

LAND COURT OF QUEENSLAND

**Individual Expert Report for Computable
General Equilibrium Modelling and Cost
Benefit Analysis**

**Dr Richard Denniss, Executive Director, The Australia
Institute**

16 March 2015

REGISTRY: Brisbane

NUMBERS: 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**

1. Summary

I disagree with the economic evidence submitted by Dr Fahrer. My key objections can be summarised as follows:

1.1 What is an economic model?

An economic model is simply a mathematical attempt to describe the linkages between different sectors of the economy.

Different economic models focus on different elements of the economy and make different assumptions about the way those elements interact. The choice of model is, in itself, one of the biggest assumptions the modeller makes.

Dr Fahrer chose to use a model which takes no account of the value of externalities such as pollution. This choice is not discussed in his report but has very significant implications for the results of his analysis.

1.2 The role of assumptions in economic modelling

The assumptions made by modellers are as important as the choice of the model. The saying ‘Garbage in Garbage Out’ is a short hand way of describing the fact that the results of any modelling exercise are only as reliable as the plausibility of the assumptions that the modeller puts into the model. In my opinion many of the key assumptions made by Dr Fahrer are implausible.

1.3 Assumptions about the Carmichael project and its impact on world coal supply and world coal price

Dr Fahrer assumes that the day the Carmichael mine opens, other mines around the world will immediately reduce their output or shut down. The result of this assumption is that, initially, there is no change in world coal supply after one of the world’s largest coal mines is built. These mines are assumed to shut down even though Dr Fahrer assumes that there will be no reduction in the world coal price.

Even more surprisingly, Dr Fahrer’s model goes on to predict that over time the amount of coal supplied around the world will be lower after the Carmichael mine is built than before.

In my opinion these assumptions and predictions are implausible.

1.4 The impact of the Carmichael mine on jobs

The Supplementary Environmental Impact Statement (SEIS) for the Carmichael project claimed that the project would create 10,797 jobs.¹ While this claim has been repeated on many occasions in the public debate about the Carmichael mine, the project proponents new expert, Dr Fahrer, estimates that the same project will create less than 20 per cent of that figure. Indeed, Dr Fahrer has himself been critical of the modelling technique used to generate the 10,797 figure. In preparing this report I requested Professor Phillip Adams to estimate the number of jobs that would be created, using the same assumptions as Dr Fahrer for the size and scope of the project, and, in turn Professor Adams estimate of job creation is around 20 per cent of those of Dr Fahrer.

¹ SEIS, Appendix E – Economic Assessment Report, p 30, Table 9

The fact that three different models, and three different modellers, have generated employment estimates that are so widely different highlights the importance of inquiring into both the model chosen by an economic modeller and the assumptions that are dialled into such a model.

Dr Fahrer's assumption that overseas coal production will fall instantly when Carmichael production comes on stream ensures that his model predicts that the new mine has minimal impact on the rest of the Australian coal industry.

Significantly, Dr Fahrer's model makes the prediction that the construction of the Carmichael mine will result in a reduction in overall employment in coal mining in Australia.

He also predicts impacts on other industries - agriculture and food employment is predicted to decline by around 200 jobs. Interestingly, he predicts increases in public service (227 jobs) and "other business services" employment (500 jobs).

In my opinion these results are implausible and are not revealed, explained or discussed in Dr Fahrer's First Report.

1.5 How choice of assumptions mean building a new mine can reduce coal output

Dr Fahrer's report provides no description of the mechanism by which opening a large new coal mine will lead to a reduction in the world supply of coal. However, after discussions with Dr Fahrer, I now understand that he believes that while the Carmichael mine will initially result in the closure of foreign mines, the assumptions he makes about an increase in world demand for Australian coal will push up the cost of production of coal in Australia and, in turn, lead to a small reduction in Australian coal supplied to the world market.

In my opinion this chain of events is implausible and Dr Fahrer provides no description of it in his report and no theoretical or empirical evidence to support his view.

1.6 Interpreting modelling results

In a large economy such as Australia, projects that cost billions of dollars and employ thousands of people can seem 'nationally significant'. However, with a population of 24 million people, projects that seem large can have a tiny impact on the national or state economy.

In my opinion Dr Fahrer has presented his results in such a way as to make the benefits of the Carmichael mine seem larger than they really are.

1.7 Cost benefit analysis (CBA)

Dr Fahrer's CBA of the Carmichael project is of little use for decision making due to several key flaws:

- no consideration of the costs and benefits to Queensland;
- no consideration of the wider costs of coal;
- assumption of financial viability and no consideration of this assumption; and
- inadequate consideration of other environmental impacts.

1.8 Transparency

The Court has been exposed to three different forms of modelling for this project. The first evidence provided by the proponent suggested that around 10,957 jobs would be created. While the proponent continues to make this claim in public debate, they withdrew these claims from their evidence.

Dr Fahrer's modelling suggests the benefits of the Carmichael mine are significantly smaller than the original claims made by the proponent, but, as discussed, in my opinion the assumptions he makes are often implausible and the way he presents his results is misleading.

Finally, Professor Philip Adams has provided modelling which shows that, among other things, small reductions in the price of coal will have very large impacts on the potential benefits to Australia.

In my opinion the main conclusion that can be drawn from the disparities among these three different attempts to model the economic impacts of the Carmichael mine highlight a simple point - the choice of model and the choice of assumptions are crucial to determining the claimed impacts presented to both courts and the public.

In my opinion it should be the court, not modellers, that decide which assumptions are plausible, and which are not.

2. My Qualifications

Attachment B to this report provides a copy of my curriculum vitae.

In preparing my report I understand my duty as an expert witness before the Court based on rule 24C of the *Land Court Rules 2000* is to assist the Court. While I appear pro bono to assist the Court in these proceedings, I note also that my duty to assist the Court would override any obligation I may have to any party to the proceeding or to any person who is liable for my fees or expenses.

3. My Opinion

3.1 Introduction

Dr Fahrer's economic assessment of the Carmichael coal and rail proposal is based on two forms of assessment - a computable general equilibrium (CGE) model and a cost benefit analysis (CBA).

I agree with the general depiction of these economic assessment tools in Dr Fahrer and Mr Roderick Campbell's joint report. CBA is a decision making tool which assesses all monetary and non-monetary costs and benefits (i.e. including environmental and social costs) to stakeholders with standing in the assessment. CBA estimates whether a project makes society better off.

CGE models do not assess the merits of a project and whether it improves the welfare of society, but attempt to estimate the impact of a project on other parts of the economy – such as other industries and employment.

Both the CBA and the CGE model that Dr Fahrer has produced are deeply flawed and in consequence, misleading. They are based on assumptions which can only be charitably

described as “far-fetched”. Some assumptions are so implausible and contrary to accepted economic theory that the model results are of little value to anyone seeking to understand the impact of the Carmichael mine. All of Dr Fahrer’s assumptions serve to exaggerate the value or benefits of the project.

Many important assumptions are not discussed at all in his report and only some have been made available to me following repeated requests during our expert meeting process. Dr Fahrer should have provided a comprehensive list of key assumptions and broad model outputs in his first individual report dated 30 January 2015 and titled Carmichael Coal and Rail Project – Economic (Dr Fahrer’s First Report). He did not.

Much of the disagreement between Dr Fahrer and I relates to his conclusion that building one of the world’s largest coal mines will not increase the world supply of coal and will not have any effect on the price of coal. This is entirely contrary to basic economic theory.

To see the invalidity of this claim, we need only look to the oil cartel, the Organisation of Petroleum Exporting Countries (OPEC). OPEC was formed by oil producing countries because increasing the supply of a commodity is widely understood to push world prices down. OPEC’s members have often worked to reduce supply in order to increase world oil prices. In recent times, new oil supply from non-OPEC countries, such as from unconventional “fracking” in the United States, has led to significant reductions in the world oil price.

Similarly, the impact of new iron ore supply in Australia is currently having a strong effect on world prices. New mines lead to expanded supply, which puts downward pressure on prices. This is the most basic logic of economics and the observed reality of commodity markets. Dr Fahrer’s work contradicts this logic and reality.

Much of this report focuses on the plausibility of specific assumptions made by Dr Fahrer. In my opinion, it is his underlying assumption that building a large coal mine neither increases world coal supply nor reduces the world price that is most important. If we reject this assumption, then the conclusions he draws about the benefits of the Carmichael mine must also be rejected. As I will show, modelling the project as an increase in supply, and/or making small changes to coal price assumptions, have a large effect on the modelled impacts of the project.

Before providing a detailed explanation of my concerns with Dr Fahrer’s report, I begin by providing an overview of what an economic model is and how an understanding of a model’s assumptions is crucial to understanding its conclusions.

3.2 What is an economic model?

An economic model is simply a mathematical attempt to describe the linkages between different sectors of the economy (e.g. mining and manufacturing) and factors of production (e.g. labour and machinery). Just as a model aeroplane can help explain the relationship between the position of the wings and the position of the cockpit, so too can an economic model help us understand the relationship between some parts of the economy.

Different economic models focus on different elements of the economy and make different assumptions about the way those elements interact. The choice of model is, in itself, one of the biggest assumptions the modeller makes. Consider the following example:

In high school, physics students are taught a simple model of how objects move when exposed to gravity. They are taught, for example, how to predict how far a cannonball would travel if it was launched at a particular velocity at a particular angle. This simple Newtonian model of motion is good for predicting the movement of heavy, round objects like cannonballs.

Unfortunately, this model is entirely useless for predicting how far a piece of paper would travel if thrown at a known velocity at a known angle. The simple model of Newtonian motion assumes that there is no air resistance. While it generates plausible results for cannonballs and tennis balls, it generates meaningless results for light objects with a large surface area like a piece of paper.

An economic modeller faces a similar choice – some models work well to explain some phenomena, while others do not. The choice of which model to use is the first choice an economic modeller faces.

3.3 Choosing an economic model

When considering the results of any modelling exercise it is essential to first consider whether the model that is being used is 'fit for purpose'. Dr Fahrer provides no description of why he chose the particular form of modelling he chose in his First Report. Indeed, while he states that he used a Computable General Equilibrium (CGE) model he does not even describe why he chose to use the 'micro industry' within his CGE model rather than the 'tech bundle' approach.

The significance of the choice of model, including choice of CGE model, is demonstrated below with reference to the disparity in modelling results generated by Professor Philip Adams and those of Dr Fahrer.

3.4 The significance of assumptions

Having chosen to use the in-house ACIL Allen global CGE model, Dr Fahrer, or whoever conducted the actual modelling exercise, then had to make many assumptions around how to define the Carmichael project within the model. Many choices were made around how to model the project's interactions with the broader Australian and international economy, but these assumptions are not spelt out in detail in Dr Fahrer's report.

Dr Fahrer's reluctance to provide the assumptions on which his modelling is based, while not uncommon among commercial economic modellers, is inconsistent with the approach of financial modellers such as actuaries who typically provide all of their key assumptions and provide clear discussion of how they were selected.

In my opinion, if economic modelling is to be relied upon by courts and other decision makers, then it is necessary to reveal all of the key assumptions in the models used. To do otherwise is to simply expect other experts, and the community more generally, to trust that the assumptions made by the modeller commissioned by a project proponent are appropriate. Too often economic models used as a tool to generate positive media attention for a proposed policy or project, rather than to guide good decision making.

As described in detail below, in my opinion, many of the assumptions that Dr Fahrer has revealed in the process of writing our joint report are extremely implausible. I cannot form a view about the plausibility of the multitude of other assumptions of which I remain unaware.

3.5 Defining the Carmichael project and its impact on world coal supply

Dr Fahrer's CGE modelling exercise concludes that the benefits of the Carmichael project:

*“are between \$18.6 billion and \$22.8 billion”.*²

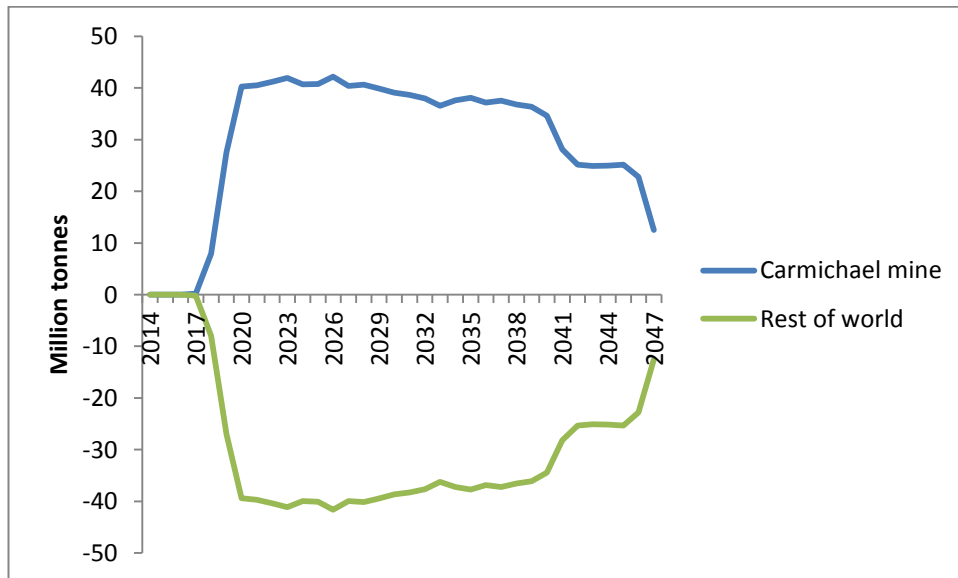
To arrive at this seemingly conclusive result, Dr Fahrer has made a wide range of assumptions, all of which influence the end result. The most important assumptions that Dr Fahrer has made are those around exactly what the Carmichael project is, and what it does to Australian and international coal markets. These are discussed below.

In my view, the Carmichael project is a very large new coal mine which will increase the worldwide supply of coal for decades to come. In Dr Fahrer's model, however, he assumes that building one of the world's largest coal mines will not increase the amount of coal supplied to the world coal market, at all, in any year.

On the contrary, his assumptions cause his modelling to suggest that by building the Carmichael mine world coal supply will actually decrease by over two million tonnes per year.

Figure 1 comes from data provide by Dr Fahrer. It shows Dr Fahrer's forecasts of coal output from the Carmichael project and world coal producers over the life of the project.

Figure 1: Coal supply assumptions



Source: based on data supplied by Dr Fahrer on request

The first thing to note in Figure 1 is the perfect symmetry of coal output from the Carmichael mine and from the rest of the world's mines. For every tonne the Carmichael coal mine produces, Dr Fahrer assumes the rest of the world immediately decides to leave that much coal in the ground.

² Dr Fahrer's First Report, para 23.

What is even more surprising than the idea that overseas coal mines will immediately reduce their output, is that these mines reduce their output despite still being profitable. In Dr Fahrer's model, world prices remaining the same. World prices do not change in the model, yet overseas producers mysteriously withdraw 40 million tonnes from supply.

If the rest of the world's mines are producing a given amount of coal before the Carmichael project comes on stream and price of coal does not fall, then conventional economics would suggest that there is no reason for them to reduce their coal production at all, let alone by 40 million tonnes. Equally, as Dr Fahrer assumes that the Carmichael mine has no impact on the world price, there is no incentive for foreign producers to increase production when the Carmichael mine winds down 30 years hence. As shown in Figure 1, however, this is exactly what Dr Fahrer's assumes will occur.

These remarkable assumptions are not disclosed or explained in any way in Dr Fahrer's report and were only made available to me after repeated requests.

Economics is based on the observation that producers and consumers usually respond to price signals and in my opinion Dr Fahrer's assumption that overseas mines shut down despite the world price remaining constant is implausible.

Even if prices were to change, I do not believe that this adjustment in the global coal production process would be instantaneous as, once constructed, coal mines can take years to respond to price signals. This is evident in Australia today, where many coal mines are operating at a loss because to close down and re-start imposes high costs. Mine owners often hope to wait out periods of low prices. Some mines also have "take or pay" contracts with rail and port providers, which oblige them to pay for transport services even if they do not use them. Such contracts can make it preferable to continue to produce at a loss rather than to shut down immediately.

In my opinion, both the assumptions made by Dr Fahrer and the conclusions he draws do not make economic sense.

In my opinion, and the opinion of multiple economists I consulted with in preparing this report, including the economic modeller Professor Phillip Adams, the construction of the Carmichael mine would place downward pressure on coal prices, which would lead to lower profits for existing coal mines (in Queensland, Australia and overseas) and eventually to the closure of other mines (in Queensland or elsewhere) unless demand increased by more than the new supply being provided by the Carmichael coal mine.

Another point to note is that any expansion in supply is likely to lead to more coal being consumed in the world. As coal use is a major source of greenhouse gas emissions, any increase in coal use caused by the project should be considered in the context of impacts on the global climate.

Given the significance of Dr Fahrer's assumption that building the Carmichael mine would not reduce the world price of coal, I think it is surprising that he did not either discuss why he made such a decision in his First Report or provide sensitivity analysis to show how varying his world coal price assumption would influence the results of his CGE model.

3.6 The impact of the Carmichael mine on jobs

Dr Fahrer's assumption that overseas coal production will fall instantly when Carmichael production comes on stream ensures that his model predicts that the new mine has minimal impact on the rest of the Australian coal industry. The only impact on the

Australian industry seems to be in response to higher input prices, e.g. mining wages, driven by the Carmichael mine. Because of these cost effects, Dr Fahrer's model makes the prediction that the Construction of the Carmichael mine will result in a reduction in overall employment in coal in Australia.

This result bears repeating – Dr Fahrer concludes 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.³

He also predicts impacts on other industries - agriculture and food employment is predicted to decline by around 200 jobs. Interestingly, he predicts increases in public service (227 jobs) and “other business services” employment (500 jobs).⁴

In my opinion these results seem implausible and are not explained by Dr Fahrer. The reasons 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 First 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.

As shown below, further modelling of the Carmichael project by Professor Philip Adams of Victoria University, estimates that the mine will result in significantly less job creation than Dr Fahrer. Significantly, both Dr Fahrer and Professor Adams estimate that the Carmichael mine will create far fewer jobs than the mine proponent has publicly claimed. The fact that three different modelling exercises have generated three significantly different estimates of job creation for the same project supports my opinion that the choice of model, and choice of assumptions, drive the results of economic models.

In my opinion courts, rather than professional economic modellers working for project proponents, should decide which assumptions are plausible and which are not. Such decisions cannot be made, however, when modellers are opaque about the assumptions they have made.

Furthermore, it is important to note that Dr Fahrer predicts that regardless of whether the Carmichael mine is built or not the unemployment rate in Australia and Queensland will be the same in the long run. To be clear, Dr Fahrer does not think that building the Carmichael mine will reduce unemployment.

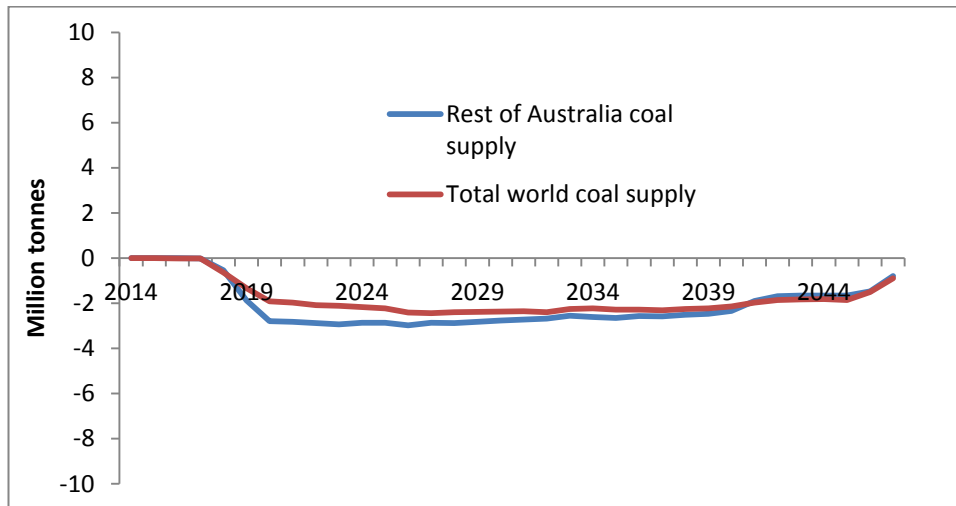
3.7 How a new coal mine can reduce world coal output

As mentioned above, another key conclusion of Dr Fahrer's modelling exercise is that building a large new coal mine will reduce the amount of coal supplied in the world. The model outputs are graphed in Figure 2 below for change in Australian coal production outside of the Carmichael coal mine and overall world supply:

³ Joint Expert Report of Deniss and Fahrer (2015), Issue 113, p5. As disclosed by the attachment to the letter form McCullough Robertson Lawyers dated 12 February 2015, a copy of which is provided in Attachment H to this report.

⁴ Joint Expert Report of Deniss and Fahrer (2015), Issue 113, p5.

Figure 2: Changes in Australian and world coal supply



Source: based on data supplied by Dr Fahrer on request

From conversations with Dr Fahrer the logic behind how building a coal mine can reduce world coal output is as follows:

- Step 1 - Dr Fahrer assumes that the world wants an extra 40 million tonnes of coal from Australia and wants 40 million tonnes of coal less from the rest of the world.
- Step 2 - The extra demand for Australian coal drives up the cost of producing coal in Australia.
- Step 3 - The increased cost of Australian coal production means that outside of the Carmichael project, Australian coal output reduces slightly, by two to three million tonnes per year.
- Step 4 - The rest of the world's reduction of 40 million tonnes in coal production and the slightly less than 40 million increase Australian coal output (including Carmichael) means that world coal output will be around 2 million tonnes per year lower if the Carmichael mine is built.

In my opinion such an outcome is entirely misguided and highlights the importance of understanding the models that are used to generate the benefits claimed by Dr Fahrer.

While the four steps described above are based on conversations I have had with Dr Fahrer it is possible the mechanism by which building a large mine reduces world coal supply is slightly different to my description. Dr Fahrer provides no description of this surprising effect in his report and his verbal accounts of the effect have at times been difficult to follow.

To illustrate how Dr Fahrer's assumptions are different from how real world markets work, recall our example of the OPEC oil cartel, discussed in the introduction (section 3.1) OPEC works on the assumption that increasing the amount of oil supplied to the world market results in lower prices and that restricting the amount of oil supplied to the world market results in higher prices. In recent years countries outside of the OPEC cartel have invested in new oil wells and, as a result, the supply has increased and the price of oil has fallen significantly.

