

## Joint Expert Report to the Land Court of Queensland

### Adani Mining Pty Ltd v Land Services of Coast & Country & Anor

#### Introduction

This joint report has been prepared by Dr Jerome Fahrer on behalf of the Applicant, Adani Mining Pty Ltd and Dr Richard Denniss on behalf of the First Respondent, Land Services of Coast and Country Inc (together, the Experts), in accordance with the orders made by the Land Court of Queensland on 20 October 2014.

This joint report sets out the areas of agreement and disagreement of the Experts in relation to the section, **Economic Assessment –Dr Fahrer** in the *First Respondent's Further Amended Preliminary Identification of Issues*, 6 February 2015.

#### Expert witness declarations

The Experts acknowledge that they have read and understood relevant extracts of the Land Court Rules 2010 (Qld) and the Uniform Civil Procedure Rules 1999 (Qld). The Experts acknowledge that they have an overriding duty to assist the Court and have discharged that duty. The Experts have not received any instructions to accept, adopt or reject any particular opinion in preparing this joint report.

The Experts confirm that:

- (a) the factual matters stated in this report are, as far as we are aware, true;
- (b) we have made all the enquiries that we consider appropriate;
- (c) the opinions in this report are genuinely held by the Experts; and
- (d) the report contains references to all matters that we consider are significant.

Richard Denniss



Jerome Fahrer



27 February 2015

Issue	Fahrer Comment	Denniss Comment
<p>109. The report from Dr Fahrer does not outline weaknesses and limitations of CGE modelling and should do so to permit proper conclusions as to the usefulness of the model's outputs.</p>	<p>The report does outline weaknesses and limitations of CGE modelling, e.g. in the section in Attachment called "Weaknesses of CGE modelling", and Section 2.3.</p>	<p>Dr Fahrer's report does not make clear that the results of his modelling exercise, or any modelling exercise, vary enormously with both the selection of the model used and the specification of the scenarios that are modelled.</p> <p>Dr Fahrer's decision to assume, for example, that building the world's largest coal mine will not result in an increase in the quantity of coal supplied in the world market, while highly significant, is not made clear in his report. He could have chosen to model the impact of an increase in the quantity of coal supplied in the world market but did not. His report provides no rationale for this key assumption and in fact fails to disclose it at all. Information on basic model inputs was only provided on repeated request, see my Attachment 3 to this joint report below.</p> <p>The model's answers are not useful unless we know the specifics of the questions it was asked. Dr Fahrer's report does not discuss the questions he asked the model, not does he discuss the alternative approaches to CGE modelling he could have undertaken, but chose not to.</p>
<p>110. Like all economic models, the accuracy and usefulness of CGE models depends on the assumptions made by the modeller</p>	<p>It is true that CGE models are complex and do contain many assumptions. It is not possible to discuss them all in a report of this type, though many are discussed in my report. Attachment A of my report is devoted to a discussion of the model.</p>	<p>While the labour market assumptions are important, the most important decision made by Dr Fahrer was his decision to assume that the construction of the Carmichael mine would lead to an increase in demand for Australian coal and cause a reduction in the supply of coal produced both overseas and from other Australian mines.</p>

<p>111. Many of the assumptions used in this CGE model have not been made explicit.</p>	<p>However, some assumptions are more important than others. The economic effect of the mine is calculated by estimating future paths for the economy with and without the mine. The effect of the mine is the difference between the paths. While many assumptions in the model are important in determining the paths of the economy with and without the mine, the critical assumption is the labour market assumption, because it is crucial for the difference between the two paths. The labour market assumption is discussed extensively in my report.</p> <p>For completeness, a detailed description of the labour market in the Tasman Global CGE model is appended to this joint report.</p>	<p>In my view it is more logical to assume that the world's largest coal mine, if approved, would increase the world supply of coal.</p> <p>Remarkably, in results provided to me that are not in the report, it is shown that Dr Fahrer's modelling assumptions lead to the bizarre conclusion that world coal output will be lower if the Carmichael mine goes ahead, see my Attachment 3 to this report below.</p> <p>The fact that such a surprising result was not included in Dr Fahrer's report, and not discussed at length, highlights how partial the evidence supplied in Dr Fahrer's report is.</p> <p>Dr Fahrer could have chosen to model the effects of the Carmichael mine leading to an increase in world coal supply, an approach in my opinion that would be far superior. His rationale for deciding to model an increase in demand rather than an increase in supply, arguably the biggest assumption he made, is not made clear.</p> <p>The detailed description provided by Dr Fahrer is far from complete. When CGE modelling is being used to inform non CGE modellers it would be helpful if modellers such as Dr Fahrer provided a clear list of the key underlying assumptions of the model as well as a clear specification of the scenario that has been modelled.</p> <p>For example, no general reader, and indeed few trained economists, would understand that Dr Fahrer has chosen to assume that building new coal mines does not increase the world supply of coal and does not affect the world price of</p>
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<p>112. The CGE model assumes that the mine is financially viable.</p> <p>(a) The CGE model provides no assessment of financial viability. If the mine is not financially viable, few or none of the modelled impacts will occur.</p>	<p>It is trivially true that if the mine does not go ahead the modelled impacts will not occur.</p> <p>CGE models are not designed to determine whether a project is financially viable. The assessment of financial viability requires a different form of analysis.</p>	<p>coal. Attachment A makes no mention of these key assumptions, which are plotted in my Attachment 3 below.</p> <p>While trained economists realise that a CGE model does not assess the financial viability of the mine, it is not always clear to a general reader that a project described as having net benefits of “between \$18.6 billion and \$22.8 billion” (para 23) may not actually be financially viable.</p> <p>The assumption that the mine will operate profitably and continuously over the full course of the projected mine life is another key assumption that is not made clear in Dr Fahrer’s report.</p> <p>In my opinion the possibility that a new mine in a highly cyclical market such as coal could shut down temporarily or permanently is far from trivial. It is a major risk which should be carefully considered as a mine that shuts down will generate no incomes, jobs or tax revenue but will still harm the environment.</p> <p>Similarly, if the project does go ahead, but coal prices decline below the prices assumed by Dr Fahrer, the benefits of the project will be lower. This is also not clear in the discussion of the CGE model.</p>
<p>113. The CGE model estimates some distributional effects on Australia, Queensland and the Mackay, Isaacs, Whitsunday, however:</p> <p>(a) There is minimal information provided on how these distributions were</p>	<p>(a) Information on industry-wage effects within the MIW region (is appended to this joint report.</p> <p>(b) As described in my report, especially Attachment A, each region in the model is treated as a separate economy, with inter-industry links between regions, and labour moving from region to region</p>	<p>(a) Dr Fahrer’s report provides no information as to how the estimates for the Mackay, Isaacs, Whitsunday region were derived. This is important as sub-state economic estimates are very uncertain. Qld Treasury and Trade (2013) describes its own regional estimates as “<i>labelled ‘experimental’ owing to the paucity of economic statistics available at the regional level to assist with more rigorous estimation.</i>” It is unclear from Dr Fahrer’s report whether he conducted any primary or secondary</p>

