover, because Adani, in all likelihood, will be selling a large proportion of the coal to itself, it is also appropriate to have regard to consumer surplus in evaluating the Project's benefits. The return to its overall business that Adani expects to receive from its investment in the Carmichael Project ultimately should be the determining factor in its decision on whether, and how much, to invest.

128 Even a parochial analyst or decision maker would include the total benefits and costs of a foreign-owned project in a CBA if that project has the potential to significantly improve the welfare of Australians, which the Carmichael Project clearly does.

129 The only way this would not be true would be if the foreign capital, technology and expertise that are invested in a project could be substituted one-for-one with domestically sourced capital, technology and expertise, and this is very unlikely to be the case in the mining industry.

130 Australia relies heavily on foreign investment, evidenced by the fact that the current account balance, which by definition is net investment in, and lending to, Australia by foreigners, has been in deficit every year but three since quarterly statistics began to be collected in 1959-60.[27] In 2013-14, the current account deficit was $47488 million, which was around 3.0 per cent of GDP.

131 According to the Reserve Bank of Australia[28] the mining sector is effectively around four-fifths foreign-owned, though this varies significantly by commodity and individual mine. In 2010-11, foreign investment in Australian mining was around two per cent of GDP (around $28 billion). Two years earlier, it was around $54 billion. These are very large numbers which illustrate well the importance of the mining sector to the Australian economy.

132 Without this foreign ownership, the economic benefits to Australians of the coal mining industry in general and the Carmichael Project in particular would not arise.

133 For the above reasons all of the benefits and costs arising from the mining, transportation and sale of coal from the Carmichael Project should be counted in the CBA.

4.4 Discounting, risk and uncertainty

4.4.1 Choice of discount rate

134 In principle, the discount rate that is used to convert future benefits and costs into present values is meant to reflect society's weighting of benefits and costs that occur in the present vis a vis the future. In theory this is formulated as a 'pure' rate of time preference, which depends on how much society prefers the present over the future as such, plus factors which reflect aversion to future fluctuations in

[27] Source: Reserve Bank of Australia, rba.gov.au, Table I1

[28] RBA, Statement on Monetary Policy, November 2011, page 43.

income (known by economists as the elasticity of the marginal utility of consumption) and expected future growth of per capita consumption.[29]

135 The arguments for using a discount rate formulated in this way originate with the English scholar Frank Plumpton Ramsey.[30] There exists a further argument, orginating with an English ethical tradition, for making the pure rate of time preference equal to zero, or close to zero [31], because the welfare of future generations should not be discounted by the present generation just because they will live in the future. This argument was put forward by Professor Nicholas Stern in his *Review of the Economics of Climate Change*.[32]

136 The effect of setting the pure rate of time preference equal to a number close to zero, given the likely values of the other parameters in Ramsey's formulation is that the discount rate will be around 2.5 per cent.[33]

137 The alternative view is that the discount rate should reflect market interest rates, however market interest rates appear to be inefficiently high because of a phenomenon known as the equity risk premium puzzle.[34]

138 An implication of the equity premium puzzle, and consistent with the Ramsey formulation with a very small pure rate of time preference, is that the discount rate should be above the "risk free" interest rate and below the market rate of interest (Grant and Quiggin, 2005).[35]

139 In practice, the risk free rate of interest is usually taken to be the 10 year government bond rate. It is risk free in the sense that the returns are fixed in dollar terms, unlike the returns from investing in the share market.

140 At the time of writing the inflation-indexed 10 year Commonwealth Government bond rate is at an extremely low 0.67 per cent. In comparison, a year earlier it was 2.00 per cent. This low point might reflect a new steady state, but on the other hand, it might also reflect a similar type of capital market failure, known in the financial

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29 David Pearce, Giles Atkinson and Susana Mourato, *Cost-Benefit Analysis and the Environment*, OECD, 2006, pp187-188. The discount rate can be expressed in algebraic form as r = p + ug, where r is the discount rate, p is the 'pure' rate of time preference, g is the growth rate of future per capita consumption, and u is the elasticity of the marginal utility of consumption i.e. the percentage change in welfare derived from a percentage change in consumption, or income.

30 F.P. Ramsey (1928), "A Mathematical Theory of Saving", *Economic Journal*, 38, pp 432-559. Ramsey (1903-1930) in his short life made profoundly important contributions to economics, philosophy and mathematical logic.

31 "it seems … clear that the time at which a man exists cannot affect the value of his happiness from a universal point of view; and that the interests of posterity must concern a Utilitarian as much as those of his contemporaries …": Henry Sidgwick (1890), *The Method of Ethics,* Macmillan, London. The argument for making the pure rate of time preference a number slightly above zero is that there is a small probability that future generations will not exist (because, say, humans have been made extinct, like the dinosaurs 66 million years ago, by an asteroid colliding with Earth): Partha Dasgupta and Geoffrey Heal (1974), "The optimal depletion of exhaustible resources", *Review of Economic Studies,* 41, 3-28, and Dasgupta and Heal (1979), Economic Theory and Exhaustible Resources, Cambridge University Press, Cambridge.

32 http://web.archive.org/web/20081211182219/http://www.hm-treasury.gov.uk/stern_review_final_report.htm

33 Pearce et.al. p 188. This assumes long run per capita consumption growth of two per cent, which is about the long term average for Australia. The value of the elasticity of the marginal utility of consumption is thought to be about one. Additional possible complications are discount rates that decline over time (hyperbolic discounting): Shane Frederick, George Loewenstein and Ted O'Donoghue (2002). "Time Discounting and Time Preference A Critical Review", *Journal of Economic Literature,* XL(2), 351-401; and discount rates that account for uncertainty around future income growth: Christian Gollier (2012), *Pricing the Planet's Future:The Economics of Discounting in an Uncertain World*, Princeton University Press, chapter 12.

34 R. Mehra and R.C. Prescott (1985), "The Equity Premium: a Puzzle, *Journal of Monetary Economics*, 15(2), 145-161

35 Simon Grant and John Quiggin (2005), "What Does the Equity Premium Mean?", *The Economists Voice*, 2(4), 1-6

economics literature as the risk free rate puzzle, that is the cause of the equity premium puzzle. [36]

141 To be conservative, I use the the inflation-indexed 10 year Commonwealth Government bond rate averaged over the year ending November 2014. This comes to 1.8 per cent.

142 To arrive at the discount rate, I add premiums of one per cent, and 2.5 per cent, giving me two discount rates, 2.8 per cent and 4.3 per cent, which I use in the CBA.

143 A discount rate of 2.8 per cent is only slightly higher than the discount rate derived from the Ramsey formulation. A discount rate of 4.3 per cent is probably too high, but is usefully conservative in that it will tend to lower the present value of the net benefits of the Project, and so the present value so derived provides the minimum net benefits from the Project.

4.4.2 The precautionary principle

144 Land Services of Coast and Country Inc, in its submission to the Department of Natural Resources and Mines on 16 June 2014, states that approval and construction of the mine would be contrary to the precautionary principle.

145 Land Services of Coast and Country Inc does not say what it means by the precautionary principle[37] but the economic interpretation is that there is value in adopting a wait-and-see approach (that is, there is an option value) before investing, where that investment might cause environmental harm; for example, in waiting for more scientific tests to see whether a pesticide is harmful, before it is deployed.

146 Confusingly, however, Land Services of Coast and Country Inc in its Statement of Issues to the Land Court criticises the economic assessment of the EIS of the Project for not conducting a CBA.

147 This is confusing because a CBA is an alternative to adopting the precautionary principle.[38] A CBA is a guide to deciding now whether an investment ought to go ahead, based on information currently available. There is no waiting-and-seeing with a CBA.

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[36] John Quiggin (2004), "Apples with apples: Comparing the cost of capital". *Public Infrastructure Bulletin* 1(3)

[37] Per Sandin (1999), "Dimensions of the Precautionary Principle", *Human and Ecological Risk Assessment* 5, 889-907 records 19 different interpretations of the precautionary principle.

[38] Joseph E. Aldy and W. Kip Viscusi (2014), "Environmental Risk and Uncertainty", in Mark J. Machina and W. Kip Viscusi. *Handbook of Risk and Uncertainty*. Elsevier, Amsterdam.

5 Externalities from the Carmichael Project

5.1 Externalities in principle

148 Negative externalities are unpriced impacts from an economic activity that impose costs on third parties.[39] They are considered to be a 'market failure' because, in the absence of any corrective action they (generally) cause too much of a good to be produced, because the producer takes no account of the costs that it is imposing on others.[40]

149 The presence of negative production externalities is a justification for governments to intervene in production processes. There are generally three types of intervention that governments can take.

150 The first type is regulation, whereby the activity that creates the negative externality is either prohibited (e.g. the production of asbestos) or the amount or method of its production is regulated in some way. Regulation of this type is ubiquitous e.g. food production which must adhere to safety standards.

151 The second type is pricing of the externality such that producers who create the externality through their production processes create less of it, as they are incentivised to do in the presence of the price. An example is the pricing of GHG emissions, which increases the price of carbon-intensive goods, thereby reducing the demand for them, and which also creates incentives for producers to switch to less carbon-intensive methods of production (e.g. electricity production from coal-fired generation to gas-fired generation, which is less carbon-intensive, or to nuclear or renewable generation, which create no GHGs).

152 The third is known by economists as Coase bargaining [41],whereby the creator of externality (person A) and the person on whom the cost is imposed (person B) agree to monetary compensation. This results in an efficient level of production.[42] In principle, this compensation could be paid either by person A to person B to compensate them for their loss, or paid by person B to person A to prevent the loss. The distributional consequences are certainly different (and considerations of fairness would usually point to the creator of the externality providing the compensation) but either way the objective of economic efficiency is achieved.

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39 Robin W. Boadway and David E. Wildasin, *Public Sector Economics,* 2nd Edition, Little, Brown and Company, Toronto, 1984, 118-127, p60.

40 The situation of 'too much' of a good being produced in the presence of negative production externalities occurs without ambiguity when the market in question is competitive and other market failures are absent, and thereby production exceeds the competitive (efficient) optimum. When the good is being produced by a monopolist, absent the externality, too little of the good is produced, relative to the competitive optimum, and therefore it is unclear whether a monopolist whose production creates negative externalities produces too much or too little.

41 Named after the economist Ronald Coase: R.H. Coase, "The problem of Social Cost, *Journal of Law and Economics,* October 1960, 1-44.

42 See Boadway and Wildasin, pp118-127; and Richard Cornes and Todd Sandler (19960, The Theory of Externalities, Public Goods and Club Goods, 2nd Edition, Cambridge University Press, Cambridge, 86-91.