Dr Fahrer has assumed that, unlike the construction of new oil wells, that the construction of new coal mines will have no impact on the supply of coal, or the world price. This is very misleading, in my opinion.

3.8 Potential benefits need to be understood as probabilities not certainties

Any benefits from the Carmichael project are contingent on it being financially viable. The CGE modelling results give no indication of financial viability, even though they appear to show a project that will deliver enormous economic benefit.

Dr Fahrer states in our joint report (page 4, issue 112) that it is 'trivial' to highlight that the benefits that he estimates flow from the Carmichael mine are contingent on his assumption that the mine will be profitable enough to operate at full capacity over the life of the mine. In my opinion this assumption is far from trivial and, again, this assumption is not disclosed in his First Report.

The very high levels of profit historically received by mining companies are often justified in terms of the risk inherent in making multimillion dollar investments based on uncertain future resource prices and demand.

In my opinion, even though Dr Fahrer significantly exaggerates the project's potential benefits to the Queensland community, even a reduced estimate should be seen as a 'best case scenario' because of this assumption that the mine operates at full capacity over many decades.

A worst case scenario would be if the project commenced, causing damage to the environment but was then mothballed due to lower than anticipated coal prices or higher than anticipated costs.

Put simply, for a project like the Carmichael mine, most of the environmental and social harms occur at the beginning of the construction process and most of the benefits accrue in future years. In my opinion, to assume that the Carmichael mine will operate continuously and profitably for 30 years and to ignore the risk of shutdown in estimating the likely benefits results in a significant overestimate of those benefits.

3.9 Presentation and interpretation of modelling results

How data is presented has a significant impact on the way people interpret it. For example, most people feel better hearing that a form of surgery is successful in 95 per cent of cases than they do learning that it is unsuccessful for 1 in 20 people. Providing context is just as important for the interpretation of economic statistics.

In my opinion, Dr Fahrer's modelling results serve to exaggerate the perception of the potential economic benefits associated with the Carmichael mine. Furthermore, Dr Fahrer's presentation of his modelling results further distorts his results for the average reader.

3.9.1 Numbers need context

Talk of projects creating thousands, or tens of thousands of jobs make them seem nationally significant with the potential to redefine regional economies. However, when seen in the context of an Australian population of 23 million, or Queensland's population

of five million, such projects account for a tiny proportion of existing and potential employment.

In recent years, thousands of people have lost their jobs in video stores and photo development labs.⁵ However, the reason so little attention is paid to such job losses is that they, like the claimed employment benefits of the Carmichael mine, are tiny when seen in the context of the entire Queensland economy.

This is not to say that the potential to create thousands of jobs is irrelevant, but it is important to place such numbers in a meaningful context before suggesting they are 'state significant'. At the 2011 census Queensland's coal industry employed 24,350 people. Without context this may seem like a lot of people, but it represents just 1.2 per cent of Queensland's 2 million strong workforce. In fact, coal is one of the smallest industries by employment in the state.⁶

3.9.2 Comparing like with like

Dr Fahrer claims that the Carmichael mine's output is equivalent to 10.3 per cent of Queensland's Gross State Product (GSP) or two per cent of Australia's Gross Domestic Product (GDP).⁷ In my opinion this claim is highly misleading and represents a major exaggeration of the importance of the project.

To arrive at these figures, Dr Fahrer estimates the annual benefits that might flow from the Carmichael mine over the 30 year life of the project and compares them to gross state product (GSP) in 2014. While Dr Fahrer insists on describing this as a 'like with like' comparison in our joint report (p4-5), in my opinion this is not correct. Consider the following example:

Imagine that a person who earns \$100,000 per year spends \$1,000 per year on coffee. Over the next 30 years they will spend \$30,000 on coffee. It is misleading to add up 30 years' worth of expenditure on coffee (\$30,000) and divide it by one year's income (\$100,000) to conclude that the person spent 30 per cent of their income on coffee.

Effectively, this is what Dr Fahrer has done in paragraph 55 of his report. The only difference is that he applies a 'discount rate' to the benefits over the 30 year life of the mine. A true 'like with like' comparison would, in my opinion, take 1 of 2 forms:

- A. benefits of the mine in any one year divided by forecast GSP in that year; or
- B. net present value of the annual benefits of the mine over the period 2015 to 2047 divided by the net present value of GSP over the same period.

In my opinion Dr Fahrer has tried to use the concept of net present value, a concept that few non-economists understand, to conceal the fact that he has compared the sum of 30 years' worth of benefits with the GSP of just one year.⁸ He uses this presentation to make the benefits of the mine appear much larger than the fraction of one per cent of GSP that they will account for even at their peak.

⁵ See for example <http://money.cnn.com/2013/01/22/news/companies/blockbuster-job-cuts/index.html> <http://www.smh.com.au/articles/2004/09/16/1095221710791.html?from=storylhs>.

⁶ (Campbell 2014).

⁷ (Fahrer 2015) p13, para 55.

⁸ Net Present Value is a tool used by economists to compare the costs and benefits of different choices when the costs and benefits accrue at different points in time. It is based on the assumption that people prefer benefits today to benefits in the future and, in turn, future benefits are 'discounted' before they are compared to present benefits.

3.9.3 Averages do not help understand distribution

Most of the results in Dr Fahrer's economic assessment are reported in regional, state or national output or income measures. These represent the average across the community and provide little information about how groups within the community are affected. For example, Dr Fahrer claims:

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.⁹

In my opinion Dr Fahrer's use of claimed 'average benefits' exaggerates benefits of the Carmichael mine. Average benefits does not mean benefits to average community members. Unfortunately such averages often conceal more than they reveal. Consider the following:

The average Australian has less than 2 legs as the number of 1 legged people exceeds the number of three legged people.

If Bill Gates moved to Australia the average incomes of Australians would rise, but the economic welfare of Australians would remain unchanged.

It is important to note that Gross State Product (GSP), for example, refers to the total value of production that occurs within a state. If a company operating in Queensland was 100 per cent foreign owned and repatriated \$10 billion in profits that \$10 billion would be included in estimates of GSP even though none of it accrues to residents of the state. Similarly, if one person in a local community received that \$10 billion in dividends then the average income of that region would increase significantly even though all but one resident would receive absolutely no benefits.

The Carmichael mine may benefit parts of the community considerably, but to suggest large benefits to the average member of the regional or Queensland community is misleading, in my opinion.

3.10 Choice of model and environmental assumptions

Dr Fahrer has chosen to rely on ACIL Tasman's in house Computable General Equilibrium model. While I am not sure if Dr Fahrer considered using any other forms of model than the ones his employer owns, his choice of model has a significant impact on both the issues he chose to include in the analysis and the end results.

In particular, in choosing to use a model that ignores the value of 'externalities' such as land, air, water and noise pollution he has implicitly assumed that these things can be valued at zero in the model. Models that attempt to include environmental and social costs are known as Integrated Assessment models.

In my opinion environmental and social cost impacts are not worth zero. Models that place non-zero numbers on these impacts exist, but Dr Fahrer provides no rationale for his choice to ignore those models and, in turn, the value of those impacts.

⁹ (Fahrer 2015), p14, para 62.

3.11 Different CGE models results for the Carmichael project

As discussed above, the choice of model and choice of assumptions significantly influences the estimated benefits of a project.

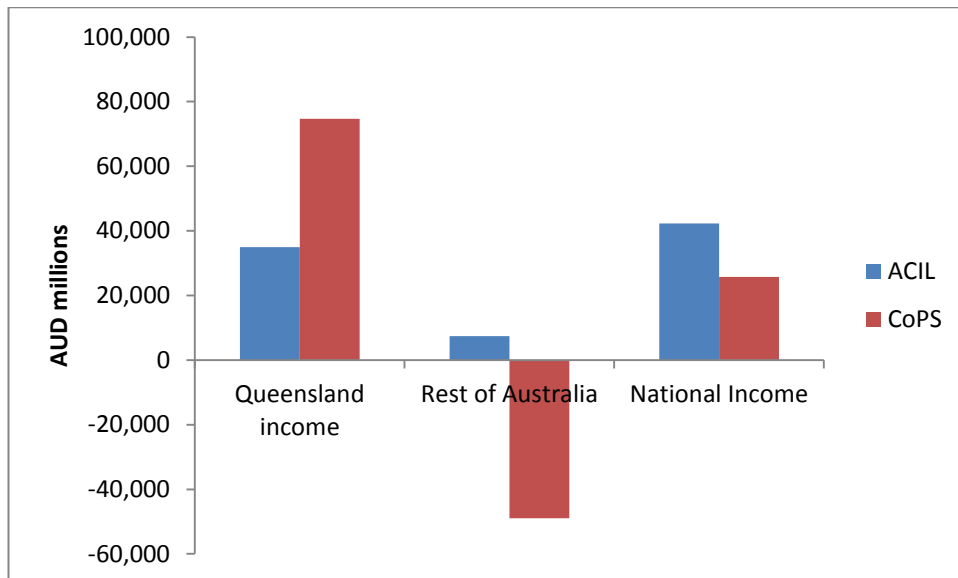
In order to both better demonstrate the significance of the assumptions discussed above I requested that Professor Phillip Adams model a project of similar size and structure to the Carmichael mine. Attachments E to H are the results of that model under the range of assumptions discussed below.

Professor Adams is a respected macroeconomic modeller who is Research Professor at the Centre of Policy Studies (CoPS), Victoria University, Melbourne (a copy of his CV is Attachment C).

Professor Adams used Dr Fahrer’s assumptions about the size and operations of the Carmichael mine to estimate the economic benefits of the Carmichael mine using the CGE model at the Centre of Policy Studies (CoPS) at Victoria University (Victoria University Regional Model – VURM). An overview of the VURM model is Attachment D.

Even though Professor Adams used the same project inputs and both his model and Dr Fahrer’s model are CGE models, they produce very different results. For instance, estimates of changes to real income for Queensland, the rest of Australia and the nation are shown in Figure 3 below:

Figure 3: Economic income results of ACIL and CoPS CGE models



Source: based on data provided by Prof Philip Adams and on Dr Fahrer’s First Report. These results are the simple sum (undiscounted) of annual estimates of changes in real income.

We see that both models have very different predictions. Although they both predict increases in national income of broadly similar magnitude – between \$25 and \$42 billion – the way each model gets to this figure is very different. The CoPS model predicts a large increase in Queensland income, offset by a decrease in income to the rest of Australia, while the ACIL model predicts more modest increases in income at both levels. From a Queensland perspective, Professor Adams’ model presents a stronger case for the Carmichael mine.

The large disparity between the results of these two models highlights the need for modellers to provide detailed and transparent discussion about their choice of model. Dr Fahrer provides no such detailed discussion.

As discussed above, in addition to choosing a model, the modeller also makes a wide range of subjective decisions about how the project should be specified in the model. There are more judgements required around all assumptions within the model. All of these subjective choices will have an impact on the end result and, again Dr Fahrer provides no empirical evidence in his report to justify the key assumptions he has made.

The results provided by Professor Adams highlight how sensitive the results of a CGE modelling exercises are to the assumptions made by the modeller. In my opinion these disparities highlight the need for modellers to be transparent about their assumptions, to openly discuss the significance of their assumptions and to provide empirical evidence to justify those assumptions when their results are being relied upon in judicial and departmental decision making.

In Table 1 below, the real national income result of Dr Fahrer's ACIL Tasman Global model is compared with:

1. a CoPS VURM model using the same assumptions disclosed in Attachment B to Dr Fahrer's First Report;
2. a CoPS VURM model using the revised assumptions disclosed in Attachment A to the Second Supplementary Report of Mr Tim Buckley of the Institute for Energy Economics and Financial Analysis (IEEFA); and
3. a CoPS VURM model using the assumptions disclosed in Attachment A to Mr Buckley's Second Supplementary Report, but allowing for 1 per cent and 5 per cent reductions in coal price (recall that Dr Fahrer assumes there is no change in coal price).

Table 1: Comparison of model assumptions

	Model	Source of model assumptions	Assumed change in coal price	Predicted life of mine real national income (millions)	Predicted life of mine employment years
1.	ACIL-Tasman Global ¹⁰	Attachment B to Dr Fahrer's First Report	0%	\$AUD 42,282	48,324
2.	CoPS - VURM ¹¹	Attachment B to Dr Fahrer's First Report	0%	\$AUD 25,699	14,498
3.	CoPS - VURM ¹²	Attachment A to Mr Buckley's Second Supplementary Report	0%	\$AUD 13,030	14,502
4.	CoPS - VURM ¹³	Attachment A to Mr Buckley's Second Supplementary Report	-1%	\$AUD -361	14,496
5.	CoPS - VURM ¹⁴	Attachment A to Mr Buckley's Second Supplementary Report	-5%	\$AUD -52,582	14,499

¹⁰ Replicated in Attachment E to this report.

¹¹ See Attachment E to this report.

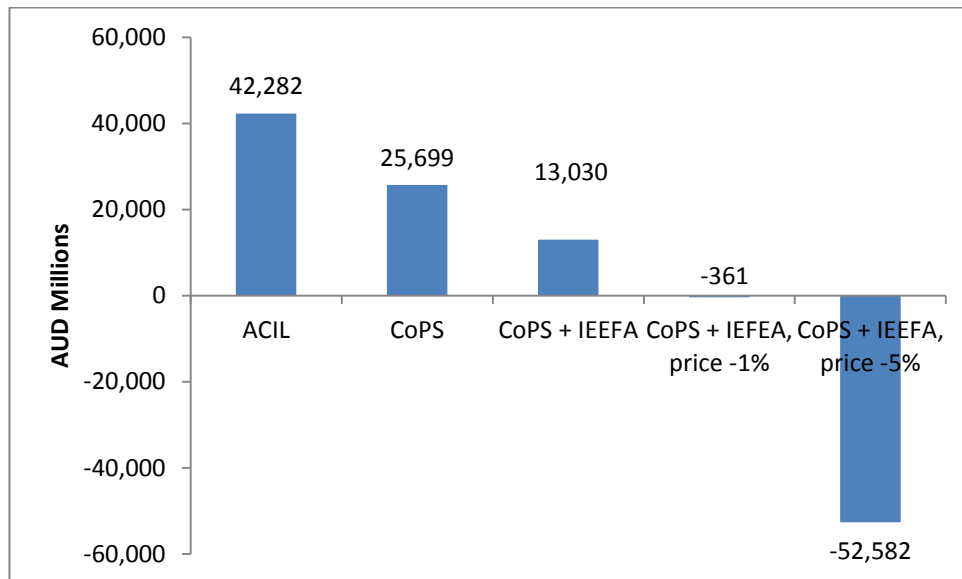
¹² See Attachment F to this report.

¹³ See Attachment G to this report.

¹⁴ See Attachment H to this report.

Figure 4 below, illustrates the life-of-mine real national income result of Dr Fahrer’s model is compared with the same project assumptions under the CoPS model and the other assumptions in Table 1 above.

Figure 4: Comparison of models and assumptions (total real \$ over life of project)



Source: based on data provided by Prof Philip Adams and on Dr Fahrer’s First Report

As shown in Table 1 and Figure 4, the CoPS model based on Mr Buckley’s assumptions about the project finances, predicts that real income in Australia would fall if the Carmichael mine caused a 1 per cent reduction in the price of coal.

Similarly, if the construction of the Carmichael mine drives a 5 per cent reduction in the world price of coal then real income in Australia would fall by over \$50 billion under the CoPS model.

While my expertise is not in the relationship between Australian coal production and the world price of coal, in my opinion as an economist it is inconceivable that the construction of a mine the size of Carmichael would not lead to a reduction in the price of coal received by Australian coal exporters.

I note that Mr Buckley, Professor Adams and every other economist I consulted agreed that the construction of a large mine would be likely to reduce the price of coal. Mr Buckley estimated that the supply from the Carmichael mine could see the forward coal price drop by up to 5 per cent.¹⁵

To be clear, Professor Adams shares my opinion that building one of the world’s largest coal mines would be likely to increase the world supply of coal.

¹⁵ Mr Buckley’s Supplementary Expert Report, Section 2, p9.

3.12 Cost benefit analysis (CBA)

Dr Fahrer's CBA of the Carmichael project is of little use for decision making due to several key flaws:

- no consideration of the costs and benefits to Queensland;
- no consideration of the wider costs of coal;
- assumption of financial viability and no consideration of this assumption; and
- inadequate consideration of other environmental impacts.

3.13 What is CBA?

I broadly agree with Dr Fahrer's description of CBA in his First Report:

Cost Benefit Analysis (CBA)...is designed to make value judgments about whether a project ought to proceed 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.

CBA asks if the project makes society better off – does it improve our economic welfare? Just as with CGE modelling discussed above, however, there are major assumptions that the modeller must make around what he/she means by “the project” and who or what is included in their definition of society.

3.14 Scope and standing in CBA – Who's costs and benefits count?

Setting the scope of the CBA is an important step. This is emphasised in all text books on CBA:

The analyst must decide who has standing; that is, whose benefits and costs should be counted. ...It is often contentious whether an analysis should be performed from the global, national, state (provincial), or local perspective. While federal governments usually take only national costs and benefits into account, critics argue that many issues should be analyzed from a global perspective. Recent environmental issues that fall into this category include ozone depletion, global climate change and acid rain. At the other extreme, local governments typically want to consider only benefits and costs to local residents and to ignore costs and benefits that occur in adjacent municipalities or are borne by higher levels of government.¹⁶

This text book's general preference is for assessment at a national level, depending on the responsibilities and interests of the decision making body, an opinion shared by Rio Tinto's expert witnesses in the New South Wales (NSW) Land and Environment Court:

BCA can potentially be applied across different definitions of society. Depending on agency jurisdiction and the geographical spread of benefits and costs, this could range from the population of a Council area through to the whole world. However, most applications of BCA are at the national level.¹⁷

Dr Fahrer's approach to the scope of the CBA is global, both in this case and when he has appeared in the NSW Land and Environment Court. He believes that all benefits of the

¹⁶ This is a very widely-used text book on CBA - (Boardman et al. 2006), p7-8.

¹⁷ (Bennett & Gillespie 2012) p19, para 54.

project should be of equal interest to decision makers. Whether these benefits accrue to Queensland residents or to foreign investors does not matter to Dr Fahrer. This is a value judgement by Dr Fahrer.

Many jurisdictions require CBA at a national, state or local level because by including benefits that accrue to global interests makes it difficult to assess the costs and benefits that accrue at the level relevant to the responsibilities of that jurisdiction. Queensland's guidelines make exactly this point:

*Before costs and benefits can be appropriately identified, the spatial reference area of the analysis needs to be determined. Do the project costs and benefits fall within the state, national or global area? The identification of the spatial area of the analysis will set the boundary for which costs and benefits are included in the analysis. Generally, for Queensland Government projects, the appropriate spatial area would be the State of Queensland. However, if it is considered that significant costs and benefits fall within the national or global area, then these costs and benefits should be identified clearly and included in the analysis.*¹⁸

NSW takes a similar approach, specifying that costs and benefits to the NSW community should be the focus of CBA.¹⁹ Dr Fahrer's refusal to comply with these guidelines was considered "regrettable" by the NSW Land and Environment Court:

*Dr Fahrer's CBA did not address the requirement specified in the [Director General's Requirements (DGRs)] and the [Planning] Department's guideline of quantification of the economic benefits to the State of NSW...Failing to comply with the DGRs and the Department's guideline is regrettable.*²⁰

In my opinion, Dr Fahrer's approach to the Carmichael CBA takes the same approach. He assumes that Queensland's decision makers should not care about whether the costs and the benefits of selling Queensland's coal accrue to Queenslanders. I believe that improving the welfare of the state of Queensland should be the main concern of Queensland's decision makers, and that the CBA for projects in the state should reflect this.²¹

One consequence of Dr Fahrer's approach is that under his global CBA, subsidies that the Queensland taxpayer may have to put into the project, through infrastructure provision, royalty waiver or other means, are not considered. Dr Fahrer's contention in our joint report that taxes and subsidies are "not relevant to CBA" is wrong if the CBA is to consider transfers from Queensland taxpayers to foreigners. For any decision maker interested in the welfare of Queenslanders, these issues are clearly of central concern.

3.15 Considering the wider costs of coal

Dr Fahrer's approach to setting the scope of his CBA extends beyond geographical boundaries. While he has considered all the benefits of the project at a global level, he has not considered all the costs at a global level. There are costs which are borne by people who live near the mine, transport infrastructure and coal-fired power stations, as well as to the global climate, which are not included in Dr Fahrer's assessment.

Dr Fahrer contends that most of these costs are not related to this project:

¹⁸ (Qld DIP 2011) p19.

¹⁹ (NSW Treasury 2012).

²⁰ Her Honour Justice Pain in *Hunter Environment Lobby Inc v Minister for Planning (No 2)* [2014] NSWLEC 129, 172 [462].

²¹ Dr Fahrer claims support for his position from the economic literature. His reference is selective and misleading. Economic literature has long discussed the need to consider scope and standing in CBA and the differences that these decisions can make. See for example (Whittington & MacRae 1986).

*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 ... 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.*²²

The difficulty with Dr Fahrer's approach is that he counts the benefits of coal mining to the world, but not all of the cost. This is because the benefits of coal – contribution to electricity production – are reflected in its market price. The costs of coal, however – greenhouse gas emissions and health impacts of coal mining, transport and combustion – are not usually reflected in the market price. A coal price that reflected its true costs and benefits would be much lower. Again, general CBA practice and Queensland's guidelines reflect this reality:

*Economic valuation of costs and benefits involves adjustments for market distortions (e.g. tax and subsidies) and the estimated valuation of inputs and outputs not traded in the market (e.g. pollution or lives saved).*²³

Dr Fahrer's refusal to acknowledge this reality serves to radically overvalue the Carmichael project.

Dr Fahrer does assign a cost to carbon emissions created directly by the mining and rail transport parts of the project, with a carbon price rising to over \$100 per tonne in 2028 and reaching \$232 per tonne by the end of the project.²⁴ This raises two questions.

Firstly, Dr Fahrer should discuss where his carbon price assumptions have come from. These prices are broadly in line with the International Energy Agency's 450ppm scenario.²⁵ Under this scenario, however, world demand for coal declines by 33 per cent, which would most likely make the Carmichael project unviable. Dr Fahrer should explain whether the project is viable under his own carbon price assumptions.

Secondly, under Dr Fahrer's global scope of CBA and assumption that other mines reduce their output as Carmichael produces, I would imagine that these mines would also be reducing their carbon emissions. The reduction of these mines activities should offset the increase in emissions by the Carmichael project, giving a net result close to zero. I hasten to emphasise that I do not believe these assumptions are plausible. These mines will continue producing and continue emitting in the real world. However, this highlights the inconsistent logic in Dr Fahrer's analysis.