<p>estimated between the geographical regions.</p> <p>(b) There is no information provided as to how the mine would impact on output, income and wages within these regions, ie between industries and social groups.</p> <p>(c) Paragraph 55 compares the present value of the mine's impacts over 30 years to one year of Queensland and Australia's output, rather than comparing 30 years of the project to 30 years of state and Australian output.</p>	<p>(c) The comparison is a like-for-like comparison, in that it compares two values in present value terms.</p> <p><b>RD: Disagree that these are like-for-like.</b></p> <p>This said, the comparison could be done the way suggested at para 113(c). However, this comparison would depend on the underlying long run growth rate for the paths of the economy with and without the mine. This in turn depends on a somewhat arbitrary assumption about the long run trend of productivity growth in the economy. (This assumption does not affect the estimate of the mine's economic impacts.)</p> <p>In my judgment, the estimate I have provided, correctly interpreted, is preferable.</p>	<p>research on the actual nature of the Mackay, Isaacs, Whitsunday region's economy to inform his report to augment the local level data that is widely considered to be of low reliability.</p> <p>(b) Dr Fahrer has provided additional information subsequent to his original report. For example, he estimates that the Carmichael project will actually reduce employment in the coal industry by up to 352 jobs and other parts of the mining industry by an average of 137 jobs. Agriculture and food employment is also predicted to decline by around 200. Interestingly, he predicts increases in public service (227) and "other business services" employment (500).</p> <p>These results seem implausible and are not explained by Dr Fahrer. Just why the Queensland or federal government are expected to employ 227 new workers is left unexplained. Such results and the assumptions behind them should have been made clear in the original report. Wage impacts should also have been discussed – agricultural wages are estimated to decrease, while other industry sectors increase. This has important equity implications that should be of interest to decision makers.</p> <p>Similarly, Dr Fahrer's results suggest that both wages and employment will rise in the retail and tourism sectors of the economy. These industries often argue that higher wages lead to a reduction in their employment. If you do not accept that employment in sectors such as retail and tourism will increase alongside rising wages, then you would have to conclude that some of the benefits in Dr Fahrer's modelling are exaggerated. Again, despite stating that he has provided a high level</p>
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		<p>of detail about the labour market assumptions in his model it is unlikely that a general reader of his report would understand that Dr Fahrer assumes that increasing wages will increase employment.</p> <p>(c) Despite stating at 111 above that “The effect of the mine is the difference between the paths. While many assumptions in the model are important in determining the paths of the economy with and without the mine” Dr Fahrer states at 113(c) that he is reluctant to estimate the long run path of the Queensland’s Gross state product as to do so “depends on a somewhat arbitrary assumption about the long run trend of productivity growth in the economy”.</p> <p>While I accept that such assumptions are arbitrary, that did not prevent Dr Fahrer making them in the course of his modelling of the impact of the Carmichael mine on the Queensland or Australian economy over the coming decades.</p> <p>Dr Fahrer’s estimates of the mine’s economic output is around \$2.5 billion in peak years. The 2013-14 ABS estimate of Queensland’s economic output (gross state product) is \$295.1 billion (ABS Catalogue 5220.0 Australian National Accounts: State Accounts). Ignoring any economic growth of the state, the output of the mine represents less than 1 per cent of Queensland’s output. Australia’s output in the year to September 2014 is \$1,568.7 billion (ABS Catalogue 5206.0 Australian National Accounts), making Dr Fahrer’s estimates of the Carmichael project’s peak output less than two one-hundredths of one per cent of national output.</p>
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<p>114. External costs are not considered by the CGE model.</p>	<p>This is true. Paragraph 27 of my report says</p> <p>“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.”</p> <p>No CGE models exists which fully integrates economic and environmental impacts.</p>	<p>I agree. This means that CGE models cannot be used to estimate changes in economic welfare when externalities such as those associated with building a project of the scale of the Carmichael mine exist.</p> <p>While it is true that no CGE model exists that fully integrates economic and environmental impacts, the model that Dr Fahrer uses does not even attempt to partially integrate these effects.</p> <p>His report makes no reference as to why he chose to use the model he did rather than to use other models that do make such an attempt. Such a choice of model is an undisclosed assumption that such factors are not worth considering.</p>
<p>115. The scenarios examined in the CGE model do not assess the impact of the mine on the existing economy. Instead, the model assumes an expansion of the world economy and estimates the effects of this expansion as well as the impacts of the mine.</p> <p>(a) This is shown by the positive terms of trade effect in Table 2. The effect of the mine on the existing economy would be to slightly reduce coal prices, which would give a negative terms of trade effect.</p> <p>(b) It is assumed a standard definition of terms of trade is being used.</p>	<p>The entire commentary in paragraph 115 of Further Amend Preliminary Identification of Issues is based, or appears to be based, on the premise that the Carmichael mine is modelled as an exogenous in supply of Australian coal in general, (i.e. an outward shift in the supply curve of Australian coal). However, the mine is modelled as a relative shift of world demand (technically, a shift of preferences) towards Galilee coal and away from coal supplied elsewhere, including elsewhere in Australia.</p> <p>This modelling technique implicitly assumes that the demand for thermal coal outside Australia will exist over the modelling period, and hence will be supplied by a coal producer somewhere in the world – if not from the Carmichael mine in the Galilee Basin, then somewhere else.</p>	<p>Dr Fahrer’s response here is the first time he has disclosed the key modelling assumptions to the court – namely, that he has modelled the mine as an increase in demand for Australian coal, not an increase in supply of coal. Despite my best efforts to inform myself via questions to Dr Fahrer I am still unclear on many of the finer points of the modelled scenario or key model results.</p> <p>It is important to note, however, that:</p> <p>By assuming that the world supply of coal will fall in response to the construction of the Carmichael mine being built, Dr Fahrer is assuming that the Carmichael project will not put downward pressure on the world coal price. If he assumed that the world supply of coal increased, and that the price of coal would in turn fall, then this would deliver lower revenues to other Australian coal mines and put downward pressure on our terms of trade.</p>