153 Two practical objections are often raised to Coase bargaining. The first is that 'transactions costs' i.e. the costs of the creator of the externality and the person who bears the burden of the externality finding and negotiating with each other, rule out Coase bargaining as a solution to the externality problem. This is often true. It would not be practical, for example, for the creators of GHG emissions around the world to bargain with all the people who are worse off because of these emissions, not least because many if not most of them have yet to be born. However with the Carmichael Project a relatively small number of people will be affected, thus transactions costs would not appear to be prohibitive and such bargaining is feasible.

154 The second objection is that Coase bargaining can fail to reach an efficient solution if one party to the transaction has a significant information advantage over the other, e.g. on the amount of externality to be created.[43] However, this is a problem that can be solved by the intervention of government, through its approval processes. For example, with the Carmichael Project, comprehensive and lengthy approval processes were undertaken by the Queensland and Australian Governments, including consultations with affected parties as a means to ensure all parties are appropriately informed.

5.2 Externalities in the Project

5.2.1 Externalities asserted by Land Services of Coat and Country Inc

155 In the objection form lodged with the Department of Natural Resources and Mines lodged on 16 June 2014, Land Services of Coast and Country Inc claims that the mine will "cause severe environmental impacts" to:

> "groundwater and dependent users, species and ecosystems; … surface water and dependent users, species and ecocsystems; … biodiversity and ecosystems on, and associated with, the area of the mine; [and] … direct and indirect emissions of greenhouse gases contributing to climate change and ocean acification from the mining, transport and ***use*** of the coal from the mine" [emphasis added].

156 With respect to the use of the coal, as argued above at paragraph 90, whatever the effects may be of GHGs created by the use of the coal, they are not properly subject to inclusion in a CBA of the Project. These effects should be included in CBAs of coal-fired electricity production in the places where the coal will be burnt, together with all the other costs and benefits of that electricity generation, for example the benefits to Indian rural households who may for the first time be connected to an electricity grid.[44]

157 The idea that downstream effects should be counted in a CBA of the upstream project is a common pitfall in cost benefit analysis. It is described by economist Richard Tresch as "the chain reaction game".[45] Tresch writes:

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[43] Joseph Farrell , "Information and the Coase Theorem", *Journal of Economic Perspectives* 1(2), Fall, 1987

[44] The Minister for the Environment, the Hon. Greg Hunt MP, in his media release of 28 July 2014, whose subject was the approval of the mine, said "It is estimated the project will provide electricity for up to 100 million people in India". http://www.environment.gov.au/minister/hunt/2014/mr20140728.html

[45] Richard W. Tresch, *Public Finance: A Normative Theory*, Business Publications Inc, Plano Texas

> "We believe that the safest strategy is simply to ignore [benefits and costs] in other industries … Can any researcher really hope to trace through all the [benefits and costs] arising from a given project, both in the short run and the long run? The question, in effect, answers itself." [46]

158 With the Carmichael Project, the estimation, at this time, of the volume of GHGs from burning the coal would depend on a host of assumptions which may prove to be wildly inaccurate in the future, such as the technology employed in coal fired power stations to the middle of the century, which affects the rate at which burning coal creates GHGs, and whether or to what extent the emissions will be captured and stored, which affects whether the GHGs will be released into the atmosphere at all.[47]

5.2.2 Regulation of externalities

159 The Coordinator General, in his report of May 2014[48], sets out a series of conditions that must be satisfied for the mine to proceed. These cover air, waste, noise, groundwater, water, sewage treatment, land and rehabilitation, offsets and biodiversity, subsidence and dams and levies.

160 These are complementary or additional to the environmental measures previously committed to by Adani.[49]

161 In addition, the Commonwealth Minister for the Environment, on 24 July 2014, prescribed a different set of conditions for the Project, covering amongst other things, groundwater management, impacts on vegetation, noise and emissions, biodiversity offsets, and subsidence.[50]

162 For example, the Minister has prescribed that 31,000 hectares be set aside for the habitat of the (southern) Black-throated Finch.[51] The value of this land is $18.6 million.[52]

163 According to Birdlife Australia, in a statement critical of the Minister's decision to approve the mine[53], "there are at least 400 Southern Black-throated Finches on the mine site".

164 Assuming that the true number is 500, the value of the land prescribed to be offset for the habitat of the (Southern) Black-throated Finch amounts to $37,200 per bird.

165 With respect to water taken from the catchment for use at the mine, my understanding is that this water will be taken under an allocation from the available

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46 Tresch (1981), page 588. Tresch uses the terminology "pure profits and losses" rather than benefits and costs.

47 For a discussion of possible future (and cleaner) coal-burning technologies, see *The Future of Coal: An Interdisciplinary MIT Study (*2007) http://web.mit.edu/coal/.

48 *Carmichael Coal Mine and Rail project: Coordinator General's evaluation report on the environmental impact statement*. http://www.dsdip.qld.gov.au/resources/project/carmichael/carmichael-coal-mine-and-rail-cg-report-may2014.pdf

49 http://www.adanimining.com/pdfs/AEIS_Final_Documents/16_Mine_EMP.pdf, http://www.adanimining.com/pdfs/AEIS_Final_Documents/17_EMP_Offsite.pdf, http://www.adanimining.com/pdfs/AEIS_Final_Documents/18_EMP_Rail.pdf,

50 http://www.environment.gov.au/epbc/notices/assessments/2010/5736/2010-5736-approval-decision.pdf

51 The minister has also prescribed offsets for the: Brigalow ecological community (815 hectares), Ornamental snake (135 hectares), Squatter pigeon (2500 hectares), Waxy cabbage palm (90 hectares) and Yakka skink (5600 hectares).

52 Assuming that the land is worth $600 per hectare http://www.adanimining.com/Common/Uploads/EISDocuments/111_EISDoc_Economic%20Assessment.pdf, p3-11.

53 http://medianet.com.au/releases/release-details?id=806988

un-supplemented Strategic Reserve. Adani will be required to pay for use of this water under the allocation.

166 With respect to financial assurance for rehabilitation costs, my understanding is that under the *Environmental Protection 1994* (Qld) Adani cannot start mining activities until it has that assurance in place to cover rehabilitation costs for approved activities in the short term (under a plan of operations, which runs for 1-5 years). As I understand it, this type of financial assurance is usually provided in the form of a bank guarantee.

167 As an economist, I have neither the scientific nor engineering expertise to comment on the hazards to the environment that may be caused by the Project or the efficacy of the regulations imposed by the Coordinator General and the Minister.

168 However, as a matter of economic analysis, it is not true that the preventative and ameliorative measures prescribed by the Coordinator General and the Minister for the Environment ought to eliminate all negative environmental externalities, or more precisely, to reduce the probablility to zero of the existence of negative externalities.

169 As a matter of economic efficiency, externalities, or the risk of them, should not be completed eliminated.[54] Rather they should be reduced to the point where the marginal social costs of a project (i.e. marginal private costs plus externality costs) equate to the marginal benefits of a project).[55] In these circumstances, production is at its efficient level, that is, the level which brings the highest value to society.[56] In contrast, the elimination of externalities altogether effectively could only be achieved with the cessation of all economic activity.

5.2.3 Pricing of externalities

170 Australia does not currently have a carbon tax or an emissions trading scheme that puts a price on GHGs. However, in the CBA of the Project these emissions should be priced. This is because a CBA properly assigns a price to all the costs of a project. Where the price does not exist, or the market price in some way is not the price that would be obtained in a distortion-free competitive market, then a shadow price should be used in the analysis.

171 I use the central estimates of the shadow price of GHGs per tonne estimated for the UK Department of Energy & Climate.[57] In real 2014 terms, these grow from £4.48 in 2014 to £77.66 in 2030. Thereafter, I assume the price grows by three per cent per year. Converting to Australian dollars using the exchange rate $A = £0.54[58], leads to a carbon price per tonne of emissions ranging from $8.68 in 2016-17 (the first year of mining) to $232.25 in 2046-47, in real 2014-15 terms.[59]. The average price is $126 per tonne.

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[54] In some extreme cases, such as the leaking of radioactivity from a nuclear reactor, the optimum amount of the externality is likely to be zero, but this kind of example does not apply to the Carmichael Project.

[55] Boadway and Wildasin,118-119

[56] When production is at its efficient level in the presence of externalities, there can be no assurance that people who are harmed by these externalities will be adequately compensated. However, that is a political, not economic, problem.

[57] https://www.gov.uk/government/publications/updated-short-term-traded-carbon-values-used-for-uk-policy-appraisal-2014

[58] This was the exchange rate at end of November 2014.

[59] A carbon price in excess of $200 per tonne is very high by today's standards, but in line with the mid century price consistent with 450 ppm CO2e mitigation strategies analysed by the Garnaut climate change review http://www.garnautreview.org.au/pdf/Garnaut_Chapter11.pdf

172 Estimates of GHGs from the Project are based on the 2012 report by GHD, *Report for Carmichael Coal Mine and Rail Project Greenhouse Gas Emissions 25215-D-RP-0008.*[60]

173 The annual derived carbon costs range up to $254 million. The full time series can be found in Attachment B of this report.

174 The other externality cost quantifiable for this CBA is the loss of value of the land in the rail corridor.[61] The lost value is about $1 million, derived from a lost area of 1795.5 hectares [62] at a land price of $600 per hectare.

5.2.4 Bargaining over externalities

175 The process for approving the Project contains numerous mechanisms for those people who are adversely affected to be compensated.

176 My understanding is that under section 279 of the *Mineral Resources Act 1989* (Qld), mining leases cannot be granted until compensation is settled between the Applicant and each owner of the surface of the relevant land, either by negotiated agreement or compensation in separate Land Court proceedings.

177 As I understand it, Adani has acquired one of the lots that is the subject of the mining lease applications, and has been in confidential negotiations with the remaining land holders.

178 Similarly, Adani is required to acquire the land for the rail corridor pursuant to the *Transport Infrastructure Act 1994* (Qld). This means it must enter into a compensation arrangement with each affected landholder. I understand that confidential negotiations are well-progressed with most of the affected landholders.

179 As I understand it, where compensation cannot be agreed, the State will acquire the land under the usual statutory process and Adani will be required to reimburse the Queensland Government for the compensation paid for any acquisitions.

180 With respect to groundwater, the Coordinator General's report commits Adani to enter into make good agreements under which it will replace or compensate for groundwater which becomes unavailable fo other users.

[60] http://www.adanimining.com/Common/Uploads/EISDocuments/124_EISDoc_Mine%20Greenhouse%20Gas%20Report_.pdf

[61] The value of the land for the mine is already included in the financial costs incurred by Adani.