At this point we should reflect on the assumptions in the CGE model, which were that coal supply would reduce and that price is unaffected by the Carmichael project. As discussed this is entirely implausible. In fact, the project is likely to lead to downward pressure on coal prices and increased production and consumption of coal. The implications of this for human health and climate change costs should have been discussed in Dr Fahrer's economic assessment.

Put simply, Dr Fahrer's assumption that building one of the world's largest coal mines will not reduce the world coal price is also the assumption that building the Carmichale mine will not result in increased greenhouse gasses. In my opinion, the Carmichael mine will increase world coal supply, reduce world coal prices and increase world greenhouse gas emissions.

²² (Fahrer 2015) p20, para 90.

²³ (Qld DIP 2011) p18.

²⁴ Real 2014-15 Australian dollars.

²⁵ (IEA 2013).

3.16 Financial viability and CBA

Dr Fahrer's approach to CBA emphasises benefits to foreign investors, but without serious consideration of whether the project is actually financially viable to these investors. Dr Fahrer's assumptions around capital and operating costs, coal quality and prices, discount rates, rail costs, rehabilitation costs and lack of port investment are all different to the study in the SEIS, are all based on sources I have not seen, and most seem very optimistic. For example, Dr Fahrer and I agree that the discount rates faced by coal companies in the real world are far higher than those used in his analysis. His assumption that no capital spending is required at the Abbot Point Port is contrary to the capacity limits reported on the Port's website and the current political debate around the port expansion.

Financial viability and the economic desirability of a project are not the same thing. This is why governments provide services that are often financially unviable, like schools, hospitals and national parks. However, as I wrote at page 10 of our joint expert report:

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 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.

Effectively, Dr Fahrer makes an assumption that the project is financially viable when he concludes that there are large net benefits of the Carmichael project. However, his report provides no insight as to whether the project is viable or not. This is surprising as Dr Fahrer agreed with Mr Roderick Campbell in their joint report on 19 December 2014 that a CBA can provide some understanding of the financial strength of the project.²⁶

3.17 Other environmental impacts

The impacts of the Carmichael mine and related infrastructure on ecology, groundwater, coastal wetlands and the Great Barrier Reef are not considered by Dr Fahrer. He appears to have done minimal research into the potential for these impacts to occur or to be mitigated or managed and what the resulting economic costs might be.

For example, his discussion of potential impacts on black-throated finch populations concludes that the offsets required will amount to a cost of \$37,200 per bird. The implication is that this is far more than an individual bird is worth. However, he makes no consideration of whether the offsets are likely to work, or of the importance of these finches to the wider population of the species. I understand it is considered an important population for the survival of the species. Economics has a long and lively literature on how to account for impacts on species or ecosystems that are in danger of extinction.²⁷ Dr Fahrer considers none of this literature and merely assumes that ecological impacts of the project will be easily managed.

On groundwater, Dr Fahrer refers to "make good arrangements under which [Adani] will replace or compensate for groundwater which becomes unavailable to other users".²⁸ I understand there is conflicting evidence over the groundwater impacts of the project. Dr

²⁶ For an example of an assessment of a coal mine that does consider financial viability in depth, see (DAE 2014).

²⁷ See for example (Krutilla 1967; Bishop 1978; Boyle & Bishop 1985; Johansson 1990).

²⁸ (Fahrer 2015) p33, para 180.

Fahrer does not consider this conflicting evidence, but assumes it will be possible for the make good arrangements to be fulfilled.

Impacts caused by dredging or shipping in the Great Barrier Reef are not considered at all by Dr Fahrer. Instead, his approach is to consider how large an environmental impact would be required to outweigh his estimate of the project's net benefits. He makes a comparison to the Deepwater Horizon oil spill in the Gulf of Mexico, claiming that a similar sized disaster would have to happen to make the project undesirable. This presents two main problems.

Firstly, Dr Fahrer is comparing the benefits of the project at a global level to environmental impacts that accrue mainly to Queenslanders. The benefits to Queensland are far lower and so a much smaller environmental impact would mean the project was undesirable for Queenslanders.

Secondly, Dr Fahrer's references for the costs of the Deepwater Horizon incident is an article that make no attempt to calculate the total economic value of the damage caused by the incident. The article focuses on payments by oil rig owners, BP. Dr Fahrer uses the figure from the article's first paragraph, where it says that "the bill so far [is] \$42.7 billion". He ignores the very next line of the article:

The final figure could be far higher, however, as the latest tally does not take account of additional provisions for economic loss claims from a further legal settlement BP has made.²⁹

The issue is not what the final figure of the Deepwater Horizon spill is. The issue is that Dr Fahrer has ignored environmental economic literature and not seriously investigated the possible economic consequences of the project's environmental impacts.

Further, as discussed above, I believe Dr Fahrer's estimates of the economic benefits of the mine are significantly exaggerated due to his choice of model and assumptions. If the benefits are significantly smaller, and most of them accrue to people outside Queensland, then the size of any accident sufficient to wipe out those benefits would also need to need to be much smaller.

4. Summary of conclusions

Dr Fahrer's economic assessment is deeply flawed and misleading. Both his CGE modelling and CBA are based on assumptions that are either non-transparent or implausible, or often both.

An economic model is an attempt to predict the unknown based on some facts that are known. Any predicted benefits from a CGE model, such as that used by Dr Fahrer, are only as useful if the model that was chosen is appropriate to the situation being examined and if the assumptions put into the model are plausible.

The Court has been exposed to three different forms of modelling for this project. The first evidence provided by the proponent in the SEIS suggested that 10,957 jobs would be created. While the proponent has continued to make this claim in public, they are now relying on evidence that significantly departs from that claim. Dr Fahrer himself has been critical of the usefulness of the kind of 'input-output' modelling used to generate those claims.

²⁹ <http://www.theguardian.com/business/2014/feb/04/bp-deepwater-horizon-bill-rises-profits-fall>.

Dr Fahrer's modelling suggests the benefits of the Carmichael mine are significantly smaller than the original claims made by the proponent, but, as discussed, in my opinion the assumptions he makes are often implausible and the way he presents his results is misleading.

Finally, Professor Adams has provided modelling which shows that, among other things, small reductions in the price of coal will have very large impacts on the potential benefits to Australia (see Figure 4 above).

In my opinion the main conclusion that can be drawn from the disparities among these three different attempts to model the economic impacts of the Carmichael mine highlight a simple point – the choice of model and the choice of assumptions behind the model are crucial to determining the claimed impacts presented to both courts and the public.

Dr Fahrer concedes that he chose to use a model that ignores the environmental costs of polluting the water, air and land. This was a very significant choice and, in my opinion, an inappropriate one. His report provides no discussion of how and why he made such a choice.

Dr Fahrer has also chosen to include some very unorthodox, and in my opinion entirely implausible, assumptions about the likely response of other coal producers to the construction of one of the world's largest coal mines. Dr Fahrer's assumption that building a very large new mine will have no impact on the world price and his conclusion that world coal output will fall slightly if the mine is approved are entirely inconsistent with economic theory and empirical evidence. While OPEC was formed on the assumption that increasing supply lowers price, and the recent expansion of iron ore production in Australia has significantly lowered price, Dr Fahrer assumes that this will not happen in the world coal market.

In my opinion Dr Fahrer's choice of model and choice of assumptions both serve to inflate the likely benefits of the Carmichael mine to Queensland.

In particular his reliance on cost and price data provided by the proponent, his assumption that the mine will operate profitably and consistently for 30 years and his assumption that the mine will cause wage rises in unrelated industries thousands of kilometres away are all poorly explained in his report, are not supported by any evidence in Dr Fahrer's report and all serve to inflate the potential benefits of the mine to Queensland. Similarly, his decision to use a model that implicitly values pollution at zero helps to inflate the potential benefits of the mine.

Dr Fahrer's decision to conduct CBA in a way that allows Queensland decision makers to see the costs and benefits of the project to Queenslanders is contrary to economic practice and Queensland's economic assessment guidelines. These guidelines also require analysts to properly consider the social and environmental costs of projects, which Dr Fahrer has not done, in my opinion.

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6. Expert's Statement – Additional Facts

I am not aware of any further readily ascertainable additional facts that would assist me to reach a more reliable conclusion.

7. Declaration

In accordance with rule 24F(3) of the *Land Court Rules 2000* (Qld), I confirm the following:

- (a) the factual matters stated in the report are, as far as I know, true;
- (b) I have made all enquiries considered appropriate;
- (c) the opinions stated in the report are genuinely held by myself;
- (d) the report contains reference to all matters I consider significant;
- (e) I understand the duty of an expert to the court and have complied with that duty;
- (f) I have read and understood the *Land Court Rules 2000* on expert evidence; and
- (g) I have not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.

Signed:



Dr Richard Denniss

16 March 2015

Attachment A - Letter of Instructions



26 February 2015

Richard Denniss
The Australian Institute
Level 5, 131 City Walk
Canberra City, ACT 2601
Australia

Sent by email: rd@tai.org.au

Dear Richard

Land Services of Coast and Country Inc. – Analysis of Carmichael coal mine assessment

We confirm that we act for Land Services of Coast and Country Inc. (**LSCC**) in respect of its concerns with the Carmichael Coal Mine (**Project**). LSCC has made an objection to the grant of a mining lease (**ML**) and environmental authority (**EA**) for the Project which are currently the subject of proceedings in the Queensland Land Court (**Proceedings**).

1. Engagement

- 1.1 On behalf of Coast and Country, we wish to engage you to provide advice on issues of concern in relation to the economic assessment of the Project and to act as an independent expert witness in relation to the economic issues in the Proceedings.

2. Instructions

- 2.1 You are instructed to review this letter and accompanying documents and provide evidence to the Court, through the expert meeting process, as to whether you consider there are any significant issues or deficiencies in the assessment of economic impacts for the Project.

3. Background information

- 3.1 The Project is a proposed open-cut and underground coal mine 160 km north-west of the town of Clermont, in Central Queensland. The mining lease application is for 30 years with an annual coal production peaking at around 60 million tonnes per annum, but it is noteworthy that the Applicant's intention is to run the mine for 60 years.

- 3.2 The Project is situated in the Galilee Basin in the catchment of the Burdekin River, which flows into wetlands and the Great Barrier Reef, and the area of the Project and its surroundings is predominantly used for agriculture, particularly grazing.
- 3.3 The thermal coal deposits for the Project are located within Mining Lease Applications 70441, 70505 and 70506 (**MLAs**). Approximately 28,000 hectares of the mining lease area is proposed to be disturbed by the open-cut and underground mining operations and related activities.
- 3.4 Adani Mining Pty Ltd (**Applicant**) lodged MLA 70441 for a mining lease (**ML**) under the *Mineral Resources Act 1989* (Qld) (**MR Act**) on or about 8 November 2010 and subsequently applied for MLAs 70505 and 70506 on 9 July 2013.
- 3.5 The Coordinator-General declared the Project a significant project¹ for which an environmental impact state (**EIS**) was required under the *State Development and Public Works Organisation Act 1971* (Qld) (**SDPWO Act**) by [gazettal notice](#) on 26 November 2010.
- 3.6 The Applicant's EIS was published and public submissions invited from 15 December 2012 to 11 February 2013. A Supplementary EIS (**SEIS**) was published and public submissions invited from 25 November 2013 to 20 December 2013.
- 3.7 The Coordinator-General's report on the Project under the SDPWO Act was delivered on 7 May 2014. The Coordinator-General recommended that the mine be approved subject to conditions.
- 3.8 The Applicant made an application for an environmental authority (**EA**) under the *Environmental Protection Act 1994* (Qld) (**EP Act**) on 11 April 2014.
- 3.9 Objections to the MLAs and EAs were referred to the Queensland Land Court on about 29 September 2014.
4. **Brief of Material**
- 4.1 Concurrent with this email we will send you an invite to the electronic brief in this matter through Dropbox. We can provide these documents in other electronic format or in hard copy if necessary.
- 4.2 A copy of the Index to that brief is **Annexure C** to this letter.
- 4.3 We draw your attention in particular to the general application and approval documents in Index B and the economics key documents in Index E of the Brief.
5. **Timing**
- 5.1 Our client lodged an objection to the ML on 17 June 2014, and an objection to the EA on 10 September 2014.
- 5.2 You will be required to participate in the proceedings in accordance with the Orders made on 30 January 2015 (document 53 of Index A of your Brief) unless these orders are further altered by the Court. These include meeting with the corresponding expert from

¹ Note that the SDPWO Act was amended in December 2012 (with the amendments taking effect on 21 December 2012). The amendments replaced the term 'significant project' with the term 'coordinated project' and these terms may be used interchangeably.

the other parties and preparing a joint report on setting out points of agreement and disagreement.

5.3 You may be required to give oral evidence, or be cross-examined on your evidence, at a hearing.

6. **Your duty to the Land Court**

6.1 We enclose as **Annexure A** rules 22 to 24I of the *Land Court Rules 2000* which govern experts in the Land Court.

6.2 In particular we note that rule 24C of the *Land Court Rules 2000* provides that you have a duty to assist the Land Court which overrides any obligations you may have to our client.

6.3 We also emphasise that we and our client don't seek to influence your views in any way and we ask for your independent opinion to assist the Land Court. Consequently, please note that any statements of fact or opinion in this letter of instructions, the above documents, or anything given or said to you by us relevant to the issues in your report do not constrain you in any way and are not intended to influence your views. We ask you to form your own opinion about the relevant facts and circumstances for the purposes of your report.

6.4 Any joint report or separate expert report you prepare should confirm that each expert understands the expert's duty to the court and has complied with that duty.

7. **Format of your statement of evidence (other than joint report)**

7.1 If you have taken part in a meeting of experts, the joint report is taken to be your statement of evidence and you are to produce a further statement of evidence in relation to any issue of disagreement.

7.2 Suggestions for the format of your report are set out in **Annexure B**, "Format of your report".

7.3 Your report must:

- (1) be addressed to the Court;
- (2) include your qualifications;
- (3) include all material facts, whether written or oral, on which your report is based;
- (4) include references to any literature or other material you relied on to prepare the report;
- (5) include for any inspection, examination or experiment you conducted, initiated, or relied on to prepare your report—
 - a) a description of what was done; and
 - b) whether the inspection, examination or experiment was done by the expert or under the expert's supervision; and
 - c) the name and qualifications of any other person involved; and

- d) the result;
- (6) if there is a range of opinion on matters dealt with in your report, include a summary of the range of opinion, and the reasons why you adopted a particular opinion;
- (7) include a summary of the conclusions you reached; and
- (8) include a statement about whether access to any readily ascertainable additional facts would assist you in reaching a more reliable conclusion;
- (9) include a confirmation at the end of the statement of evidence:
 - a) the factual matters included in the statement are, as far as the expert knows, true; and
 - b) the expert has made all enquiries considered appropriate; and
 - c) the opinions included in the statement are genuinely held by the expert; and
 - d) the statement contains reference to all matters the expert considers significant; and
 - e) the expert understands the expert's duty to the court and has complied with the duty; and
 - f) the expert has read and understood the rules contained in this part, as far as they apply to the expert; and
 - g) the expert has not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.
- (10) include your signature.

7.4 You should attach to the report:

- (1) a copy of your Curriculum Vitae; and
- (2) a copy of this letter.

7.5 Please number all pages and paragraphs of your report. You may wish to include an index.

7.6 If your report includes any photographs, measurements, graphs or illustrations these should be firmly attached to the report, and clearly identified and numbered.

8. **Change of opinion**

8.1 If for some reason, you change your opinion after delivering your report, please advise us as soon as possible. If that change is material, a supplementary report will need to be prepared, which explains the reasons for the change in your opinion.

9. Confidentiality and privilege

9.1 In accepting this engagement, you agree that:

- (1) this letter and all future communications (whether electronically maintained or not) between us are confidential. These communications may be subject to client legal privilege;
- (2) you must take **all** steps necessary to preserve the confidentiality of our communications and of any material or documents created or obtained by you in the course of preparing your report;
- (3) you must not disclose the information contained in our communications or obtained or prepared by you in the course of preparing your report without obtaining consent from us;
- (4) you must not provide any other person with documents which come into your possession during the course of preparing this report, whether created by you or provided to you by us or our clients, without obtaining consent from us.

9.2 The duty of confidentiality continues beyond the conclusion of your instructions.

9.3 If you are ever obliged by law to produce documents containing any of this confidential information (whether by subpoena, notice of non-party discovery or otherwise) please contact us immediately so that we may take steps to claim client legal privilege.

9.4 You should ensure that you retain copies of all drafts of your report together with all documents that you rely on in preparing your report. We will inform you when you are no longer required to retain them.

9.5 If requested, you must return to us all documents and other material (including copies) containing confidential information. Where any confidential information is in electronic form, we may require you to delete this information instead.

9.6 Any internal working documents and draft reports prepared by you may not be privileged from disclosure and may be required to be produced to the opposing parties in the litigation, and to the Court.

9.7 You may be cross-examined about any changes between your working documents and your report. The Court will be interested to understand the reason or reasons for any changes, and you should be prepared to, and able to, explain them.

10. Document management

10.1 Please ensure that all documents created pursuant to this retainer are marked "Privileged and Confidential: prepared for the purpose of the Queensland Land Court objection hearing to the Carmichael Coal Mine".

11. Court appearance

11.1 At the hearing of any objection, you may be required to attend Court and give evidence. You must be personally involved and knowledgeable in all aspects of the preparation of the report.

11.2 If you are required to attend Court to give evidence, we will contact you to discuss your availability and make the necessary arrangements.

If you have any questions regarding your engagement or require further information, please do not hesitate to call us on 3211 4466.

Yours faithfully

Environmental Defenders Office (Qld) Inc

A handwritten signature in black ink, appearing to be 'Sean Ryan', written in a cursive style.

Sean Ryan

Senior Solicitor

To provide feedback on EDO services, write to us at the above address.

ANNEXURE A - Land Court Rules 2000 (Qld)

Part 5 Evidence

Division 1 Preliminary

22 Definitions for pt 5

In this part—

expert means a person who would, if called as a witness in a proceeding, be qualified to give opinion evidence as an expert witness in relation to an issue in dispute in the proceeding.

joint report, for a proceeding, means a report—

- (a) stating the joint opinion of experts in relation to an issue in dispute in the proceeding; and
- (b) identifying the matters about which the experts agree or disagree and the reasons for any disagreement.

meeting of experts—

- 1 A meeting of experts is a meeting at which experts in each area of expertise relevant to a proceeding meet, in the absence of the parties—
 - (a) to discuss and attempt to reach agreement about the experts' evidence in relation to an issue in dispute in the proceeding as it relates to the experts' area of expertise; and
 - (b) to prepare a joint report.
- 2 The term includes —
 - (a) a resumed meeting of experts or further meeting of experts; and
 - (b) a meeting attended by the experts in either, or a combination, of the following ways—
 - (i) personally;
 - (ii) a way that allows contemporaneous communication between the experts, including by telephone, video link or email.

party, for a proceeding, means a party to the proceeding or the party's lawyer or agent.

statement of evidence, of an expert, see rule 24E.

Division 2 Meetings of experts

23 Application of div 2

Unless the court otherwise orders, this division applies in relation to a meeting of experts ordered or directed by the court at any time in a proceeding.

24 Party must ensure expert ready to take part in meeting of experts

Before a meeting of experts, a party to a proceeding must do all things reasonably necessary or expedient to ensure an expert chosen by the party is ready to take part fully, properly and promptly in the meeting, including by giving the expert—

- (a) reasonable prior notice that the court has ordered or directed a meeting of experts; and
- (b) notice of the contents of any order or direction about the meeting, including the time by which the meeting must be held; and
- (c) reasonable notice of the issue in dispute in the proceeding to the extent it is relevant to the expert's expertise; and
- (d) enough information and opportunity for the expert to adequately investigate the facts in relation to the issue in dispute in the proceeding; and
- (e) written notice that the expert has a duty to assist the court and the duty overrides any obligation the expert may have to the party or any person who is liable for the expert's fee or expenses.

24A Experts attending meeting must prepare joint report

(1) The experts attending a meeting of experts must, without further reference to or instruction from the parties, prepare a joint report in relation to the meeting.

(2) However, the experts attending the meeting may, at any time before the joint report is completed, ask all parties to respond to an inquiry the experts make jointly of all parties.

(3) Despite subrule (1), any of the experts may participate in a mediation involving the parties.

(4) The joint report must—

- (a) confirm that each expert understands the expert's duty to the court and has complied with the duty; and
- (b) be given to the parties.

(5) The applicant or appellant must deliver to the registry, personally or by facsimile or email, a copy of the joint report received under subrule (4) at least 21 days before the date set for the hearing.

24B Admissions made at meeting of experts

(1) Subrule (2) does not apply to a joint report prepared in relation to a meeting of experts.

(2) Evidence of anything done or said, or an admission made, at a meeting of experts is admissible at the hearing of the proceeding or at the hearing of another proceeding in the court or in another civil proceeding only if all parties to the proceeding agree.

(3) In this rule—

civil proceeding does not include a civil proceeding founded on fraud alleged to be connected with, or to have happened during, the meeting.

Division 3 Evidence given by experts

24C Duty of Expert

- (1) A witness giving evidence in a proceeding as an expert has a duty to assist the court.
- (2) The duty overrides any obligation the witness may have to any party to the proceeding or to any person who is liable for the expert's fee or expenses.

24D Giving or accepting instructions to adopt or reject a particular opinion prohibited

A person must not give, and an expert must not accept, instructions to adopt or reject a particular opinion in relation to an issue in dispute in a proceeding.

24E Expert must prepare statement of evidence

- (1) An expert must prepare a written statement of the expert's evidence (a statement of evidence) for the hearing of a proceeding.
- (2) If the expert has taken part in a meeting of experts—
 - (a) a joint report prepared in relation to the meeting is taken to be the expert's statement of evidence in the proceeding; and
 - (b) a further statement of evidence in relation to any issue of disagreement recorded in the joint report is to be prepared by the expert.
- (3) However, the further statement of evidence must not, without the court's leave—
 - (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.