<p>(c) The model should show how much of the terms of trade benefit is as a result of the increase in demand expressed through higher export prices and how much is due to the mine itself</p> <p>(d) The model could be useful to the Court if the model's predictions for increases in output, income and employment for the assumed increase in demand are provided without the impact of the mine. The two results could then be compared to assess the mine's impacts.</p> <p>(e) The model should explain the sources of the increase in net foreign income in Table 2 and whether this relates to the increase in demand or to the effect of the mine</p>	<p>One implication of this assumption is that the Carmichael mine will have no effect on the world price of coal (measured in \$US).</p> <p>The alternative assumption, that the supply of coal from the Carmichael mine results from an overall increase in the demand for in the world, would lead to <b>larger</b> economic gains in terms of GDP and other measures of economic activity</p> <p>The effect of a shift in world demand to Galilee Basin coal is an appreciation of the real exchange rate, or effectively equivalently, an increase in Australia's terms of trade.</p> <p>This real appreciation/ToT effect begins with the construction of the mine, financed foreign capital. During the construction period, Australia effectively is exporting labour services. This has the same qualitative effect on the real exchange rate as the export of coal.</p> <p>Table 2: Note that 'foreign' means foreign to the region/state/nation, and that these are net transfers. The \$46610 million out of the QIW region essentially reflects the transfer of profits from the mine (there being few if any Adani shareholders living in the region). The positive transfers to the rest of Queensland and the Rest of Australia mostly represent spending of royalties and tax receipts from the mine (cf paras 58 and 59 of my report).</p>	<p>Nothing in Dr Fahrer's report highlights the significance of these key assumptions and, in turn, the implausibility (in my opinion) of his key results, especially the result that after the world's biggest coal mine is built the world supply of coal is reduced, see my Attachment 3 to this joint report below.</p> <p>Dr Fahrer's is now informing the court that "the Carmichael mine will have no effect on the world price of coal (measured in \$US)". However, he is also assuming that other coal mines will reduce their supply to the global market. Just why they would likely do so if the coal price remains unchanged is unexplained by Dr Fahrer.</p>
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<p>117. The CGE model implies that the amount of coal burned in the world will increase as a result of the mine as:</p> <p>(a) The positive terms of trade effect in Table 2 implies increased price of coal from an increase in demand greater than the increase in supply from the mine.</p> <p>(b) The cost of increased coal combustion as a result of the mine is not considered.</p>	<p>See above</p>	<p>I now understand that Dr Fahrer has assumed that building the Carmichael mine will result in a reduction in the supply of coal from other mines and have no impact on the world price. The terms of trade benefits Dr Fahrer describes are best understood as an assumption he put into the model not a conclusion he drew from it.</p> <p>In my opinion these assumptions are highly implausible</p>
<p>118. Employment impacts predicted by the CGE model are far lower than the SEIS and are highly dependent on labour market assumptions. The assumptions behind these calculations should be provided, such as assumed rates of employment, unemployment and factors affecting the size of the labour force.</p>	<p>The most relevant assumptions are provided: paras 41-43, 65, all of section 3.6, attachment 2.</p> <p>A detailed and somewhat technical description of the labour market in the Tasman Global CGE model is appended to this joint report.</p>	<p>While the attached description of labour assumptions is broadly in line with my understanding of CGE models, what is not provided is a discussion of why Dr Fahrer’s estimates of employment impacts (1,464 full time equivalent jobs) are so much lower than the 10,000 jobs estimated in the SEIS, which have been widely publicised by the proponents. Dr Fahrer’s modelled “unconstrained” labour scenario should approximate the input-output model used in the SEIS. He estimates of 250,468 “employee years” under this scenario, an average impact of 8,349 jobs which, while still implausible, is also well below the publicly available estimates. I am unclear as to why this difference exists and in my opinion it should be explained to decision makers.</p> <p>It is important to note that Dr Fahrer’s modelling suggests that the Carmichael mine will have zero impact on the long term rate of unemployment at the local, state or national level. As discussed above, Dr Fahrer’s modelling also</p>

