ASSESSMENT OF INCOME, OUTPUT AND EMPLOYMENT EFFECTS OF INCREASED COAL PRODUCTION IN QUEENSLAND

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Executive Summary

- Queensland is currently embarking on major reform of the States' rail transport industry. Part of this reform involves a substantial reduction in rail freight rates that will stimulate increased production of export coal. Coal industry consultants Energy Economics and Barlow-Jonker, have provided predictions of increases in coal output following such a freight price cut. The purpose of this report is to use their findings as the basis for modelling the potential economic value to the Queensland economy from pursuing such a strategy.
- The modelling was achieved by the use of the Queensland Multi-Regional Model (QMRM) developed at the University of Queensland. This is one of a number of alternative models that might have been used for such a task, each of which has their respective strengths and weaknesses. The main advantage of the QMRM is its ability to provide disaggregated economic impact estimates across industry and region. Its main weakness is that it is exclusively demand-driven and not supply constrained. In the context of the current usage, this is not a particular problem, as the increased coal sales will represent an exogenous injection of income into the State from an industry that clearly has excess capacity. As well, authoritative economic impact analysis should, to a large degree, isolate itself from the vagaries of specific models. In other words, a feasible project should be able to be supported on the basis of sound economics.
- Modelling is an important accompaniment to economic analysis, providing as it does, quantification of economic activity, however, inventive modelling will not justify a project that is founded on poor economic fundamentals. In this particular case the economic strategy that is being proposed is expected to build on what is already the

State’s major export industry and at the same time promises to usher in structural reform within the rail transport industry and State infrastructure as a whole. Weighed up against these benefits is the likely loss of some freight revenue in the short to medium term and the budgetary implications this has for QR and for the State as a whole.

- Considerable differences emerged between the estimated coal production responses provided by Energy Economics and Barlow-Jonker on the other hand. The expected coal export estimates by Energy Economics were much higher. These differences in the consultants’ estimates spring from different perceptions of surplus capacity in the black coal industry and to different estimates of short-term supply elasticity for black coal in general. However, in this study the estimates were taken as exogenous and evaluated in their own right without attempting to argue which was the more likely to occur
- The modelling proceeded in two stages. The first stage examined the impact of the estimated coal production increases independently of any freight revenue losses or royalty gains. This was considered important because it gives policy makers the chance to examine the potential that reduced costs have to increase coal exports (and, to some extent, exports in general). This in turn identifies the potential benefits that increased efficiencies in transport, and other input services, have to increase economic performance in the State. Secondly, there are some concerns about if, to what extent, and how, the issue of reduced rail freight revenues to QR should be included in the modelling. For example, these reductions might be absorbed by structural and behavioural changes in rail transport or funded by increased budget allocations in the belief that potential benefits of the coal production increases represent a useful investment. In this case there would be no real need to include them in the analysis. Alternately they may be funded by increased

taxes and charges or by reduced services and clearly represent current economic loss. Finally, part of the total losses in freight revenue might be offset by rigidities in contractual arrangements, increased throughput, or by additional royalties and other revenues. Figure E.1 sets out estimates of potential economic benefits of the output predictions by both consultants without considering the issue of freight revenue losses.

Table E.1 Economic Impacts without consideration of freight revenue Implications (1997/98 prices)

Energy Economics Estimates	***Output ($M)***	***Regional Income ($M)***	***Value-added ($M)***	***Jobs created or maintained ****
Average for period 2002-2010	1373	319	604	11330
Post 2010 annual average	1916	445	844	15818
Total % point contribution to GSP 5.6% to 6.1%				
Barlow- Jonker Estimates				
Average for period 2002-2010	367	85	162	3033
Post 2010 annual average	572	134	252	4726
Total % point contribution to GSP 1to 1.7%				

- It may be seen from table E.1 that the estimates of economic benefit using the Energy Economics data are large, with a period average net annual addition to GSP of over 600 $million, and output effect of 1.4 billion and the creation or maintenance of 11,300 full-time job equivalents. This annual average rises to over 1.9 $billion in output, 844 $million net additions to GSP and the creation or support of over 15,800 jobs, the bulk of which are in Central Queensland/Fitzroy. Over the period 2002-2010, the total additions to GSP are sufficient on their own to raise the GSP level (based on 1998/99) by between 5.5 and 6.1 percentage points. As would be expected, the estimates of economic activity associated with the Barlow-Jonker data are significantly less but, without the need to compensate for freight revenue losses, are still significant. Over the period 2002-2010, the average annual impact increases output by 367 $million, increases GSP by over 161 $million and creates or supports 3033 FTEs. After 2010 these estimates increase to 572 $million in annual output, 252 $million in net annual additions to GSP and a job impact of over 4726 FTEs. Over the period 2002-2010, the aggregate impact would raise GSP from its current level by between 1.2 and 1.7 percentage points.