24F Requirements for statement of evidence other than joint report

- (1) An expert's statement of evidence, other than a joint report, must be addressed to the court and signed by the expert.
- (2) The statement of evidence must include the following information, to the extent the information is not already contained in a joint report prepared for the proceeding—
 - (a) the expert's qualifications;
 - (b) all material facts, whether written or oral, on which the statement is based;
 - (c) references to any literature or other material relied on by the expert to prepare the statement;
 - (d) for any inspection, examination or experiment conducted, initiated or relied on by the expert to prepare the statement—
 - (i) a description of what was done; and
 - (ii) whether the inspection, examination or experiment was done by the expert or under the expert's supervision; and
 - (iii) the name and qualifications of any other person involved; and
 - (iv) the result;

- (e) if there is a range of opinion on matters dealt with in the statement, a summary of the range of opinion and the reasons why the expert adopted a particular opinion;
 - (f) a summary of the conclusions reached by the expert;
 - (g) a statement about whether access to any readily ascertainable additional facts would assist the expert in reaching a more reliable conclusion.
- (3) The expert must confirm, at the end of the statement of evidence—
- (a) the factual matters included in the statement are, as far as the expert knows, true; and
 - (b) the expert has made all enquiries considered appropriate; and
 - (c) the opinions included in the statement are genuinely held by the expert; and
 - (d) the statement contains reference to all matters the expert considers significant; and
 - (e) the expert understands the expert's duty to the court and has complied with the duty; and
 - (f) the expert has read and understood the rules contained in this part, as far as they apply to the expert; and
 - (g) the expert has not received or accepted instructions to adopt or reject a particular opinion in relation to an issue in dispute in the proceeding.

24G Serving statement of evidence other than joint report

- (1) This rule applies to a statement of evidence other than a joint report.
- (2) A party to a proceeding intending to call evidence by an expert in the proceeding must deliver to the registry, personally or by facsimile or email, and serve on each other party to the proceeding, a copy of the expert's statement of evidence.
- (3) A party must comply with subrule (2) at least 21 days before the date set for the hearing or, if the court directs a different time, within the time directed by the court.

24H Matters contained in statement of evidence not to be repeated

During examination in chief, an expert must not, without the court's leave, repeat or expand on matters contained in the expert's statement of evidence or introduce new material.

24I Evidence from only 1 expert may be called

Other than with the court's leave, a party to a proceeding, at any hearing of the proceeding, may call evidence from only 1 expert for each area of expertise dealt with in the hearing.

ANNEXURE B – Format of report

Court Rules

- 1 A copy of the relevant sections of the *Land Court Rules 2000* is provided at Annexure A.
- 2 While the format of your report is discretionary, you should ensure that your report complies with the above requirements, and that compliance with these requirements is readily apparent.

Format

- 3 We make the following suggestions regarding the layout of your report.
- 4 Ensure that your report contains your full name and address.
- 5 Please number all pages and paragraphs of your report. You may wish to include an index. If your report includes any photographs, measurements, graphs or illustrations these should be firmly attached to the report, and clearly identified and numbered.
- 6 Your report may include the following sections and headings:

6.1 “Introduction”

This section should:

- refer to, and annex, the letter of instructions received from me;
- refer to, and disclose, the substance of any conversations that you have had **and** to which you have had regard in preparing the report;
- specifically identify and refer to any literature or other source materials (eg text books, industry guidelines and handbooks) used in support of your opinion. This will include the documents supplied by me, as well as any other documents to which you have referred. If lengthy, it may be practical to list this material in an annexure to the report. If for some reason, you do not refer to certain material when preparing your report, please specifically identify this material and outline the reasons it was not referred to; and
- refer to any methodology you have adopted in preparing the report, including a detailed description of any test or examinations, who carried them out, their qualifications and the results.

6.2 “My qualifications”

In this section of your report, you need to qualify yourself as an expert in the areas in which you have been asked to provide an opinion. You should describe how your specialist knowledge (whether obtained through training, study or experience), your experience and qualifications qualify you as an expert in these areas.

Your curriculum vitae should also be annexed to your report and referred to under this heading.

6.3 “Summary of my opinion”

You are required to include a summary of your opinion.

6.4 “Background facts and assumptions”

The Court Rules require you to list all “facts, matters and assumptions on which each opinion expressed in the report is based”.

The facts and assumptions you rely on need to be linked to their sources and clearly stated and verifiable. These may be sufficiently set out in our letter of instructions.

If you are called as a witness, you may be required to give evidence in relation to your assumptions.

6.5 “My opinion”

This part of your report should contain your detailed reasons for your opinions on the questions put to you. This will be the most substantial part of your report.

When drafting your report, you should make it clear that the opinion is wholly or substantially based on your expert knowledge. Your opinions must be confined to areas within your expert knowledge.

You must set out the process of reasoning that you followed in coming to your opinion and identify the facts and assumptions upon which you rely for the opinion. Where there are alternative views available, you should explain why you have chosen a particular alternative.

6.6 “Qualification of the opinion”

If appropriate, you should set out any qualification of your opinion, without which the report would be incomplete or inaccurate. If applicable, you should state that a particular question or issue falls outside your relevant field of expertise.

You should also state if your opinion is not concluded because of insufficient research or data or for any other reason.

6.7 “Confirmation”

You must confirm, at the end of the report—

- (a) the factual matters stated in the report are, as far as the expert knows, true; and
- (b) the expert has made all enquiries considered appropriate; and
- (c) the opinions stated in the report are genuinely held by the expert; and
- (d) the report contains reference to all matters the expert considers significant; and
- (e) the expert understands the expert’s duty to the court and has complied with the duty.

Please ensure that you make all necessary inquiries in a timely fashion to enable you to confirm these matters.

6.8 “Signature”

The final page of your report must be signed by you.

ANNEXURE C – Index to Brief

Attachment B - Curriculum Vitae

Dr. Richard Denniss – C.V.

Richard is the Executive Director of The Australia Institute – Australia’s most influential progressive think tank.

An economist by training, Richard has worked for the past 20 years in a variety of policy and political roles. In recent years he has been at the forefront of the national policy debates surrounding climate change policy and the Australian mining boom. He is an Adjunct Associate Professor at the Crawford School of Economics and Government at the Australian National University.

Prior to taking up his current position Richard was the Strategy Adviser to the Leader of the Australian Greens, Senator Bob Brown, was Chief of Staff to the then Leader of the Australian Democrats, Senator Natasha Stott Despoja, and held teaching and research jobs at Australian universities.

Key Points:

- Executive Director of The Australia Institute
- Adjunct Associate Professor at the Crawford School of Economics and Government at the Australian National University
- PhD in economics from University of Sydney
- Prominent economist in Australia with fortnightly columns in the *Australian Financial Review* and *Canberra Times*
- Expert witness experience in:
 - Bulga Milbrodale Progress Association Inc v Minister for Planning and Infrastructure and Warkworth Mining Limited (aka Warkworth case)
 - Hunter Environment Lobby Inc vs Minister for Planning and Infrastructure (aka Ashton case)

Education

2004 **PhD in Economics**

University of Sydney

Thesis topic: Measuring Fiscal Stance in Australia

1992 **Bachelor of Commerce (Honours)**

University of Newcastle

Employment

July 2008 – Present **Executive Director**

The Australia Institute, Canberra

June 2008 – Present **Adjunct Associate Professor**

Crawford School of Economics and Government

Australian National University, Canberra

Jan 2008 – June 2008 **Associate Professor**

Crawford School of Economics and Government

Australian National University, Canberra

Aug 2005 – November 2007 **Strategy Adviser**

Senator Bob Brown

Leader of The Australian Greens, Canberra

Mar 2004 - Aug 2005 **Deputy Director**

Aug 2003 - Mar 2004 **Acting Executive Director**

Nov 2002 - Aug 2003 **Senior Research Fellow**

The Australia Institute, Canberra

Dec 2001 - Nov 2002 **Chief of Staff**

May 2001 - Dec 2001 **Senior Policy Adviser**

Senator Stott Despoja

Leader of the Australian Democrats, Canberra

Apr 2000 - May 2001 **Research Fellow**

The Australia Institute, Canberra 23

Feb 1995 - Apr 2000 **Lecturer, Level A**

Department of Economics

University of Newcastle, NSW

Books

2015: *Minority Policy: Rethinking Governance when Parliament Matters* co-authored with Brenton Prosser

2013: *Introduction to Australian Public Policy, Second edition* Cambridge University Press, Manuscript submitted in July 2008. (with Sarah Maddison)]

2008: *Introduction to Australian Public Policy*, Cambridge University Press, Manuscript submitted in July 2008. (with Sarah Maddison)]

2005 Clive Hamilton and Richard Denniss, *Affluenza*, Allen and Unwin, Sydney.

Refereed Journal Articles

2012 'Complementary Climate Change Policies: A Framework for Evaluation', *The Economic and Labour Relations Review* February 2012 23: pp. 33-46, with M. Grudnoff and A. Macintosh

2007 Richard Denniss, 'Crisis of cash or crisis of confidence – the costs of ageing in Australia', *Journal of Australian Political Economy*, forthcoming.

2007 Hugh Saddler, Mark Diesendorf and Richard Denniss, 'Clean energy scenarios for Australia', *Energy Policy*, Vol. 35, No. 2, pp. 1245-1256.

2007 Martin O'Brien, Abbas Valadkhani, Peter Waring and Richard Denniss, 'The Australian labour market in 2006', *Journal of Industrial Relations*, Vol. 49, No. 3, pp. 311-326.

2006 Martin O'Brien, Richard Denniss and John Burgess, 'The Australian labour market in 2005', *Journal of Industrial Relations*, Vol. 48, No. 3, pp. 305-318.

2005 Richard Denniss, 'Young people's attitudes to workplace bargaining', *Journal of Australian Political Economy*, No. 56, pp. 145-155.

2005 Sarah Maddison and Richard Denniss, 'Democratic constraint and embrace: implications for progressive non-government advocacy organisations in Australia', *Australian Journal of Political Science*, Vol. 40, No. 3, pp. 373-389.

2005 Richard Denniss, 'Private health insurance in regional Australia', *Medical Journal of Australia*, Vol. 182, No. 6, pp. 290-293.

2005 Bruce Chapman and Richard Denniss, 'Using financial incentives and income contingent penalties to detect and punish collusion and insider trading', *Australia and New Zealand Journal of Criminology*, Vol. 38, No. 1, pp. 122-140.

2005 Richard Denniss, 'From Working Nation to thriving nation: the role of Working Nation in shaping the labour market of 2004 and beyond', *Journal of Economic and Social Policy*, Vol. 9, No. 2, pp. 111-123.

2004 Clive Hamilton, Budhima Lokuge and Richard Denniss, 'Barrier to trade or barrier to profit? Why Australia's pharmaceutical benefits scheme worries U.S. drug companies', *Yale Journal of Health Policy, Law, and Ethics*, Volume 4, No. 2, pp. 373-385. 24

2004 Clive Hamilton and Richard Denniss, 'The costs of Clayton's health insurance products', *Journal of Economic and Social Policy*, Vol. 8, No. 2, Winter, pp. 54-63.

- 2004 Richard Denniss, 'Paid annual leave in Australia: An analysis of actual and desired entitlement', *Labour and Industry*, Vol. 15, No. 1 August, pp. 1-16.
- 2004 Richard Denniss and Clive Hamilton, 'The slow road from rhetoric to reform: An analysis of road pricing policy in Australia', *Economic Papers*, Vol. 23, No. 1, March, pp. 88-99.
- 2003 Richard Denniss, 'Flexible measures for a flexible labour market', *Australian Bulletin of Labour*, Vol. 29 No. 2, pp. 113-125.
- 2001 Clive Hamilton and Richard Denniss, 'Generating emissions? The impact of microeconomic reform on the electricity industry' *Economic Papers*, Vol. 20, No. 3, pp. 15-28.
- 2001 Richard Denniss and Martin Watts, 'Regional labour markets: naturally less efficient?', *Employment and Labour Relations Review*, Vol. 12, Supplement, pp. 166-182.
- 1999 Richard Denniss, 'Managing the transition from public to private sector delivery of services', *Journal for Institutional Innovation, Development and Transition*, Vol. 3, No. 1, pp 1-16.
- 1999 Richard Denniss and P. Toner, 'On the wrong track? An analysis of the suitability of contracting out in the NSW rail industry', *Economic Analysis and Policy*, Vol. 29, pp. 117-131.

Book Chapters

- 2014 'The Role of Contingent Loans in Providing Equitable Access to Legal Aid' in *Theory, Practice and Prospects*, Edited by Joseph E. Stiglitz, Timothy Higgins, Bruce Chapman, Palgrave
- 2014 'Utilising the Low Transaction Costs of Contingent Loans - A General Framework for Policy Application' in *Theory, Practice and Prospects*, Edited by Joseph E. Stiglitz, Timothy Higgins, Bruce Chapman, Palgrave
- 2010 'Climate Change' in *The Rudd Government: Australian Commonwealth Administration 2007-10*, edited by Chris Aulich and Mark Evans, ANU Press.
- 2007 'The role of leisure time in achieving sustainability' in *Steering Sustainability* (Anitra Nelson ed.) Ashgate Publishing, Melbourne (forthcoming).
- 2007 'The Commodified environment: How the economy feeds obesity' in *The seven deadly sins of obesity: how the modern world is making us fat*, Jane Dixon and Dorothy Broom (eds.), UNSW Press.
- 2006 'Criminal Reparations: Using Financial Incentives and Income-Contingent Fines for White Collar Crimes', in *Government Managing Risk: Income Contingent Loans for Social and Economic Progress*, Bruce Chapman (ed.) pp. 248-276.
- 2006 'The role of market based instruments in addressing environmental problems', in *The Australian Economy: A students Guide to Current Economic Conditions*, Warringal Publishing, 2006. 25
- 2006 'Policy Research and Organisational Demands', in *Beyond the Policy Cycle* (Hal Colebatch ed.), Allen and Unwin.
- 2005 'The transition to a post growth society' in J. Goldie, B. Douglas and B. Furnass (eds.) *In search of sustainability*, CSIRO Publishing, Melbourne (with Clive Hamilton).
- 2003 'Taxes and Charges for Environmental protection' in G.A.Grown (Ed.) *Environmental Awareness and Obligations: An Australian Management Perspective*, Thompson CPD, Kew, Australia.
- 2003 'Policy Priorities and Processes: a Research Institute Perspective', in *Facing the Future: Engaging Stakeholders and Citizens in Developing Public Policy*, Meredith Edwards and Richard Curtain (eds), National Institute for Governance, Canberra.
- 2000 'Impact of Microeconomic Reform on Greenhouse Gas Emissions from the Electricity Sector' in Productivity Commission *Microeconomic Reform and the Environment*, pp. 79-97, Ausinfo, Canberra. (with C. Hamilton)
- 2000 'Governments and Market Failure' in P. Kneist and J. Burgess (eds.) *Introduction to Micro Economics*, pp 173-202. Macmillan Publishers Australia, South Yarra. (with Burgess, J. and Kneist, P.)
- 2000 'Markets and the Environment' in P. Kneist and J. Burgess (eds.) *Introduction to Micro Economics*, pp 257-251. Macmillan Publishers Australia, South Yarra. (with Kneist, P.)
- 1999 'The Budget Balance and The Stance of Fiscal Policy' in S. B. Dahiya (ed.) *The Current State of Economic Science* Vol. 4 pp. 1799-1816, (with John Burgess)

Monographs

- 2011 Mining Australia's Productivity: The Role of the Mining Industry in Driving Down Australia's Productivity Growth, Australia Institute with David Richardson
- 2011 An analysis of the economic impacts of the China First mine, The Australia Institute
- 2012 The Use and Abuse of Economic Modelling in Australia: Users' Guide to Tricks of the Trade, Australia Institute
- 2012 Too Much of a Good Thing?: The Macroeconomic Case for Slowing Down the Mining Boom, Australia Institute, with Matt Grudnoff
- 2007 *Economists and Environmentalists: Together at last?*, The Australia Collaboration, Melbourne.
- 2005 *Wasteful Consumption in Australia*, The Australia Institute, Discussion Paper no. 77. (with Clive Hamilton and David Baker)
- 2004 *A Clean Energy Future for Australia*, WWF, Australia, 162 pages. (with Hugh Saddler and Mark Diesendorf)
- 2004 *Property Rights and the Environment: Should farmers have a right to compensation?*, The Australia Institute, Discussion paper no. 74. 62 pages. (with Andrew Macintosh)
- 2004 *Silencing Dissent: Non-government organisations and Australian democracy*, Discussion Paper no. 65, The Australia Institute, Canberra. (with Sarah Maddison and Clive Hamilton). 63 pages. 26
- 2004 *The accountability of private schools to public values*, Discussion Paper no. 71, The Australia Institute, Canberra. (with Deb Wilkinson and Andrew Macintosh). 90 pages.
- 2003 *Annual Leave in Australia: An analysis of entitlements, usage and preferences*, Discussion Paper No. 56, The Australia Institute, Canberra.
- 2003 *Trading in Our Health System? The impact of the Australia-US Free Trade Agreement on the Pharmaceutical Benefits Scheme*, Discussion Paper No. 55, The Australia Institute, Canberra, (with K. Lokuge). 43 pages
- 2003 *A critique of the claimed economic benefits of GM food crops in Australia*, Network of Concerned Farmers. (with Stephen Rix)
- 2002 *Taxes and Charges for Environmental Protection*, Discussion Paper No. 46, The Australia Institute, Canberra. (with Clive Hamilton and Hal Turton)
- 2001 *Measuring Employment in the 21st Century: New measures of Underemployment and Overwork*, Discussion Paper Number 36, The Australia Institute, Canberra.
- 2000 *Tracking Well-being in Australia: The Genuine Progress Indicator 2000*, Discussion Paper Number 35, The Australia Institute, Canberra. (with Clive Hamilton)
- 2000 *Taxing Concern? The performance of the Green Power Scheme in Australia*, Australia Institute Discussion Paper No. 31, the Australia institute, Canberra.
- 1999 *How Low Can We Go? An Analysis of the pressure on Coal prices and Employment*. Report for the CFMEU. ESC Working Paper no. 139. (with Peter Waring)
- 1998 *Paying to Protect the environment: Any Volunteers?* Public Sector Research Centre Paper no. 50. UNSW, Sydney.
- 1998 *On the Wrong Track: The Impact of Contracting Out by Rail Services Australia on Regional Economies and the Labour Market*. Employment Studies Working Paper No. 38 (with P. Toner)
- 1998 *Redressing the Earnings Gap*. Employment Studies Centre Working Paper No. 37. (with J. Burgess, R. Green and G. Strachan)
- 1997 *Supplementary Labour: What is it and Where will it Lead?* Employment Studies Centre Working Paper No. 34.
- 1997 *The construction Industry and Enterprise Bargaining, Part 1: Industry Structure, Bargaining Characteristics and the Spread of Bargaining*. Employment Studies Centre Working Paper No. 32. (with J. Burgess, R. Green and B. Mills)
- 1997 *The construction Industry and Enterprise Bargaining, Part 2: The prospects for a two-tier Labour Market Emerging and intensifying Under Enterprise Bargaining*, Employment Studies Centre Working Paper No. 33. (with J. Burgess, R. Green and B. Mills)
- 1995 *The Economic Impacts of An Increase In Construction Industry Wages*. Employment Studies Centre Research Paper, October 1995

1995 *The State of Australian Government 1994-95*. Evatt Foundation, Sydney.
1994 *The State of Australian Government, 1993-94*. Evatt Foundation, Sydney.

Other Papers

2006 'Unemployment is in the eye of the beholder: an analysis of the definition of unemployment in Australia', published by the office of Senator Rachel Siewert.

2005 'The Attitudes of Young People to the Environment', The Australia Institute.

2005 'Who benefits from private health insurance in Australia?', The Australia Institute.

2005 'Demographic Trends in Private Health Insurance Membership', The Australia Institute.

2004 'Public Attitudes to Discrimination in Private Schools', The Australia Institute. (with D. Wilkinson, A. Macintosh)

2004 'Tax Deductibility of Donations to School Building Funds', The Australia Institute. (with D. Wilkinson)

2004 'Overconsumption of pet food in Australia', The Australia Institute.

2004 'Buying an education: Where are the returns highest?', The Australia Institute.

2003 'A backdoor to higher medicine prices? Intellectual property and the Australia-US Free Trade Agreement', The Australia Institute. (with B. Lokuge, T. Faunce)

2003 'Using rewards to catch white collar criminals', The Australia Institute. (with Bruce Chapman)

2003 'Health Spending in the Bush: an analysis of the geographic distribution of the private health insurance rebate' The Australia Institute.

2003 'The double dividend: an analysis of the job creation potential of purchasing additional holiday leave', The Australia Institute.

2003 'Funding sport fairly: an income-contingent loans scheme for elite sports training, The Australia Institute.

2002 'Tax Flight? An analysis of the 'duty free' system in Australia', The Australia Institute.

2002 'Health Insurance Tax Rort', The Australia Institute. (with Clive Hamilton)

Attachment C – Curriculum Vitae Prof Adams

Philip D. Adams

Curriculum Vitae

December 2014

Address: Centre of Policy Studies
Victoria University
300 Flinders St

PO Box 14428,
Melbourne
Victoria 8001,
Australia

Telephone: +61 3 9919 1435

E-mail: philip.adams@vu.edu.au

Personal

Date of birth: 8 September 1958.

Nationality: Australian.

Married: Yes.

Summary

Philip is Professor at the Centre of Policy Studies (CoPS), Victoria University, Melbourne. Prior to his current position, Philip was Director and Professor at CoPS, Monash University (2004-2013). He is also past Australian coordinator for the Economic Outlook taskforce of the Pacific Economic Co-operation group. Prior to 2004, he held positions as Senior Research Fellow and then Director of Consulting at CoPS, having previously worked at the Bureau of Agricultural Economics (now the Australian Bureau of Agricultural and Resource Economics) and at the Institute of Applied Economic and Social Research (now the Melbourne Institute). He holds a Masters Degree and a Ph.D., both in economics, from the University of Melbourne.

Philip's main area of expertise is the application of large multi-sectoral and multi-regional economic models for policy analysis and forecasting. Since completing his Ph.D., he has been involved in the implementation of several large models of the Australian economy: a short-run macro model; the Australia-wide MONASH model; and the MMRF dynamic model of Australia's eight states and Territories. Philip has also been active in developing models for overseas organisations, including central government organisations in Saudi Arabia, Oman, Jordan, Uganda, South Africa,

Taiwan, Denmark, and Thailand. He has also run a number of training courses in the use of single- and multi-country CGE models. The multi-country training was undertaken using the GTAP model, built and maintained at the Global Trade and Protection (GTAP) project at Purdue University.