		<p>suggests that higher wages will be the cause of increased employment in the retail and tourism industry.</p> <p>Given the emphasis the mine proponents place on the potential for the Carmichael mine to create jobs, and Dr Fahrer's view that he has been quite clear about the labour market assumptions he has used, it would help non expert readers of Dr Fahrer's report to highlight that his model concludes the project will not reduce the unemployment rate and will create jobs by increasing the wages paid by non-mining employers. These results are not clear from dr Fahrer's report</p>
<p>119. The Cost Benefit Analysis (CBA) assumes that the mine is financially viable. If the mine is not financially viable, few or none of the estimated benefits will occur. The CBA suggests the project is financially viable with its conclusion that the mine's costs are outweighed by revenues. However, there are several issues that are not addressed, or not addressed in detail, in Dr Fahrer's report that are important for financial and economic analysis:</p> <p>(a) Coal price – no discussion of whether the price used reflects benchmark prices or the discounted prices mine's coal would receive due to lower quality as discussed in</p>	<p>(i) financial viability – not relevant to CBA</p> <p>(ii) various costs – all included, as per attachment B. Selling Costs includes rail and port charges.</p> <p>(iii) I used the coal price data provided to me by Adani. I have reviewed the source of this data and satisfied myself that a reasonable methodology was used for the coal price forecasts.</p> <p>(iv) As set out in my report, the coal output data (and hence expenditure data) that I used are based on the banking feasibility study (BFS) which focuses on phase 1 of the project. Output of around 40 mtpa is associated with the BFS, compared to 60 mtpa associated with the SEIS.</p> <p>(v) discount rates – as discussed at length in the report (section 4.4), discount rates used for a</p>	<p>By not considering financial viability, Dr Fahrer provides decision makers with no understanding of the risks involved with the project. It is possible that if approved, the project may not proceed, or will not operate continuously as Dr Fahrer assumes.</p> <p>Financial analysis involves assessing only monetary costs and benefits to the proponent, while cost-benefit analysis involves estimating costs and benefits to all relevant parties whether they are monetary or otherwise, ie including environmental and social impacts.</p> <p>It is possible, therefore, for a project to be unviable financially (as it does not provide sufficient return to the proponent) but to be economically beneficial to society due to these wider impacts. Schools, hospitals and national parks could be examples of this, which is why they are often provided by governments.</p> <p>However, in the case of a private coal mine which generates significant costs to others, its financial viability is very important to consider. If the project becomes unviable none</p>

<p>paragraph 16 of Dr Fahrer’s report.</p> <p>(b) Wash yields.</p> <p>(c) Capital expenditure – Dr Fahrer’s report uses lower capital expenditure values than reported in the SEIS.</p> <p>(d) Operating expenditure – Dr Fahrer’s report uses lower operating expenditure rates than reported in the SEIS, which are in turn far below Australian averages.</p> <p>(e) Discount rates – Discount rates used are far lower than would be used for financial analysis.</p> <p>(f) Cost of rail assets, including rolling stock, and operations.</p> <p>(g) Cost of port developments and operations – this may represent another cost to the proponents.</p> <p>(h) Rehabilitation costs.</p> <p>(i) Potential subsidies, tax offsets and deductions, or royalty waivers.</p>	<p>CBA are conceptually different from those used for financial less, and would be expected to be “far lower”</p> <p>(vi) subsidies and taxes – as discussed in the report, these are not relevant to a CBA as they represent a transfer of income, but do not affect total costs or benefits</p>	<p>of the public benefits will occur without government subsidy. This is presumably why some Queensland government policies have proposed to subsidise the development (including providing infrastructure) of the Carmichael project.</p> <p>So while financial viability is not exactly the same as a positive outcome in a cost benefit analysis, in this case it is clearly important to understanding what, if any, public costs (financial or non-financial) and public benefits are involved in the project.</p> <p>Coal prices are clearly an important part of economic and financial viability. I am unclear as to what benchmark coal prices Dr Fahrer has assumed and how he adjusted these prices to reflect the quality of the project’s coal. I have asked for information on this point, as well as wash yields, capital and operating expenditure figures, port costs, rehabilitation costs, subsidies and financial assistance, which are also important to understanding financial and economic viability.</p> <p>The discount rates used are low for a coal project, which has considerable risk. When assessing other coal projects, Dr Fahrer has used discount rates of 4%, 7% and 10%, in line with standard practice. The lower discount rates that Dr Fahrer uses here serve to inflate the value of the project and give an unrealistic impression of its financial viability. He provides no sensitivity analysis at higher discount rates.</p> <p><b>JF: In conducting a CBA the Ashton South East Open Cut Project, I followed the methodology of a previous CBA of that project, which used discount rates of 4%,</b></p>
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		<b>7% and 10%, so as to make the results of the CBAs comparable. Moreover, that Project was analysed for the years 2014-15 to 2021-22. The choice of discount rate is relatively unimportant for projects which are not long lasting.</b>
<p>120. The scope of the CBA is global. It does not assess whether the benefits of the mine to Queensland (or Australia) outweigh the costs of the project borne by Queenslanders (or Australians).</p> <p>(a) In particular, no present value figure is provided for royalty and tax revenues to Queensland and Australian governments and no discussion around what may affect these values.</p> <p>(b) No discussion of subsidies or other potential fiscal impacts on governments.</p>	<p>As discussed in the report, the scope of the CBA is properly global.</p> <p>Taxes and subsidies are irrelevant to the CBA: see my report paras 87-88.</p>	<p>In my opinion Queensland decision makers, considering a project to develop Queensland's coal, should primarily consider the costs and benefits of the project to Queensland and Queenslanders. Dr Fahrer's approach ignores this and conflates the benefits to foreign shareholders with the costs imposed on Queenslanders.</p> <p>Put simply, a project that delivered significant costs to a local community and significant benefits to foreign shareholders should be considered differently to one in which both the costs and benefits accrued to the same residents.</p> <p>While economic theory may assert that if 10 people lose \$10 and one person gains \$200 the world is a better place, such notions of equity are not widespread outside a segment of the community of professional economists.</p> <p>I disagree that royalties and subsidies are unimportant. Clearly, Queensland's budget would suffer from subsidising a mine that did not return a sufficient payment in royalties. I am unsure why Queensland decision makers would approve a project that cannot demonstrate a strong return to the state. Queensland Treasury states that money spent subsidising mining is money that is not spent on hospitals and schools.</p>
<p>121. In relation to external costs the CBA:</p>	<p>(a) It is not possible to estimate economic impacts on groundwater, surface water, terrestrial or marine ecosystems without any estimates of</p>	<p>Dr Fahrer appears not to have conducted any primary or secondary research on the external impacts of the project. He does not discuss them other than a quote in section 5.2.1</p>

