

Gillespie Economics

Environmental and Resource Economics: Environmental Planning and Assessment

PO Box 171, West Ryde, NSW 1685
Telephone (02) 9804 8562
Mobile 0419 448238
Email gillecon@bigpond.net.au

Deputy Secretary
Growth, Design & Programs Division
Department of Planning and Environment
GPO Box 39
Sydney NSW 2001

Re: Guideline for Economic Assessment of Mining and Coal Seam Gas Proposals

I refer to the abovementioned guideline that the NSW Department of Planning and Environment has prepared to provide guidance on undertaking economic analysis as part of mining and coal seam gas proposals.

As an experienced practitioner in this area I would like to make a number of comments and suggestions. These are provided in Attachment 1.

I would be happy to discuss any aspect of these comments with you.

Regards

24/11/15

Dr Rob Gillespie
Principal
Gillespie Economics

ATTACHMENT 1

COST BENEFIT ANALYSIS

Context

Historically, CBA of mining proposals has been guided by Gillespie and James (2002), NSW Treasury (2007) and more recently NSW Government (2012). These are all **general guidelines**, leaving the detail of the analysis and compliance with welfare economic theory to the practitioner.

Recently, to overcome contention around aspects of these economic analyses, proponents have tended to commission an independent peer review of the economic analysis and the NSW DP&E has also made it policy to obtain a second independent peer review.

Notwithstanding, objectors have continued to raise spurious issues about the scope and nature of the economic assessments and the PAC has continued to ignore the peer reviews. Examination of PAC reviews of economic analyses reveals a long list of economic anomalies, often informed by the un-peer reviewed submissions of institutions whose mission statement is to oppose all mining.

The Guidelines are Highly Prescriptive

It is uncertain that the addition of the highly prescriptive approach adopted in the draft guideline will remedy the situation. Indeed, the highly prescriptive approach is likely to have the opposite effect because:

- it is not possible in prescriptive guidelines to foresee all issues and hence there will continue to be controversy around some aspects economic assessments e.g. for some projects there may be a need for the shadow pricing - internal sales at cost (rather than market prices) in vertically integrated businesses;
- while the guidelines correctly allow for variations to the prescriptive approach when warranted, provided the prescriptive approach is also adopted - these will continue to be challenged and will also result in multiple results over which there will be much debate;
- the prescriptive guideline is likely to be interpreted by opponents of mining very precisely with any variation used to point out the deficiency of economic analysis, even in situation where the deficiency is with the guideline not the economic analysis.

Gillespie Economics considers that the optimal approach would be to:

- supplement the current NSW Government (2012) guidelines with notes that briefly address the broad range of issues raised in previous submissions to economic assessments e.g.
 - GHG - scope 1 emissions only
 - Dust - include costs of acquisitions required by policy and mitigation costs for moderately affected properties
 - Air - include costs of acquisitions required by policy and mitigation costs
 - Water - include acquisition costs of water required for the project and diverted from other users
 - Offsets - include capital and operating costs of offsets
 - Aboriginal heritage - identify number of sites of different significance impacted
 - Historic heritage - identify number of sites of different significance impacted - include benefit transfer from literature where possible

- Roads - include costs of works required where capacity is constrained, road user costs where roads are closed or realigned
 - approach to company tax - use 30% of producer surplus with sensitivity testing as a base level analysis or provide more detailed analysis using asset depreciation and pooled project costs depreciation in accordance with the Australian Tax Laws - apportion to NSW based on relative population;
 - Royalties - apply the relevant royalty rate to sales revenue or tonnage as mandated, with consideration of deductions optional
 - Net revenue (after tax) - apportion based on ownership and population
- have economic assessments peer reviewed;
 - required the PAC to be bound by the economic assessment and peer reviews in the same way that they are restricted in their consideration of noise and dust to the Voluntary Land Acquisition and Mitigation Policy.

Issue of Immateriality Ignored and So Additional Resources will be Needed to Address Immaterial Impacts

The highly prescriptive approach contravenes the issue of materiality referred to in the NSW Government (2012) guideline by requiring considerable additional analysis even where the impacts are likely to be miniscule from an aggregate economic efficiency perspective e.g. visual impacts (refer to worked example later in this submission).

In some situations, the information needed to complete workbooks will require considerable additional analysis and/or reporting by technical specialists. For instance, the approach to air quality is inconsistent with the current government policy and assessment approach - refer below - and hence will require air quality specialists to undertake additional or alternative analysis. The approach to road user impacts is also inconsistent with the current assessment approach - refer below - and will require the specialist to undertake additional analysis. The approach to Aboriginal heritage and historic heritage will require the technical specialist to fill in the multi-criteria analysis workbooks (the problems with MCA are well documented - see Dobes and Bennett (2009) Agenda, Volume 16, Number 3) in addition to the normal assessments.

Gillespie Economics considers that instead of workbooks adopting the flawed MCA approach, the economic assessment should include a summary of the results of the technical assessments undertaken in accordance with government policy and current practice, with impacts valued using normal welfare economic principles where this is possible and warranted, or remaining unquantified when it is not.

In this respect, it is important that the guidelines recognise that in many situations it will not be possible to value all impacts and that this does not render a CBA flawed, as claimed by submissions to coal mining projects.

Commercial in Confidence Nature of Data is Ignored

The draft guideline (p. 24) states that the report should be transparent and contain sufficient discussion and information to allow the results to be replicable. However, much of the data required to undertake the CBA is commercial in confidence information that proponents do not permit to be published. There is no recognition in the draft guideline that due to the commercial in confidence nature of the financial information on which the economic assessment is based that there are limits to the level of information that can be published in publicly available documents. This has repeatedly been acknowledged in NSW DP&E assessment reports.

Jurisdictional Definition of Society is Questionable

The main analysis in the guideline relates to CBA undertaken at the NSW level. This is in contrast to most guidelines and applications of CBA which recommend a National perspective. The basis for undertaking CBA from a National perspective is the notion that the citizens of a country share a common constitution that sets out fundamental values and rules for making collective choices i.e. the citizens are part of a common society. Citizens of other countries have their own constitutions that make them distinct societies. This is not the case for states within countries.

Most CBA guidelines e.g. Boardman et al. (2001) Cost-Benefit Analysis: Concepts and Practice, Prentice Hall, New Jersey, USA, caution against a sub-national approach to CBA because:

- it makes CBA a less valuable decision rule for public policy
- it invariably results in a range of costs and benefits being omitted;
- creates an argument to include costs and benefits not normally included in CBA e.g. secondary costs and benefits (since offsetting secondary effects assumed at the national level may occur outside the State the subject of the CBA); and
- requires often complex and contentious attribution of costs and benefits to a sub-national level. This is the case with the draft guidelines culminating in inconsistent attribution of costs and benefits to NSW. See discussion of GHG impacts later in this submission.