Philip has around 60 refereed publications covering topics such as: the prospects for industries, states and regions; the economic effects of import tariffs; the contribution of international tourism; the benefits and costs of major export projects; and the impacts of greenhouse-response policies for Australian regions. His articles have been published in a wide range of journals, including: the Journal of Policy Modelling, the International Journal of Forecasting, the Pacific Economic Review, the World Economy, Applied Economics, Economic Letters, Economic Studies Quarterly, the Asia-Pacific Economic Review and the Economic Record. With Brian Parmenter he is the co-author of a chapter on Environmental modelling in the *Handbook on CGE modelling* (published in 2013 by Elsevier B.V).

Philip's primary responsibility at CoPS is contract research. His research clearly engages with important "real world" issues, and demonstrates impact through relevance and excellence. Indicators of the impactfulness of Philips' research are the number of organisations that provide repeat funding and the considerable income that his research projects bring to the University. Between 2006 and the middle of 2014 that income amounted to \$695,000 on average per annum.

Over this period his contract work has focussed on three areas.

1. *The economics of climate change, climate change adaptation and climate change mitigation*. Clients include: the Garnaut Climate Change Review, the Federal Treasury, the state treasuries of VIC, NSW, QLD and WA, the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the DCCEE, Climate Works, Climate Institute and the WWF. His technical advice for the Federal Treasury led to the adoption of the MMRF system as Treasury's principal tool for analysis greenhouse mitigation policies from 2006 through to the present day. His October-2007 report for the Climate Institute on the economic implications of forcing large cuts in greenhouse emissions in Australia was reported widely in the Australian Press. Philip also delivered one of the key invited lectures (November 2008) of Monash's 50th Anniversary Public Lecture Series, focussing on the insurance-aspects of an emissions trading scheme. Most recently he has worked: as technical advisor for Australia's participation in the global 2050 Deep Decarbonisation Pathways Project (DDPP), coordinated by the Sustainable Development Solutions Network (SDSN) (<http://www.climateworksaustralia.org/project/current-project/pathways-deep-decarbonisation-2050-how-australia-can-prosper-low-carbon>); for the International Policy Division of the Department of Foreign Affairs (Climate change and sustainability branch) on a fact-finding mission to India (June 2013) designed to find potential partners for a joint Australia/India study on climate change issues; and with the CSIRO on a project to develop a large scale, detailed Integrated Assessment Model (IAM) covering global and detailed Australian regions.

2. *Modelling emerging economies in the Middle East, Africa and Asia.* Clients include: the Ugandan Ministry of Finance through Oxford Policy Management, the Jordanian Ministry of Planning and International Cooperation through Leading Point Management, the government of Oman (through the Sultan Qaboos University), the Saudi Arabian Ministry of Commerce and Industry, the Chinese Academy of Sciences and the State Information Centre (a Chinese government *think tank* affiliated to the National Development and Reform Commission). All of these projects have involved capacity transfer of models, database and software through training courses and project documentation, and applications to key policy issues. The issues examined include: the economic, social and fiscal impacts of a large new oil discovery (Uganda); the removal of subsidies on energy and food (Jordan); the training and occupation implications of moving from an oil-focussed economy (Oman and Saudi Arabia); and the economics of climate-change action at the provincial level (China).
3. *The economic impacts of large projects in mining, manufacturing, infrastructure and defence.* Clients include: Acil Tasman (and now Acil Allens), Deloitte Economics, PwC, Ernst and Young, SGS Economic and Planning, the Australian Energy Market Operator (AEMO), Centre of International Economics (CIE), Frontier Economics, KPMG, Urbis, SKM, the airport authorities of Melbourne, Sydney and Brisbane, the Department of Materiel Organisation (DMO), BHP Billiton, Chevron, Woodside, Tennis Australia, Transurban, and the state government treasuries of Vic, NSW, QLD, WA and SA. This work typically involves extensions of Cost Benefit Analysis (CBA) to cover the wider economic implications of specific large scale projects (construction and operation). Reporting is often confidential commercial in confidence, but the work is nearly always crucial in final decision making concerning the viability of various very large projects. For example, Philip recently completed a detailed study for DMO examining the economic impacts of various options for the next generation of submarines to be purchased by the Australian government. The overall cost of the program is reported to be around \$50 billion.

Education and qualifications

1989 Ph.D., Department of Economics, University of Melbourne.

1986 M.Com, University of Melbourne.

1980 B.Ec (Hons), Monash University.

Career to date

2014- Research Professor (level E) at the Centre of Policy Studies (CoPS), Victoria University.,

2004-2013 Research Professor (level E) at the Centre of Policy Studies (CoPS), Monash University.

1995-2004 Senior Research Fellow (level D, equivalent to Associate Professor) at CoPS.

1991-1994 Senior Research Fellow (level C, equivalent to Senior Lecturer) at CoPS.

1989-1990 Senior Research Fellow (level C, equivalent to Senior Lecturer) at Institute of Applied Economic and Social Research, University of Melbourne (now the Melbourne Institute).

1980-1989 Research Officer (Assistant, Senior, Principal) at the Bureau of Agricultural Economics (now the Australian Bureau of Agricultural and Resource Economics), Canberra. On assignment to the IMPACT Project from 1985 to 1989.

Major leadership positions

2004-2013 Director, Centre of Policy Studies (CoPS), Monash University

2001-2004 Director, Consulting, CoPS, Monash University.

1990-2010 Pacific Economic Outlook taskforce coordinator, AUSPECC.

1989-1995 Australian editor for *Economic Forecasts: A World-wide Survey* (North Holland).

Membership of associations

- Australian Economic Society.
- Australian Agricultural and Resource Economics Society.
- International Society of Forecasters.
- Regional Science Association International, Australia and New Zealand Section.

Research and scholarship

- Has authored over 130 papers since 1986. About sixty have appeared as refereed publications.
- Research has been of considerable media interest, with radio interviews on: ABC Rural (1993, 1994, 1995, 1996, 2002, 2006, 2007, 2009, 2010, 2011, 2012, 2013, 2014); and ABC Melbourne, Adelaide Perth and Hobart (1994, 1995, 1996, 1998, 2002, 2008, 2010, 2012, 2011, 2012 and 2013). He appeared on the ABC's 7.30 Report (4/6/2007). Articles referring to research and commercial work have appeared in the main Australian newspapers: the Melbourne Age, the Australian, the Sydney Morning Herald, the Australian Financial Review, the West Australian and the Adelaide Advertiser. Some very recent examples can be viewed at <http://www.copsmodels.com/carboncuts.htm>.
- Has refereed articles for a wide range of international and domestic journals, including: Energy Economics, the Energy Journal, Applied Economics, the American Journal of Agricultural Economics, the Pacific Economic Review, the Australian Journal of Agricultural and Resource Economics, Economic Record, Australian Economic Papers, the Australian Economic Review, and the Review of Marketing and Agricultural Economics.
- Has supervised more than ten Ph.D. candidates, all of whom have successfully completed their studies. These include:
 - Samuel Otim (joint with Brian Parmenter) (Ph.D., thesis, 1999, awarded) *Inventories and Economic Fluctuations: A Computable General Equilibrium Analysis of the Australian Economy*.
 - Sharn Enzinger (Ph.D., thesis, 2001, awarded) *Impacts of Carbon abatement policies on Regional Victoria*.
 - Paresh Nayan (joint with Peter Dixon and Fashid Vasid) (Ph.D., thesis, 2003, awarded) *Tourism Impacts in Fiji*.
 - Amale Scally (joint with the Department of Accounting and Finance) (Ph.D., thesis, 2005, awarded) *An Examination Of The Impact Of Regional Integration on FDI: The Case of AFTA*.

- *Jeremy Rothfield* (Ph.D., thesis 2008, awarded) *An Economic Analysis of Placing Electricity Cables Underground*.
- *Sothea Oum* (Ph.D., thesis 2009, awarded) *Poverty Issues in Cambodia: a CGE Analysis*.
- Has been invited to give the following outside presentations (since 1997):
 - “Economic impacts of LNG developments in QLD, presented to the Melbourne Economics Forum, 20 November 2014. <http://www.melbourneconomicforum.com.au/forums/energy-policy>
 - “How much will climate change action cost Australia”, paper presented to the Mannix College Fellows, 24 September 2014.
 - “Modelling of greenhouse gas mitigation at the region level”, paper presented to the Chinese Academy of Science, Beijing, June 2014.
 - “Effects of lifting subsidies on fuels purchased by households”, paper (co-authored by Louise Roos) presented to the Jordanian Ministry of Finance, May 2014.
 - “Greenhouse action: Coalition versus Labour” presented to the Victorian Young Economists group, Melbourne, November 2013 <http://youngeconomists.org.au/vic/> .
 - Greenhouse Insurance: How much will Clean Energy Future cost Australia”, presentation to the KEEI International Workshop on Top-down Models of Climate Change, Seoul, October 2013. http://www.keei.re.kr/main.nsf/index_en.html .
 - “Climate change modelling in Australia”, presentation to the Integrated Research and Action for Development (IRADe), New Delhi, June 2013. <http://www.irade.org/> .
 - “Design and effectiveness of Australian greenhouse policy” presentation to the NDRC-SIC Carbon Market Beijing International Workshop, January 2013. <http://www.copsmodels.com/pdf/chinacereport.pdf>
 - “Greenhouse Policies in Australia”, presentation to the UNU Wider sponsored workshop on Climate Change and Developing Countries, Helsinki, September 2012. http://www.wider.unu.edu/events/2012-conferences/Climate-change-2012/en_GB/28-09-2012/
 - “Transforming Data into Votes: Should current climate change policies in Australia sway your vote in the next election: Broad Economic Impacts”, presentation to Melbourne University sponsored workshop, Melbourne May 2012. <http://live.unimelb.edu.au/episode/transforming-data-votes>
 - “Insurance against Catastrophic climate change: How much will climate change mitigation policies cost Australia?”, presentation to an international symposium on "ETS and its impact on industry", Japanese Ministry of Environment Tokyo, March 2012. <http://www.env.go.jp/en/policy/>
 - “Economic Modelling”, presentation to the 2011 Australia 2050 workshop sponsored by CSIRO, Bowral July 2011. <http://www.science.org.au/news/media/26july11.html>
 - “Challenges for Taiwan from a Global Environmental Tax”, presentation to the Taiwan Institute of Economic Research, Taipei, June 2011. <http://english.tier.org.tw/>
 - “Effects of the CPRS” presentation to officials from the National Australia Bank, Melbourne, April 2010.
 - “Further Insights into CGE Analysis of Water and other Environmental Issues”, presentation to the Second International Symposium on Integrated Catchment Management in response to Climate Change meeting, Melbourne, September 2009.
 - “Prospect for Renewables to replace Nuclear in Electricity Generation in Taiwan”, presentation to the Taiwan Institute of Economic Research, Taipei, August 2009.
 - “CGE Analysis of Water and other Environmental Issues”, presentation to the International Symposium on Integrated Catchment Management in response to Climate Change meeting, Hanoi Vietnam, July 2009.
 - “Quantitative analysis in assessing the economy-wide effects of industry adjustment to policy reform”, paper presented to the course, Policy Reform and Structural Adjustment in Agriculture, held between 8 and 14 December 2008 and organised partly by the APEC Study Centre.
 - “Insurance against catastrophic climate change: How much will an Emissions Trading Scheme cost Australia?” for Monash's 50th Anniversary Public Lecture Series, 27 November 2008.
 - “Economic impacts of Integrated Gasification Combined Cycle generation technology for the Taiwan economy”, presentation to the Taiwan Institute of Economic Research, Taipei, July 2008.

- “China and beyond – Australia’s position in rapidly growing Asia”, presentation to the Asia-Pacific Business Economics study group within the Griffith Asia Institute (GAI) at Griffith University, May 2008.
- “Briefings to various senior managers of Victorian government departments regarding possible climate change policies”, Melbourne over a number of weeks in December 2007 organised by Katrina Herman.
- “An economic perspective on climate change”, presentation to the Monash Forum on Sustainability, Caulfield, 5 October 2007.
- “Climate change – policy implications”, presentation to the Fabian Society forum on Greenhouse issues, 21 July 2007.
- “Impacts of Climate Change on the Australian Economy, with special emphasis on the tourism industry”, presentation to the Tourism CRC, Melbourne, 6 July 2007.
- “Use of Economic Modelling in policy development in Australia”, presentation to a Chinese delegation from the Development Research Centre, Melbourne, April 2007.
- “The economic impacts of an Emissions Trading Scheme for Australia”, presentations to two Melbourne Institute public forums – Melbourne (19 April 2007) and Canberra (17 April 2007).
- “Fuel cells for transport – economic modelling for Taiwan”, presentation to the Taiwan Institute of Economic Research, Taipei, January 2007.
- “The role of quantitative analysis in assessing the economy-wide effects of industry adjustment to policy reform”, paper presented to the course, Policy Reform and Structural Adjustment in Agriculture - Economic change in the Sugar Industry, held between 24 October and 3 November 2006 and organised by the APEC Study Centre.
- “The Australian economy in 2006 and 2007”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Osaka, March 2006.
- “Linking models: Experience from the IMPACT Project and CoPS” to a workshop held at the Melbourne Institute on Monday 9 May. The workshop’s theme was “The next generation: Building a bridge between micro simulation, life-cycle, and macroeconomic models”, May 2005.
- “Energy and the macro-economy”, presentation to the Golden Key Association of students at Monash University, April 2005.
- “The Australian economy in 2005 and 2006”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Osaka, March 2005.
- “Situation and Prospects for the Australian economy”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Vancouver, December 2004.
- “The year ahead”, invited paper to the 2004 Australian Agri-Food Forum, Grand Hyatt, Melbourne, 29 October 2004.
- “The role of quantitative analysis in assessing the economy-wide effects of industry adjustment to policy reform”, paper presented to the APEC Study Centre’s training course, “Managing structural adjustment from trade reform”, Saville on Russell, Melbourne, 11-19 November 2004.
- “Forecasting with CGE models”, keynote presentation to the First International Macroeconomic Forecasters Conference hosted by the Thailand Office of the National Economic and Social Development Board, Bangkok, 26 August 2004.
- “Current economic conditions”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, San Francisco, December 2003.
- “Water issues and the Monash Model”, paper presented to the Urban Water Issues Conference, Melbourne, 30 October 2003.
- “Medium term prospects for Australian regions”, paper presented to the “City and the Bush Conference”, Melbourne, 1 August 2003.
- “Energy and the Australian Economy”, paper presented to the Energy Focus National Conference, Sydney, 3-4 April 2003.
- “Australia in 2003 and 2004”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Osaka Japan, March 2003.

- “Regional Prospects and Impacts of the drought”, presented to the ABARE Outlook Conference, 4-5 March 2003.
- “Modelling developments at the Centre of Policy Studies”, presented to the Victorian Department of Primary Industries, 26 February 2003.
- “Regional prospects for Australia”, presented to the ABARE Regional Outlook Conference in Alice Springs, NT, 5 December 2002.
- “Regional implications of early-2002 Kyoto compliance”, presentation to the Australian Greenhouse Office, 10 October 2002.
- “Regional prospects for the Goldfields-Esperance region”, presented to the ABARE Regional Outlook Conference in Kalgoorlie, Western Australia, 2 October 2002.
- “Prospects for regions”, presented to the ANZRASI workshop on regional development, Hamilton Victoria, 9 August 2002.
- “Top-down and Bottom-up Modelling Perspectives: CoPS experience”, presented to the ABARE international seminar – Top-down and Bottom-up modelling perspectives, The Boat House by the Lake, Canberra, 28 May 2002.
- “Commentary”, presented at a conference organised by the CRC for sustainable tourism, Sydney, April 2002.
- “Australia in 2002 and 2003”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Osaka Japan, March 2002.
- “GE Modelling and tourism”, presented at a conference organised by the CRC for sustainable tourism, Sydney, April 2001.
- “Australia in 2001 and 2002”, paper presented to the Forecasting Committee of the Pacific Economic Co-operation Council, Osaka Japan, March 2001.
- “Good modelling of Greenhouse Issues” presentation to a roundtable discussion of modelling greenhouse issues, hosted by Productivity Commission, Canberra, December 2000.
- “Outlook for Australian Regions”, plenary session at the 24th Australian and New Zealand meeting of the Regional Science Association International, Hobart, December 2000.
- “Prospects and policy dilemmas for the Chinese economy”, presentation to participants at the APEC 2001 program, organised by the RMIT APEC Studies Centre, March and July 2000.
- “Prospects for Australia”, paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 2000.
- “Australia in 1999 and 2000”, paper presented to the Standing Committee of the Pacific Economic Co-operation Council, Canberra, April 1999.
- “Short-term Economic Prospects for the Australian Economy”, paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1999.
- “Australia and the Asia Crisis”, paper presented to the AARES Symposium on the Australian Agricultural and Resource Economy and the Asian Crisis, Sydney, November 1998.
- “CGE Analysis of the Effects on Australia of the Asia Crisis”, paper presented at *Crisis in Asia - Impact on Australia*, organised by the Economic Modelling Bureau of Australia (EMBA), Canberra, August 1998.
- “Business Conditions in 1998-99 and Beyond: The Budget and Other Factors”, presentation to *Briefing on the 1998-99 Budget*, organised by Department of Business Administration, Monash University, Frankston, May 1998.
- “Short-term Economic Prospects for the Australian Economy”, paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1998.
- “The Effects of Economic Upheaval in Asia”, paper presented to clients of Arthur Andersen in Melbourne, February 1998.
- “APEC Trade Liberalisation and its Effects on the Chinese Economy”, paper presented to Asian Liberalisation Conference, School of Australian and International Studies, Deakin University, December 1997.

Teaching

Subjects taught:

- 1991, 1992 Microeconomics for managers (MBA course), *taught jointly with Professors Peter Dixon and Brian Parmenter at Monash University.*
- 1992, 1993 Intermediate microeconomics (2nd year undergraduate), *taught jointly with Professors Dixon and Parmenter at Monash University.*
- 1994-2000 Applied general equilibrium economics (3rd year undergraduate) *taught jointly with Professor Dixon at Monash University.*
- 1995, 1996 Economics and commerce issue seminar (4th year honours) *taught jointly with Professor Parmenter at Monash University.*
- 2003 Economic modelling for agricultural analysis (Masters course, University of Pretoria).
- 2004 Economic modelling for agricultural analysis (Masters Course, University of Western Cape, South Africa), *taught jointly with Mark Horridge.*
- 2005 Economic modelling for agricultural analysis (Masters Course, University of Western Cape, South Africa), *taught jointly with Mark Horridge.*
- 2007 Trade modelling using CGE models (University of Pretoria, hosted by the AFRINEM (African Institute for Economic Modelling)).
- 2010-2014 Three lectures on CGE modelling and Greenhouse Issues (Carbon Pricing Unit, AFF9012, Monash)

Awards and Grants

- *Sustaining Regions Award*, presented for the paper judged to be the best contribution in 2002 to the ANZRSAL's journal *Sustaining Regions* (2002).
- Delivered one of the key invited lectures (November 2008) of Monash's 50th Anniversary Public Lecture Series, focussing on the insurance-aspects of an emissions trading scheme.
- 2009 *Australian Treasury*, appointment to the *Model Development Independent Advisory Panel*.

List of Publications

Articles in Refereed Journals and Books

1. Roos, E.L., Philip D. Adams, and J.H. van Heerden (forthcoming), "Construction a CGE database using GEMPACK for an African country", *Computational Economics*. DOI:10.1007/s10614-014-9468-1.
2. Philip D. Adams, Brian R. Parmenter and George Verikios (2014), "An Emissions Trading Scheme for Australia: National and Regional Impacts", *Economic Record*, Vol 90, Issue 290, August 2014, pp. 316-44.
3. Philip D. Adams and Brian R. Parmenter, "Computable General Equilibrium Modelling of Environmental issues in Australia: Economic Impacts of an Emissions Trading Scheme" in P.B. Dixon and D. Jorgenson (eds) *Handbook of CGE Modelling, Vol. 1A*, 2013, Elsevier B.V.
4. Philip D. Adams, "Exploring the Future with Quantitative Models", Chapter 5 in Raupach M.R et al. (eds) *Negotiating our future: Living Scenarios for Australia to 2050*. Volume 1. Australian Academy of Science, 2012, <http://www.science.org.au/policy/australia-2050/>, pp. 152-187.
5. Philip D. Adams, "Economic Approaches to Modelling", in Raupach M.R et al. (eds) *Negotiating our future: Living Scenarios for Australia to 2050*. Volume 2. Australian Academy of Science, 2012, <http://www.science.org.au/policy/australia-2050/>, pp. 160-172.
6. YinHua Mai, Philip Adams, Peter Dixon and Jayant Menon, "The Growth locomotive of the People's Republic of China: Macro and Terms of Trade Impacts on Neighbouring Countries", *Asian Development Review*, 27 (2), 2010.
7. Reyno Seymore, Philip D. Adams, Margaret Mabugu, Jan Van Heerden and James Nelson Blignaut (2010), "The Impact of an Environmental Tax on Electricity Generation in South Africa", *Journal for Studies in Economics and Econometrics*, 34(2). pp. 1-18.
8. Yin Hua Mai and Philip Adams, "Resources Sector and Foreign Investment" Chapter 7 in Jayasuriya, S. D. MacLaren and G. Magee (eds.) *Negotiating a Preferential Trading Agreement*, Edward Elgar, Cheltenham, UK, 2009.
9. Philip Adams, "Insurance against Catastrophic Climate Change: How Much Will and Emissions Trading Scheme Cost Australia?", *The Australian Economic Review*, Vol. 40, No. 4, December 2007, pp 432-52.
10. Philip Adams, "Interpretation of Results from CGE Models such as GTAP", *Journal of Policy Modelling*, Vol. 27, December 2005, pp. 941-59.
11. Philip Adams, "Prospects for the Australian Economy and the Impact of Meeting Australia's Kyoto Commitment", *Farm Policy Journal*, Vol. 1, No. 3, November 2004, pp 26-35.
12. Philip Adams, "Medium term Prospects for the Australian Economy and the Impact of Kyoto-Compliance", *Australian Bulletin of Labour*, 30(1), March 2004, pp. 1-15.
13. Siobhan K. Dent, John P. Switala, Philip D. Adams and Mark h. O'Sullivan, "Foot-and-Mouth Disease Outbreak: Modelling Economic Implications for Queensland and Australia", *Australasian Journal of Regional Studies*, 8(3), 2002, pp. 303-26
14. Philip Adams, Mark Horridge, John Madden and Glyn Wittwer, "Drought, Regions and the Australian Economy between 2001-02 and 2004-05", *Australian Bulletin of Labour*, 28(4), December 2002, pp. 223-249.
15. Philip Adams, Peter Dixon and Maureen Rimmer, "The September 11 Shock to Tourism and the Australian Economy from 2001-02 to 2003-04", *Australian Bulletin of Labour*, 27(4), December 2001, pp. 241-257.
16. Tony Meagher and Philip Adams, "Trade Liberalisation and the Demand for Skilled Labour in Australia", *The Australian Journal of Labour Economics*, 4(4), December 2000, pp. 318-34.
17. Philip Adams, Mark Horridge and Brian Parmenter, "Forecasts for Australian Regions Using the MMRF-Green Model", *The Australasian Journal of Regional Studies*, Volume 6, Number 3, 2000, pp. 293-323.
18. Philip Adams, Peter Dixon, Daina McDonald and Maureen Rimmer, "The Exchange Rate Puzzle and Forecasts for the Australian Economy from 2000-01 to 2004-05", *Australian Bulletin of Labour*, 26(4), December 2000, pp. 174-195.
19. Philip Adams, "Dynamic-AAGE: A dynamic CGE model of the Danish Economy Developed from the AAGE and Monash Models", *Report no. 115*, Danish Institute of Agricultural and Fisheries Economics (2000), 135 pages.
20. Philip Adams, Mark Horridge, Brian R. Parmenter and Xiao-Guang Zhang, "Long-run Effects on China of APEC Trade Liberalisation", *Pacific Economic Review*, 5(1), February 2000, pp. 15-48.