[62] The rail corridor will be 189 kilometres long and 95 metres wide: http://www.adanimining.com/Common/Uploads/SEISDocuments/44_SEISDoc_Appendix%20E%20-%20Economic%20Assessment%20Report.pdf, p39.

6 Estimation of the Benefits and Costs of the Project

181 The benefits and costs of the Project, in present values terms, are shown in Table 5, below. The time period for the calculation is AFY2014-15 to AFY2046-47.

182 Benefits (excluding consumer surplus) are revenues from the sale of coal.

183 The data used in these calculations are in Attachment B of this report. Where necessary, data in $US have been coverted to $A with an exchange rate of A$ = US$0.8491.

184 Consumer surplus, with an assumed value for the elasticity of demand of (minus) one, is 50 per cent of revenue.[63]

Table 5 **Present Value of Project Benefits and Costs ($m, real, $2014-15)**

	r=2.8%	r=4.3%
Benefits (excluding CS)	$55,424	$44,263
Costs	$38,849	$31,940
Consumer surplus (CS)	$27,712	$22,132
Benefits minus Costs (excluding CS)	**$16,576**	**$12,323**
Benefits minus Costs (including CS)	**$44,288**	**$34,454**
Benefit Cost Ratio (excluding CS)	1.4	1.4
Benefit Cost Ratio (including CS)	2.1	2.1

Source: Author's estimates

185 As Table 5 shows, the net benefits of the Carmichael Project are very stongly positive, under either discount rate. Under the preferred discount rate, 2.8 per cent, the present value of the net benefits excluding Consumer Surplus is $16.6 billion. Including consumer surplus the net benefits are $44.3 billion.

186 Looking at the benefit-cost ratio, under either discount rate the benefits in present value terms, excluding consumer surplus, are 40 per cent bigger than the costs. Including consumer surplus, the benefis are more than double the costs.

[63] With a linear demand curve, a price elasticity of demand with an absolute value of one, and price and quantity in the market of P^ and Q^, the demand curve cuts the P axis in Figure 6 at a value of 2P^. It follows that the value of consumer surplus is equal to 0.5*(2P^-P*)*Q^ = 0.5*P^Q^ i.e. half of revenue.

7 Sensitivity

7.1 Introduction

187 The estimates of net benefits reported in the last chapter depends largely on forecasts for thermal coal prices and volumes. Accordingly, it is appropriate to see how sensitive the estimates are to different forecasts of these variables.

188 Additionally, it is appropriate to test the sensitivity of the estimates to different assumptions for the value of negative externalities.

189 There are infinite variations to the questions, "what would happen if prices are x% lower, volumes y% lower, or external costs (those associated with negative externalities) z% higher". Since any particular value of x,y, or z chosen to answer this question is arbitrary, and therefore not very informative, it makes more sense to ask what value of z, y, and z would be the break-even value for the CBA. That is, how much lower would prices or volumes have to be, or how much higher would external costs have to be, for the present value of the net benefits to be zero?

190 If the break-even reductions in prices or volumes or increases in externality costs are unreasonably large, then it can be be safely concluded that the CBA is robust, and the conclusions from the analysis are not sensitive to the anticipated values of key variables.

191 As it turns out, the CBA for this Project is very robust to changes in the values of key variables. Depending on assumptions about the exchange rate and the choice of discount rate, the percentage break-even reduction in the coal price ranges between 28.4 per cent and 40.6 per cent. For a reduction in coal volumes, it is between 66.3 per cent and 71.0 per cent. An unforeseen externality cost would need to be extremely large to offset the positive value of the Project.

7.2 Coal prices

192 Thermal coal prices in the CBA range in real AFY2014-15 terms, from A$73.51 to A$92.98, with an average of A$85.40.

193 The first row of Table 6 below shows the break even percentage reduction in the coal price, that is, the percentage reduction in the coal price at which the present values of benefits and costs of the Project are equal. The analysis is conducted on the assumption that nothing else changes, including the $US/$A exchange rate.

Table 6 **Break even percentage reduction in coal prices and implied average prices (real AFY 2014-15 prices)**

	r=2.8%	r=4.3%
Exchange rate $A=US$0.85	29.9% A$59.86	27.8% A$61.66
Exchange rate $A=US$0.70	40.2% A51.07	38.4% A$52.61

Source: Author's estimates

194 As can be seen, this percentage reduction is very large: 29.9 per cent when r=2.8% and 27.8% when r=4.3%. This implies an average break-even coal price in real AFY 2014-15 Australian dollars of $59.86 to $61.66.

195 I note that in their November 2013 report *Remote Prospects: A financial analysis of Australia's coal gamble in the Galilee Basin*[64], authors Tim Buckley and Tom Sanzillo state (at page 49) that "thermal coal prices are likely to track the global marginal cost curve".

196 According to the global marginal cost curve reported by Buckley and Sanzillo, in a chart at page 50 of their report, global marginal costs into the forseeable future will be around US$90 per tonne, or about $106 per tonne in Australian dollars.

197 Not only is this well above the break-even coal price, it is considerably higher than the estimate of the coal price that I have used in the CBA. If the coal price is as predicted by Buckley and Sanzillo, then the benefits of the CBA will be over 20 per cent larger than I have estimated.

198 Furthermore, it is likely that an even larger reduction in the coal price is required for the Project to break even, in CBA terms, than I have discussed above. This is because if there is a large fall in the coal price, it will be likely to be accompanied by a large depreciation in the exchange rate. The second row of Table 6 shows the break-even percentage fall in the coal price when the $US/$A exchange rate is 0.70.

199 In this case, the break even even percentage fall in the coal price (in $A) is 40.2 per cent (r=2.8%) and 38.4 per cent (r=4.3%), implying an average coal price of $51.07 to $52.61.

200 I conclude that the benefits of the Project exceed its costs for any reasonable coal price.

7.3 Coal volumes

201 An another sensitivity test is to ask by how much coal volumes would need to be lower for the CBA to break even, other things being equal. This involves reducing coal sales by a fixed percentage every year.

202 In this scenario, coal prices are the same as projected in the estimates of net benefits reported in the previous chapter of this report. This is consistent with a situation where the global balance between demand for and supply of coal is unchanged, but Adani does not produce or export as much coal from its Carmichael mine, because, say, it loses market share to a competitor.

203 Since Adani, in all likelihood, will be selling a large proportion of the coal to its parent company, it is difficult to see how this scenario could eventuate, but it is included for completeness.

204 The results of this sensitivity test are shown in Table 7. The break-even percentage reduction in coal volumes ranges from 64.9 per cent to 69.9 per cent.[65] This reduction is significantly larger than the break-even reduction in prices, even at the lower exchange rate. This is because, unlike the price reduction scenario, if the

64 http://ieefa.org/adani_coal_report/

65 This does not mean that Adani's business case would still pass with a reduction in volumes of this magnitude. That is a different question. But the social benefit cost test would pass.

Carmicael Project produces and sells less coal, then its costs will be lower too, as will carbon costs. With lower costs, the required reduction in revenue to break even requires a larger percentage reduction in volumes than the percentage reduction in prices.

Table 7 **Break even percentage reduction in volumes and implied volumes (tonnes)**

	r=2.8%	r=4.3%
Percentage reduction in volumes	69.9%	64.9%

Source: Author's estimates

205 I conclude that the benefits of the Project exceed its costs for any reasonable coal volumes that Adani is likely to produce and sell.

7.4 Externalities

206 In this scenario, an event causing a big negative environmental externality (e.g. a coal ship runs aground on the Barrier Reef) occurs in one year during the life of the Project. The question is how big this externality needs to be (in monetary terms) to offset the net benefits of the Project.[66] I assume here that the net benefits do **not** include consumer surplus; this has the effect of significantly reducing the cost of the break-even externality i.e. makes it more likely that a large negative externality will make the net benefits of Project negative.

207 In such a scenario, for a given discount rate, when this event occurs makes a difference. The later it occurs, the smaller it is in present value, so a later event would have to be more bigger and hence more costly in the dollars of the day, than an earlier event, to be a break-even event.

208 The choice of discount rate makes a difference here also. As shown in Chapter 6, with a lower discount rate, the present value of the net benefits is larger, meaning a a more costly event is needed for the CBA to break even, other things being equal.

209 In the analysis, the event occurs in one of the years 2020, 2032 or 2044. The choice of years (early, middle and late years of the Project) illustrates the importance of the timing of the event.

210 Table 8 shows the size of the negative externality, at different dates and discount rates, for the CBA to break even.

Table 8 **Break even negative externality ($m, real AFY 2014-15 prices)**

Year occurring	r=2.8%	r=4.3%
2020	$19,050	$15,860
2032	$26,550	$26,300
2044	$36,960	$43,600

Source: Author's estimates

[66] A significant environmental externality need not occur as a one-off event. The scenario could be modelled as a series of smaller events. But the point is most easily made by modelling a single event.

211 Table 7 shows that, regardless of the discount rate or when the event occurs, the size of the event would have to be extremely large to totally undo the net benefits of the Project.

212 If the event occurs in 2020, the event would have to cost either $19.1 billion (when r=2.8%) or $15.9 billion (r=4.3%). The break-even cost is lower at the higher discount rate because at that discount rate the present value of the net benefits are lower (per Table 5 in the previous chapter).

213 If the event occurs in 2032, the size of the break-even externality cost is higher, because the event has occurred later. Again, the the cost is lower when r=4.3%, but not by much.

214 If the event occurs in 2044, the size of the break-even externality cost is extremely high ($37.0 billion or $43.6 billion), at either discount rate, because it has occurred many years into the future. On this occasion, the break-even cost is bigger when r=4.3 per cent. This is because events that are very distant are discounted very heavily to the present.

215 Concentrating on the preferred discount rate, r=2.8%, the break-even cost ranges between $19.1 billion and $37.0 billion. To put these figures into perspective, the cost of the Deepwater Horizon explosion and oil spill in 2010 is estimated to be US$42.7 billion.[67] 780,000 cubic metres of crude oil were spilled over 180,000 km2 in the Gulf of Mexico, causing immense environmental damage. It was according to Greenpeace, the worst environmental disaster in North American history.[68]

216 In other words, to undo the net benefits of the Carmichael Project, an environmental catastrophe of the same order of magnitude as the Deepwater Horizon event would have to occur during the life of the mine. This would seem unlikely.

217 I conclude that the benefits of the Project exceed its costs including any reasonable environmental cost that might occur but has not been counted in the CBA.

[67] http://www.theguardian.com/business/2014/feb/04/bp-deepwater-horizon-bill-rises-profits-fall

[68] http://www.greenpeace.org/usa/en/news-and-blogs/news/The-BP-Oil-Spill-One-Year-Later/

8 Conclusions

218 The analysis in this report shows that the economic benefit of the Carmichael Project is very large.

219 The CGE analysis shows a highly positive economic impact on incomes in the MIW region, Queensland and Australia. In Queensland, real incomes will rise between $18.6 billion and $22.8 billion, in real present value terms.