While the reason for the NSW focus in the draft guideline is understood, it is considered that the guideline should make it explicit that the analysis should initially be undertaken from a National perspective with subsequent consideration of distribution and attribution undertaken to identify costs and benefits to NSW. In this way, the decision maker can be cognizant of the costs and benefits to Australia that accrue outside of NSW.

In Contrast to the Treatment of Other Impacts, the Treatment of Air Quality Impacts is Inconsistence with Government Policy

The approach to dealing with noise, biodiversity and Aboriginal heritage is consistent with Government policy. In particular, the approach to biodiversity impacts recognises that in most cases offsets will compensate for the impacted area and therefore only the capital and operating costs of offsets need to be included in the analysis. Similarly, consistent with the NSW Voluntary Land Acquisition and Mitigation Policy, the draft guideline specifies that noise impacts are to be assessed in accordance with the NSW Industrial Noise Policy and recognises that the cost of management, mitigation and acquisition required under this policy should be included in the proponents operating and capital costs.

However, the treatment of air quality impacts diverges from Government policy and practice in the assessment of air quality impacts. The NSW Voluntary Land Acquisition and Mitigation Policy and Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (EPA 2005) include assessment criteria to protect the amenity, health and safety of people. The health criteria is focused on PM10 concentrations at nearby receptors. Where these human health criteria are exceeded at nearby receptors, acquisition of the affected property is required. Consistent with the approach for noise and biodiversity offsets, these costs should be included in the CBA.

However, the draft guideline takes a completely different approach of estimating PM2.5 emissions generated and applying a damage cost per tonne of emissions. The damage costs per tonne of emission are sourced from overseas studies. Specific issues with this approach are:

- Air quality assessments undertaken for major project currently do not detail PM2.5 emission as there is no mandatory standard for PM2.5 emissions - the human health criteria referred to in NSW assessment guidelines and policy relates to PM10 concentrations at receptors.
- the approach in the draft guideline estimates impacts regardless of whether there are any people/receptors exposed i.e. it is based on emissions from source;
- the value estimates are from overseas and arguably not relevant to Australia - see general literature on benefit transfer which cautions against using values from different populations and contexts;
- the approach is likely to result in very large health impacts from any mining project even where assessment under current guidelines and policy would indicate no impacted receptors;
- an approach that generates large health impacts regardless of exposure at receptors is inconsistent with:
 - current Government policy and assessment methods;
 - the available medical research - Merritt, T., Cretikos, M., Smith, W. and Durrheim. D. (2013) The health of Hunter Valley communities in proximity to coal mining and power generation, general practice data, 1998-2010, NSW Public Health Bulletin, Vol 24(2), NSW Health, in an analysis of general practice data for rural communities in close proximity to coal mining and coal-fired power generation in the Hunter Valley region of NSW found that there is no significantly higher rates of problems managed or medications prescribed for Hunter region residents compared with the rest of rural NSW. It is therefore unlikely that a single mining project that meets government air quality criteria at nearby properties will have any material health impacts for inclusion in the CBA. These findings are more consistent with the existing government policy approach to air quality than those of the draft guidelines.
 - NSW Health Fact Sheet - Mine Dust and You - which states "Provided that mines are operated with proper dust controls it is unlikely that healthy adult residents would suffer any serious health effects from the expected exposure to particulate matter."

Gillespie Economics therefore considers that the draft guideline should be amended to following the same approach as for noise and biodiversity i.e. be consistent with Government policy, and so CBA should include the cost of acquisition for impacted properties in accordance with the NSW Voluntary Land Acquisition and Mitigation Policy.

Attribution of Greenhouse Gas Impacts is Inconsistent with Attribution of other Costs and Benefits

A considerable portion of the draft guidelines is dedicated to attributing benefits and costs on different geographical scales e.g. NSW residents share of company tax, NSW residents share of the net producer surplus, local areas share of employment benefits. However, when it comes to GHG a different and inconsistent approach is used. The prices of carbon in the draft guideline represent proxies for the global social damage cost of carbon i.e. the cost of carbon emissions to the population of the whole world. Yet the draft guideline attributes all the social damage costs of GHG emissions to NSW despite most of the social damage costs of carbon occurring overseas. This was raised by a reviewer of the draft guideline and dismissed by NSW DP&E as follows:

*" The draft guidelines focus on calculating the relative cost or benefit to NSW. For the most part this requires proponents to calculate the environmental and social costs that will be attributable to NSW. **The***

fact that GHG impacts will not be localised to NSW is noted, however it is considered appropriate to value these based on the amount of emissions that are produced in NSW".

No explanation is given why a different approach is "considered appropriate" for GHG compared to ALL other costs and benefits. It makes no sense and is inconsistent with economic principles and the views of leading CBA and environmental valuation experts such as Dr Jeff Bennett from the Australian National University. Overseas this has also become a matter for the attention of academics and is discussed in Gayer, T. and Viscusi, W.K. (2014) *Determining the Proper Scope of Climate Change Benefits*, Working Paper of The George Washington University Regulatory Studies Centre, The George Washington University, Washington DC. GHG impacts have no special claim in welfare economics and CBA and when undertaking a CBA from a NSW or Australian perspective should be apportioned in a consistent way with all other costs and benefits.

Inclusion of Secondary Impacts - Economic Benefit to Suppliers - Questionable

The draft guideline identifies that there may be economic benefits to local suppliers from higher surpluses from supplying the mining/coal seam gas project, and that these should be included in the CBA.

However, these types of potential benefits meet the normal definition of "secondary" benefits. Most CBA guidelines (including the draft guideline) recommend against the inclusion of secondary benefits - see Sinden and Thampapillai (1995), Boardman et al. (2001) etc. This is because in a competitive market, all resources are assumed to be fully employed, and so increases in the production of goods and services required as inputs to the mining project will withdraw labour and raw materials from other industries. The additional net benefits (surpluses) to suppliers to a project will be offset by decreases in net benefits in other industries and so there is no net secondary benefit to the economy as a whole - normally assumed to be the nation.

However, complications arise when CBA is undertaken at a sub-national level because secondary net benefits that accrue to firms within the NSW may be offset by a reduction in economic activity outside of NSW and hence additional secondary surpluses may accrue NSW. In these instances there is an argument for inclusion of some secondary benefits. However, the estimation of these would be complicated and highly contentious.

Gillespie Economics considers that secondary benefits to suppliers should be removed from the guidelines as a relevant consideration for CBA undertaken at the National and State level.