21. Philip Adams and Brian Parmenter, "Forecasting the Australian Economy: the Role of the MONASH Model", chapter 5 in Peter Abelson and Roelyne Joyeux (eds), *Economic Forecasting*, Allen and Unwin, Australia, January 2000.
22. Philip Adams, Peter Dixon, Daina McDonald, G.A. Meagher and Maureen Rimmer, "Employment in Australia: Occupations, Threats and Opportunities", *Australian Bulletin of Labour*, 25(4), December 1999, pp. 283-305.
23. Philip Adams and Brian Parmenter, "General Equilibrium Models", chapter 10 in K. Corcoran, A. Allcock, T. Frost and L. Johnson (eds.), *Valuing Tourism: Methods and Techniques*, BTR Occasional Paper No. 28, March 1999.
24. Philip Adams, review of "Potential Impact of Farm Forestry Industry on the Goulburn Regional Economy" in *Agricultural and Resource Economics*, 43(1), March 1999, pp. 142-144.
25. Philip Adams, "Prospects for the Australian Economy and the Impact of the Asian Crisis" *Australian Bulletin of Labour*, 24(4), December 1998, pp. 247-278.
26. Philip Adams, "Long-run Effects of APEC Trade Liberalisation: A Computable General Equilibrium Analysis", *The World Economy*, 21(7), September 1998, pp. 931-952.
27. Philip Adams, Karen M. Huff, Robert McDougall, K.R. Pearson and Alan A. Powell, "Medium- and Long-run Consequences for Australia of an APEC Free-trade Area: CGE Analyses using the GTAP and Monash Models", *Asia-Pacific Economic Review*, 3(1), April 1997, pp. 19-42.
28. Philip Adams and Tony Meagher, "The Outlook for Employment by Occupation", *Australian Bulletin of Labour*, 23(4), December 1997, pp. 229-254.
29. Philip Adams and Peter B. Dixon, 'Generating Detailed Commodity Forecasts from a CGE Model', *International Journal of Forecasting*, 13(2), June 1997, pp. 223-236.
30. Philip Adams and Peter B. Dixon, 'Prospects for Australian Industries, States and Regions: 1993-94 to 2001-02', *Australian Bulletin of Labour*, 21(2), June 1995, pp. 87-108.
31. Philip Adams and Peter B. Dixon, '56 Separate Regions of Australia Analysed and Forecasted to 2002', *National Business Bulletin*, 5(9) (pp. 18-23) and 5(10) (pp. 25-30), 1995.
32. Philip Adams and B.R. Parmenter, 'An Applied General Equilibrium Analysis of the Economic Effects of Tourism in a Quite Small, Quite Open Economy', *Applied Economics*, Vol. 27, 1995, pp. 985-94.
33. Philip Adams and Peter B. Dixon, 'Prospects for Australian Industries, States and Regions: 1992-93 to 2001-02', pp. 7-20 in N. Burdess (ed.), *Emerging Opportunities for Regional communities: a Conference on Regional Development, Proceedings*, Centre of Regional Development, Deakin University, Warrnambool, May 1994.
34. Philip Adams, Peter B. Dixon, Daina McDonald, G.A. Meagher and Brian R. Parmenter, 'Forecasts for the Australian Economy Using the Monash Model', *International Journal of Forecasting*, Vol. 10, 1994, pp. 557-71.
35. Philip Adams, Peter B. Dixon and Daina McDonald, 'The Australian Economy in 1994-95 and 1995-96: Strong Growth or Wage Breakout?', *Australian Bulletin of Labour*, 20(4), December 1994, pp. 255-71.
36. Philip Adams, Peter B. Dixon and Daina McDonald, 'MONASH Forecasts of Output and Employment for Australian Industries: 1992-93 to 2000-01', *Australian Bulletin of Labour*, 20(2), June 1994, pp. 83-96.
37. Philip Adams and Peter B. Dixon, 'Prospects for Australian Industries and States in the 1990s', *Regional Policy and Practice*, 3(1), May 1994, pp. 8-18.
38. Philip Adams and Brian R. Parmenter, 'Microeconomic Reform and Employment in the Short Run', *Economic Record*, 70(208), March 1994, pp. 1-11.
39. Philip Adams, Peter B. Dixon and Daina McDonald, 'Prospects for the Australian Economy in 1993-94', *Australian Bulletin of Labour*, 19(2), June 1993, pp. 83-96.
40. Philip Adams, Peter B. Dixon and Brian R. Parmenter, 'Productivity Growth, International Competitiveness and Australia's Economic Prospects', *Economic Studies Quarterly*, Volume 44(1), March 1993, pp. 54-67.
41. Philip Adams and David Godden, 'The Enhanced Greenhouse Effect and Australian Agriculture', Chapter 17 in J.M Reilly and M. Anderssen (eds.), *Economic Issues in Global Climate Change: Agriculture, Forestry and Natural Resources*, 1992, Westview Press, Boulder Col.
42. Philip Adams, Peter B. Dixon and Brian R. Parmenter, 'Medium-Term Prospects for the Australian Economy: 1989-90 To 2000-01', *Australian Bulletin of Labour*, 18(4) 1992, pp. 239-66.

43. Philip Adams, Peter B. Dixon and Brian R. Parmenter, 'Prospects for the Australian Economy 1989-90 to 2001-02: ORANI-F Projections for the Ecologically Sustainable Development Working Groups', Chapter 6 in Colin P. Hargreaves (ed.), *Macroeconomic Modelling of the Long Run*, 1992, Edward Elgar, Aldershot, U.K.
44. Philip Adams and Peter B. Dixon, 'Limitations of the Budget as an Instrument of Macroeconomic Policy in 1992-93', *Australian Economic Review*, 4th quarter 1992.
45. Philip Adams, Peter B. Dixon and Daina McDonald, 'Prospects for the Australian Economy in 1992-93', *Australian Bulletin of Labour*, 18(2), 1992, pp. 75-90.
46. Philip Adams, Peter B. Dixon and Daina McDonald, 'Macroeconomic Prospects for the Australian Economy', *Australian Bulletin of Labour*, 17(2), 1991, pp. 263 to 283.
47. 'Australia', *Economic Forecasts: A Monthly World-wide Survey*, twice each year since 1989, 2 pages.
48. Philip Adams Peter B. Dixon and B.R. Parmenter, 'Sources and Effects of Productivity Growth', Economic Planning Advisory Council *Background Paper No. 8*, Australian Government Publishing Service, 1991, January.
49. Philip Adams, Peter B. Dixon and Daina McDonald, 'Macroeconomic Forecasts for the Australian Economy: 1990-91 and 1991-92', *Australian Economic Review*, 4th Quarter, 1990, pp. 5-23.
50. Philip Adams and Peter B. Dixon, 'Macroeconomic Forecasts for the Australian Economy: 1989-90 and 1990-91', *Australian Economic Review*, 1st Quarter, 1990, pp. 5-22.
51. Philip Adams, 'An Extended Linear Expenditure System with Assets', *Economic Record* (International Economics Postgraduate Research Conference Volume), 1991.
52. Philip Adams and Peter J. Higgs, 'Calibration of Computable General Equilibrium Models from Synthetic Benchmark Equilibrium Data Sets', *Economic Record*, 66 (193), 1990, pp. 110-26.
53. Philip Adams, 'The Extended Linear Expenditure System with Financial Assets', *Economic Letters*, 31, 1989, pp. 179-82.
54. Philip Adams and Peter B. Dixon, 'Forecasts for the Australian Economy in 1989/90 and 1990/91', *Australian Economic Review*, 4th Quarter, 1989, pp. 5-31.
55. Philip Adams, 'Recent Developments in the Australian Economy: An Update to 1988-89', *Australian Economic Review*, 3rd Quarter, 1989, pp. 39-44.
56. Philip Adams and B.R Parmenter, 'Economic Prospects: 1988-89 to 1994-95', *Australian Economic Review*, 3rd Quarter, 1989, pp. 5-15.
57. Philip Adams, 'Comparisons of Recent Estimates of Agricultural Supply Elasticities for the Australian Economy', *Review of Marketing and Agricultural Economics*, 56(3), 1988, pp. 326-60.
58. Philip Adams, 'Agricultural Supply Response in ORANI', *Review of Marketing and Agricultural Economics*, 51(2), 1983, pp. 213-29.
59. Philip Adams, 'Interpreting Estimates of Farm Output and Income', *Quarterly Review of the Rural Economy*, 5(2), 1983, pp. 156-9.
60. Philip Adams and P. Minnis, 'The Campbell Inquiry and the Rural Sector', *Bureau of Agricultural Economics Occasional Paper*, No. 62, 1982, 33 pages.

Papers in Non-refereed journals

1. Philip Adams and Peter Dixon, "Climate Change Insurance", *Monash Business Review*, Volume 3, No. 2, July 2007, pp. 6-8.
2. Philip Adams, "Prospects for Australian Regions", *Sustaining Regions*, Volume 1, No. 2, 2002, pp. 4-16.
3. Philip Adams, "Fifty-six region survey of business prospects to the year 2010", *National Business Bulletin*: 12(9), November 2002, pp. 23-27; 12(10), December 2002, pp. 16-21.
4. Philip Adams and Peter B. Dixon, "Australian Regions and Industries Forecasted to 2005", *National Business Bulletin*: 8(7), October 1998, pp. 22-26; 8(8), November 1998, pp. 19-22; and 8(9), December 1998, pp. 18-21.

Unpublished research papers

1. G.A. Meagher, P.D. Adams and Felicity Pang, "Climate Change Mitigation, Economic Growth and the Distribution of Income", IMPACT/CoPS Working Paper No. G-247, June 2014, 32 pages.

2. Philip Adams, Brian Parmenter and George Verikios, "An Emissions Trading Scheme for Australia: National and Regional Impacts", IMPACT/CoPS Working Paper No. G-247, September 2013, 28 pages.
3. Louise Roos, Philip Adams and Jan van Heerden, "Construction and updating of a Ugandan CGE database", Impact/CoPS Working Paper No. G-242, September 2013, 87 pages.
4. Philip Adams and Louise Roos, "Construction and updating of a Ugandan CGE database – first steps", Impact/CoPS Working Paper No. G-226, March 2012, 56 pages.
5. Philip Adams, Janine Dixon, James Giesecke and Mark Horridge, "MMRF: Monash Multi-Regional Forecasting Model: A Dynamic Multi-Regional Model of the Australian Economy", Impact/CoPS Working Paper No. G-223, December 2010, 210 pages.
6. Yinhua Mai, Philip Adams, Peter B. Dixon, "China's Growing Demand for Energy and Primary Inputs - Terms of trade Effects on Neighbouring Countries", Impact/CoPS Working Paper No. G-196, August 2009, 24 pages.
7. Yinhua Mai, Philip Adams, Mingtai Fan, Ronglin Li and Zhaoyang Zheng, "Modelling the Potential Benefits of an Australia-China Free Trade Agreement", Impact/CoPS Working Paper G-153, October 2005, 30 pages.
8. YinHau Mai and Philip Adams, "Trade Liberalisation Scenarios for Wool Under an Australia-China Free Trade Agreement", CoPS/Impact Working Paper No. G-156, October 2005, 32 pages.
9. Yinhua Mai, Philip D. Adams, Mingtai Fan, Ronglin Li and Zhanoyang Zheng, "Modelling the potential benefits of an Australia-China Free Trade Agreement", DFAT Australia-China FTA Feasibility Study technical paper, December 2004, 89 pages.
10. Philip D. Adams and J. Mark Horridge, "The Effects of a Free Trade Agreement Between the USA and the South African Customs Union (SACU)", CoPS/Impact Working Paper No. G-147, July 2004, 35 pages.
11. Philip D. Adams, "The Effects of a Free Trade Agreement Between Australia and the USA with Special Reference to the Victorian Economy: Main Report", CoPS/IMPACT Working Paper No. G-148, December 2003, 39 pages.
12. Philip D. Adams, Mark Horridge and Glyn Wittwer, "MMRF-GREEN: A Dynamic Multi-Regional Applied General Equilibrium Model of the Australian Economy, Based on the MMR and MONASH Models:" CoPS/IMPACT Working Paper No. G-140, October 2003, 127 pages.
13. Philip D. Adams, Mark Horridge, John Madden and Glyn Wittwer, "Drought, Regions and the Australian Economy between 2001-02 and 2004-05", CoPS/IMPACT Working Paper No. G-135, December 2002, 18 pages.
14. Philip Adams, Lill Andersen and Lars-Bo Jacobsen, "Does Timing and announcement matter? Restricting the production of pigs within a dynamic CGE model", SJFI *Working Paper*, No. 18/2001.
15. Philip Adams, "Economic Impacts of an Outbreak of Foot and Mouth Disease: Implications for QLD and Australia", QLD Department of Primary Industries discussion paper, June 2001, 59 pages.
16. Philip Adams, "Economic Impacts of Greenhouse Response: Implications for QLD and Australia", Australian Greenhouse Office Working Paper, June 2001, 223 pages.
17. Philip Adams, Brian Parmenter and Mark Horridge, "MMRF-GREEN: A Dynamic, Multi-Sectoral, Multi-Regional Model of Australia", IMPACT/CoPS Working paper No. OP-94, October 2000, 26 pages.
18. Philip Adams, Brian Parmenter and Mark Horridge, "Forecasts for Australian Regions using the MMRF-Green Model", paper prepared for the 24th ANZRSI Annual Conference, Hobart, December 2000, 26 pages.
19. Philip Adams, Brian Parmenter and Mark Horridge, "Analysis of Greenhouse Policy using MMRF-GREEN", paper presented at the Third Annual Conference on Global Economic Analysis, June 2000, 19 pages.
20. Tony Meagher, Philip Adams and Mark Horridge, "Applied General Equilibrium Modelling and Labour Market Forecasting", paper presented at the Third Annual Conference on Global Economic Analysis, June 2000, 21 pages.
21. Philip Adams, Johnathan Thomas, Nigel Hall and Bill Watson, "Water and the Australian Economy", a joint study project of the Australian Academy of Technological Sciences and Engineering and the Institution of Engineers Australia, April 1999, 137 pages.
22. Philip Adams and Greg Watts, "The Regional Consequences of the GST: Analysis based on the QGEM-F model, paper prepared for the second meeting of the Regional modelling Group, Adelaide, July 1999, 17 pages.

23. Philip Adams, "The Consequences for Australia of the Asian Crisis, in Proceedings of the Inaugural AARES Symposium - The Asian Crisis and Australia's Agricultural and Resource Sectors, November 1998. Available from the Australian Agricultural and Resource Economics Society.
24. Philip Adams and Brian Parmenter, 'Forecasting the Australian Economy: the Role of the MONASH Model', paper prepared for the Business Symposium on Economic forecasting, 27th Annual Conference of Economists, Sydney, October 1998, 28 pages.
25. Philip Adams, 'Glossary and Coverage of MONASH Industries and Commodities After Conversion to an ANZSIC-Based Classification', *mimeo*, June 1998, 37 pages.
26. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1997, 15 pages
27. Philip Adams and Matthew Cole, 'Splitting Pharmaceuticals, Veterinary Products and Pesticides (Monash commodity 54/Industry 52)', paper prepared for the Industry Commission, Melbourne, January 1996, 20 pages.
28. Philip Adams and Peter B. Dixon, 'Reaching the Planners: Generating Detailed Commodity Forecasts from a Computable General Equilibrium Model', *Centre of Policy Studies and the IMPACT Project Preliminary Working Paper*, No. OP-83, 1996, iii + 27 pages.
29. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1996, 15 pages
30. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1995
31. Philip Adams and Peter B. Dixon, 'Reaching the Planners: Generating Detailed Commodity Forecasts from the MONASH Model of Australia, paper presented to the Fifteenth International Symposium on Forecasting, Toronto, Canada, June, 1995.
32. Philip Adams and Peter B. Dixon, 'Prospects for Australian Industries, States and Regions: 1992-93 to 2000-01', paper prepared for *Corporate Brief*, August 1994, 20 pages. Available from Syntec Economic Services, Melbourne.
33. Philip Adams and Brian R. Parmenter, 'ORANI-F and MONASH: General Equilibrium Models of the Australian Economy for Medium-Run Forecasting', *Centre of Policy Studies and the Impact Project Preliminary Working Paper*, No. OP-80, July 1994, 19 pages. Available from the Impact Project, Monash University, Clayton Vic 3168. Earlier version presented to the Conference of Economists, Perth, September 1993.
34. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, February 1994, 10 pages.
35. Philip Adams and Peter B. Dixon, 'Prospects for Australian Industries and States: 1992-93 to 2000-01', paper prepared for *Corporate Brief*, August 1993, 19 pages. Available from Syntec Economic Services, Melbourne
36. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1993, 10 pages.
37. Philip Adams and Brian R. Parmenter, 'An Applied General Equilibrium Analysis of the Economic Effects of Tourism in a Quite Small, Quite Open Economy', *Centre of Policy Studies Discussion Paper*, No. D158, Centre of Policy Studies, Monash University, September 1992.
38. Philip Adams, Peter B. Dixon, and Barry Jones, 'The MENSA Model: An Exposition', *Centre of Policy Studies Discussion Paper*, No. D155, Centre of Policy Studies, Monash University, July 1992.
39. Philip Adams, 'Short-term Economic Prospects for the Australian Economy', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, Osaka, Japan, March 1992, 10 pages.
40. Philip Adams and Brian R. Parmenter, 'Microeconomic Reform and Employment in the Short Run', *Centre of Policy Studies Discussion Paper*, No. D154, Centre of Policy Studies, Monash University, February 1992.
41. Philip Adams and David Parsons, 'Medium-term Outlook for World Prices of Minerals and Metals other than Oil', paper presented to Forecasters meeting of the Pacific Economic Co-operation Conference, San Francisco, United States, January 1992
42. Philip Adams, 'ABARE Commodity Projections', *mimeo*, prepared for the ESD Working Groups, September 1991, 34 pages.

43. Philip Adams, Peter B. Dixon and Brian R. Parmenter, 'Productivity Growth, International Competitiveness and Australia's Economic Prospects', *Centre of Policy Studies Discussion Paper*, No. D150, Centre of Policy Studies, Monash University, September 1991.
44. Philip Adams, Peter Dixon and B.R. Parmenter, "Prospects for the Australian Economy 1989-90 to 1995-96: A Base Case for the Ecologically Sustainable Development Working Groups", *Ecologically Sustainable Development Working Groups Discussion Paper*, May 1991, 23 pages.
45. Philip Adams and P.B Dixon, "Effects of Subsidising Investment", Australian Manufacturing Industry Council paper, June 1990, 13 pages.
46. Philip Adams, P.B. Dixon, G.A. Meagher, B.R. Parmenter and M.W. Peter, "Survey of Selected Computable General Equilibrium Models as Background for the Industry Commission's Salter Model", Industry Commission working paper, June 1990, 118 pages.
47. Philip Adams, B.R. Parmenter and M.W. Peter, 'Australia's Medium-run Economic Prospects, Including an Analysis of the Role of Immigration', Paper presented at the Economic Modelling of Australia Conference organised by the Economic Modelling Bureau of Australia, Canberra, 14 and 15 June 1990, 25 pages.
48. Philip Adams, B.R. Parmenter, G.A. Meagher, D. McDonald, 'Structural Change in the Australian Economy: Historical Simulations with ORANI-F', Paper presented to the Conference on Economic Modelling, Urbino, Italy, July 1990, 24 pages.
49. Philip Adams, P.B. Dixon, D. McDonald and M. Horridge, 'A Short-run Forecasting Model of the Australian Economy', Revised *IAESR Working Paper*, No. 6/1989, 110 pages.
50. Philip Adams, 'An Updated Calibration of NAGA, and of the Investment Theory and Foreign Debt Module of ORANI-F', *IAESR Research Paper*, No. 3/1989, June 1989, 37 pages.
51. Philip Adams, Alan Powell and Ching Fan Chung, 'Australian Estimates of Working's Model Under Additive Preferences: Revised Estimates of a Consumer Demand System for Use by CGE modellers and Other Applied Economists', *IMPACT Working Paper*, No. O-61, 1988, iii + 89 pages.
52. Philip Adams, 'Estimation of the Extended Linear Expenditure System with Assets', *IMPACT Preliminary Working Paper*, No. IP-38, 1988, iii + 77 pages.
53. Philip Adams, 'Initial Estimates of the Extended Linear Expenditure System with Assets', University of Melbourne, mimeo, 1988, iii + 78 pages.
54. Philip Adams, 'Australian Household Sector Wealth Statistics for the Estimation for the Extended Linear Expenditure System with Assets', *IMPACT Preliminary Working Paper*, No. IP-34, 1987, iv + 88 pages.
55. Philip Adams, 'Short-Run Macroeconomic Closure of ORANI: An Alternative to the IMPACT Paradigm', *IMPACT Working Paper*, No. OP-60, 1987, iii + 102 pages.
56. Philip Adams, 'From ELES to ELES: A Linear Expenditure System with Assets', *IMPACT Preliminary Working Paper*, No. IP-28, 1986, i + 18 pages.
57. Philip Adams and Peter J. Higgs, 'Calibration of Computable General Equilibrium Models from Synthetic Benchmark Equilibrium Data Sets', *IMPACT Preliminary Working Paper*, No. OP-57, 1986, 37 pages.
58. Philip Adams, 'The Cost of Manufacturing Protection to the Rural Sector', University of Melbourne, mimeo, 1986, 16 pages.
59. Philip Adams, 'A User's Guide for Computing Detailed Short-Run Agricultural Sector Results with the Melbourne Version of ORANI 78', *IMPACT Computing Document*, No. C6-01, 1986, 37 pages.
60. Philip Adams, 'Agricultural Supply Response in ORANI', *IMPACT Working Paper*, No. O-44, 1985, 29 pages.
61. Philip Adams, 'The Typical Year Data Base for the Agricultural Sector of ORANI 78', *IMPACT Preliminary Working Paper*, No. OP-45, 1984, 113 pages.
62. Philip Adams, 'The Short-Run Behaviour of Agricultural Industries in ORANI 78 -- Methodological Overview and Analysis of Base Year Data', *IMPACT Preliminary Working Paper*, No. OP-42.