220 This estimated impact is conservative in that it assumes labour that is employed in the Project is drawn from other industries, apart from small labour supply effects. This assumption necessarily places a limit on the extent to which the Project can increase output and incomes in the economy.

221 The Cost Benefit Analysis (CBA) shows that net benefits, in real present value terms, range between $12.3 billion and $16.6 billion, if estimates of consumer surplus are excluded from the analysis. If they are included, the net benefits range from $34.5 billion and $44.3 billion. The costs included in the CBA include the cost of GHGs from the mine and from the electicity that is used to power the mine, at an average carbon price of $126 per tonne.

222 The conclusion that the benefits of the Project well exceed its costs does not change even if much lower coal prices, much lower coal volumes and much higher environmental costs are assumed.

Attachment A Modelling of the economic impacts

A.1 Overview of input-output multipliers and computable general equilibrium models

Input-output (I-O) tables are at the heart of both multiplier analysis and CGE models. Input-output tables provide a comprehensive picture of the supply and consumption of all commodities within the economy, including detailed information on factor incomes, taxes and the source (domestic or foreign) of every commodity. They are essentially the bottom-up accounting framework that underlies the calculation of aggregate GDP. Unlike the GDP accounts, however, I-O tables retain all intermediate consumption and therefore provide a detailed picture of the structure and interrelationships of industries. An important feature of I-O tables is that they are fully balanced matrices. For example, production costs (including returns to factors of production) equals sales revenue.

I-O multipliers are summary measures generated from input-output tables that can be used for predicting the total impact on all industries in the economy of changes in demand for the output of any one industry. The tables and multipliers can also be used to measure the relative importance of the product chain linkages to different parts of the economy. In most circumstances, the results of I-O multiplier analysis should be treated as upper level impacts.

CGE models mimic the workings of the economy through a system of interdependent behavioural and accounting equations which are linked to an input-output database. These models provide a representation of the whole economy, set in a national and international trading context, starting with individual markets, producers and consumers and building up the system via demands and production from each component. When an economic shock or disturbance is applied to a model, each of the markets adjusts according to the set of behavioural parameters which are underpinned by economic theory. The generalised nature of CGE models enable a much broader range of analysis to be undertaken (generally in a more robust manner) compared to I-O multiplier techniques.

Limitations of I-O Analysis

The limitations of the I-O analysis relate to four key simplifying assumptions underpinning the model:

- Each industry in the I-O table is assumed to produce a single output
- There can be no substitution between the goods or services of different industry sectors (or their source)
- There are constant returns to scale in production such that the inputs to production of all industry sectors are in fixed proportion to the level of output from that industry
- The total effect of production in several sectors is equal to the sum of the separate effects.

Therefore, particular care should be used when interpreting multiplier impacts, as they represent a linear response from the increase in final demand under implicit assumptions that an economy or industry has no spare capacity and that the productivity of that industry is constant.

The I-O approach ignores the opportunity costs associated with diverting resources from other productive activities as the model has no mechanism whereby the prices of factors

(land, labour and capital) adjust in response to changes in demand. As such, I-O analysis does not consider the efficiency of an investment and the wider social implications. I-O analyses are not well suited to the analysis of social or population changes that might arise over the life of a project.

Weaknesses of CGE modelling

One complaint sometimes levelled at CGE modelling is that the models are 'black boxes'. In part this complaint arises because of the computing used to drive the model and the thousands of simultaneous equations which are solved to reach a modelled equilibrium. However, it must be stressed that the equations which underpin the credible models used in Australia are based on rigorous economic theory.

This theory and the use of the models are generally well understood and respected by Australian Government decision makers. CGE models can be a powerful tool for understanding the implications of a project to a region and the State as it recognises not only the direct and second round impacts but the third and fourth round etc. impacts of a project in a region.

A weakness of CGE models is that they can only model market impacts on economic variables such as regional gross product, consumption, production and population etc. CGE models generally do not have the capacity to model wider social or environmental impacts although various modern models have attempted to capture some of these aspects (such as greenhouse gas emissions which are widely modelled using CGE models or incorporating the value of leisure time into the household decision making functions).

A.2 The *Tasman Global* model

ACIL Allen's computable general equilibrium model *Tasman Global* is a powerful tool for undertaking economic impact analysis at the regional, state, national and global level.

There are various types of economic models and modelling techniques. Many of these are based on partial equilibrium analysis that usually considers a single market. However, in economic analysis, linkages between markets and how these linkages develop and change over time can be critical. *Tasman Global* has been developed to meet this need.

Tasman Global is a large-scale computable general equilibrium model which is designed to account for all sectors within an economy and all economies across the world. ACIL Allen uses this modelling platform to undertake industry, project, scenario and policy analyses. The model is able to analyse issues at the industry, global, national, state and regional levels and to determine the impacts of various economic changes on production, consumption and trade at the macroeconomic and industry levels.

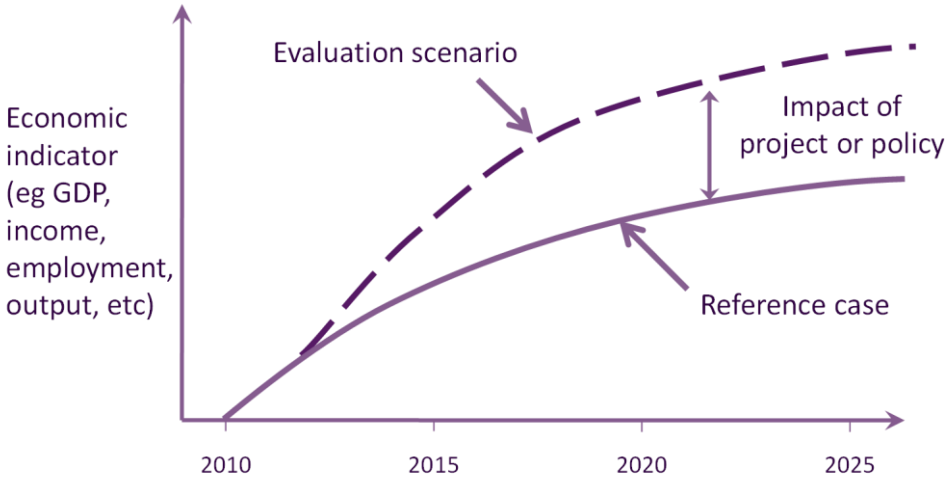
A dynamic model

Tasman Global is a model that estimates relationships between variables at different points in time. This is in contrast to comparative static models, which compare two equilibriums (one before a policy change and one following). A dynamic model such as *Tasman Global* is beneficial when analysing issues where both the timing of and the adjustment path that economies follow are relevant in the analysis.

In applications of the *Tasman Global* model, a Reference Case simulation forms a 'business-as-usual' basis with which to compare the results of various simulations. The Reference Case provides projections of growth in the absence of the changes to be

examined. The impact of the change to be examined is then simulated and the results interpreted as deviations from the Reference Case (see Figure A1).

Figure A1 **Illustrative scenario analysis using *Tasman Global***



Source: ACIL Allen Consulting

The database

A key advantage of *Tasman Global* is the level of detail in the database underpinning the model. The database is derived from the latest Global Trade Analysis Project (GTAP) database (version 8.1). This database is a fully documented, publicly available global data base which contains complete bilateral trade information, transport and protection linkages among regions for all GTAP commodities.

The GTAP model was constructed at the Centre for Global Trade Analysis at Purdue University in the United States. It is the most up-to-date, detailed database of its type in the world.

Tasman Global builds on the GTAP model's equation structure and database by adding the following important features:

- dynamics (including detailed population and labour market dynamics)
- detailed technology representation within key industries (such as electricity generation and iron and steel production)
- disaggregation of a range of major commodities including iron ore, bauxite, alumina, primary aluminium, brown coal, black coal and LNG
- the ability to repatriate labour and capital income
- a detailed emissions accounting abatement framework
- explicit representation of the states and territories of Australia
- the capacity to explicitly represent multiple regions within states and territories of Australia.

Nominally the *Tasman Global* database divides the world economy into 141 regions (133 international regions plus the 8 states and territories of Australia) although in reality the regions are frequently disaggregated further. ACIL Allen regularly models Australian projects or policies at the regional level.

The *Tasman Global* database also contains a wealth of sectoral detail currently identifying up to 70 industries (Table A1). The foundation of this information is the input-output tables that underpin the database. The input-output tables account for the distribution of industry production to satisfy industry and final demands. Industry demands, so-called intermediate usage, are the demands from each industry for inputs.

For example, electricity is an input into the production of communications. In other words, the communications industry uses electricity as an intermediate input. Final demands are those made by households, governments, investors and foreigners (export demand). These final demands, as the name suggests, represent the demand for finished goods and services. To continue the example, electricity is used by households – their consumption of electricity is a final demand.

Each sector in the economy is typically assumed to produce one commodity, although in *Tasman Global*, the electricity, transport and iron and steel sectors are modelled using a 'technology bundle' approach. With this approach, different known production methods are used to generate a homogeneous output for the 'technology bundle' industry. For example, electricity can be generated using brown coal, black coal, petroleum, base load gas, peak load gas, nuclear, hydro, geothermal, biomass, wind, solar or other renewable based technologies – each of which have their own cost structure.

Table A1 **Sectors in the *Tasman Global* database**

	Sector		Sector
1	Paddy rice	36	Paper products, publishing
2	Wheat	37	Diesel (incl. nonconventional diesel)
3	Cereal grains nec	38	Other petroleum, coal products
4	Vegetables, fruit, nuts	39	Chemical, rubber, plastic products
5	Oil seeds	40	Iron ore
6	Sugar cane, sugar beef	41	Bauxite
7	Plant- based fibres	42	Mineral products nec
8	Crops nec	43	Ferrous metals
9	Bovine cattle, sheep, goats, horses	44	Alumina
10	Animal products nec	45	Primary aluminium
11	Raw milk	46	Metals nec
12	Wool, silk worm cocoons	47	Metal products
13	Forestry	48	Motor vehicle and parts
14	Fishing	49	Transport equipment nec
15	Brown coal	50	Electronic equipment
16	Black coal	51	Machinery and equipment nec
17	Oil	52	Manufactures nec
18	Liquefied natural gas (LNG)	53	Electricity generation
19	Other natural gas	54	Electricity transmission and distribution
20	Minerals nec	55	Gas manufacture, distribution
21	Bovine meat products	56	Water
22	Meat products nec	57	Construction
23	Vegetables oils and fats	58	Trade
24	Dairy products	59	Road transport
25	Processed rice	60	Rail and pipeline transport
26	Sugar	61	Water transport
27	Food products nec	62	Air transport
28	Wine	63	Transport nec
29	Beer	64	Communication
30	Spirits and RTDs	65	Financial services nec
31	Other beverages and tobacco products	66	Insurance
32	Textiles	67	Business services nec
33	Wearing apparel	68	Recreational and other services
34	Leather products	69	Public Administration, Defence, Education, Health
35	Wood products	70	Dwellings

Note: nec = not elsewhere classified

The other key feature of the database is that the cost structure of each industry is also represented in detail. Each industry purchases intermediate inputs (from domestic and imported sources) primary factors (labour, capital, land and natural resources) as well as paying taxes or receiving subsidies.