Estimation of Company Tax Simplistic and Will Understate Company Tax in Most Cases

The procedure in the draft guideline for the estimation of company tax is 30% of earnings before interest and tax (i.e. producer surplus less royalties), in each year i.e. revenue - capital costs - operating costs - royalties.

This is a simplified approach to the estimation of company tax which treats capital costs as and when they occur and results in negative company tax in early years where capital investment occurs and positive company tax in latter years.

However, this is not how company tax is normally calculated. Even in a discounted cash flow analysis which is focused on financial rather than economic costs and benefits, company tax is normally estimated from a side calculation of **taxable income** where taxable income is revenues - operating costs - royalties - **depreciation**. For the purpose of a tax calculation depreciation is deducted rather than capital costs.

There are generally two components to the depreciation associated with a mining project:

- depreciation of assets - capital equipment - over the asset life; and
- depreciation of the project pool (non-asset capital expenditure) over the project life at a rate of 200%.

Because assessments are normally undertaken on a standalone project basis - losses in any particular year are carried forward and hence tax does not apply until taxable income in a particular year (with losses in previous years carried forward) is positive.

This more technical correct estimation of company tax generally results in significantly larger estimates of company tax than the approach suggested in the draft guideline because of how capital is spread out over the project life.

Gillespie Economics considers that the guideline should allow an option for the more technically correct estimation of company tax.

Benefits to Landholders Requires Commercial in Confidence Information to be Published

The draft guideline includes an economic benefit to landholders from payments that exceed the opportunity cost of the land. There are two issues with inclusion of this benefit in a CBA.

Firstly, there is a consumer surplus with land over and above its market value - since the market value does not reveal the maximum WTP for the land - only what has to be paid to beat the WTP of the second highest bidder. It is unclear how much the premiums paid for land by proponents are in excess of the economic value of land when the unspecified consumer surplus is included.

Secondly, inclusion of a benefit to landholders in the manner proposed requires the revelation of commercial in confidence information i.e. how much was paid to landholders, and how much over the market price they received. This is problematic.

The Method for Estimation of Benefits to Workers is Flawed

One of the categories of benefit included in the draft guideline is the economic benefit to workers. In the draft guideline, this is estimated as the difference between project wages and minimum wage required in mining sector. The draft guideline states that "The economic benefit to workers migrating to NSW should not be included in the CBA for NSW".

There are number of issues with this approach.

Firstly, the draft guideline identifies this benefit potentially accrues to workers who would **otherwise be unemployed, working part time, working in other non-mining sectors**. Yet the estimation method provided is the difference between the wage that a worker is paid in the mining project and the minimum (reservation) wage that they would accept for working elsewhere in the **mining sector**. This is only a potentially relevant calculation for those who would otherwise be working elsewhere in the mining sector in the region. But in a competitive market there is unlikely to be a wage premium for workers in a new project compared to existing mining activities (unless it relates to disamenities such as greater isolation of the project etc).

The real benefit to workers relates to those who would otherwise be unemployed, working part-time or in lower paid non-mining sector. The reservation wage for each of these is different and for the unemployed

and those working part time or in non-mining sectors the reservation wage has not been addressed in the guideline. For the otherwise unemployed, the reservation wage would normally be equivalent to unemployment benefits plus income tax payable on a mining wage (refer to Streeting and Hamilton 1991). This of course requires assumptions about the percentage of workers that would otherwise be unemployed and how long they would have been unemployed for. The consideration of this potential benefit in the draft guideline is very incomplete.

Secondly, the approach in the draft guideline to the issue of apportionment is questionable. The draft guideline states that this benefit should only apply to workers already residing in NSW prior to the project (the base case). However, the CBA is of the incremental effects of the Project (not the base case) and the incremental effect is that workers residing in NSW (including those that migrate in and stay at least for the duration of the Project) would potentially obtain an employment benefit via increased wages. By migrating into NSW, these people become part of the NSW community that a NSW level CBA is attempting to address. There is no justification for their exclusion from the analysis. In a NSW CBA, only those living outside the state during the project (including FIFO) should be excluded.

Nonuse Values for Employment Ignored

The abovementioned approach to valuing labour is related to the market value or opportunity cost of labour resources, only. However, CBA also includes non-market values i.e. the values that individuals in a community hold for things even though they are not traded in markets. For example, people have been shown to value environmental resources even though they may never use the resource. These are referred to as existence values and are underpinned by the view in neoclassical welfare economics that individuals are the best judge of what has value to them.

As identified by Portney (1994¹), the concept of existence values should be interpreted more broadly than just relating to environmental resources.

“If I derive some utility from the mere existence of certain natural environments I never intend to see (which I do), might I not also derive some satisfaction from knowing that refineries provide well-paying jobs for hard-working people, even though neither I nor anyone I know will ever have such a job?. I believe I do. Thus, any policy change that “destroys” those jobs imposes a cost on me – a cost that, in principle, could be estimated using the contingent valuation method.... Since regulatory programs will always impose costs on someone – taking the form of higher prices, job losses, or reduced shareholder earnings – lost existence values may figure every bit as prominently on the cost side of the ledger as the benefit side (Portney 1994, p. 13).

The utility (welfare) of individuals may therefore be affected by changes in their own well-being as well as changes in the well-being of others (Rolfe and Bennett 2004²). This is consistent with the observed behaviour of altruism (Freeman III 2003³).

¹ Portney, P. (1994) The Contingent Valuation Debate: Why Economists Should Care, *Journal of Economic Perspectives* 8:4, 3-18.

² Rolfe and Bennett (2004) *Assessing Social Values for Water Allocation with the Contingent Valuation Method*, Valuing Floodplain Development in the Fitzroy Basin Research Reports, Research Report No. 11, Central Queensland University, Emerald.

³ Freeman III, A. Myrick. (2003) *Economic Valuation: What and Why*. In A Primer on Non-market Valuation, Eds Champ, P., Boyle, K. and Brown, T. Kluwer Academic Publishers, London.