- The second set of estimates produced in the report incorporated potential freight revenue losses. This immediately raises the question of what stage in the modelling process should these costs be included and what level of potential compensation should be considered. If the exercise is seen purely as one of compensating QR for revenue losses out of accrued benefits, then these costs might logically be taken out ex-poste from the total (direct and indirect) benefits of the increased coal revenues. The problem here is that there are numerous beneficiaries rather than one single beneficiary. This would make it difficult to identify which group or groups would be required to pay the compensation. In such circumstances compensation could only be achieved from increased taxation either for the public as a whole or for the coal exporters. However, if the reduced freight revenues are modelled as having an immediate budgetary or opportunity cost, they would need to come in at the front end of the modelling and be deducted from the initial estimates of exogenous income generated by the coal sales.
- In the absence of any appropriate means of incorporating these losses ex-post, they were added to the front-end of the modelling process after being discounted for additional royalties and after taking into account rigidities in contractual arrangements that lock coal exporters into a fixed price even after the regulated access charges become effective which are expected to reduce haulage charges by 30 per cent. No consideration was given

to further reducing the real magnitude of freight revenue losses by allowing for reductions in deadweight losses in the rail transport industry although this will almost certainly occur. Overall, it was felt that the method employed resulted in the maximum possible reduction in statewide benefits being attributed to the reduction in coal freight revenues. This occurs because it is assumed that the loss of economic welfare from a reduction in or transfer of Government revenue should be treated as being equal in relative importance with the increased exogenous spending on mining production. This symmetrical treatment of impacts, in terms of net state benefits, is probably not correct in that it overstates the negative impacts. Also, any efficiency improvements that QR could introduce in response to the loss of coal freight revenue have not been included in the analysis

- Despite this conservative approach, the amended estimates associated with the Energy Economics estimates were still significant; a period annual average impact of 1038 $million in output, an additional 241 $million in net income to factors of production, over 450 $million in net additions to GSP and over 8500 jobs supported or created. The combined impact in value added over the period 2002-2010 is sufficient to raise the 1998/99 GSP figure by 4.2 to 4.7 percentage points.
- However, the economic impacts associated with the Barlow-Jonker estimates become marginal, even negative, when freight revenue reductions considerations are included in the analysis. The annual averages 2002-2010 are of the order of -75 $million in output impacts, -18 $million in regional income, an annual change in GSP of -33 $million and the potential loss of 621 jobs. The negative signs here indicate that the State economy would be worse off after the reform than if the status quo were maintained. After 2010,

the project will record a small annual surplus of 28.7 $million (output), 7 $million (income), 13.00 $million (value-added) and 237 FTEs.

- The upshot is that the crucial factors in determining the feasibility of the project are the size and speed of the coal export responses to freight rate reductions, the method by which any revenue shortfall to QR is funded and the hedonic value placed upon the likely micro efficiencies introduced in rail transport sector by reductions in freight rail charges. In a sense these are matters of resource economics and Government policy. Almost any economic model would predict economic advantages from such a large additional level of coal exports (Energy Economics scenario) although they may disagree on the exact amount of benefit and its' spatial distribution. However, when the estimated coal export increases are much smaller (such as in the Barlow-Jonker estimates), the overall impacts are much less clear-cut and vagaries in particular economic models become more important.

1.0 Introduction

1.1 Importance of Black Coal to Australia

The Australian coal industry is of major importance to the Australian economy. It is at the heart of Australia's comparative advantage in increasingly 'globalised' world markets and, as such, is important in realising the aspirations of Australians for ongoing improvements in their living standards. This prospect exists by virtue of Australia's high value resources, the scope for further productivity improvement to maintain competitive advantage and the proximity to growing regional markets for coal in countries that need an inexpensive source of energy to underpin their economic development. In this context, Australian coal is critical for allaying the energy concerns of Japan, Korea, Taiwan and other key Australian trading partners. Key statistics on the Australian industry are described in Box 1.