Factors of production

Capital, land, labour and natural resources are the four primary factors of production. The capital stock in each region (country or group of countries) accumulates through investment (less depreciation) in each period. Land is used only in agriculture industries and is fixed in each region. *Tasman Global* explicitly models natural resource inputs as a sector specific factor of production in resource based sectors (coal mining, oil and gas extraction, other mining, forestry and fishing).

Population growth and labour supply

Population growth is an important determinant of economic growth through the supply of labour and the demand for final goods and services. Population growth for the 112 international regions and for the 8 states and territories of Australia represented in the *Tasman Global* database is projected using ACIL Allen's in-house demographic model. The demographic model projects how the population in each region grows and how age and gender composition changes over time and is an important tool for determining the changes in regional labour supply and total population over the projection period.

For each of the 120 regions in *Tasman Global*, the model projects the changes in age-specific birth, mortality and net migration rates by gender for 101 age cohorts (0-99 and 100+). The demographic model also projects changes in participation rates by gender by age for each region, and, when combined with the age and gender composition of the population, endogenously projects the future supply of labour in each region. Changes in life expectancy are a function of income per person as well as assumed technical progress on lowering mortality rates for a given income (for example, reducing malaria-related mortality through better medicines, education, governance etc.). Participation rates are a function of life expectancy as well as expected changes in higher education rates, fertility rates and changes in the work force as a share of the total population.

Labour supply is derived from the combination of the projected regional population by age by gender and the projected regional participation rates by age by gender. Over the projection period labour supply in most developed economies is projected to grow slower than total population as a result of ageing population effects.

For the Australian states and territories, the projected aggregate labour supply from ACIL Allen's demographics module is used as the base level potential workforce for the detailed Australian labour market module, which is described in the next section.

The Australian labour market

Tasman Global has a detailed representation of the Australian labour market which has been designed to capture:

- different occupations;
- changes to participation rates (or average hours worked) due to changes in real wages;
- changes to unemployment rates due to changes in labour demand;
- limited substitution between occupations by the firms demanding labour and by the individuals supplying labour; and
- limited labour mobility between states and regions within each state.

Tasman Global recognises 97 different occupations within Australia – although the exact number of occupations depends on the aggregation. The firms who hire labour are provided with some limited scope to change between these 97 labour types as the relative real wage between them changes. Similarly, the individuals supplying labour have a limited ability to change occupations in response to the changing relative real wage between occupations. Finally, as the real wage for a given occupation rises in one state relative to other states, workers are given some ability to respond by shifting their location. The model produces results at the 97 3-digit ANZSCO (Australian New Zealand Standard Classification of Occupations) level which are presented in Table A2.

The labour market structure of *Tasman Global* is thus designed to capture the reality of labour markets in Australia, where supply and demand at the occupational level do adjust, but within limits.

Labour supply in *Tasman Global* is presented as a three stage process:

1. labour makes itself available to the workforce based on movements in the real wage and the unemployment rate;
2. labour chooses between occupations in a state based on relative real wages within the state; and
3. labour of a given occupation chooses in which state to locate based on movements in the relative real wage for that occupation between states.

By default, *Tasman Global*, like all CGE models, assumes that markets clear. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model).

Table A2 **Occupations in the Tasman Global database, ANZSCO 3-digit level (Minor Groups)**

ANZSCO code, Description	ANZSCO code, Description	ANZSCO code, Description
1. MANAGERS	**3. TECHNICIANS & TRADES WORKERS**	**5. CLERICAL & ADMINISTRATIVE**
111 Chief Executives, General Managers and Legislators	311 Agricultural, Medical and Science Technicians	511 Contract, Program and Project Administrators
121 Farmers and Farm Managers	312 Building and Engineering Technicians	512 Office and Practice Managers
131 Advertising and Sales Managers	313 ICT and Telecommunications Technicians	521 Personal Assistants and Secretaries
132 Business Administration Managers	321 Automotive Electricians and Mechanics	531 General Clerks
133 Construction, Distribution and Production Managers	322 Fabrication Engineering Trades Workers	532 Keyboard Operators
134 Education, Health and Welfare Services Managers	323 Mechanical Engineering Trades Workers	541 Call or Contact Centre Information Clerks
135 ICT Managers	324 Panelbeaters, and Vehicle Body Builders, Trimmers and Painters	542 Receptionists
139 Miscellaneous Specialist Managers	331 Bricklayers, and Carpenters and Joiners	551 Accounting Clerks and Bookkeepers
141 Accommodation and Hospitality Managers	332 Floor Finishers and Painting Trades Workers	552 Financial and Insurance Clerks
142 Retail Managers	333 Glaziers, Plasterers and Tilers	561 Clerical and Office Support Workers
149 Miscellaneous Hospitality, Retail and Service Managers	334 Plumbers	591 Logistics Clerks
	341 Electricians	599 Miscellaneous Clerical and Administrative Workers
2. PROFESSIONALS	342 Electronics and Telecommunications Trades Workers	**6. SALES WORKERS**
211 Arts Professionals	351 Food Trades Workers	611 Insurance Agents and Sales Representatives
212 Media Professionals	361 Animal Attendants and Trainers, and Shearers	612 Real Estate Sales Agents
221 Accountants, Auditors and Company Secretaries	362 Horticultural Trades Workers	621 Sales Assistants and Salespersons
222 Financial Brokers and Dealers, and Investment Advisers	391 Hairdressers	631 Checkout Operators and Office Cashiers
223 Human Resource and Training Professionals	392 Printing Trades Workers	639 Miscellaneous Sales Support Workers
224 Information and Organisation Professionals	393 Textile, Clothing and Footwear Trades Workers	**7. MACHINERY OPERATORS & DRIVERS**
225 Sales, Marketing and Public Relations Professionals	394 Wood Trades Workers	711 Machine Operators
231 Air and Marine Transport Professionals	399 Miscellaneous Technicians and Trades Workers	712 Stationary Plant Operators
232 Architects, Designers, Planners and Surveyors	**4. COMMUNITY & PERSONAL SERVICE**	721 Mobile Plant Operators
233 Engineering Professionals	411 Health and Welfare Support Workers	731 Automobile, Bus and Rail Drivers
234 Natural and Physical Science Professionals	421 Child Carers	732 Delivery Drivers
241 School Teachers	422 Education Aides	733 Truck Drivers
242 Tertiary Education Teachers	423 Personal Carers and Assistants	741 Storepersons
249 Miscellaneous Education Professionals	431 Hospitality Workers	**8. LABOURERS**
251 Health Diagnostic and Promotion Professionals	441 Defence Force Members, Fire Fighters and Police	811 Cleaners and Laundry Workers
252 Health Therapy Professionals	442 Prison and Security Officers	821 Construction and Mining Labourers
253 Medical Practitioners	451 Personal Service and Travel Workers	831 Food Process Workers
254 Midwifery and Nursing Professionals	452 Sports and Fitness Workers	832 Packers and Product Assemblers
261 Business and Systems Analysts, and Programmers		839 Miscellaneous Factory Process Workers
262 Database and Systems Administrators, and ICT Security Specialists		841 Farm, Forestry and Garden Workers
263 ICT Network and Support Professionals		851 Food Preparation Assistants
271 Legal Professionals		891 Freight Handlers and Shelf Fillers
272 Social and Welfare Professionals		899 Miscellaneous Labourers

Source: ABS (2009), ANZSCO – Australian and New Zealand Standard Classifications of Occupations, First Edition, Revision 1, ABS Catalogue no. 1220.0.

Greenhouse gas emissions

The model has a detailed greenhouse gas emissions accounting, trading and abatement framework that tracks the status of six anthropogenic greenhouse gases (namely, carbon

dioxide, methane, nitrous oxide, HFCs, PFCs and SF_6). Almost all sources and sectors are represented; emissions from agricultural residues and land-use change and forestry activities are not explicitly modelled.

The greenhouse modelling framework not only allows accounting of changes in greenhouse gas emissions, but also allows various policy responses such as carbon taxes or emissions trading to be employed and assessed within a consistent framework. For example, the model can be used to measure the economic and emission impacts of a fixed emissions penalty in single or multiple regions whether trading is allowed or not. Or, it can be used to model the emissions penalty required to achieve a desired cut in emissions based on various trading and taxation criteria.

Detailed energy sector and linkage to *PowerMark* and *GasMark*

Tasman Global contains a detailed representation of the energy sector, particularly in relation to the interstate (trade in electricity and gas) and international linkages across the regions represented. To allow for more detailed electricity sector analysis, and to aid in linkages to bottom-up models such as ACIL Allen's *GasMark* and *PowerMar*k models electricity generation is separated from transmission and distribution in the model. In addition, the electricity sector in the model employs a 'technology bundle' approach that separately identifies up to twelve different electricity generation technologies:

1. brown coal (with and without carbon capture and storage)
2. black coal (with and without carbon capture and storage)
3. petroleum
4. base load gas (with and without carbon capture and storage)
5. peak load gas
6. hydro
7. geothermal
8. nuclear
9. biomass
10. wind
11. solar
12. other renewables.

To enable more accurate linking to *PowerMark* the generation cost of each technology is assumed to be equal to their long run marginal cost (LRMC) while the sales price in each region is matched to the average annual dispatch weighted prices projected by *PowerMark* – with any difference being returned as an economic rent to electricity generators. This representation enables the highly detailed market based projections from *PowerMark* to be incorporated as accurately as possible into *Tasman Global*.

A.3 Database aggregation

The database which underpins the model contains a wealth of sectoral detail. The foundation of this information is the set of input-output tables that underpin the database. Industries and regions in the model can be aggregated or disaggregated as required for a specific project. For this project the model has been aggregated to:

- Four economies, namely the Local affected LGA's, the Rest of Queensland, the Rest of Australia and the Rest of the World

— Forty-two industries/commodities as presented in Table A3.

The aggregation was chosen to provide the maximum detail possible for the key industries in the Queensland economy.