Whether people have existence values for the employment of others, as hypothesised by Portney, is an empirical issue. A number of non-market valuation studies published in peer reviewed academic journals have found evidence that people hold existence values for the employment of others:

- Johnson, F. and Desvougues, W. (1997) Estimating Stated Preferences with Rated-Pair Data: Environmental, Health and Employment Effects of Energy Programs. *Journal of Environmental Economics and Management*, 34, 75-99, estimated the non-market value of employment effects of energy programs.
- Adamowicz, W., Boxall, P., Williams, M. and Louviere, J. (1998) Stated Preference Approaches to Measuring Passive Use Values: Choice Experiments Versus Contingent Valuation, *American Journal of Agricultural and Economics*, 80, 64-75, in a study on the protection of old growth forests included an attribute for forest industry employment losses.
- Morrison, M., Bennett, J. and Blamey, R. (1999) Valuing improved wetland quality using choice modelling, *Water Resources Research* (Vol. 35, No. 9, pp. 2805-2814) valued irrigation related employment losses as a result of wetland protection.
- Blamey, R., Rolfe, J., Bennett, J., and Morrison, M., (2000) Valuing remnant vegetation in Central Queensland using choice modelling, *The Australian Journal of Agricultural and Resource Economics*(44(3): 439-56) in a study of broadscale tree clearing in the Desert Uplands of Queensland, Australia included an attribute for jobs lost to the region.
- Do, T.N. and Bennett, J. (2007) Estimating Wetland Biodiversity Values: A Choice Modeling Application in Vietnam's Mekong River Delta, Australian National University, Economics and Environmental Network Working Paper estimated values for the number of farmers affected by a change in wetland management of Tram Chim.
- Othman, J., Bennett, J., Blamey, R. (2004) Environmental values and resource management options: a choice modelling experience in Malaysia, *Environ. Dev. Econ.* 9, 803–824, valued local employment losses from different conservation management strategies for the Matang Mangrove Wetlands in Perak State, Malaysia.
- Marsh, D. (2010) Water Resource Management in New Zealand: Jobs or Algal Blooms? Presented at the Conference of the New Zealand Association of Economists Auckland 2 July 2010, valued employment losses as a result of improvements in water quality in a dairy catchment in Waikato region of New Zealand the catchment.
- Longo A, Markandya A, Petrucci M (2008) The Internalization of Externalities in the Production of Electricity: Willingness to Pay for the Attributes of a Policy for Renewable Energy, *Ecological Economics* 67:140-152, in the context of renewable energy projects valued additional electricity sector jobs.
- Colombo, S., Hanley, N., and Requena, J.C. (2005) Designing Policy for Reducing the Off-farm Effects of Soil Erosion Using Choice Experiments, *Journal of Agricultural Economics*, 56(1), 81-96, valued local employment generated from watershed policies to reduce soil erosion.
- Caparrós A, Oviedo JL, Campos P (2008) Would you choose your preferred option? Comparing choice and recoded ranking experiments. *Am J Agricult Econ* 90(3):843–855, valued increases in local employment from a NP reforestation program.
- Windle, J. and Rolfe, J. (2014) Assessing the trade-offs of increased mining activity in the Surat Basin, Queensland: preferences of Brisbane residents using non-market valuation techniques, *Australian Journal of Agricultural and Resource Economics*, 58, pp. 111-129, valued jobs generated

by mining developments in the Surat Basin, as well as social impacts of mining developments such as increased housing prices and increase wages in non-mining sectors.

- Gillespie, R. and Kragt, M. (2012) Accounting for non-market impacts in a benefit-cost analysis of underground coal mining in New South Wales, Australia, *Journal of Benefit Cost Analysis*, 3(2): article 4, valued direct coal mining jobs.
- Gillespie, R. and Bennett, J. (2012) Valuing the Environmental, Cultural and Social Impacts of Open Cut Coal Mining in the Hunter Valley of NSW, Australia, *Journal of Environmental Economics and Policy*, Volume 1, Issue 3, 1-13, valued direct coal mining jobs.

Existence values for employment provided by mining projects are valid economic values for inclusion in CBA. Notwithstanding this, it is recognised that because this is a new frontier of economic research, some people may view these values as contentious. Consequently, the draft guidelines should at the very least acknowledge this new frontier of economic research and allow the results of the CBA for mining projects to be reported “with” and “without” the non-use values for employment being included.

Separate Reporting of Mitigation Costs is Difficult in Practice

The CBA workbook attempts to separate out decommissioning costs, environmental mitigation costs, rehabilitation costs and transport management costs and report these on a standalone basis.

However, some of these costs will be embedded in normal operating costs e.g. progressive rehabilitation of open cut mines, normal noise and air quality monitoring etc. Separating these out of normal operating costs serves no particular purpose in an economic analysis and would be difficult, particularly as they make up a small component of these costs. While it is correct that an allowance should be included in the CBA for additional capital and operating costs required to address specific environment impacts, my experience has been that proponents oppose these being separately reported and so they are generally added to the capital and operating costs of the project for the purpose of reporting.

The issues of practicality and commercial in confidence impede any attempt to separately report environmental mitigation costs, rehabilitation costs and transport management costs. Separate reporting of these values also serves no particular purpose in CBA.

Local Contributions are Generally Part of the Producers Surplus that is Shared with Local Councils rather than an Economic Cost to Society

Local contributions are treated in the draft guideline as an economic cost of mining projects. This is appropriate for contributions that relate to an economic cost generated by the Project e.g. road pavement repair from heavy vehicle usage. However, for the most part contributions to Councils under Voluntary Planning Agreements are not related an increased demand for infrastructure but are part of the producer surplus that is shared with the local area. Any demand for community infrastructure arises from changes in population and this is already funded via S94 contributions on sub-divisions and housing developments.

As identified in the NSW Government (2012) guidelines "*the provision of social infrastructure associated with employment and population growth (such as housing and land development, community services, schools and hospitals) should generally not be included as a cost against an economic development. There are two reasons for this. Firstly, some of the services, such as housing, land and community services should be self-financing from any new housing development and should not require a subsidy from existing communities. Secondly, schools and hospitals will be needed generally across NSW to accommodate population growth irrespective of its location. This means that expense in one area is*

generally transferred from expense in another." This of course applies most when CBA is undertaken at a national level and is less true at the State level.

Visual Impacts are Unlikely to be Material and the Approach in the Guideline is Unwarranted

In relation to visual impacts, the draft guideline suggests an intricate approach that includes the development of an impacted property matrix with estimates of annual rental value, level of impact, duration of impact, and then either undertaken an hedonic pricing study (which would be expensive and impractical - particularly since many hedonic pricing studies fail to show significant relationships) or use real estate agents or property valuation sources on the likely change in property rentals (additional cost).

This is a considerable effort and potential cost for what in almost every case will be an immaterial impact. As an extreme example, consider a situation where 100 properties are visually impacted to the extent that the rental of \$300 per week per property (which is higher than the median weekly rent of Singleton) is reduced by 5%, 10% or 15% (very large impacts) in every year over a 30 year period project life. The present value of this impact is \$1M, \$2M and \$3M respectively, at 7% discount rate.

It is difficult to justify the time and cost of implementing the template for these immaterial impacts.