Box 1: Key features of the black coal industry

Australian black coal production is divided roughly evenly in terms of quantity between thermal coal and coking coal.

Australia has about 120 black coal mines:

- About half are surface (open cut) and half underground;
- NSW produces around 46% of coal underground, Queensland produces about 86% by open cut;
- Queensland and NSW, which account for about 95% of Australian production, produce about the same amount of black coal.

Australia is the fifth largest producer of black coal world-wide:

- 219 million tonnes in 1998;
- Around 76% of Australia's production is exported;
- Black coal is Australia's largest export industry;
- Australia is the world's largest coal exporter, accounting for almost 30% of world coal trade;
- In 1998, at a value of over $9.7 billion, coal accounted for about 10% of Australia's exports and more than 1.5% of GDP.

According to the Productivity Commission, employment in the black coal industry was about 23,800 in 1997, although productivity improvement in the industry over the last few years has resulted in a reduction in total employment.

Source: Hitchins and Mangan, ACIL 1999.

The 24% of Australian coal production that is used domestically is principally used for electricity generation. In this role, it is an important contributor to Australians having amongst the lowest priced electricity in the world (second only to South Africa as reported in a survey carried out by the Electricity Supply Association of Australia)[1]. This not only benefits all consumers but also provides a crucial competitive advantage supporting employment in all sectors of the economy — and notably in industries like metals smelting, which are electricity intensive.

Table 1 illustrates that the domestic market for coal is dominated by steaming coal production (45.1Mt). In 1998, black coal supplied the energy sufficient to produce 56% of total electricity generation in Australia.

Table 1: Australian Black Coal Production

BLACK COAL PRODUCTION	For Domestic Market	For Export Market	Total
Steaming Coal	45.1 Mt (36%)	83 Mt (64%)	128.1 Mt
Coking Coal	7.4 Mt (8%)	83.6 Mt (92%)	91 Mt
Total	52.5 Mt (24%)	166.7 Mt (76%)	219.1 Mt

Forecasts suggest that black coal will remain the most important source of energy for electricity generation in Australia, including in the event Australia complies with its Kyoto Protocol greenhouse gas emission commitments in the period 2008-12.

1.2 Importance of Black Coal to Queensland

In its submission to the Productivity Commission inquiry into the black coal industry in 1997, the Queensland Government described the industry as "critical to the State's economy".

In 1998, the industry contributed:

- Coal output valued at about $6 billion, being over 60% of the total value of mineral production in Queensland;[2]
- Over $5.6 billion in export earnings or 35% of the State's total export receipts;
- Direct employment of over 14,000 persons (1997), predominantly full-time and a larger number indirectly employed by flow-on effects from this capital-intensive industry;

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[1] In *Electricity Australia '99* published by the ESAA.

[2] Estimates vary over the exact value of production. Using ABS data on levels of production and the FOB price of coking and thermal coal the value of production is closer to $6.6 billion.

- Approximately $170 million in royalty payments to the State Government; and
- Between 1987-1997 the black coal industry provided over $4 billion in private investment and infrastructure spending in Queensland.

1.3 Defining Full Industry Significance

The data cited above, although impressive in their own right, understate the full significance of the coal industry to the Queensland economy because they do not include indirect or flow-on effects. Fully quantifying these effects is difficult, but not impossible. Most studies of industry significance involve some form of input-output model. These vary in sophistication from simple (traditional) models to demo-economic models and multi-regional models. The main problem with these models, in terms of economic modelling, is that they are exclusively demand-side models and do not take account of supply-side constraints. This is particularly limiting in terms of modelling economic impact of exogenous economic investment but is of less importance in measuring economic significance, particularly where the I-O tables are hierarchically balanced. A balanced I-O table for Queensland (1992/93) was produced by the Government Statistician's Office and this forms the basis for the construction of the multi-regional model.[3] Interrogating the table for industry significance reveals indirect effects of the coal production (as a multiple of the direct effects) in the order of 1.8-2.02 (production), 0.78 (value-added or net additions to GSP), 0.3- 0.35 (regional income) and 1.3 (employment). On that basis and depending upon what estimate of GSP is taken, Black Coal production contributes between 6-7 per cent of GSP.[4]

1.4 Methodology

This study uses the Queensland Multi-regional Model (QMRM) to examine the impact of estimated production and export increases from freight rail reductions and their consequent impact to the Queensland economy. The QMRM was developed in 1998, specifically as a project impact model for the Department of Premier and Cabinet to provide accurate estimates

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[3] It should be noted that in the I-O sector Coal is included with Crude oil in the Coal and Crude Oil production sector. However the sector is dominated by Coal.