<p>(a) Does not attempt to evaluate impacts on groundwater, surface water, terrestrial or marine ecosystems.</p> <p>(b) Compares these potential impacts, which would accrue to Queenslanders with payments that accrue largely outside of Queensland.</p> <p>(c) Compares potential environmental costs with the “costs” of the Deepwater Horizon oil spill. Confuses the “cost” of the oil spill with the fines paid by the owner of the rig, BP. These fines are likely to be smaller than the wider cost, as is made clear in the source article.</p>	<p>physical impacts. If reliable estimates of the physical impacts existed (over and above the effects of the regulations whose purpose is to reduce, if not minimise or eliminate those impacts), then economic impacts could be estimated in theory by e.g. surveys asking people what they would be prepared to pay to avoid those impacts. However such surveys are not reliable.</p> <p>(b) As discussed in my report, questions around the distribution of benefits and costs between people in Queensland (or Australia) and people outside Queensland (or Australia) involves subjective value judgments. Such value judgments are not matters of economic analysis.</p> <p>(c) The article cited, <a href="http://www.theguardian.com/business/2014/feb/04/bp-deepwater-horizon-bill-rises-profits-fall">http://www.theguardian.com/business/2014/feb/04/bp-deepwater-horizon-bill-rises-profits-fall</a>, is about total costs, not just fines. See also <a href="http://www.theguardian.com/environment/2014/sep/04/bp-reckless-conduct-oil-spill-judge-rules">http://www.theguardian.com/environment/2014/sep/04/bp-reckless-conduct-oil-spill-judge-rules</a></p> <p>“BP says it has spent more than \$24bn in spill-related expenses, including cleanup costs and payments to businesses and residents who claim the spill cost them money. The company also has estimated that it will pay a total of \$42bn to fully resolve its liability.”</p> <p>I do not claim that the total amount to be paid by BP exactly equals the amount of economic cost</p>	<p><i>Externalities asserted by Land Services of Coat [sic] and Country Inc.</i></p> <p>Impacts on water resources, air and water quality and ecosystems can be evaluated in many ways, including through market mechanisms. Dr Fahrer appears confident making a wide range of assumptions when estimating economic benefits but appears uncomfortable using the best available data to make assumptions about non-financial variables.</p> <p>While attempts to estimate non-financial factors can be difficult, a recent example of an evaluation of a coal project utilising various methods, market-based and survey-based, is the evaluation of the Mount Owen coal project in NSW (Deloitte Access Economics 2014).</p> <p>The external costs of Carmichael the project on air, water and biodiversity would largely be borne by Queenslanders, while benefits largely accrue overseas. Dr Fahrer says that there are “numerous mechanisms for those people who are adversely affected to be compensated” (para 175), even though he thinks there is no reliable way of estimating environmental values.</p> <p>Just how Queensland residents would extract compensation for reductions in health and amenity from foreign shareholders is not made clear by Dr Fahrer.</p> <p>In practice, economists often are unable to incorporate monetary values of environmental impacts into cost benefit analysis. A qualitative comparison of the benefits of the project with potential environmental costs is then made. Dr Fahrer does not list possible environmental impacts that</p>
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	<p>caused by the Deepwater Horizon oil spill, though conceptually the sum of clean up costs, fines and damages is not far from that economic cost.</p> <p>I do argue that an environmental catastrophe of the same order of magnitude as Deepwater Horizon would have to occur for the net economic benefits of the Carmichael Project to be negative.</p>	<p>accrue to Queensland and does not quantify the relevant benefits to Queensland to enable this comparison.</p> <p>It is surprising that Dr Fahrer would use a newspaper article about an oil spill in the Gulf of Mexico, which makes no mention of total environmental costs, as a reference to consider the environmental impacts of the Carmichael project.</p>
<p>122. The CBA model implies that the amount of coal burned in the world will increase as a result of the mine as:</p> <p>(a) The slope of the demand curve in Figure 6 and 7 is not vertical and the supply/marginal cost curve is not horizontal.</p> <p>(b) The cost of increased coal combustion as a result of the project is not considered.</p>	<p>The CBA model, like the CGE analysis, assumes that the coal is supplied as a result of demand from outside Australia. But this has nothing to do with Figures 6 and 7, which are only illustrative for the purposes of explaining the concept of consumer surplus and producer surplus.</p> <p>The reasons why the costs of the use of the coal are not considered are set out at length in the report.</p>	<p>I now understand that Dr Fahrer expects world coal production to decline if the Carmichael mine is approved. I find this conclusion, and the assumptions on which it is based, implausible.</p> <p>Dr Fahrer's cost benefit analysis is based on the estimated market price of coal. The market price of coal reflects the benefits that users of the coal expect to derive from its use. It does not reflect the social costs that arise from its use, relating to air quality and climate change. Because the market price does not reflect the impacts of coal on health or the climate, from an economic perspective, it is important to consider the full greenhouse gas and air quality impacts of the project, which are likely to be considerable.</p> <p>Dr Fahrer believes that benefits to foreigners from the coal mine should be included but he has provided no estimate of the cost to foreign residents associated with coal dust released via transport, particulate pollution via combustion or greenhouse gas emissions as a result of waste disposal into the atmosphere.</p>

References cited above:

Deloitte Access Economics, 2014. *Cost Benefit Analysis and Economic Impact Analysis of the Mount Owen Continued Operations Project*, Commissioned by Umwelt (Australia) Pty Ltd, for Glencore. Available at: <https://majorprojects.affinitylive.com/public/90e8e023258ddc533e414fa75c8a31d7/20>. MOCO Project - EIS - Appendix 17 - Cost Benefit Analysis and Economic Impact Analysis.pdf.