Estimation of Royalties Should Explicitly Recognise that Deductions have Little Impact

The proposed approach for the estimation of royalties is to apply the ad valorem rate to mineral value or quantum royalty to production levels. This excludes any consideration of deductions which Gillespie Economics has demonstrated in numerous submissions to PACs makes little impact to royalty estimates. However, since this has been a issue in the submissions of many objectors and in PAC reports, it is suggested that the guideline makes explicit reference to the fact that deductions have little impact on royalty estimates and that the extra time and cost of including them in the assessment is not warranted.

Net Public Infrastructure Cost Estimation is Impractical

In principle any net public infrastructure cost of a project should be included in the CBA. However, it is difficult to see situations where this will occur and the level of assessment proposed is warranted and able to actually be undertaken.

The realignment of power lines, provision of services to the project site, road intersection upgrades etc would all be normal costs for inclusion in the capital costs of a project.

The draft guideline suggests the requirement for analysis of the difference between the cost of utilities providing a service and the amount actually paid by the proponent. To the extent that this is actually relevant to any Project, how is the proponent to determine the extent to which utilities pricing covers the cost of their service provision?

The guide continually suggests that local contributions paid by a proponent have some nexus to increased demand for infrastructure. However, this is often not the case, and as identified above, contributions often fall into the category of a share of the producer surplus being provided to local government as a result of rent seeking.

MCA Approach to Assessment of Aboriginal Heritage Impacts is Questionable

The draft guideline goes a step further than identifying the number, type and significance of Aboriginal heritage sites impacted (the normal approach to Aboriginal heritage assessment) and utilises a MCA

framework to develop a categorisation for the impact on individual sites of very high value, high value, medium value and low value. However, there a number of issues with this approach:

- the problems with MCA are well documented - see Dobes and Bennett (2009) Agenda, Volume 16, Number 3;
- such a categorisation is totally at odds with welfare economics - what dollar value constitutes a "very high value impact"?
- this scoring may create confusion for decision-makers when an impact assessed via the MCA comes out as "very high value" but in a welfare economics framework would have immaterial values - particularly after mitigation, offset and compensation.

The MCA approach is considered arbitrary, subjective and unnecessary. It would suffice for the CBA to provide a summary of the Aboriginal heritage impacts e.g. 7 sites of high significance will be partly impacted, 6 sites of moderate significance totally impacted etc. These unquantified impacts can then be considered alongside the quantified benefits of projects without the use of subjective terms like "very high value impacts".

MCA Approach to Groundwater Assessment is Questionable

The draft guideline identifies that the cost of WALs - which in a market for water should reflect its marginal value product - should be included in the CBA but goes a step further by constructing an additional qualitative MCA framework to develop a categorisation for the impact on individual sites of very high value, high value, medium value and low value. As for Aboriginal heritage assessment, there a number of issues with this approach:

- the problems with MCA are well documented - see Dobes and Bennett (2009) Agenda, Volume 16, Number 3);
- such a categorisation is totally at odds with welfare economics - what dollar value equates to a "very highly significant impact" on ground water?;
- this scoring may create confusion for decision-makers when an impact assessed via the MCA comes out as "very highly significant impact" or "highly significant impact" but in a welfare economics framework would have minor values.

The MCA approach is considered arbitrary, subjective and unnecessary. It would suffice for the CBA to provide a summary of the groundwater impacts as per normal ground water assessments and include the cost of WALs and any costs (hypothetical or otherwise) to compensate water users for drawdown.

MCA Approach to Non-Aboriginal Heritage Assessment is Questionable

The draft guideline goes a step further than identifying the number, type and significance of non-Aboriginal heritage sites impacted (the normal approach to non-Aboriginal heritage assessment) and utilises a MCA framework to develop a categorisation for the impact on individual sites of very high value, high value, medium value and low value. However, there a number of issues with this approach:

- the problems with MCA are well documented - see Dobes and Bennett (2009) Agenda, Volume 16, Number 3);
- such a categorisation is totally at odds with welfare economics - what dollar value equates to a "very highly significant impact" or "highly significant impact"?

- this scoring may create confusion for decision-makers when an impact assessed via the MCA comes out as "very highly significant" but in a welfare economics framework would have modest values - particularly after mitigation, offset and compensation.

The MCA approach is considered arbitrary, subjective and unnecessary. It would suffice for the CBA to provide a summary of the non-Aboriginal heritage impacts e.g. 7 sites of high significance will be partly impacted, 6 sites of moderate significance totally impacted etc.

Furthermore, the CBA could draw on values from Australian choice modelling studies such as by the Allens Consulting Group (2005) Valuing the Priceless: The value of historic heritage in Australia, prepared for the Heritage Chairs and Officials of Australia and New Zealand.

Value of Lost Production is Not the Correct Measure of the Economic Value of Surface Water

The draft guideline (p. 81) mistakenly identifies "the value of lost production" as an indicator of economic cost when a project diverts surface water from another use. However, this is incorrect. Many inputs go to the value of production not just water. The appropriate indicator of value when production is lost as a result of water reallocation is the marginal value product of water in that use, not the total value of that lost production and not even the net value of that lost production.

Proposed Assessment of Traffic Impacts is Inconsistent with Current Assessment Methods

The specialist traffic impact assessment is normally undertaken in accordance with RTA (2002) Guide to Traffic Generating Developments. For mining projects the focus is on level of service for intersections, road capacity and safety considerations.

The draft guideline requires additional assessment in relation to travel times of existing users, broken down by vehicle type and how these will change with the project having regard to displaced traffic from existing land use. This information is not currently forthcoming from traffic assessments.

While conceptually correct, it is difficult to justify the time and cost of revising the approach to traffic assessments and implementing the template for what is likely to be immaterial impacts.

Opportunity Cost of Capital Equipment is Excluded

Where projects are an extension of an existing project there can be an opportunity cost associated with the continued use of land and capital equipment. There can also be benefits from delayed decommissioning and rehabilitation costs. These are currently omitted from the draft guidelines.

LOCAL EFFECTS ANALYSIS

Local Area Effects to be included in an LEA are Reasonable

Local Area Effects to be included in an LEA include:

- effects relating to local employment;
- effects related to non-labour project expenditure; and
- environmental and social impacts on the local community.

This seems reasonable with the latter effects being directly transferable from the CBA. However, there are a number of issues with the approach recommended for the former two impacts and the recommended spatial boundary for analysis.

Local Government Area Boundaries are a More Suitable Basis for LEA than Statistical Area Level 3

The draft guideline suggests the use of Statistical Area Level 3 which contains the Project as the spatial boundary for the LEA. While these have been constructed to represent functional areas of regions, they may or may not coincide with local government area boundaries. It is these political boundaries that are more relevant to local stakeholders such as councils and households and would provide a better basis for LEA than SALs.

The Method for Assessing Local Employment Impacts has No Basis in the Literature and is Fundamentally Flawed

The proposed approach for examining direct local employment effects would not appear to have any basis in the peer reviewed literature and ignores contemporary literature on employment effects of projects and policies.