Table A3 **Industry/Commodity aggregation used in Tasman Global modelling**

	Industry/Commodity		Industry/Commodity
1	Crops	22	Chemicals, rubber, plastics
2	Livestock	23	Textiles, clothing and footwear
3	Fishing	24	Wood and paper products; publishing and printing (excluding furniture)
4	Forestry	25	Fabricated metal products
5	Sugar cane	26	Motor vehicle and parts
6	Processed food	27	Electronic equipment
7	Sugar	28	Other machinery and equipment
8	Coal	29	Other manufacturing
9	Oil	30	Water
10	Gas	31	Construction
11	Electricity	32	Trade services (includes all retail and wholesale trade, hotels and restaurants)
12	Petroleum & coal products	33	Road, rail, pipeline and other transport
13	Iron & steel	34	Water transport services
14	LNG	35	Air transport services
15	Iron ore	36	Communications services
16	Bauxite	37	Other financial services
17	Other mining	38	Insurance services
18	Alumina	39	Other business services (including financial, insurance, real estate services)
19	Primary aluminium	40	Recreational and other services
20	Other nonferrous metals	41	Government services (including public administration and defence)
21	Non metallic minerals (including cement, plaster, lime, gravel)	42	Dwellings

Note: Excludes micro-industries developed specifically for this analysis

Data source: ACIL Allen aggregation

Micro industry approach

To accurately assess the economic impacts or economic contribution of a major project, such as the Project, it must be accurately represented in the model's database. An accurate representation can be guaranteed by establishing the proposed project as a new 'micro' industry in the database.

The micro industry approach is so called because it involves the creation of one or more new, initially very small, industries in the *Tasman Global* database. The specifications of each of the micro industry's costs and sales structures are directly derived from the financial data for the project to be analysed. At the outset, the new industry is necessarily very small so that its existence in the *Tasman Global* database does not affect the database balance or the "business-as-usual" Reference Case outcomes.

Besides having a separate cost structure for the project of interest, a further challenge is to faithfully represent the time profile of the individual cost items. This is particularly important for the investment phase where there are typically large changes in demands for machinery,

labour and imported components year on year. This challenge is met in *Tasman Global* through incorporating detailed year on year, input specific shocks by source

Using the micro industry approach for project evaluations is the most accurate way to capture the detailed economic linkages between the project and the other industries in the economy. This approach has been developed by ACIL Allen because each project is unique relative to the more aggregated industries in the *Tasman Global* database.

Consequently, in addition to the 42 industries identified in Table A3, the database also identified the construction and operation phases of the Carmichael Coal Mine and Rail Project as separate industries with their own input cost structure, sales, employment, tax revenues and emissions based on detailed information provided to ACIL Allen by Adani.

Another important aspect in the CGE modelling approach used for this analysis is to have separate identification of the capital stock created as part of the project's investment phase and isolating it until the capital is available for use, thereby preventing the economy gaining false benefits from, say, half a bridge. In the past, some CGE models potentially overstated the impact of an investment, because investment in one period was automatically added to capital stock in the next period and was made available to the rest of the economy, thereby spuriously increasing GDP.

As mentioned in Section A.2, the model has the ability to explicitly account for the repatriation of profits (for example through foreign ownership of capital or through the use of fly-in, fly-out or drive-in, drive-out workers). For this project, 100 per cent of the capital has been assumed to be foreign owned while 40 per cent of workers have been assumed to live in the local region, 55 per cent sourced from the Rest of Queensland with the remaining 5 per cent sourced from interstate. As with any asset, the ownership is not guaranteed to remain the same in the future.

Attachment B Data

Table B1 **Data used in CGE analysis and CBA**

	Coal Mined (Mt)	Product Coal (Mt)	Coal Price ($US nominal)	Coal Price ($A real AFY 2014-15)	Capital expenditure ($A million real AFY 2014-15)	Sustaining capex per Mt ($A real AFY 2014-15)	Operating expenditure per Mt ($A real AFY 2014-15)	Selling costs per Mt ($A real AFY 2014-15)	Rail Costs ($A million real AFY 2014-15)	Carbon price ($A real AFY 2014-15)	Carbon costs ($A million real AFY 2014-15)	Decline in land values ($A million real AFY 2014-15)	Rehab. costs ($A million real AFY 2014-15)	Royalties ($A million real AFY 2014-15)	Corporate tax ($A million real AFY 2014-15)
2014	0	0			772.5	0								0	0
2015	0	0			171.91	0								0	0
2016	0	0			601.6	0			833.33			3.59		0	0
2017	0.19	0.19	78.67	88.18	1418.17	0	151.79	18.5	833.33	8.68	0.06		116.69	1.15	0
2018	8.72	7.92	67.22	73.51	611.13	0	75.23	18.55	833.33	8.93	2.69			40.73	0
2019	29.54	27.53	73.63	78.56	104.83	0	31.36	17.7		9.28	9.73			151.4	0
2020	42.91	40.26	77.72	80.9	156.92	0	23.49	17.79		9.63	14.77			227.98	0
2021	43.08	40.52	79.58	80.82	62.03	1.18	24.78	18.1		13.24	20.44			229.25	96.45
2022	43.52	41.16	84.83	84.05	34.39	1.18	23.94	18.56		26.61	41.73			248.94	338.11
2023	44.35	41.91	91.41	88.36	27.43	1.18	23.3	16.59		39.99	63.84			283.32	434
2024	44.17	40.66	93	87.7	150.5	1.18	24.78	16.96		53.36	82.65			278.17	395.74
2025	43.92	40.71	96.13	88.44	51.67	1.18	26.63	17.21		66.74	103.51			288.67	383.63
2026	44.88	42.19	99.1	88.95	27.04	1.18	24.84	17.59		80.13	128.79			308.09	431.51
2027	43.22	40.4	102.81	90.03	86.78	1.18	25.98	18.31		93.5	143.90			306.06	408.2
2028	43.25	40.59	105.97	90.53	103.62	1.18	24.38	16.4		106.88	165.27			315.55	469
2029	42.93	39.88	110.47	92.07	170.76	1.18	24.11	15.75		120.25	182.67			323.12	486.83
2030	42.08	39.06	114.34	92.98	121.35	1.18	25.2	16.09		133.62	198.83			328.78	473.63
2031	41.38	38.66	115.73	91.81	55.67	1.18	26.8	16.63		144.73	213.14			325.33	441.23
2032	40.94	37.96	116.86	90.45	226.56	1.18	24.58	17.16		149.07	215.56			318.02	449.61
2033	39.54	36.53	118.15	89.22	196.04	1.18	23.85	14.89		153.55	213.69			305.26	450.26
2034	40.62	37.57	120.5	88.77	41.77	1.18	23.73	15.23		158.15	226.37			317.33	461.64
2035	40.89	38.06	123.75	88.94	57.1	1.18	23.94	15.76		162.9	236.18			327.84	468.51
2036	39.98	37.13	125.66	88.11	74.57	1.18	24.57	16.15		167.78	237.34			319.62	440.42
2037	40.3	37.51	128.77	88.09	41.16	1.18	23.97	16.57		172.82	246.93			326.97	450.73
2038	39.93	36.77	131.27	87.61	23.06	1.18	23.95	14.35		178.00	249.34			321.84	457.19

	Coal Mined (Mt)	Product Coal (Mt)	Coal Price ($US nominal)	Coal Price ($A real AFY 2014-15)	Capital expenditure ($A million real AFY 2014-15)	Sustaining capex per Mt ($A real AFY 2014-15)	Operating expenditure per Mt ($A real AFY 2014-15)	Selling costs per Mt ($A real AFY 2014-15)	Rail Costs ($A million real AFY 2014-15)	Carbon price ($A real AFY 2014-15)	Carbon costs ($A million real AFY 2014-15)	Decline in land values ($A million real AFY 2014-15)	Rehab. costs ($A million real AFY 2014-15)	Royalties ($A million real AFY 2014-15)	Corporate tax ($A million real AFY 2014-15)
2039	39.47	36.33	132.43	86.23	66.29	1.18	23.45	14.71		183.34	253.73			314.39	444.26
2040	37.64	34.64	134.75	85.6	30.11	1.18	23.87	15.25		188.84	249.18			300.14	410.97
2041	30.96	28.13	133.15	82.52	83.45	1.18	26.18	15.66		194.51	208.40			233.81	284.33
2042	28	25.17	133.22	80.55	36.89	1.18	25.16	16.07		200.34	192.07			204.36	246.52
2043	28	24.9	135.11	79.7	56.18	1.18	25.24	16.21		206.35	195.70			201.55	241
2044	28	24.98	137.11	78.91	9.14	1.18	25.32	16.83		212.54	202.27			201.82	236.84
2045	28	25.14	140.52	78.9	32.31	1.18	24.96	17.26		218.92	209.67			205.42	242.7
2046	28	22.78	143.66	78.7	0	1.18	27.78	17.45		225.49	195.71			187.47	199.91
2047	14	12.48	146.14	78.1	2	1.18	24.58	18.19		232.25	110.40			102.67	123.39

Notes:

Years are AFY ending 31 March

Real data calculated assuming 2.5% annual inflation

$US/$A exchange rate for 2013-14 is 0.9148

$US/$A exchange rate from 2014-15 onward is 0.8491

GBP/$A exchange rate used to calculate carbon prices in $A is 0.5406
Capex for 2013/14 includes prior years
Source: data coal volumes, prices, capital expenditure, operating expenditure, selling costs and royalties provided by Adani.
Source for rail cost: Instructions from McCullough Robertson

Attachment C Curriculum Vitae

Personal

Born: 14 March 1960, Sydney Australia

Nationalities: Australian, French

Residential Address: 6 Hector Street
Brighton
Victoria 3186

Employment

Currently: Director, ACIL Allen Consulting (until April 2013, Allen Consulting Group), January 1995 – currently

In this role I provide economics and public policy advice to corporates and governments, in the areas of competition policy and litigation, regulation, project and industry evaluation, program evaluation and economic policy. I have led around 300 major consulting projects (details available on request).

j.fahrer@acilallen.com.au

www.acilallen.com.au

Member of the Board of Directors, Alzheimer's Australia (Victoria)

The Board provide the strategic direction for the organisation, ensure internal and external accountability and supervise the overall business and compliance performance of AAV.