[4] There are some differences between the State Accounts provided by the Queensland Government and the ABS data. Calculations of net additions to GSP in this paper are based on the Qld State Accounts estimates of GSP 1998/99, at factor cost, of $87.3billion.

of the potential economic impact of projects and new industries to the State. The model has a number of features that make it suitable for this task:

- It contained a number of default values that enable projects to be modelled on the basis of limited or incomplete information.
- It enabled the economic impact to be spatially distributed across Queensland Regions.
- Where appropriate base data was available, it allowed the calculation of impacts across time and/or the calculation of present values.

However the original QMRM was essentially a project specific model. It was less suited to the evaluation of the economic significance of established industries. For this reason a larger, 32 sectors, QMRM was developed which was designed to provide industry specific impacts. It also added to the spatial disaggregation capabilities by adding a rest of Australia (ROA) sector. The sector distribution of the model is shown below in table (2).

Table 2: 32 sector classification used in QMRM

Sheep	Wood and paper	Electricity	Textiles, clothing and footwear
Meat cattle	Coal and crude petroleum	Gas and water	Finance, property and business services
Milk cattle and pigs	Chemicals, petroleum and coal products	Residential building	Ownership of dwellings
Cereal grains	Non-metallic mineral products	Other building and construction	Public administration
Sugar cane	Other mining	Trade	Defense
Other agriculture	Metals, metal products	Rail transport	Community services
Forestry	Machinery and equipment	Other transport (inc. ports)	Recreation and personal services
Fishing	Other manufacturing	Communication	
Food manufacturing			

2.0 Construction of the QMRM

The methodology used in the construction of the QMRM is similar to that developed by Professor Guild at the University of Auckland. There are, however, some important differences that strengthen the QMRM. These are the use of Queensland-specific data, derived by the Government Statistician's Office and, in particular, the use of hierarchically balanced input-output tables that are specifically designed to limit the double counting and over-estimation problems associated with traditional input-output tables. Specifically:

1. Guild used a national table as the parent table. The current model was able to achieve greater disaggregation by using a sub-national table, Queensland, as the parent table. The use of a State-based parent table offers the advantage of being less reliant on identifying external trade patterns. It is well established that external trade is more important to the national economy than to the state economy and while interstate and international trade is clearly important to the Queensland economy, it has less effect on this economy than for the national as a whole. The choice of Queensland as the parent table also allowed us to use the hierarchically balanced input-output tables for Queensland and Queensland regions constructed by, what was then known as Government Statistician's Office[5] and is now part of the Office of Economic and Statistical Research (OESR) within Queensland Treasury.
2. Guild used the parent table as a means of estimating, through mechanical techniques, the regional tables required. By comparison, the I-O tables for Queensland regions are those derived by data intensive methods by the Queensland Treasury and balanced to the Queensland table. As such, these tables represent a superior form of data.
3. Guild, due to the unavailability of inter-regional trade data, was forced to construct his data artificially. To do this he assumed that regions import in proportion to total production in exporting areas. The current model relies upon officially supplied and estimated inter-regional data.

2.1 Model construction

- For a given input I, exporting regions (those with a location quotient greater than 1) are assumed to export all their surplus (E_I), and importing regions are assumed to import a total amount T of input i in proportion to the surplus from each region.

- Actual data on inter-regional imports were obtained from the Government Statistician's Office (GSO). These were allocated across regions on the basis of data supplied by GSO.

[5] See, Input-Output tables for Queensland and Queensland Regions, Government Statistician's Office 1994

Where hard data were not available, it was assumed that regions import in proportion to total production in exporting districts.

- As a result of this simplifying assumption, input specific trade vectors can be generated (see, appendix 1) and spliced together to form the inter-regional trade matrix.

Compared to the simple location quotient method of estimating trade flows, which generate many pairs of zero trade between regions, and Guild's artificial methods, this trade matrix exhibits larger and seemingly more realistic trade flows. As a result, the standard objections to multi-regional input-output models are significantly reduced.