The most widely used method to assess the direct and indirect economic activity from a project or policy at the regional level is input-output (IO) analysis, a nobel prize winning methodology. CGE analysis can also be undertaken at the regional level although it is more costly and has its limitations at this scale of analysis. A comparison of the methods is provided in Attachment 1.

There has been a concerted campaign by opponents of mining to discredit IO analysis (so as to limit reporting of employment and other economic activity associated with a project to direct effects). However, any rational review of the issues raised leads to their dismissal. The primary concern with IO analysis is its use to justify projects when CBA is the main method that should be used to justify projects from an economic perspective. As a tool to assess regional economic activity it is perfectly reasonable with a long established theory and practice.

The draft guideline utilises IO concepts such as multipliers without ever acknowledging IO analysis or that undertaking an actual IO analysis would be better and preferred to simply borrowing a multiplier from an aggregate mining sector (i.e. combined coal mining, metal ore mining, construction material mining and mining services) of an IO table and applying this to a spurious estimate of incremental wages impacts. A comparison of direct effects and multiplier effects from IO analysis and the draft guideline methodology is made below.

IO analysis begins with identification of the direct gross regional economic activity footprint of a project for the region. If a project provides 100 jobs at the mine site then all these jobs are counted in IO analysis as

a direct effect i.e. direct employment in the region, because the jobs are located in the region. However, in IO analysis only the income of employees living in the region are counted as direct income effects since it is only wages expenditure of those living in the region that flows through the regional economy. In IO analysis, if 40% of a projects jobs are filled by people who already reside in the region then the **total** mining wages of these people is counted as a direct regional income effect of the project. Similarly, if 40% of the new jobs are taken by people who migrate into the region this is also counted as direct income for the region, as it is income that will accrue to people living in the region even though they are new residents. In IO analysis, the income of those residing outside the region is excluded as most of their income will be taken home after shift and spent where they live or elsewhere.

These direct employment and income effects for the region are those **associated** with the Project i.e. the gross footprint, rather than specifically an assessment of **incremental** effects. This is partly because assessment of incremental effects becomes highly contentious and difficult. However, as will be shown below, these gross direct effects associated with a project can also be a reasonable approximation of incremental effects when "trickle down" or "job chain" effects are considered.

However, lets first make a comparison between how IO analysis treats direct employment and income effects (as explained above) and what is proposed in the draft guideline.

The draft guideline splits labour into those ordinarily resident in the region and those not ordinarily resident in the locality. For those ordinarily resident in the region the guideline suggest calculation of incremental income as the difference between a mining income and the average level of income in other industries in the region. Incremental direct employment is then calculated by dividing this incremental income by the average wage in mining. However there are numerous flaws with this approach

Firstly, it has no basis in the peer reviewed literature.

Secondly, the guideline ignores workers who migrate into the region to work. It appears that the guideline treats these people as temporary residents and the incremental income they provide to the region ignored. However, using the rationale of the draft guideline, workers who migrate into the region to take jobs in a project provide a greater level of incremental income and spending in the region than those to take jobs in a project and who already reside in the region. The entire wage of those migrating into the region is additive to regional income in comparison to wage increments for those already residing in the region.

Table 1 provides an example of incremental wages using the draft guideline method and when income from those migrating into the region is counted. If only the incremental wages of those who already reside in the region are counted the incremental impact is \$1.4M in annual wages. However, if the incremental wages to the region from those who migrate into the region are included, as they should be, this increases to \$5.4M.

Table 1 - Incremental Income when Inmigrating Workforce is Included

Categories of Workers	Direct Empl	Current Wages @\$65k	New Wages @\$100k	Incremental New Wages for Workers	Incremental New Wages to the Region
Already Live in Region	40	2,600,000	4,000,000	1,400,000	1,400,000
Migrate into Region to Live	40	2,600,000	4,000,000	1,400,000	4,000,000
Commute from outside	20	1,300,000	2,000,000	700,000	0
Total Direct Empl	100	6,500,000	10,000,000	3,500,000	5,400,000

Thirdly, even for those already living in the region who are already employed, the incremental income estimated using the draft guideline will substantially understate additional regional income effects. This is because new jobs in a region create a chain of job opportunities (referred to in the literature as the "trickle down" effect or "job chain" - see Persky et al, 2004 What are jobs worth?, Employment Research Vol 11 , 3).

An already employed person in the region moving into a mining job, creates a job vacancy, which can be filled by those in the region (already employed, unemployed or attracted into the labour force) or by in-migration. Where this job is filled by those already employed in the region this in turn creates another vacancy etc. Following the entire chain through, the cumulative increase in wages to a region would approach the wages of the total direct mining jobs. It would only be discounted if the chain ends with employment of those from local residents in the unemployment pool (who are receiving an allowance and hence already are spending income in the region) or if jobs remain unfilled. In periods of higher unemployment rates jobs along the job chain remaining unfilled is unlikely. If the chain ends with in-migrating employment or employment of those in the region that are new to the workforce then the incremental wages is equal to the total wages of the new mining jobs.

Table 2 demonstrates the "trickle down" effect in relation to 40 new mining jobs filled by already employed local workers. It shows that the total annual wages of the new mining jobs is \$4M. Under the trickle down approach where all jobs are backfilled including ultimately by 40 local residents from the unemployment pool the incremental wages to the region are \$3.5M. If some of these jobs filled from the unemployment pool are ultimately filled by in-migration the difference between the incremental wages to the region and the total annual mining jobs wages will lessen.

The draft guideline ignores the "trickle down" effect and essentially assumes that the previous jobs of "job movers" in the region remain vacant for the life of the Project. **This is clearly incorrect.**

Incorporation of consideration of the "trickle down" effect means that the direct incremental income to a region approximates that assumed in IO analysis (i.e. the gross footprint of economic activity estimated using IO analysis is also an indicator of the net effect).

Table 2 - Demonstration of the Trickle Down Effect for 40 Jobs Filled by Locals Who are Already Employed in the Region

	Total wages	Increment Wages Gain to Region
1. New mining wage for 40 workers @\$100k	\$4,000,000	\$1,400,000 (1-2)
2. Current Wages for 40 workers @\$65k	\$2,600,000	\$1,000,000 (2-3)
3. Wage of people filling above 40 positions @\$40k	\$1,600,000	\$800,000 (3-4)
4. Wage of people filling above 40 positions @\$20k	\$800,000	\$ 255,664 (4-5)
5. Wages of the unemployed filling above 40 positions (Newstart - single no children)	\$544,336	
Total		\$3,455,664

The draft guideline proposes that type 11 employment multipliers in the range of 2 to 3 be applied to the direct incremental employment as estimated by the draft guideline method rather than the normal IO method. The source of this information is AURIN. AURIN is an online IO analysis tool. The multipliers are generated via normal IO methods albeit for an amalgamated mining sector (i.e. combined coal mining, metal ore mining, construction material mining and mining services) in various regions.