Member, Essential Services Commission of Victoria Appeal Panel

Previously: Member, Tasmanian Government Expert Panel reviewing the electricity supply industry (2010-2012)

Principal Fellow (Associate Professor) Melbourne Business School, 2006-2011

Reserve Bank of Australia (January 1982 – December 1994): head of macroeconomic research

Education

B. Com (Hons) UNSW, 1981, first class honours, major in economics and econometrics

MPA Princeton University, 1987

MA Princeton University 1987

PhD Princeton University 1989

Dissertation: Three Essays on Comparative Macroeconomics

Adviser: Professor Ben Bernanke

Academic Honours and Awards

Woodrow Wilson Fellowship, Princeton University, 1985–1989

Olin Foundation Research Fellowship, Princeton University, 1988

Readers Digest Prize for Excellence in Teaching, Princeton University, 1988

Brinds Ltd Prize for Best Performance in Third Year Economics, UNSW 1980

Independent expert/litigation support engagements

- Ashton Coal in relation to the proceedings commenced by Hunter Environment Lobby Inc in the NSW Land and Environment Court Matter No. 11154 of 2012 (2013).
- Guardian Property & Asset Management in proceedings against JLF Corporation Pty Ltd Federal Court Proceedings VID 1019 / 2012 (2013)
- A major chemicals manufacturer on the economics of the transportation and disposal of hazardous waste (2012)
- Betfair, in its dispute with Racing NSW on the discriminatory and protectionist characteristics of racing fields fees (2010)
- Sony Music and Universal Music on the economics of the digital music industry (2009)
- AGL, in its dispute with Origin Energy on the wholesale price of natural gas (2009)
- Two large manufacturers on damages arising from the Visy Amcor packaging cartel (2007, 2008)
- Donaldson Coal on the proposed vessel queue management system at the Port of Newcastle (2007)
- Wilson Transformer Company on damage estimation from price fixing in the electrical transformer industry (2006)
- Reserve Bank of Australia (designation of EFTPOS system) (2005)
- A large wine company on changing supply and demand conditions in the wine industry (contract dispute) (2005)
- NEMMCO on compensation for Directed Parties under the National Electricity Rules (2005 – 2010)
- NEMMCO on competition in system restart ancillary services (2005)
- NEMMCO on the structure of Participant Fees (2002, 2005, 2006)
- Gerrard Signode on interpretation and application of 'internationally competitive' pricing (contract dispute) (2005)
- A major energy utility on the trade practices implications of the sale of the Dampier to Bunbury Natural Gas Pipeline (2004)
- A large gas producer on how gas prices affect electricity costs and prices (contract negotiations) (2005)
- A large gas producer on the competitiveness of South Australian gas in the national electricity (contract negotiations) (2004)
- AMP Henderson for its Airports Fund Prospectus (2001)

Consulting projects on resources industry matters

- Clean Energy Finance Corporation on capital market failures affecting the financing of renewable energy projects (2013)
- AGL on the economics of coal seam gas in the Hunter Valley (2013)
- Actew AGL on calculating the CARC for an efficient full-market electricity retailer in the ACT (2012)
- Consumer Advocacy Panel (2010 and 2011) — Evaluation of grants directed towards consumer advocacy and research on electricity and gas issues
- Victorian Department of Treasury and Finance on climate change adaptation (2010)

- Victorian Government on the economics of carbon capture and storage (2010)
- Victorian Department of Premier and Cabinet on policy measures to achieve energy efficiency in domestic dwellings (2010)
- Australian Energy Market Commission — Review of the effectiveness of retail electricity competition in the ACT (2010)
- Independent Market Operator of Western Australia — cost of capital for electricity generation (2010)
- BHP Billiton on greenhouse gas emissions trading (2007, 2008)

Publications

Academic Journals

"Broadband in Australia: Present and Future", *The Melbourne Review*, Vol 2(2) November 2006

"Public Hospital Costs in Two Australian States", (with Justin G. Fung and Ian R. Harper), *Australian Economic Review, Vol.33, No.2,* June 2000

"Leader or Also Ran? Australia's Competitive Position in Asia Pacific Regional Financial Markets" (with V FitzGerald), forthcoming, *Journal of Applied Finance and Investment* Special Supplement, 1997

"Capital Constraints and Employment" (with John Simon), *Australian Economic Review,* 1st Quarter, 1995

"The Unemployment–Vacancy Relationship in Australia", (with Andrew Pease) *Australian Economic Review*, 4th Quarter, 1993.

"Some Tests of Competition in the Australian Housing Loan Market", (with Thomas Rohling), *Australian Economic Papers*, December 1994

"Financial Deregulation and the Monetary Transmission Mechanism", (with Thomas Rohling), *Australian Economic Review*, 1st quarter, 1992, reprinted in Peter Stemp and Judith Milne–Pott (ed), *Australian Readings in Monetary and Financial Economics*., Longman, Melbourne, 1996.

Books and Conference Volumes

"International Trade and the Australian labour market", (with Andrew Pease) in P Lowe and J Dwyer (eds), *The International Integration of the Australian Economy*, Reserve Bank of Australia, 1994

"Major Influences on the Australian Dollar Exchange Rate", (with Adrian Blundell–Wignall and Alexandra Heath), in a Blundell–Wignall (ed), *The Exchange Rate, International Trade and the Balance of Payments*, Reserve Bank of Australia, 1993

"Is Pitchford Right? Current Account Adjustment, Exchange Rate Dynamics and Macroeconomic Policy" in M Johnson, P Kriesler and A Owen, (eds) *Contemporary Issues in Australian Economics*, MacMillan, Melbourne, 1991

"Some Macroeconomic Implications of Wage Indexation: A Survey", published in V E Argy and J W Nevile (eds) *Inflation and Unemployment: Theory, Experience and Policy Making*, George Allen and Unwin, London, 1985 (with J Carmichael and J Hawkins)

Reserve Bank of Australia Research Discussion Papers

"Wage dispersion and Labour Market Institutions: A Cross–Country Study", June 1994, (with Michael Coelli and Holly Lindsay)

"Capital constraints and Employment", June 1994, (with John Simon)

"The Unemployment–Vacancy Relationship in Australia", (with Andrew Pease) June 1993,

"The Evolution of Employment and Unemployment in Australia", (with Alexandra Heath), December 1992

"Indicators of Inflationary Pressure", (with Michael Coelli),July 1992

"Some Tests of Competition in the Australian Housing Loan Market", (with Thomas Rohling), February 1992

"Inflation in Australia: Causes, Inertia and Policy ", (with Justin Myatt), July 1991

"An Empirical Model of Australian Interest Rates, Exchange Rates and Monetary Policy (with Lynne–Ellen Shori), November 1990

"Financial Deregulation and the Monetary Transmission Mechanism", (with Thomas Rohling), November 1990.

"Wage Contracts, Sticky Prices and Exchange Rate Volatility: Evidence from Nine Industrial Countries", November 1990

"Is Pitchford Right? Current Account Adjustment, Exchange Rate Dynamics and Macroeconomic Policy", May 1990

"Optimal Wage Indexation, Monetary Policy and the Exchange Rate Regime", December 1989

"Modelling Recent Developments in Australian Asset Markets: Some Preliminary Results", (with R Rankin), August 1984

"The Equations of the RBA82 Model of the Australian Economy", (with R Rankin and J Taylor), August 1984

Book Reviews

A Wood, "North South Trade Employment and Inequality", in *Agenda, Vol2(3), 1995*

C DeNeubourg (ed) "The Art of Full Employment", in *Economic Analysis and Policy*, September 1993

R Barro, "Macroeconomic Policy", in *Economic Analysis and Policy*, March 1992

J Pitchford, "Australia's Foreign Debt: Myths and Realities", in *Economic Papers*, September 1990

Other

Various articles in the Australian Financial Review on economic policy

Referee for papers submitted to:

The Economic Record

The Australian Economic Review

Open Economies Review

The Journal of Macroeconomics

Invited Seminar Presentations

Princeton University, University of New South Wales, University of Sydney, Macquarie University, University of Melbourne, LaTrobe University, Victoria University of Wellington, Auckland University, Waikato University

Conference Presentations

5th World Econometric Congress, Barcelona, 1990; Australian Conference of Economists 1984, 1990, 1991, 1992, 1993, 1995, 1997; Australasian Meetings of the Econometric Society, 1991, 1993; Melbourne Money and Finance Conference 1996, Law Society of Australia Trade Practices Workshop 2006.

Other Professional Activities

Council Member, Economic Society of Australia (Victorian Branch) 1995–98 and 2013

Member, Law Society of Australia Competition and Consumer Committee, 2011-present

Honorary Treasurer, Economic Society of Australia, 1997–2000

Council Member and Vice President, Economic Society of Australia (NSW Branch) 1990-1994.

Member, American Economic Association.

Attachment D Instructions from McCullough Robertson

Partner Peter Stokes
Writer Claire Meiklejohn
Direct line 07 3233 8760
Email cmeiklejohn@mccullough.com.au
Our reference CEM:PWS:159359-00022

Lawyers | McCullough Robertson

29 January 2015

Dr J Fahrer
Director
ACIL Allen Consulting

Email J.Fahrer@acilallen.com.au

Dear Jerome

Adani Mining Pty Ltd v Land Services of Coast & Country Inc. & Anor Land Court of Queensland Proceedings no. MRA428-14, EPA429-14, MRA430-14, EPA431-14, MRA432-14 and EPA433-01

We refer to:

1 Mining Lease Applications (**MLAs**) 70441, 70505 and 70506 made by Adani Mining Pty Ltd (**Adani**);

2 the associated environmental authority application, as re-made on 14 April 2014;

3 the Environmental Impact Statement (**EIS**), Supplementary EIS (**SEIS**) and Additional Information to the EIS (**AEIS**) prepared for Adani and made publicly available under the *State Development and Public Works Organisation Act 1971* (Qld);

4 the draft Environmental Authority (**EA**) issued by the Statutory Party on 28 August 2011;

5 the Objection of Land Services of Coast and Country Inc (**LSCCI**) to the MLAs dated 16 June 2014;

6 the Objection of LSCCI to the EA made 10 September 2014;

7 the submission (dated 17 June 2014) and objection (dated 25 September 2014) about the EA made by Debi Goenka of the Conservation Action Trust (**CAT**);

8 the Preliminary List of Issues for the LSCCI dated 2 December 2014;

9 your joint report, with Mr R Campbell, dated 19 December 2014 (**Joint Report**); and.

10 our letter of instruction to you dated 29 January 2015.

Instructions

11 We require you to provide a further statement of evidence under the *Land Court Rules 2000* (Qld) (**Rules**).

12 In accordance with orders made by the Court, your further statement of evidence is required by **Friday, 6 February 2015**. However, as discussed with you, we have informed the LSCCI's solicitors that we will provide your statement of evidence one week early, i.e. by Friday, 30 January 2015.

13 We confirm the Land Court proceeding numbers are as listed in the subject line of these instructions.

Rail alignment

14 As you know, Adani is proceeding with the North Galilee Bain Rail Project alignment in preference to the full rail alignment as set out in the EIS and SEIS. The investment associated with this has been calculated at $2.2 billion.