Qld Treasury and Trade, 2013. *Experimental Estimates of Gross Regional Product, 2000-01, 2006-07 and 2010-11*, Available at: <http://www.qgso.qld.gov.au/products/reports/experimental-estimates-grp/experimental-estimates-grp-2010-11.pdf>.

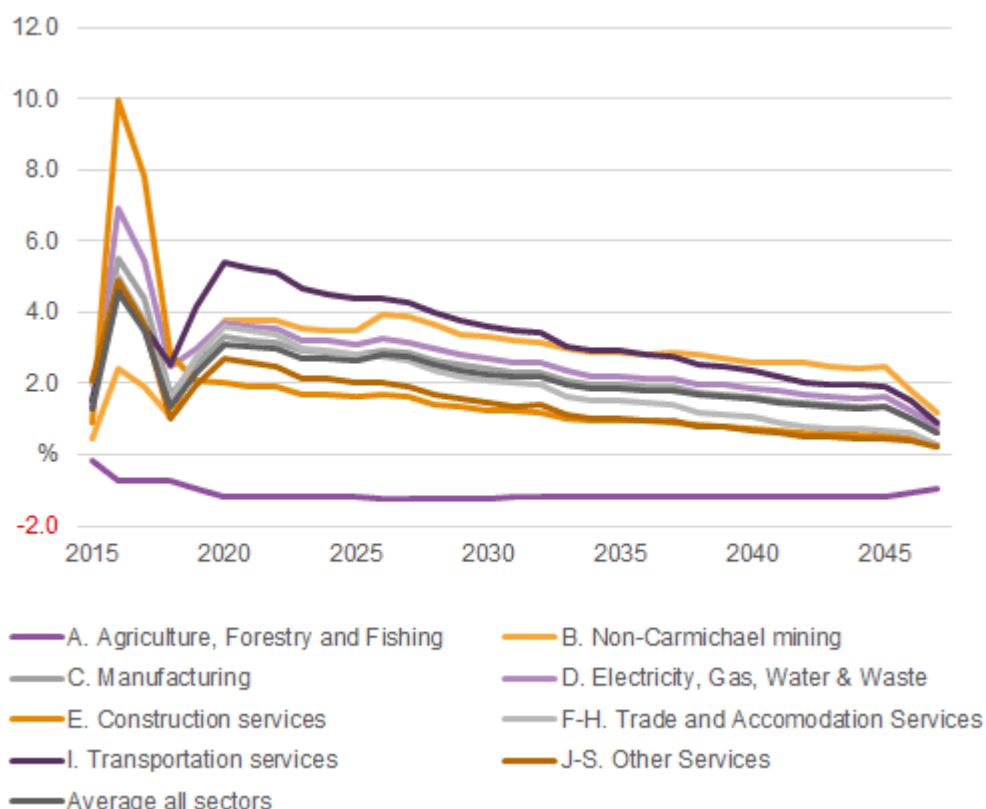
## Attachment 1 by Jerome Fahrner: Changes in real wages by industry in the MIW region

Figure 1 below shows the change in real wages by industry in the MIW as a result of the Carmichael Project from AFY2015 to AFY20147. . It can be seen that significant real wage gains occur in every industry, except agriculture, where real wages fall by about one per cent. (Note that these real wage gains are not the only changes that will occur in these industries; they are over and above those that would otherwise occur).

The largest increase is to real wages in the construction services industry during the construction of the mine; otherwise the largest increases generally occur in the transportation services industry.

In the model, wages are determined in the markets for various occupations; the market clearing wage in each occupation is that which equates demand for and supply of that occupation. Thus the effect of the mine on wages by industry is a reflection of demand and supply for the occupations that are employed in each industry. Thus, for example, the increase in real wages in the transportation services reflects the increase in real wages paid to truck drivers.

Figure 1: Changes in real wages by industry in the MIW region (%)





## Attachment 2 by Jerome Fahrer: The Tasman Global labour market

### 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 1 of my 30b January 2015 report..

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).

### Database

The *Tasman Global* database includes a detailed representation of the Australian labour market which has been designed to capture the supply and demand for different skills and occupations by industry. To achieve this, the Australian workforce is characterised by detailed supply and demand matrices.

On the supply side, the Australian population is characterised by a five dimensional matrix consisting of:

- 7 post-school qualification levels
- 12 main qualification fields of highest educational attainment

- 97 occupations
- 101 age groups (namely 0 to 99 and 100+)
- 2 genders.

The data for this matrix is measured in persons and was sourced from the ABS 2011 Census. As the skills elements of the database and model structure have not been used for this project, it will be ignored in this discussion.

The 97 occupations are those specified at the 3-digit level (or Minor Groups) under the Australian New Zealand Standard Classification of Occupations (ANZSCO) (see **Error! Reference source not found.**).

On the demand side, each industry demands a particular mix of occupations. This matrix is specified in units of full-time equivalent (FTE) jobs where an FTE employee works an average of 37.5 hours per week. Consistent with the labour supply matrix, the data for FTE jobs by occupation by industry was also sourced from the ABS 2011 Census and updated using the latest labour force statistics.

Matching the demand and supply side matrices means that there is the assumption that the average hours per worker can differ across occupations but are the same for all workers within a particular occupation (and by implication each occupation has the same average hours across all industries).