An important aspect of multipliers, recognised in the literature and most guidelines, is that their level is project specific and depends on, among other things, the ratios of employment to output of a project, the profitability of a project, the expenditure profile of a project and how much is spent in the region, the residential location of the workforce, the size and structure of the region within which a project is located. There is no "universal" set of multipliers for mining projects. These will vary on a case by case basis and can only be estimated for a specific project using actual IO analysis.

Actual application of IO analysis will also yield information for other indicators of regional economic activity that may also be of interest to decision-makers such as direct and indirect value-added and income. It is unclear why the guidelines are borrowing some parts of IO analysis e.g. employment multipliers, without using other parts i.e. the approach to estimation of direct effects. The outcome is that the approach in the draft guideline significantly downplays the economic activity that mining projects provide to regional economies.

It is recommended that the draft guideline be amended to:

- recognise the trickle-down effect and so identify total income and employment of workers located in the region during the project life as the direct contribution of projects to the regional economy;
- address the IO analysis and CGE analysis debate head on and recognise both as valid tools for regional assessment (both with assumptions and limitations) but not compulsory;
- acknowledge that multipliers are project and region specific and that caution should be applied to "borrowing" multipliers;
- allow application of guide multipliers where no actual IO analysis is undertaken;
- allow more detailed analysis using IO (or CGE) if the proponent wishes.

ATTACHMENT 1 – INPUT-OUTPUT ANALYSIS AND COMPUTABLE GENERAL EQUILIBRIUM ANALYSIS

Input-Output Analysis

- IO analysis is a cost effective and simple method for estimating the gross market economic activity i.e. financial transactions and employment, in a specified region that is associated with a project.
- IO analysis is the most widely used model for regional impact assessment (West and Jackson 2005).
- IO analysis can be undertaken at the LGA or aggregation of LGAs level.
- IO analysis can provide disaggregation of economic activity impacts across many sectors – 111 sectors based on current National IO tables.
- IO analysis was developed by Wassily Leontief for which he received the Nobel Prize in Economics.
- IO analysis is a static analysis that looks at economic activity impacts in a particular year e.g. a typical year of a projects operation.
- IO analysis has historically been applied at the regional level to assess the economic activity impacts of individual projects.
- IO analysis involves the development of an IO table representing the buying and selling of goods and services in the economy. These fixed average ratios are used to estimate the direct and indirect impacts of a change in expenditure in a region.
- IO analysis identifies the gross direct and indirect additional (positive) regional economic activity associated with a project in terms of a number of indicators of economic activity – output, income, value-added⁴ and employment.
- Economic activity measures used in IO are not measures of benefits and costs relevant to a BCA.
- IO analysis does not attempt to examine non-market environmental, social or cultural impacts.
- IO analysis does not depend on the assumption “*that there is a ghost pool of highly skilled yet unemployed people*” in a region as suggested by a Land and Environment Court Judgement.
- The estimation of economic activity impacts in IO analysis are based on a number of simplifying assumptions – most notable is that the regional economy has **access to** sufficient labour and capital resources (from both **inside** and **outside** the region) so that an individual project does not result in any regional price changes e.g. wages in other industries or house rentals, which would lead to contractions (“crowding out”) of economic activity in other sectors in the region.
- For the assessment of the impacts of individual projects on small open regional economies, this is a reasonable assumption.
- Nevertheless, the results of IO modelling can be seen as representing an upper bound for the net economic activity associated with a project.

Computable General Equilibrium Modelling

- CGE modelling is an alternative more expensive, complicated but theoretically more sophisticated method for estimating the economic activity associated with a project.

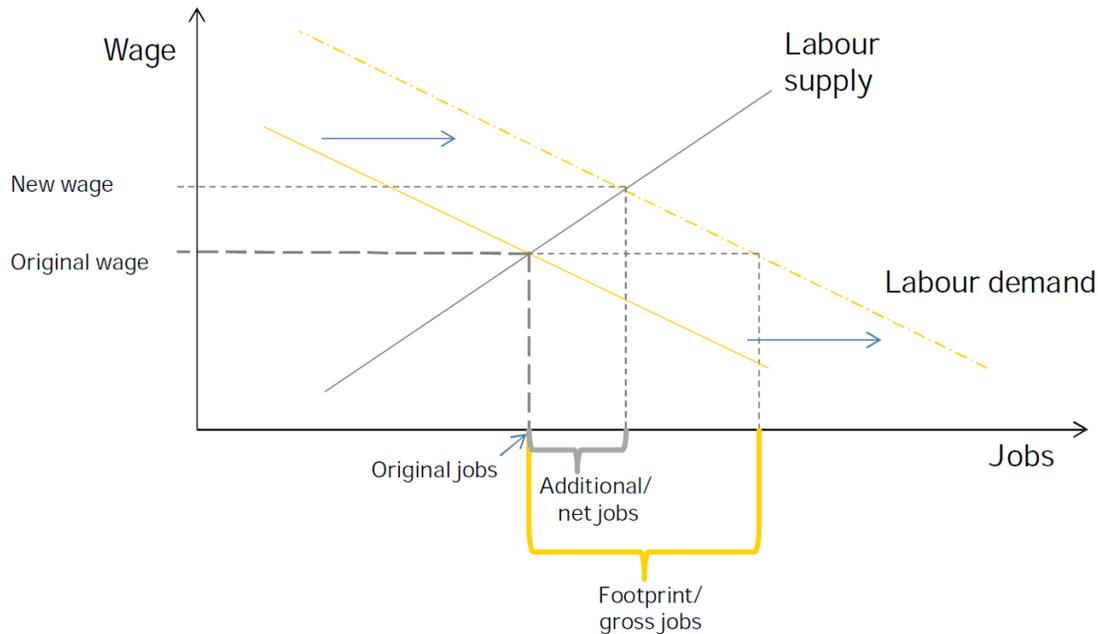
⁴ Value-added is the difference between the gross value of business turnover and the costs of the inputs of raw materials, components and services bought in to produce the gross regional output.