15 However, a portion (but not all) of SP1 as presented in the EIS and SEIS will also be constructed, representing the first approximately 70 kilometres of rail leading from the mine itself. The investment associated with the whole of the rail aspect of the project is approximately $2.5B (inclusive of contingency and transactional costs).

16 The revised SP1 alignment will no longer connect directly with the existing Goonyella or Newlands rail systems.

Ramp up of production

17 Evidence has already been produced for Adani explaining the Mine BFS scenario, the initial phase of which relates to construction and ramping up of production to 40 mtpa, covering a period of up to 30 years (see affidavit of Rajesh Kumar Gupta, **attached**). As you know, after this time, Adani anticipates a second phase of the project will begin, which is likely to see production increase to 60 mtpa. Accordingly, approval has been sought for up to 60 mtpa.

18 In our view, it is appropriate for your report to refer to the BFS scenario on which much of your analysis is based, given a greater level of detail is available for this initial phase. Your report should also note that approval is being sought for a higher rate in order to facilitate a subsequent second phase of the Mine (which will be the subject of further analyses at the appropriate time).

Intended market for product

19 Adani is continuing to negotiate coal offtakes with various parties. These negotiations are on an ongoing basis.

20 The product coal from the Mine will be of a quality which can be sold in the market generally in the region, including to countries such as China, Korea, Japan, Taiwan, Thailand and Malaysia, and may be spot traded. This is in addition to Adani's Indian entities engaged in power generation, who are seeking to secure a reliable source for coal for their expansion plans, as well other potential purchasers in India.

21 Domestic coal producers in India are unable to produce and distribute enough coal for all users. As India increases electrification, this supply gap will continue to grow (getting to 320MMT by 2025 according to Wood Mackenzie). There is a significant shortage of rail capacity to transport coal internally in India, and many power generation projects are located in coastal areas and built specifically for imported coal.

Format of report

22 When preparing the further statement of evidence, please deal with the following:

SECTION A - Qualifications and Curriculum Vitae

23 Please attach your curriculum vitae to the report.

SECTION B - Material relied on in preparing the statement

24 Lists are sufficient for the statement, however, it would be useful to ensure that you (and we) have a copy of all the listed material when finalising your report. In particular, you should list:

(a) all material facts, written or oral, on which the statement of evidence is based; and

(b) reference to any literature or other material relied on by you to prepare the statement.

25 You do not need to list material you have **not** relied on.

26 Any inspection, examination or experiment conducted, initiated or relied on by you to prepare the statement must also be described. This will involve describing the modelling work carried out, as you have been progressing.

SECTION C – Background to Report

27 Please set out the extent of your previous involvement in the Carmichael Coal Mine Project (**Mine**). Specifically, we would like you to:

(a) indicate whether you were involved in the preparation of any material in support of the proposed Mine and, if so, provide details of that work;

(b) confirm that you have since been engaged by McCullough Robertson, on behalf of Adani, to provide an expert report in the Land Court proceedings;

(c) confirm that you have read this letter of instruction (and attach a copy of this letter of instruction to your report), and confirm that you understand your duties to the Land Court as an expert witness;

(d) confirm that, notwithstanding your previous relationship with the Mine (if any), you consider you are able to provide an informed, independent opinion about the matters contained within your Report.

28 Please also include a note along the following lines:

I am instructed by Adani's solicitor Peter Stokes of McCullough Robertson that the Land Court is required to consider whether any good reason has been shown for a recommendation that the application be refused pursuant to section 269(4)(l) of the Mineral Resources Act. Although the Applicant complied with the Terms of Reference (section 5.1) and examined the economic benefits of the project based upon an Input-Output economic model an outcome so produced might be seen as providing an incomplete response to whether good reason has been shown to recommend a refusal of a grant of a mining lease. The report I have prepared examines the question of economic value based on two complementary models in order to answer the question of whether any good reason exists from an economic benefit standpoint to warrant an unfavourable recommendation for the grant of the lease.

SECTION D – Opinion on objections

29 Please review the objections and respond to any issues within your field of expertise which concern the MLAs and EAs.

30 All of the grounds of each objection are set out below for convenience.

MLAs objection

The application for the mining leases under the Mineral Resources Act 1989 (Qld) (MRA) for the Carmichael Coal Mine (the mine) should be refused on the basis of the considerations stated in section 269(4)(c), (f), (i), (j), (k), (l) and (m) of the MRA:

1. *If the mine proceeds, there will be severe and permanent adverse impacts caused by the operations carried out under the authority of the proposed mining leases.*

2. *If the mine proceeds, the public right and interest will be prejudiced.*

3. *Good reason has been shown for a refusal to grant the mining leases due to the risk of severe environmental impacts and the lack of scientific certainty regarding those impacts.*

4. *Taking into consideration the current and prospective uses of the land, the proposed mining operation is not an appropriate land use.*

5. *There is an unacceptable risk that will there will not be an acceptable level of development and utilisation of the mineral resources within the area applied for because the mine, if it proceeds at all, is likely to cease to be economically viable within the term of the lease, resulting in some or all of the environmental impacts without realising the full economic benefits predicted.*

6. *The Applicant does not have the necessary financial capabilities to carry on mining operations under the proposed mining leases.*

7. *If the mine proceeds, the operations to be carried on under the authority of the proposed mining leases will not conform with sound land use management.*

8. *In the alternative to grounds 1-7 above, if the applications are not refused, conditions should be imposed to address the matters raised in grounds 1-7.*

EA application objection

The application for the environmental authority for the Carmichael Coal Mine (the mine) should be refused under the Environmental Protection Act 1994 (Qld) (EPA) on the basis of the considerations stated in ss 3, 5, 171 and 191 of the EPA and other relevant considerations having regard to the subject-matter, scope and purpose of the EPA:

1. *Approval of the mine is contrary to the object of the EPA stated in s 3 because approval and construction of the mine will not protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development).*

2. *Approval of the mine would be contrary to the requirement in s 5 of the EPA for the administering authority and the Land Court to perform a function or exercise its power under the Act in a way that best achieves the object of the Act.*

3. *Approval and construction of the mine would be contrary to the precautionary principle, which is a principle of environmental policy as set out in the Intergovernmental Agreement on the Environment and, therefore, part of the standard criteria for the decision.*

4. *Approval and construction of the mine would be contrary to intergenerational equity, which is a principle of environmental policy as set out in the Intergovernmental Agreement on the Environment and, therefore, part of the standard criteria for the decision.*

5. *Approval and construction of the mine would be contrary to the conservation of biological diversity and ecological integrity, which is a principle of environmental policy as set out in the Intergovernmental Agreement on the Environment and, therefore, part of the standard criteria for the decision.*

6. *Approval and construction of the mine will cause environmental harm to the character, resilience and value of the receiving environment.*

7. *Approval and construction of the mine would be contrary to the public interest.*

8. *Approval and construction of the mine will cause material and serious environmental harm.*

9. *In the alternative to grounds 1-8 above, if the application is not refused, conditions should be imposed to address the matters raised in grounds 1-8 above.*

31 We also ask you to consider those 'Facts and Circumstances' relied on in support of each objection that are relevant to your field of expertise, namely:

(a) paragraphs 28 to 34 of the Facts and Circumstances in the MLAs objection; and

(b) paragraphs 28 and 29 of the Facts and Circumstances in the EA objection.

32 Your further statement of evidence should also build on your joint expert report, which sets out in detail those notified issues relevant to your field of expertise. Please note that, pursuant to the Rules, your further statement may not:

(a) contradict, depart from or qualify an opinion in relation to an issue the subject of agreement in the joint report; or

(b) raise a new matter not already mentioned in the joint report.

33 Your further statement of evidence will effectively expand upon your notes set out in the joint report. In our view, it is appropriate to describe much of the commentary as being a response to the first respondent's preliminary identification of issues as they relate to the economic assessment of the project.

34 We ask that you seek to relate your explanation and opinion back to any relevant Facts and Circumstances and Grounds of the objections. In dealing with the points of disagreement in your joint report, and responding to the relevant Facts and Circumstances and grounds of the objections, please also specifically identify any relevant conditions of the draft EA and express your opinion as to the appropriateness of the draft condition or its relevance to the grounds of the objections.

35 Please also address the CAT submission and objection to the extent they are relevant to your field of expertise.

SECTION E – Summary of conclusions

36 The Rules require your further statement to provide a summary of the conclusions you have reached. In our view, this is often best presented in a separate, concluding section (or at the start of the statement).

SECTION F – Expert's confirmation

37 It is important that the report you prepare be an independent report prepared bearing in mind an expert witness' overriding duty to the court. The overriding duty encompasses the following points:

(a) You have an overriding duty to assist the Court on matters relevant to your area of expertise;

(b) You are not an advocate for a party, even when giving testimony that is necessarily evaluative rather than inferential; and

(c) Your paramount duty is to the Court and not to the person retaining you.

38 An example of the type of thing that might be said in this section is as follows:

(a) *I have read and understood relevant extracts of the Land Court Rules 2010 (Qld) and the Uniform Civil Procedure Rules 1999 (Qld). I acknowledge that I have an overriding duty to assist the Court and state that I have discharged that duty.*

(b) *I have provided within my report:*

(i) *details of my relevant qualifications;*

(ii) *details of material that I relied on in arriving at my opinions; and*

(iii) *other things as required by the Land Court Rules.*

(c) *I confirm that:*

(i) *the factual matters included in the statement are, to the best of my knowledge, true;*

(ii) *I have made all enquiries I consider appropriate for the purpose of preparing this statement;*

(iii) *the opinions included in this statement are genuinely held by me;*

(iv) *this statement contains reference to all matters I consider significant for its purpose;*

(v) *I have not received or accepted any instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.*

(d) *If I become aware of any error or any data which impact significantly upon the accuracy of my report, or the evidence that I give, prior to the legal dispute being finally resolved, I shall use my best endeavours to notify those who commissioned my report or called me to give evidence.*

(e) *I shall use my best endeavours in giving evidence to ensure that my opinions and the data upon which they are based are not misunderstood or misinterpreted by the Land Court.*

(f) *I have not entered into any arrangement which makes the fees to which I am entitled dependent upon the views I express or the outcome of the case in which my report is used or in which I give evidence.*

Confidentiality

39 Any report generated by you should remain in draft until such time as we are in a position to discuss the contents of the report with you. We ask that the report be kept strictly confidential as it is to be used for the purpose of obtaining legal advice or for use in legal proceedings. You are not authorised to provide these instructions or your report to any other person or party.

If you would like any further material, or have any questions, please contact us.

Yours sincerely

Peter Stokes
Partner

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