## Model structure

In the model, the underlying growth of each industry in the Australian economy results in a growth in demand for a particular set of skills and occupations. In contrast, the supply of each set of skills and occupations in a given year is primarily driven by the underlying demographics of the resident population. This creates a market for each skill by occupation that (unless specified otherwise) needs to clear at the start and end of each time period.<sup>1</sup> The labour markets clear by a combination of different prices (i.e. wages) for each labour type and by allowing a range of demand and supply substitution possibilities, including:

- changes in firms demand for labour driven by changes in the underlying production technology:
- for technology bundle industries (electricity, iron and steel and road transportation) this occurs due to changes between explicitly identified alternative technologies
- for non-technology bundle industries this includes substitution between factors (such as labour for capital) or energy for factors
- changes to participation rates (or average hours worked) due to changes in real wages
- changes in the skills of people and changes in the occupations of a person with a given skill due to changes in relative real wages
- substitution between occupations by the firms demanding labour due to changes in the relative costs
- changes to unemployment rates due to changes in labour demand, and
- limited labour mobility between states due to changes in relative real wages.

All of the labour supply substitution functions are modified-CET functions in which people supply their skills, occupation and rates of participation as a positive function of relative wages.

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<sup>1</sup> For example, at the start and end of each Indian financial year for this analysis. *Tasman Global* can be run with different steps in time, such as quarterly or bi-annually in which case the markets would clear at the start and end of these time points.

However, unlike a standard CET (or CES) function, the functions are ‘modified’ to enforce an additional constraint that the number of people is maintained before and after substitution.<sup>2</sup>

Although technically solved simultaneously, the labour market in *Tasman Global* can be thought of as a five stage process:

- labour makes itself available to the workforce based on movements in the real wage (i.e. it actively participates with a certain average hours worked per week)
- the age, gender, skill level and occupations of the underlying population combined with the participation rate by gender by age implies a given supply of labour (the potentially available workforce)
- a portion of the potentially available workforce is unemployed implying a given available labour force
- labour chooses to move between skills and occupations based on relative real wages
- industries alter their demands for labour as a whole and for specific occupations based on the relative cost of labour to other inputs and the relative cost of each occupation.

By default, *Tasman Global*, like all CGE models, assumes that markets clear at the start and end of each period. Therefore, overall, supply and demand for different occupations will equate (as is the case in other markets in the model). In principle, (subject to zero starting values) people of any age and gender can move between any of the 97 occupations while industries can produce their output with any mix of occupations. However, in practice the combination of the initial database, the functional forms, low elasticities and moderate changes in relative prices for skills, occupations etc. means that there is only low to moderate change induced by these functions. Thus the changes are sufficient to clear the markets, but not enough to radically change the structure of the workforce in the timeframe of this analysis.

Factor-factor substitution elasticities in non-technology bundle industries are industry specific and are the same as those specified in the GTAP version 8 database<sup>3</sup>, while the fuel-factor and technology bundle elasticities are the same as those specified in GTEM.<sup>4</sup> The detailed labour market elasticities are based on assumptions previously calibrated in the context of the model framework to replicate the historical change in the observed Australian labour market over a five year period<sup>5</sup>. More specifically, all labour market elasticities are neutral across industries, regions, age and gender with each responding to changes in relative wages with the ability to change occupations having an elasticity of 0.1, the ability to migrate between different regions of Australia having an elasticity of 0.025, the ability to alter hours worked/participation rate having an elasticity of 0.000375. The unemployment rate function in the policy scenarios is a non-linear function of the change in the labour demand relative to the reference case with the elasticity being a function of the unemployment rate (ie the lower the unemployment rate the lower the elasticity and the higher the unemployment rate the higher the elasticity). The exact effects change year on

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<sup>2</sup> As discussed Dixon, P.B., Parmenter, B.R., Sutton, J. and D.P. Vincent (1997). ORANI: A Multisectoral Model of the Australian Economy, North-Holland Press, a standard CES/CET function is defined in terms of *effective units*. Quantitatively this means that, when substituting between, say,  $X_1$  and  $X_2$  to form a total quantity  $X$  using a CET function a simple summation generally does not actually equal  $X$ . Use of these functions is common practice in CGE models when substituting between substantially different units (such as labour versus capital or imported versus domestic services) but was not deemed appropriate when tracking the physical number of people. Such ‘modified’ functions have long been employed in the technology bundles of *Tasman Global* and GTEM. The Productivity Commission has proposed alternatives to the standard CES to overcome similar and other weaknesses when applied to internationally traded commodities.

<sup>3</sup> Narayanan, G., Badri, Angel Aguiar and Robert McDougall, Eds. 2012. *Global Trade, Assistance, and Production: The GTAP 8 Data Base*, Center for Global Trade Analysis, Purdue University

<sup>4</sup> Pant, H.M. 2007, *GTEM: Global Trade and Environment Model*, ABARE Technical Report, Canberra, June.