- CGE modelling can be dynamic or comparative static⁵ and has historically been applied at the State and National level for determining the potential economic activity associated with the introduction of major government policy changes and investment in large infrastructure projects.
- CGE modelling can also be undertaken at a regional level but normally at no finer scale than the Statistical Subdivision level.
- CGE modelling estimates the additional net (positive and negative) economic activity associated with a project in terms of a number of economic indicators – including value-added and employment – but also real income, government tax revenue and components of value-added.
- Economic activity measures used in CGE modelling are not generally measures of benefits and costs relevant to a BCA, although CGE modelling can also be used to estimate market costs or market benefits, as part of a BCA, where the magnitude of a project will affect a large number of sectors and the effects will be spread more broadly throughout the economy.
- Economic activity impacts can be disaggregated by sector but this is not normally as disaggregated as in IO analysis.
- CGE modelling does not attempt to examine non-market environmental, social or cultural impacts.
- CGE modelling is underpinned by an IO database as well as a system of interdependent behaviour and accounting equations which are based on economic theory (but mostly without econometric backing at the regional level).
- The equations in CGE models ensure that any change in demand in a region, no matter how small, translates into some change in prices and hence there is always some ‘crowding out’ of other economic activity in the region.
- At the regional level, CGE results can be very sensitive to changes in these behavioural assumptions.
- ‘Crowding out’ of other economic activities estimated via CGE modelling does not reflect losses of jobs but the shifting of labour resources to higher valued economic activities.

⁵ Comparative static models compare one equilibrium point with another but do not trace the impact path along the way. Dynamic models give year by year impacts of a shock.

Comparison of IO Analysis and CGE Modelling

Figure A1.1 – Comparison of Employment Estimates in IO Analysis and CGE Modelling



Source: Ernst Young (2014) Capital Metro Job Creation Analysis, p. 30.

- Figure A1.1 illustrates the difference between the output of IO analysis and the output of CGE with respect to employment. IO analysis estimates the employment footprint or gross jobs from a project. It can also be taken as an indicator of net jobs from a project where there is no or little upward pressure on wages for the region in question as a result of the individual project and hence no or little crowding out of other economic activity⁶. CGE modelling assumes upward pressure on wages and hence some crowding out of other economic activity in the region. Under this assumption CGE estimates additional net jobs as being less than the employment footprint/gross jobs.
- Which modelling approach best represents the true situation depends on whether and to what extent price changes occur at a regional level as a result of individual projects. This is an empirical issue and would depend on the migration of labour into the region, commuting of labour and timely management of land releases by Councils. Few studies exist that examine this issue.
- IO analysis provides decision-makers with information on the relative employment footprint/gross jobs of different projects, without going to the second and more complicated stage of trying to model wage rises and “crowding out” across all other sectors in the economy.
- Regional economic activity, estimated by IO analysis or CGE modelling, is just one piece of information that decision-makers may take into account in considering a project.

⁶ This is akin to the marginal assumption in BCA.

Guidelines

- Both IO analysis and CGE modelling are identified in the DP&I's *draft Guideline for Economic Effects and Evaluation in EIA* (James and Gillespie 2002) as appropriate methods for examining regional economic impacts i.e. impacts on economic activity – the size and structure of an economy.
- Other guidelines to recognise the role of IO analysis include:
 - US Environment Protection Agency (2010) *Guidelines for Preparing Economic Analyses*;
 - Australian Bureau of Rural Science (2005) *Socio-economic Impact Assessment Toolkit: A guide to assessing the socio-economic impacts of Marine Protected Areas in Australia*.
- NSW Treasury (2007) identify that IO analysis is commonly used to assess the regional impacts of a project. However, IO analysis is concerned with measuring economic activity, and is not a tool for the evaluation of projects (in the way that BCA is).

Government Applications of IO Analysis

- Applications of IO analysis commissioned by Government agencies include:
 - Department of Sustainability, Environment, Water, Population and Communities (2011) *Assessing the Socio-Economic Impacts of Sustainable Diversion Limits and Water for the Future Investments: An Assessment of the Short-Term Impacts at a Local Scale*
 - NSW Natural Resources Commission (2009) *River Red Gum Assessment: Socio-economic impact assessment*,
 - Victorian Environmental Assessment Council (2007) *River Red Gum Forests Investigation – Socio-Economic Assessment*.
 - Resource and Conservation Division of the NSW Department of Urban Affairs and Planning (1999) *Regional Impact Assessments as part of the NSW Comprehensive Regional Assessments under the National Forestry Policy*.
 - Reserve Bank of Australia (2012) *Industry Dimensions of the Resource Boom: An Input-Output Analysis*.
 - DECCW (2009) *Economic benefits of national parks and other reserves in New South Wales - Summary report*, reports the results of numerous studies it and its' predecessors have commissioned on the regional economic impacts of national parks and protected areas.
 - DECCW (2006) *Socio Economic Assessment of the Batemans Bay Marine National Park*
 - DECCW (2006) *Socio Economic Assessment of the Port Stephens – Great Lakes Marine Park*
 - National Parks Service, US Department of the Interior (2014) *2012 National Parks Visitor Spending Effects: Economic Contribution to Local Communities, States and the Nation*.

Criticisms Misrepresented

- The main concern that economists e.g. the Productivity Commission, NSW Treasury and ABS (as quoted by The Australia Institute in numerous submissions to mining projects in NSW) have with IO is its use as a substitute for BCA, not its use for estimating direct and indirect regional economic activity impacts.

- NSW Treasury (2009) "*Model based economic impact assessment [such as IO analysis] is not a substitute for a thorough economic analysis of a policy. The appropriate method for analysing policy alternatives is benefit cost analysis (BCA)*".
- The main "abuse" reported by the Productivity Commission is using IO analysis to "*make the case for government intervention*" when BCA is the appropriate method for doing this.
- ABS's concerns with IO being "*biased*" refer to it being a "*biased estimator of the benefits or costs of a project*". IO does not estimate benefits and costs but economic activity.
- Concerns of the Warkworth Judgement with IO analysis being "deficient" related to the data (industry data from surveys undertaken in 2001 and assumptions used (see next dot point)), but more fundamentally for not "*assisting in weighing the economic factors relative to the various environmental and social factors, or in balancing economic, social and environmental factors*". This is an inappropriate criticism of the IO method, since it does not pretend to do this.
- IO analysis does not depend on the assumption "*that there is a ghost pool of highly skilled yet unemployed people*" in a region as suggested in the Warkworth Judgement. It allows for labour to come from within or outside the region.

Latest Use of IO Analysis

- BAEconomics (2014) in its Economic Impact Assessment for Warkworth Continuation 2014 and Mt Thorley Operations 2014 justifies the use of IO analysis to estimate economic activity associated with the Project.
- Dr Brian Fisher, the Managing Director of BAEconomics is a highly respected resource economist who previously held the positions of Executive Director of the Australian Bureau of Agricultural and Resource Economics (ABARE) and Associate Commissioner of the Productivity Commission. He received an Order of Australia in the Queen's Birthday Honours List in 2007.