In other diagnostics tests the model has performed well. The disaggregated regional multipliers aggregate the State total and demonstrate stability in the coefficients and in terms of ten per cent stability shocks. As a result, the current model provides an efficient means of estimating industrial significance and allocating this across regions and to the rest of Australia.

However it should be remembered that all economic models have their limitations. Witness the recent debates over the "true impact" of the imposition of the GST where the use of different economic models became a means of supporting preconceived opinions rather than a means of establishing objective results. The major pre-requisite in studies such as these is to correctly understand the economic context in which evaluations are taking place and the strengths and limitations of the available forms of economic modelling. The economic context here is that the Coal industry in Queensland is a major industry and one that offers the greatest short to medium-term potential to significantly increase GSP through its dominant role in the world trade in black coal. There are a number of other issues relating to the overall economic impact of reductions in coal freight rates. These include:

- The sensitivity (essentially the own-price elasticity) of coal production and international coal demand.
- The incidence of impact, for example the differential impacts on existing and new coal ventures.

- The budgetary impact on Queensland Rail and other transport operators of reduced freight rates but expanded throughput.
- The impact on State revenues in general.
- In estimating Rest of Australia effects it is assumed that no displacement will occur, that is that all induced coal production will be exported and no disruption of domestic coal sale will occur. However, there is a possibility that there may be some displacement of export coal sale from New South Wales.
- The long-term benefits to the Queensland Economy of increased efficiency in the use of railway stock.

These issues, though of considerable importance, are, with the exception of diminished freight revenues, and potential displacement of exports from other Australian states are not developed here[6]. This paper takes as exogenous, the ranges of output expansions produced by Energy Economics (2000) and Barlow-Jonker (1999)[7]. There are, however, some significant differences in the estimates. Energy Economics predict that coal exports will rise over the period 2002-2010 from 137.8 MTPY to approximately 155 MTPY following a 30 per cent decline in rail freight charges for export coal. In contrast the Barlow-Jonker (BJ) estimates of output expansion are much more modest, with coal exports reaching 142.7 MTPY by 2010. The differences between the Energy Economics estimates and the BJ estimates result from differences over methodology, particularly the degree of short-run elasticity of production that exists in the industry. However, the differences have severe implications for the estimated economic value of the coal freight reduction strategy to the Queensland economy. Taken cumulatively, the total differences in terms of aggregate coal exports over the period are of the order of 80 MT of coking and thermal coal. In short, if the Energy Economics estimates are accurate, the economic benefit to the Queensland economy of the freight reduction will be substantial, in their right, and will be augmented by microeconomic reform and improvements to structural efficiency. If the BJ estimates are accurate then the net direct value of the freight reduction strategy, in terms of the exogenous effect of

[6] The output and other aspects have been undertaken by other consultants, see Energy Economics (2000) and Barlow- Jonker (1999)

increased export earnings will become less important and the microeconomic efficiency arguments will become much more influential to the assessment of public benefit.

2.2 Evaluating the Economic Impacts of Freight Reductions

Projections of output increases, following a 30 per cent cut in freight rail charges, provided by Energy Economics and BJ were used as the basic data for the QMRM. However, all of the estimates were in terms of physical data. The QMRM model requires financial (value) data. To produce the appropriate financial data, two sets of assumptions were needed. These concerned average traded prices for coal, based upon expected returns and the country-specific distribution of expected new sales, and the distribution of coal sales into thermal and coking coal components. Data on these were gathered from the Queensland Government statistics web site covering the period 1998/99. Prices over the period of the estimates were adjusted for anticipated inflation and, for the period 2002-2009/10, estimates were made of likely productivity increases in assigning employment and income impacts.[8]

In this particular case the starting estimates were derived by applying a weighted average to the annual price estimates for coking and thermal coal produced by Energy Economics for the period 2000-2010. The corresponding estimates of increased export tonnage of coal were used as the weights. This procedure produced average prices of 63.5 $A/tonne for coking coal and 45.2 $A/tonne for thermal coal. The ratio in exports between coking and thermal coal was assumed to remain at 69/31. In terms of appropriate modelling techniques, there exist a number of different forms of modelling that might have been used ranging from traditional input-output, through to computable general equilibrium models (CGE) and econometric/I-O models. Most disagreements over modelling technique surface over the allocation of flow-on or indirect benefits and the relative importance of marginal as opposed to average effects. The models used here have the advantage of having been specifically constructed for the Queensland economy and of being able to allocate economic flows across regions and the rest of Australia and across industries. They have the disadvantage of not being supply constrained. In impact studies involving relatively small economic aggregates, the assumption of zero supply constraint is of no real concern.