Contract Research

Projects since 2009 for which I have been principal investigator

Short description	Client	Project end date
Energy efficiency improvements	McLennan Magasanik Associates	30/04/2009
Expanded renewable energy target	McLennan Magasanik Associates	27/02/2009
Transurban car network in Melbourne	Ernst & Young (Melbourne)	30/12/2009
Impact of gambling	Allen Consulting Group	30/12/2009
Costs and benefits of large projects in Vic	Marsden Jacobs	30/12/2009
Vic Government Science Technology and Innovation initiative	Deloitte Touche Tohmatsu	26/06/2009
Revised modelling LNG facility at Gladstone	URS Australia Pty Ltd	28/03/2009
Economic futures of NT	Deloitte Touche Tohmatsu	31/03/2009
Climate adaptation in Vietnam	World Bank	16/07/2010
forestry industry in Tasmania	Deloitte Touche Tohmatsu	31/03/2009
Advice & tech assist mode Fed Government carbon policy	CRC for Sustainable Tourism	17/03/2009
Electricity tariffs on the NT economy	Deloitte Touche Tohmatsu	31/03/2009
Disaggregation of the agriculture sector in MMRF	DAFF, Department of Agriculture, Fisheries and Forestry (Australian Government)	29/05/2009
Extension climate change abatement	Frontier Economics	29/05/2009
Melbourne Park	Ernst & Young (Melbourne)	30/01/2009
Impacts of different rules for shielding	Climate Institute	30/11/2009
Economic contribution of Sports	Frontier Economics	08/12/2009
Better Place - Electric vehicles	Deloitte Touche Tohmatsu	18/03/2011
Pharmaceutical industry	Deloitte Touche Tohmatsu	16/12/2009
The national economic impacts from broadband	Allen Consulting Group	27/11/2009
MMRF4 with basecase and policy simulation to model the Carbon Pollution Reduction Scheme	Department of Infrastructure, Transport, Regional Development and Local Government	26/08/2009
Changes in the costs of Abatement	DIIRD, Department of Innovation, Industry and Regional Development (Victorian Government)	16/04/2010
Provision of MMRF model code and database	PricewaterhouseCoopers (Melbourne)	11/11/2009
Provision of model code and database, and for modelling advice over the course of 2010	Allen Consulting Group	19/11/2009
The impacts of Asian Soccer Cup for Australia	PricewaterhouseCoopers	11/12/2009
Comparative economic impacts of pursuing greenhouse gas reduction through domestic action	Department of Innovation, Industry and Regional Development	17/12/2010
Update of the MMRF modelling framework, 2010	Productivity Commission	28/06/2012
On-site support for the Department of Treasury and Finance	DTF, Department of Treasury and Finance (Victorian Government)	14/06/2011
National Integrated Assessment Model: proof of	CSIRO Energy Transformed Flagship	30/06/2011

Short description	Client	Project end date
Impacts of Jabirum Metals Stockman project	Deloitte Touche Tohmatsu	27/08/2010
prospects for the Australian and Queensland economy	QIC Limited	15/06/2010
Jobs and Economy Model: Technical analysis Project	Department of Sustainability and Environment, Julian Smith	25/03/2011
Work on the economics and adaptation to climate change: macro level assessment for Vietnam	World Bank	31/03/2010
Vietnam food security	World Bank	28/07/2011
Future Scenarios for Australia	Insight Economics	22/04/2011
MMRF Baseline forecast	QIC Limited	31/03/2012
Provision of Computable General Equilibrium Modelling to the Federal Treasury	Department of the Treasury (Australian Government)	01/07/2011
Model of Uganda	Oxford Policy Management	30/06/2015
Carbon price impacts - Red meat sector	Meta Economics Consulting Group	03/10/2011
Modelling of Federal government carbon policy for QLD government	Office of Economic and Statistical Research, Queensland Treasury (Queensland Government)	14/08/2011
Modelling the economic impacts of the twenty per cent emissions reduction target by 2020	DTF, Department of Treasury and Finance (Victorian Government)	12/08/2011
The economic impacts of the Melbourne GP	Ernst & Young (Melbourne)	18/12/2011
Further CSIRO CoPS collaboration	CSIRO Energy Transformed Flagship	29/06/2012
Economic impacts of Electricity sector reform in Tasmania	Electricity Industry Expert Panel	29/02/2012
2 projects for Stephen Anthony	Stephen Anthony, Macroeconomics	13/10/2011
Skills Victoria scenarios	Allen Consulting Group	29/02/2012
Native Forest Harvest Scenarios in Tasmania	Department of Infrastructure, Energy and Resources (Tasmanian Government)	10/10/2011
Update of Victorian 20 by 20 modelling	DPC, Department of Premier and Cabinet (Victorian Government)	29/02/2012
SIC climate change project with DCCEE	DCCEE	19/12/2012
Economic effects of a new Sydney casino (confidential)	Allen Consulting Group	01/08/2012
CRC research effectiveness	Allen Consulting Group	01/11/2012
ACT greenhouse policy	Stephen Anthony, Macroeconomics	12/07/2012
Japanese emissions policy seminar	Japan Ministry of Environment	06/06/2012
Contribution of Melbourne Airport	SGS Economics and Planning Pty Ltd	30/11/2012
Economic impacts of various options for the Sydney airport	Ernst & Young	21/12/2012
Queensland multi-regional forecasting model	Office of Economic and Statistical Research, Queensland Treasury (Queensland Government)	30/06/2013
Modelling regional demands for energy	CSIRO Newcastle	10/12/2012

Short description	Client	Project end date
Economic Impacts of new convention facility in NSW	PricewaterhouseCoopers (Sydney)	29/06/2012
Contribution of Australian Open Tennis championship	Tennis Australia	28/11/2012
Modelling advice to Federal Department of Tourism	Department of Employment, Economic Development and Innovation	10/08/2012
3E CGE model for Taiwan	Taiwan Institute of Economic Research (TIER)	28/09/2012
MMRF Baseline forecast Part 2	QIC Limited	28/09/2012
Development of an Omani CGE model	Sultan Qaboos University	04/11/2014
LNG in MMRF (Part 1: requirements 1 to 3)	Department of the Treasury (Australian Government)	19/04/2013
Further modelling of international nickel trade	Frontier Economics	31/12/2013
Scoping study to India	Department of Employment, Economic Development and Innovation	28/06/2013
Modelling services for the DMO	Macroeconomics	30/06/2014
Australia-wide impacts of changes in Australia's tax system, plus additional tax work for BCA	PwC	26/07/2013
Advice and review comments on Draft treasury paper on the effects of GNI of different emission caps	Department of the Treasury (Australian Government)	22/07/2013
Modelling of the impacts of the Sydney casino	PricewaterhouseCoopers	08/08/2013
MMRF database for DOT modelling	KPMG	14/10/2013
MMRF database for SA employment impact modelling	KPMG	30/11/2013
Audit of QGEMF	Office of Economic and Statistical Research, Queensland Treasury (Queensland Government)	31/12/2013
Building modelling capacity at QIC	QIC Limited	12/12/2013
state fiscal impediments to household mobility	DTF, Department of Treasury and Finance (Victorian Government)	30/06/2017
Use of MMRF for the blue project	KPMG (Sydney)	14/02/2014
Provision of Modelling services to inform the 2050 deep decarbonisation pathway project	Monash University ClimateWorks Australia	01/12/2014
Jordan dynamic model	Leading Point Management Advisory Services	31/05/2014
Australian National Outlook scenarios	CSIRO, CMAR	01/07/2014
Practical GE modelling course	Chinese Academy of Sciences, Institute of Policy and Management	11/07/2014
MMRF Database for Bloomfield project	KPMG (Sydney)	06/06/2014

Short description	Client	Project end date
Development and application of a dynamic CGE model of the Saudi economy	Ministry of Commerce and Industry	15/04/2015
Victoria University Multi-Regional Model and database	Productivity Commission (Canberra)	19/12/2014
The use of MMRF data for Barangaroo Project	KPMG (Sydney)	17/07/2014

Projects prior to 2009 for which I have been principal investigator

1. "State action on Climate Change for the NSW Treasury" (Frontier Economics) (October 2008 – February 2009)
2. "Potential economic impacts of a new LNG plant for QLD (URS corporation) (October 2008-January 2009)
3. "Implications of a Collapse in Investment spending" (Allen Consulting) (December 2008)
4. "NT Mining Development and its implications for the State Economies (Deloitte) (October 2008-January 2009)
5. "Reforms of urban water pricing" (Victorian Department of Infrastructure) (October 2008-December 2008)
6. "Adaptation greenhouse policies for South Africa (South African Treasury and Pretoria University) (August 2008-September 2008)
7. Costs and Benefits of various mining projects (Insight Economics) (March-July 2008)
8. Impacts of the Melbourne F1 Grand Prix on Victoria and Australia (Ernst and Young) (February, March 2008)
9. "Costs and benefits of the Transurban road system in Sydney (Ernst and Young) (January 2008 – March 2008)
10. "Development of the MMRF model for climate change policy analysis" (Federal Treasury) (November 2007 – October 2008).
11. "NETT3 – Emissions trading scheme analysis" (NETT secretariat) (August 2007 -)
12. "Garnaut Review modelling" (Garnaut Review) (October 2007 – August 2008)
13. "Efficiency improvements in the construction sector" (Allen Consulting Group) (June 2007)
14. "Efficiency improvements in the grocery retail sector" (Allen Consulting Group) (June 2007).
15. "Economic impacts of an emissions trading scheme (Climate Institute) (August 2007 to November 2007).
16. "Stationary Energy Projections, 2007" (Australian Greenhouse Office) (March 2007 to July 2007).
17. "Economic benefits and costs of renewable generation" (Renewable Generators Association through MMA) (May 2007).
18. "Effects of improved port facilities" (Allen Consulting) (May 2007 to July 2007).
19. "Roofing insulation – the economic effects" (Insight Economics) (March 2007).
20. "Modelling the impacts of autonomous energy efficiency improvements in the construction sector" (Centre of International Economics) (March 2007 to June 2007).
21. "Pricing of electricity in Tasmania" (Hydro Tasmania) (May 2007).
22. "New defence ship building program for Australia" (Insight Economics) (March 2007).
23. "Constructing parts for the JSF plane in Victoria" (Insight Economics) (March 2007).
24. "The impacts of an Australia-Chile FTA for the Australian mining industry" (Allen consulting) (January 2007 to April 2007).
25. Increased productivity via increased R and D in the Victorian brown coal industry" (Insight economics) (February 2007).
26. "Economic impacts of the Melbourne Desalination proposal" (Department of Sustainability and Environment) (February 2007- June 2007).
27. "Increased Federal funding for new roads in Victoria (Victorian Department of Infrastructure) (February 2007 to May 2007).
28. "Impact of the QLD CIF" (Allen Consulting) (December 2006).
29. Preparation of a new version of the MMRF model (with Glyn Wittwer and Mark Horridge) (Productivity Commission) (January 2006-December 2006).
30. Economic impacts of a high gas price for WA" (Insight Economics) (November 2006).

31. "Economic Impacts of the Browse LNG Development" (Insight Economics) (September 2006 to November 2006).
32. "Impacts of the Olympic Dam Development in SA" (Insight Economics) (June 2006 to November 2006).
33. "Economic Impacts of the Pluto LNG Development in WA" (Insight Economics) (June 2006 to November 2006).
34. "Impact of a New Coal Export Terminal at Koorgang Island in NSW" (Allen Consulting Group (August 2006-September 2006).
35. "Economic Impacts of the Victorian Grand Prix in 2005" (Allen Consulting Group) (June 2006 to September 2006).
36. "Economic Impacts of Increased Agricultural and Forestry Output due to the CRC for Dryland Salinity" (University of Western Australia) (August 2006).
37. "Economic Impacts of the Easter Water Recycling Project for Victoria" (PriceWaterhouseCoopers) (March 2006 to July 2006).
38. "Economic Impacts of the Chalco Proposal for a new QLD Bauxite Mine and Alumina Refinery" (Office of the Coordinator-General, QLD) (September 2006).
39. "Economic Impacts of Greenhouse Issues for the Victorian Government" (MMA) (May to August 2006).
40. "Modelling and Review Associated with a Study on New air cargo Security Procedures (Bureau of Transport Economics) (June 2006).
41. Economic Impacts of R and D (Allen Consulting Group) (March 2006 to June 2006).
42. "Evaluation of Demand and Supply Elasticities for Various Vitamin Related Products "(Frontier Economics) (June 2006).
43. "Greenhouse Options for the Victorian Economy" (Victorian Department of Treasury and Finance and McLennan, Magasanik and Associates) (January 2006-February 2006).
44. "Changes in the Composition of Motor Vehicle Manufacturing (private sector client and the Allen Consulting Group) (December 2005-January 2006).
45. "Impact of the Victorian Racing Industry and implications of changes in government support" (IEA) (January 2006-February 2006).
46. "Greenhouse Options for the Tasmanian Economy" (Allen Consulting Group) (December 2005-January 2006)
47. "Economic Impacts of Reduced Use of Plastic Bags in Retailing" (Allen Consulting Group) (November 2005).
48. "Economic Contribution of the Victorian Spring Racing Carnival" (IEA) (December 2005-January 2006).
49. "Contribution of the Spring Racing Carnival to the Victorian Economy" (IEA) (December 2005-January 2006).
50. "Revised Estimates of the Impacts of a new pulp paper mill for Tasmania" (Tasmanian Treasury and Allen Consulting) (December 2005-January 2006).
51. "Impacts of the new Iluka Mineral Sands project in SA" (Allen Consulting Group) (November 2005).
52. "Effects of expanding Victoria's Forestry Sector" (Allen Consulting Group) (November, December 2005).
53. "Review of Economic modelling of Climate Change Policies in the UK (OXERA consulting group, London) (October 2005).
54. "Economic impacts of Proposed Spending on Victoria's Suburban Rail Network (Allen Consulting Group) (October 2005).
55. "Improved Energy and Greenhouse Gas Modelling" (MMA) (August 2005 – September 2005).
56. "Advice on Regional Modelling" (Victoria Department of Treasury) (October 2005-).
57. "Trade Liberalisation Scenarios for wool under an Australia-China FTA" with Yin Hua Mai (ITS Global) (July 2005).
58. "Options for the Renewable Energy Strategy of Victoria" (Sustainable Energy Authority of Victoria) (September 2005).
59. "Policies to Slash Greenhouse Gas Emissions by 2050" (Australian Conservation Foundation and the Allen Consulting Group) (August 2005).
60. "Analysis of the SACU/India Free Trade Agreement" with Mark Horridge (South African Department of Agriculture) (April 2005- May 2005).
61. "Economic impacts of a large Defence Shipbuilding Project" (Acil Tasman) (January-March, 2005).
62. "Alternative allocation methods for Logs in Victoria" (PWC for VicForests) (December 2004).
63. "Economic impacts of a new pulp mill for Tasmania" (Tasmanian department of Treasury) (October 2004).
64. "Energy for minerals development in the South West Region of WA: Economic modelling of alternative scenarios" (Sleeman consulting for the WA department of Industry and Resources) (September 2004).
65. "Economic impacts of alternative development proposals for the Argyle diamond mine" (Allen consulting for the Argyle operators) (July 2004).
66. "Impacts of a new accreditation scheme for builders in Victoria" (Allen consulting) (June 2004).

67. "Modelling for Victorian Greenhouse Challenge for energy" (Victorian government taskforce on energy with Allen Consulting) (June 2004).
68. "Projections of Stationary energy use and greenhouse emissions" (AGO) (June 2004).
69. "Development options for Black Tip gas, WA" (Acil Tasman) (March 2004).
70. "Impacts of an expansion to the Alcan smelter at Gove, NT" (Acil Tasman) (March 2004).
71. "Training in the use of GTAP for global policy analysis" (funded by AusAid, training in South Africa) (March 2004).
72. "Evaluation of the proposed NEET scheme" (Allen Consulting for SEAV) (October 2003).
73. "Impacts of the proposed US/AUS free trade agreement for Australia, with special emphasis on the Victorian economy" (Department of Premier and Cabinet, Victoria) (October and November 2003).
74. "Counterfeiting and piracy: Their impacts on the Australian economy" (Allen Consulting) (October 2003).
75. "Impacts of the proposed US/AUS free trade agreement for Australia, with special emphasis on the South Australian economy" (Allen Consulting for the South Australian government) (September 2003).
76. "Potential benefits of a plan to revitalise the NSW racing industry" (Allen Consulting) (September 2003).
77. "Long-term economic futures for the Victorian economy" (Victorian Department of Treasury and Finance) (September 2003).
78. "Impacts of a new airframe production plant" (Allen consulting) (September 2003).
79. "Impacts of defence base closures" (Australian Defence Force) (September 2003).
80. "The economic contribution of Monash University" (Monash University) (August 2003).
81. "Future coal and gas scenarios for electricity generation" (MMA for the AGO) (August 2003).
82. "Impacts of an expansion to the Victorian convention centre" (PricewaterhouseCoopers) (July 2003).
83. "Impacts of a free trade agreement between the USA and SACU (South African Department of Agriculture) (May-June 2003), jointly with Mark Horridge.
84. "Policies for attaining Kyoto commitment" (AGO) (April-June 2003).
85. "Costs and benefits of changes to the MRET" (MMA for the AGO) (April 2003).
86. "AusLink – advisory work for the Bureau of Transport Economics" (BTE) (March, April 2003).
87. "Increased efficiencies in stationary energy processes" (Sustainable Energy Authority of Victoria - SEVA) (2003).
88. "Impacts of a shift to Eco-efficient sugar cane farming in Queensland" (QLD Department of Primary Industries) (2003).
89. "Impacts of the Australian Rally on the WA economy" (Allen Consulting for the WA state Treasury) (December 2002 to January 2003).
90. Training course in the use of the MMRF-Green model (WA Department of Mineral and Petroleum resources, and the Department of Treasury) (25-29 November 2002).
91. "Kyoto Compliance and its impacts on NSW" (Allen Consulting for the NSW Government's review of environmental policies) (2002).
92. "Impacts of policy options relating to emissions abatement in the stationary energy sector", (Allen Consulting for the COAG energy market review) (2002).
93. The economic benefits of capacity expansions in alumina smelting and aluminium refining (ACIL) (2002)
94. The impacts of the international vitamin cartel (Frontier Economics and Maurice, Blackburn, Cashman) (2002-)
95. Options relating to renewable electricity generation (Victorian Department of Premier and Cabinet) (2002)
96. Sustainable energy options (Sustainable Energy Development Authority – SEDA, NSW) (2002)
97. Impacts of electricity reform on the WA economy (WA Department of Treasury) (2002)
98. Improvements in Melbourne Port Efficiency (Victorian Department of Infrastructure) (2002)
99. The impacts of an increase in insurance premiums (Victorian Department of Treasury) (2002)
100. Modelling the effects of changes in the electricity industry (Productivity Commission) (2002)
101. The costs and benefits of new gas pipeline alternatives for the QLD economy (QLD Department of Treasury) (2002)
102. Prospects for Greenhouse emissions from the stationary energy sector (AGO) (2002)
103. Costs and benefits of new energy standards for housing (Allen Consulting and the Sustainable Energy Authority of Victoria) (2002)
104. The economic significance of changes in Defence infrastructure spending (ACIL consulting) (2002)
105. The economic significance of an outbreak of Foot and Mouth Disease in QLD (QLD Department of Primary Industries) (2001)
106. The effects of mine closure in the Broken Hill area (Allen Consulting) (2001)
107. The effects of a new automotive parts industry in NSW (Allen Consulting) (2001)
108. The effects of a new Nickel mine and smelter (Allen Consulting) (2001)

- 109.The effects of a Space launch Centre on the Christmas Islands (Allen Consulting) (2001)
- 110.Impacts of a new steel and iron plant for WA (Allen Consulting) (2001)
- 111.Impacts for QLD of global trading in greenhouse emissions permits and other strategies for reducing emissions (Australian Greenhouse Office, QLD Department of Treasury) (2001)
- 112.Transport enhancements in MMRF (Bureau of Transport Economics) (2000 and 2001)
- 113.Impacts of carbon trading on Australia and its regions (Allen Consulting and Minerals Council of Australia) (2000)
- 114.Impacts of global and domestic carbon trading (Allen Consulting and the Australian Greenhouse Office) (2001)
- 115.Impacts of an ASEAN free trade zone on the Thailand economy (Thai government and Chulalongkorn University) (2000)
- 116.Implications for Australia and South Australia of a large-scale mining project (confidential) (2000)
- 117.The construction of a dynamic multiregional model of the Danish economy (Danish Institute of Agricultural and Fisheries Economics) (2000, 2001, 2002)
- 118.The contribution of exports to the regional economies (Department of Foreign Affairs and Trade) (2000)
- 119.Implications for Australia of a large-scale mining project in QLD (confidential) (2000)
- 120.Regional impacts of taxation policies assessed using a dynamic regional general equilibrium model (an ARC SPIRT project) (1999, 2000, 2001)
- 121.Projections of long-term energy supply and demand for the South Australian economy (Allen Consulting) (1999)
- 122.Construction of a dynamic model of the QLD economy and the Rest of Australia (QLD Department of Treasury) (1999)
- 123.The impacts of a large scale mining project on the Queensland economy (Allen Consulting) (1999)
- 124.Labour market projections to the year 2010 (Office of the federal leader of the Opposition) (1999)
- 125.Future infrastructure needs in Melbourne (Infrastructure Victoria) (1998, 1999)
- 126.The regional impacts of the GST (Queensland Treasury) (1998, 1999)
- 127.Impacts of E-Commerce (Allen consulting) (1998, 1999)
- 128.Productivity improvements in agriculture (Department of Natural Resources, Victoria) (1997, 1998, 1999)
- 129.Water and the Australian economy (Australian Academy of Technological Science) (1997, 1998)
- 130.The contribution of exports to the Australian economy (Department of Foreign Affairs and Trade) (1998).
- 131.Effects of technical change in coal production (Productivity Commission) (1997,1998)
- 132.Projections of Australian greenhouse gas emissions (Department of Environment, Sport and Territories) (1997).
- 133.Forecasts for the WA economy (Western Power) (1996).
- 134.Analysis of the effects of regulatory arrangements on the QLD sugar industry (Boston Consulting Group) (1996).
- 135.Analysis of the long-term growth prospects of the WA economy (WA Department of Commerce and Trade) (1995).
- 136.Analysis of the prospects for employment by industry (Commonwealth Department of Employment, Education and Training) (1994-95).
- 137.Development of the semi-annual publication, *Guide to Growth*, which details the growth prospects of over 100 industries in the Australian economy (Syntec economic services) (1993).
- 138.Analysis of the effects of international tourism on the Australian economy (Bureau of Tourism Research) (1989-93).