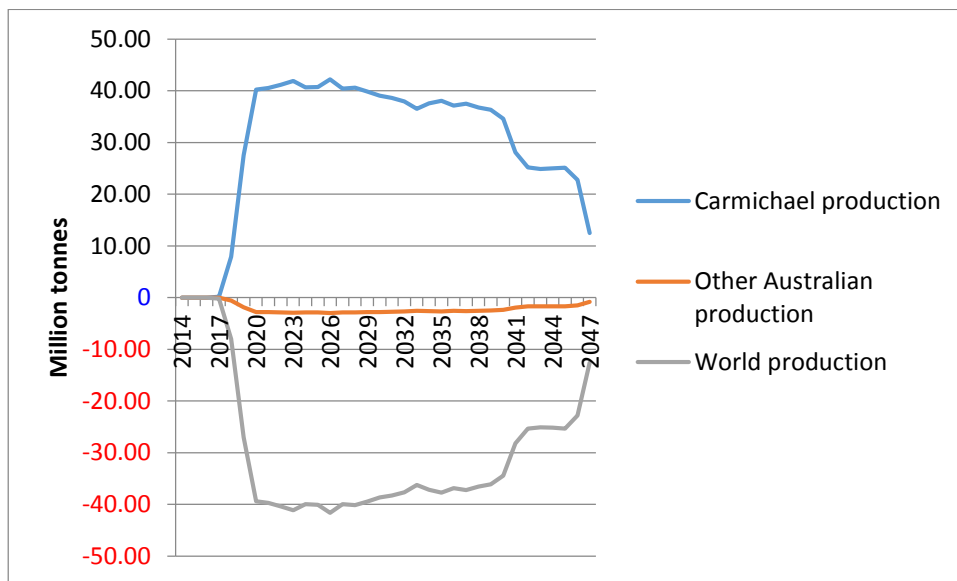
<sup>5</sup> This method is a common way of calibrating the economic relationships assumed in CGE models to those observed in the economy. See for example Dixon, P.B. and Rimmer, M.T. 2002, *Dynamic general equilibrium modelling for forecasting and policy*. Contributions to Economic Analysis 256, North Holland, Amsterdam.

year, but with the long run unemployment assumption of 5.5 per cent, the parameters in the unemployment function change the projected unemployment rate in the MIW region by no more than -0.1 percentage points.

### Attachment 3 by Richard Denniss

After repeated requests I have been provided with the basic modelling assumptions around coal supply in Dr Fahrer's model. He assumes that Carmichael supplies up to 40 million tonnes per year to the world coal market. This increased supply is almost perfectly and immediately offset by reductions in supply from coal mines in the rest of the world and the rest of Australia, as shown in the Figure 1 below:

**Figure 1- Coal supply assumptions:**

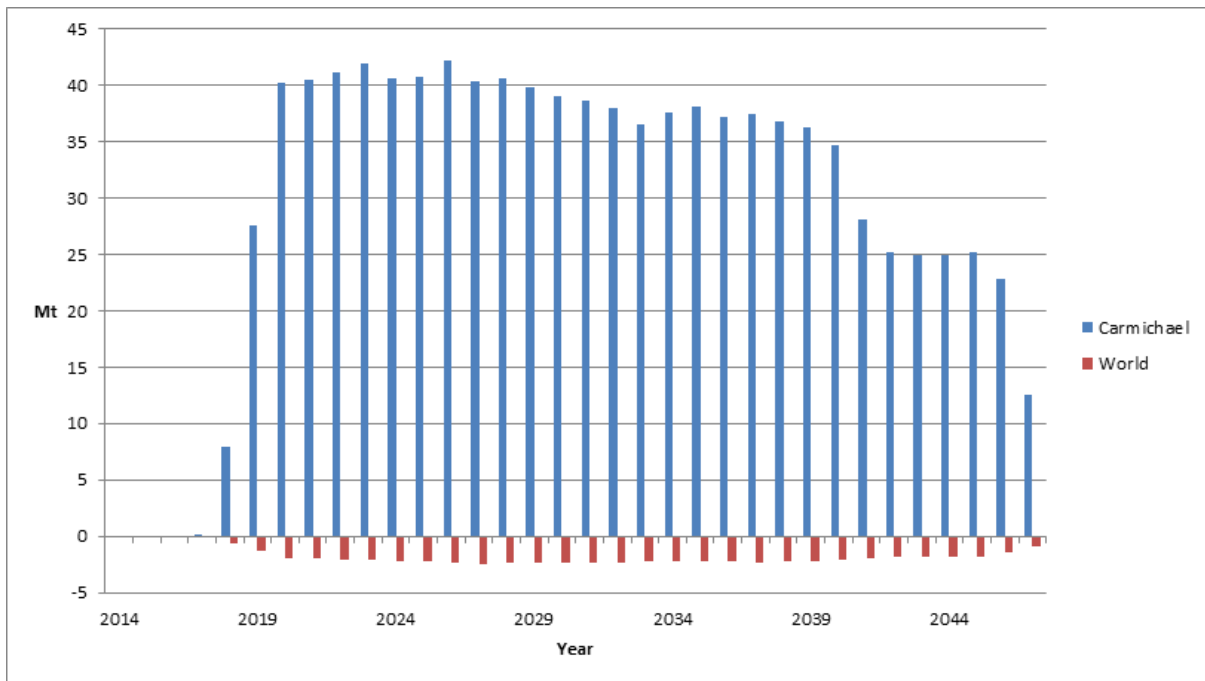


Source: Data provided by Dr Fahrer on request

Figure 1 shows that Dr Fahrer assumes the world coal market adjusts in almost perfect symmetry to the advent of the Carmichael project. With every tonne produced by the Carmichael project, almost exactly a tonne of supply is reduced by the rest of the world. I do not think these assumptions are plausible, particularly as Dr Fahrer assumes that the average world price of coal does not change. In the real world coal mines will continue producing, particularly if the price they can sell at is not changed. It is not clear to me why Dr Fahrer assumes that mines operating profitably at current prices suddenly withdraw their supply from the market.

Beyond these assumptions, Dr Fahrer's modelling comes to the conclusion that building the Carmichael project will actually reduce the supply of coal in the world, as shown in Figure 2 below:

**Figure 2: Carmichael production and impact on world production**



Source: Data provided by Dr Fahrer on request

Figure 2 shows that even though the Carmichael project is adding 40 million tonnes per year of coal supply, Dr Fahrer concludes that the total world coal supply is reducing by around 2 million tonnes per year. This is the net result of the curves in Figure 1 – that production from Carmichael, less the changes in Australian and world supplies actually nets out to reduce world coal supply. I do not think it is logical that building a large coal mine leads to a reduction in world coal supply and no change in price.