Attachment D – Victoria University Regional Model (VURM)

The Victoria University Regional Model (VURM) model is a multi-regional, dynamic computable general equilibrium (CGE) model. It distinguishes up to eight Australian regions (six States and two Territories) and, depending on the application, up to 144 commodities/industries. The model recognises:

- domestic producers classified by industry and domestic region;
- investors similarly classified;
- up to eight region-specific household sectors;
- an aggregate foreign purchaser of the domestic economy's exports;
- flows of greenhouse gas emissions and energy usage by fuel and user;
- up to eight state and territory governments; and
- the Federal government.

The model contains explicit representations of intra-regional, inter-regional and international trade flows based on regional input-output data developed at CoPS, and includes detailed data on state and Federal governments' budgets. As each region is modelled as a mini-economy, VURM is ideally suited to determining the impact of region-specific economic shocks. Second round effects are captured via the model's input-output linkages and account for economy-wide and international constraints. Outputs from the model include projections of:

- GDP and aggregate national employment;
- sectoral output, value-added and employment by region;
- export earnings, import expenditure and the balance of trade;
- greenhouse gas emissions by fuel, fuel user and region of fuel use;
- energy usage by fuel, energy user and region of energy use;
- State and Territory revenues and expenditures;
- regional gross products and employment; and
- regional international export earnings, international import expenditures and international balance of payments.

Numerous applications of VURM have been commissioned by commercial and government organizations. Some of these studies simulated:

- the regional effects of national policies;
- the effects of region-specific infrastructure projects;
- the effects of alternative regional forestry policies;
- the effects of different policies to reduce Australian emissions of CO₂ in line with Kyoto commitments.

Attachment E

Table of comparisons (Acil and CoPS), 2015-2047 Effects of Coal mine (revised ACIL assumptions) + 0 per cent reduction in world price of thermal coal	Acil (simple sums of annual changes)			CoPS (simple sums of annual changes)			CoPS (NPV, 2.8 %)			CoPS (NPV, 4.3%)		
	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia	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	15,382	5,320	20,702	49,071	-35,814	13,257	28,996	-19,610	9,386	22,484	-14,575	7,908
Investment	3,335	704	4,039	19,240	-20,055	-815	13,031	-11,706	1,324	10,898	-9,011	1,887
Government consumption	7,415	-11	7,404	10,849	-5,635	5,214	6,433	-2,950	3,483	4,998	-2,224	2,773
International exports	na	na	68,267	83,109	-38,211	44,898	49,914	-23,103	26,811	38,974	-18,941	20,033
International imports (contribution)	na	na	-38,839	-13,798	8,547	-5,251	-8,674	4,622	-4,052	-6,975	3,547	-3,428
Real economic output	60,024	1,553	61,577	113,639	-56,336	57,303	67,745	-30,792	36,952	52,752	-23,579	29,173
Real income												
Real economic output	60,024	1,553	61,577	113,639	-56,336	57,303	67,745	-30,792	36,952	52,752	-23,579	29,173
Terms of trade	9,366	2,988	12,354	980	3,179	4,159	783	2,375	3,158	694	2,133	2,827
Net foreign income	-34,478	2,828	-31,650	-39,963	4,199	-35,764	-24,437	2,412	-22,025	-19,267	1,841	-17,427
Real income	34,913	7,369	42,282	74,656	-48,958	25,699	44,091	-26,006	18,085	34,179	-19,605	14,574
Employment (total person years)	39,796	8,528	48,324	120,829	-106,332	14,498	<i>not relevant</i>					

Attachment F

Table of results, 2015-2047 Effects of Coal mine (revised IEEFA assumptions) + 0 per cent reduction in world price of thermal coal	CoPS (simple sums of annual changes)			CoPS (NPV, 2.8 %)			CoPS (NPV, 4.3%)		
	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia
	2014-15 A\$m			2014-15 A\$m			2014-15 A\$m		
Real economic output (expenditure side)									
Private consumption	28,889	-21,928	6,960	17,645	-12,208	5,437	13,909	-9,147	4,761
Investment	13,794	-12,243	1,551	9,787	-7,365	2,422	8,365	-5,748	2,617
Government consumption	6,367	-3,573	2,793	3,908	-1,880	2,028	3,088	-1,419	1,669
International exports	43,753	-26,225	17,528	27,260	-16,610	10,649	21,646	-13,921	7,725
International imports (contribution)	-9,753	5,261	-4,492	-6,404	2,852	-3,552	-5,259	2,186	-3,073
Real economic output	60,740	-36,400	24,340	37,321	-20,337	16,984	29,493	-15,794	13,700
Real income									
Real economic output	60,740	-36,400	24,340	37,321	-20,337	16,984	29,493	-15,794	13,700
Terms of trade	915	2,915	3,829	716	2,149	2,865	629	1,921	2,550
Net foreign income	-17,814	2,675	-15,139	-11,274	1,571	-9,703	-9,033	1,212	-7,821
Real income	43,841	-30,811	13,030	26,763	-16,617	10,146	21,089	-12,661	8,428
Employment (total person years)	77,903	-63,401	14,502	<i>not relevant</i>					

Attachment G

Table of results, 2015-2047. Effects of Coal mine (revised IEEFA assumptions) + 1 per cent reduction in world price of thermal coal	CoPS (simple sums of annual changes)			CoPS (NPV, 2.8 %)			CoPS (NPV, 4.3%)		
	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia
	2014-15 A\$m			2014-15 A\$m			2014-15 A\$m		
Real economic output (expenditure side)									
Private consumption	10,562	-12,229	-1,667	7,716	-7,567	149	6,565	-5,974	591
Investment	177	-6,230	-6,052	2,084	-4,326	-2,242	2,523	-3,594	-1,071
Government consumption	2,231	-2,568	-337	1,656	-1,489	167	1,418	-1,187	231
International exports	33,072	-8,714	24,358	21,813	-6,843	14,971	17,772	-6,238	11,534
International imports (contribution)	-3,454	3,603	148	-2,910	2,128	-783	-2,638	1,707	-932
Real economic output	32,595	-16,145	16,450	22,271	-10,009	12,262	18,454	-8,099	10,354
Real income									
Real economic output	32,595	-16,145	16,450	22,271	-10,009	12,262	18,454	-8,099	10,354
Terms of trade	-607	-1,603	-2,211	-268	-682	-950	-172	-446	-618
Net foreign income	-15,843	1,243	-14,600	-10,221	811	-9,410	-8,260	657	-7,603
Real income	16,144	-16,505	-361	11,783	-9,880	1,903	10,022	-7,889	2,133
Employment (total person years)	33,270	-18,774	14,496	<i>not relevant</i>					

Attachment H

Table of results, 2015-2047. Effects of Coal mine (revised IEEFA assumptions) + 5 per cent reduction in world price of thermal coal	CoPS (simple sums of annual changes)			CoPS (NPV, 2.8 %)			CoPS (NPV, 4.3%)		
	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia	Queensland	Rest of Australia	Australia
	2014-15 A\$m			2014-15 A\$m			2014-15 A\$m		
Real economic output (expenditure side)									
Private consumption	-60,894	25,548	-35,346	-31,024	10,499	-20,525	-22,101	6,373	-15,728
Investment	-52,997	17,253	-35,744	-28,020	7,542	-20,478	-20,319	4,816	-15,503
Government consumption	-13,891	1,356	-12,535	-7,127	29	-7,098	-5,101	-288	-5,389
International exports	-8,430	60,053	51,623	647	31,552	32,199	2,717	23,981	26,698
International imports (contribution)	21,059	-2,957	18,102	10,699	-744	9,955	7,576	-197	7,379
Real economic output	-77,036	63,136	-13,901	-36,385	30,438	-5,948	-24,589	22,045	-2,544
Real income									
Real economic output	-77,036	63,136	-13,901	-36,385	30,438	-5,948	-24,589	22,045	-2,544
Terms of trade	-6,621	-19,524	-26,146	-4,151	-11,915	-16,066	-3,333	-9,835	-13,168
Net foreign income	-8,168	-4,367	-12,536	-6,114	-2,170	-8,284	-5,247	-1,523	-6,770
Real income	-91,826	39,244	-52,582	-46,651	16,353	-30,298	-33,169	10,687	-22,482
Employment (total person years)	-141,011	155,510	14,499	<i>not relevant</i>					

Attachment I

Employment by industry - National		Average	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045	2046	2047	2048	2049	
a	0 Crops	-85.4409	-18.51	-35.56	-87.25	-86.69	-61.92	-77.23	-93.09	-93.24	-101.23	-102.05	-104.25	-101.57	-98.99	-97.89	-95.54	-95.76	-92.82	-89.95	-91.06	-84.21	-80.76	-81.98	-80.47	-78.84	-75.40	-75.27	-71.93	-63.17	-56.01	-56.83	-56.00	-56.57	-58.51	-48.11	0	0	
a	1 Livestock	-42.8849	-12.19	-21.30	-54.78	-56.02	-41.31	-44.72	-51.43	-49.70	-50.70	-49.33	-51.30	-48.84	-45.74	-44.98	-42.48	-42.10	-39.84	-37.96	-38.43	-34.51	-31.53	-31.66	-30.91	-29.43	-27.58	-26.00	-23.29	-20.11	-20.59	-20.06	-20.20	-21.96	-18.86	0	0		
a	2 Sugar cane	6.063125	-1.02	-1.51	-3.29	-1.44	-1.89	1.72	3.55	4.24	4.27	5.46	4.99	6.57	7.66	8.49	10.15	11.27	13.08	14.83	15.35	18.79	21.63	22.66	24.23	26.22	28.94	30.31	32.61	35.38	38.59	39.81	41.50	42.71	44.82	49.52	0	0	
a	3 Forestry	-10.2241	-1.64	-1.55	-5.98	-7.80	-9.04	-9.40	-11.05	-11.09	-12.15	-12.36	-13.09	-12.66	-12.62	-12.68	-12.44	-12.55	-12.04	-11.49	-11.94	-10.92	-9.94	-10.11	-9.90	-9.58	-9.09	-9.02	-8.34	-7.26	-6.12	-6.11	-5.79	-5.90	-5.28	-2.93	0	0	
a	4 Fishing	-3.2404	-0.95	-1.84	-4.51	-3.93	-2.45	-3.28	-4.05	-3.82	-3.56	-3.27	-3.58	-3.50	-3.42	-3.48	-3.25	-3.27	-3.20	-3.17	-3.32	-2.95	-2.72	-2.81	-2.81	-2.71	-2.49	-2.51	-2.35	-2.04	-1.65	-1.67	-1.58	-1.60	-1.59	-0.88	0	0	
d	5 Processed food	-42.7616	-18.80	-37.37	-105.73	-107.42	-71.37	-64.94	-75.71	-62.69	-49.53	-39.17	-44.83	-35.73	-28.10	-27.39	-20.55	-19.28	-14.03	-8.87	-13.99	-8.72	-0.16	1.11	1.12	4.39	6.90	5.81	6.39	2.02	0.15	-0.44	0.88	0.95	-1.09	-8.51	0	0	
d	6 Sugar	-30.7414	-0.02	-1.39	-14.84	-15.14	-25.74	-29.30	-35.22	-35.68	-37.35	-37.36	-38.07	-37.47	-38.13	-38.40	-38.97	-39.13	-38.65	-38.16	-38.70	-37.10	-35.95	-36.21	-35.85	-35.43	-34.44	-34.05	-32.93	-31.32	-29.76	-29.35	-28.72	-28.62	-23.00	-15.57	0	0	
c	7 Coal	-283.249	-37.25	-86.40	-307.93	-269.72	-147.03	-232.48	-313.15	-317.50	-331.25	-323.85	-332.69	-332.04	-352.59	-352.47	-339.28	-332.27	-324.00	-315.37	-321.26	-296.45	-281.64	-286.15	-282.33	-280.71	-268.47	-264.65	-250.52	-228.94	-210.57	-206.48	-200.51	-205.14	-168.10	-100.01	0	0	
c	8 Oil	-1.80013	-0.51	-0.90	-3.14	-3.23	-1.72	-1.33	-1.62	-1.55	-1.86	-1.94	-2.06	-1.85	-1.87	-1.89	-1.93	-1.77	-1.58	-1.77	-1.61	-1.36	-1.31	-1.24	-1.17	-1.17	-1.17	-1.17	-1.04	-0.90	-0.75	-0.74	-0.66	-0.69	-0.55	-0.30	0	0	
e	9 Gas	-8.89328	-1.95	-2.91	-10.35	-11.94	-10.88	-9.67	-10.44	-10.11	-11.47	-11.80	-11.80	-10.67	-9.76	-9.33	-9.01	-8.83	-7.74	-6.61	-6.73	-5.86	-4.71	-4.48	-4.04	-3.52	-3.18	-3.03	-2.45	-1.67	-0.89	-0.88	-0.57	-0.53	-0.60	-0.17	0	0	
e	10 Electricity	-58.5081	-11.91	-20.56	-61.60	-54.06	-39.64	-46.90	-59.01	-61.10	-65.18	-63.75	-67.42	-70.58	-71.04	-68.77	-68.77	-68.23	-67.88	-70.41	-65.62	-62.04	-64.28	-64.76	-64.39	-62.50	-62.45	-59.46	-56.17	-51.50	-51.23	-49.93	-51.86	-42.77	-25.54	0	0		
d	11 Petroleum & coal products	9.101562	-0.07	-1.00	-13.84	-12.33	5.38	14.48	15.70	17.00	16.70	16.08	16.75	16.08	16.24	14.69	13.86	12.31	11.21	11.29	11.82	9.25	8.01	8.76	8.62	8.16	7.78	7.11	6.42	6.05	4.25	2.99	2.82	2.93	2.60	3.55	1.30	0	0
d	12 Iron & steel	-65.2284	-12.19	-6.65	-44.78	-19.92	-29.43	-58.44	-66.90	-76.10	-89.16	-90.00	-83.02	-86.59	-92.77	-88.03	-85.47	-86.66	-79.03	-78.40	-71.02	-67.01	-70.40	-70.10	-67.22	-68.33	-66.82	-63.25	-60.62	-52.30	-50.66	-48.40	-48.53	-48.78	-37.88	-22.12	0	0	
d	13 LNG	0.039778	0.06	0.11	-0.50	-0.84	-0.39	-0.03	0.00	0.10	0.22	0.34	0.20	0.28	0.25	0.23	0.18	0.14	0.15	0.17	0.05	0.04	0.13	0.12	0.10	0.12	0.10	0.12	0.10	0.03	0.03	0.02	0.05	0.04	0.06	0.01	0	0	
c	14 Iron ore	2.604349	0.58	1.01	3.00	2.69	2.06	2.76	2.94	3.13	3.45	3.45	3.23	3.28	3.14	2.96	2.78	2.59	2.52	2.46	2.15	1.91	1.94	1.91	1.79	1.73	1.60	1.48	1.36	1.01	0.80	0.76	0.76	0.73	0.69	0.22	0	0	
c	15 Bauxite	-2.95284	-0.52	-0.88	-3.05	-2.99	-2.40	-2.82	-3.36	-3.38	-3.48	-3.40	-3.42	-3.52	-3.49	-3.33	-3.26	-3.17	-3.09	-2.85	-2.67	-2.69	-2.65	-2.60	-2.49	-2.44	-2.29	-2.10	-1.88	-1.85	-1.78	-1.80	-1.51	-0.85	0	0			
c	16 Other mining	-137.913	-30.21	-51.27	-171.38	-162.77	-83.76	-91.39	-122.22	-124.26	-142.55	-144.15	-154.41	-147.98	-161.35	-164.43	-165.33	-169.55	-165.88	-159.83	-177.34	-168.19	-155.90	-162.49	-163.96	-165.85	-162.88	-166.37	-159.39	-152.55	-144.71	-146.25	-143.22	-151.56	-123.53	-83.12	0	0	
d	17 Alumina	-6.3395	-0.83	-1.81	-7.33	-7.51	-5.78	-6.12	-7.40	-7.27	-7.41	-7.17	-7.48	-7.20	-7.35	-7.37	-6.95	-6.80	-6.50	-6.22	-6.41	-5.87	-5.29	-5.33	-5.25	-5.10	-4.87	-4.77	-4.44	-4.20	-3.80	-3.49	-3.54	-2.80	-1.60	0	0		
d	18 Nonmetallic minerals	-7.95344	-1.34	-2.52	-9.02	-8.08	-6.03	-7.18	-8.65	-8.82	-9.24	-9.09	-9.34	-9.20	-9.48	-9.40	-9.02	-8.88	-8.69	-8.51	-8.64	-8.02	-7.51	-7.64	-7.57	-7.46	-7.18	-7.07	-6.65	-6.18	-5.61	-5.49	-5.28	-5.38	-4.39	-2.47	0	0	
d	19 Nonferrous metals	-96.3029	-15.88	-30.39	-102.88	-98.19	-78.39	-86.36	-103.19	-104.42	-110.22	-107.99	-114.34	-111.39	-113.16	-109.10	-106.46	-103.97	-99.67	-92.02	-94.28	-93.85	-92.08	-88.57	-88.00	-82.64	-76.58	-68.25	-67.60	-64.81	-66.57	-55.44	-30.54	0	0	0	0		
d	20 Nonmetallic minerals	-8.66639	22.34	80.76	191.96	135.41	-18.32	-21.39	-26.37	-25.16	-26.88	-26.90	-30.22	-28.28	-30.19	-31.46	-31.27	-31.95	-30.16	-28.01	-31.75	-29.50	-25.30	-25.95	-25.99	-25.46	-24.64	-25.02	-23.23	-22.99	-21.24	-21.11	-19.81	-20.78	-15.53	-9.07	0	0	
d	21 Chemicals, rubber, plastics	-155.6624	-28.69	-37.56	-147.69	-166.48	-145.74	-138.79	-165.48	-163.32	-182.00	-183.54	-195.10	-182.46	-182.53	-182.29	-178.84	-180.97	-170.32	-169.79	-153.52	-134.42	-125.34	-131.42	-125.34	-116.91	-115.93	-104.55	-90.82	-75.10	-74.23	-67.76	-69.16	-56.94	-29.18	0	0		
d	22 Textiles, clothing, footwear	-90.7708	-16.48	-34.35	-117.60	-120.28	-86.10	-80.34	-94.08	-92.07	-97.88	-98.15	-106.95	-101.81	-99.39	-100.77	-98.03	-100.28	-95.56	-90.72	-97.05	-87.52	-76.84	-78.69	-77.63	-73.92	-68.99	-69.33	-63.10	-54.64	-42.94	-43.45	-39.87	-40.83	-38.31	-18.45	0	0	
d	23 Wood, pulp and paper	-93.7046	-8.70	5.74	-19.07	-58.27	-104.42	-94.73	-110.11	-116.53	-114.24	-115.53	-126.88	-119.08	-117.04	-119.07	-116.58	-119.15	-111.81	-104.00	-112.60	-101.38	-86.56	-87.69	-85.73	-80.78	-75.25	-75.13	-67.36	-59.68	-47.81	-47.65	-42.78	-43.59	-37.22	-17.81	0	0	
d	24 Metal products	-7.28643	6.01	50.98	106.58	57.33	-20.80	8.08	5.90	7.76	5.24	-13.58	-23.70	-16.11	-24.78	-29.67	-39.74	-46.29	-41.53	-32.70	-51.14	-53.08	-38.88	-40.83	-41.77	-41.31	-44.72	-48.19	-43.37	-46.72	-45.17	-46.20	-41.43	-45.94	-27.64	-18.52	0	0	
d	25 Transport equipment and parts	-147.5121	-23.33	13.02	-75.40	-205.73	-188.25	-133.58	-106.79	-146.98	-176.36	-189.70	-161.82	-174.39	-190.98	-183.66	-181.00	-163.16	-174.39	-189.42	-139.86	-139.48	-173.02	-171.96	-164.45	-169.64	-173.00	-158.22	-157.01	-122.99	-115.47	-109.90	-117.57	-113.29	-107.62	-55.16	0	0	
d	26 Electronic equipment	-41.0258	-9.91	-16.73	-50.77	-40.90	-30.75	-36.55	-41.06	-43.73	-49.59	-50.65	-50.30	-49.99	-49.71	-47.62	-45.95	-44.83	-43.49	-42.34	-39.71	-35.94	-35.08	-35.04	-33.43	-32.16	-30.31	-28.55	-26.21	-20.38	-16.55	-15.76	-15.29	-14.84	-14.01	-7.74	0	0	
d	27 Machinery and equipment nec	-152.6324	-57.83	-113.24	-266.35	-415.22	-371.22	-156.19	-103.67	-263.71	-341.00	-353.19	-179.24	-324.09	-359.93	-279.15	-245.34	-146.95	-211.36	-297.47	-62.03	-78.37	-277.53	-264.00	-235.68	-277.45	-288.25	-227.01	-256.79	-151.15	-180.78	-154.14	-207.80	-183.14	-192.91	-102.77	0	0	
d	28 Other Manufacturing	-36.5494	-10.30	-18.26	-74.64	-81.03	-35.21	-20.78	-31.01	-26.17	-31.14	-31.72	-38.75	-31.28	-33.85	-36.27	-37.63	-41.56	-37.23	-31.31	-43.65	-39.2																	