[8] See, http:/www.statistics.qld.gov.au/stab

However, the size of economic adjustment examined in this case is such that the lack of supply constraints may be important. The results of the study should be analysed with this in mind because they assume that the coal industry can respond quickly to incentives to increase production.

The impacts for Coal were modelled through sector 23 in the Queensland QMRM.[9] To test model consistency, data were also fed through MRIP. The QMRM results were within the range set by the upper and lower estimates from the MRIP model.

2.3 Economic Impacts

The data, as described above, was applied to the 32-sector QMRM model. The aggregate results are shown in table (4). The model also predicts regional and industry-specific estimates. However, given the lack of specific data as to the exact geographic areas of impact, less reliance attaches to the spatial distribution of the impacts than to the aggregate estimates and was not reported.

It should be stressed that estimates are conservative. While the multi-regional model differs considerably from the standard I-O table, the approach used here is similar to the practice of using type 1 estimates rather than type 11 estimates as a means of producing parsimonious estimates of flow-on, particularly consumption-induced, effects. Therefore it is likely that the estimates, with the exception of employment, which is notoriously difficult to estimate, are understatements.

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9 This corresponds with sector 3 in the Queensland Table

Table 3: Estimated Increases in Coal Exports following a 30 % Reduction In Coal Freight (MTPY)

Year	Energy Economics.	Barlow-Jonker
2002	4.1	0.6
2003	8.9	1.6
2004	9.6	2.4
2005	9.5	2.4
2010	16.4	4.8

Source: Barlow-Jonker Pty Ltd (1999), Energy Economics (2000)
** Estimates of annual production for the years 2006-2009, in both cases, was obtained by interpolation

The projected production increases supplied by both consultants were considered annually over the period 2002-2010. Output increases predicted for earlier periods were not included, as the rate reduction strategy is not considered likely to be operative before that period. Over such a lengthy period it is likely that productivity effects will impact upon employment effects and regional income generation. As a result, in the calculation of job estimates an average total period productivity effect of 30 per cent on direct coal sector jobs was assumed.

Table 4: Summaries of Economic Impacts from Freight Induced Coal Export Production $A Million

Energy Economics Estimates	Output ($M)	Regional Income ($M)	Value-added ($M)	Jobs created or maintained *
Annual average for period 2002-2010	1372	319	604	11330
Post 2010 annual average	1916	445	844	15818
Total % point contribution to GSP 5.50% to 6.1% on 1998 GSP over period 2002-2010				
Barlow-Jonker Estimates				
Annual average for period 2002-2010	367	85	162	3033
Post 2010 annual average	572	133	252	4726
Total % point contribution to GSP 1.00% to 1.7.00% on 1998 GSP over period 2002-2010				

Source: Estimated from QMRM (1998)
*Full-time job equivalents and adjusted for anticipated productivity increases in direct coal jobs
** A full annual listing 2002-2010 is shown in appendix 2

The results show both the large potential benefits to the State's economy from the reform process. The substantial differences in the estimates depend upon which set of production increase estimates are used. Estimates should be evaluated in the context of a 1998 GSP at factor cost of approximately 87.3 $billion. The Energy Economics production estimates bring, on the basis of expected world prices, very large benefits to the State and National economies. Over the period 2002-2010 output impacts average 1.4 billion dollars which leads to 319 $million in net regional income and 604 $million in value added or net contribution to GSP. Using the data cited above indicates that the aggregate impact of the process (other things being held constant) over the period (2002-2010) will be to raise the GSP estimate (1998/99) by between 5.5 to 6.1 percentage points. In terms of employment, the results are more difficult to interpret. Many jobs tend to last longer than one year. Jobs created in the first period need to be sustained by continued production and new jobs usually only arise from marginal additions to prior output levels. Aggregated over the whole period, the total value of new production would produce or sustain over 100,000 jobs. However, many of these are repeat jobs. Nevertheless, for the Energy Economics estimates there are significant yearly (marginal) increases in output. As a result, a period average is a reasonable estimate of the net permanent job creation over the period (2002-2010). This yields an average over the period of 11,300 FTEs. This is expected to rise to over 15,800 post-2010. The likely distribution of jobs created in this process is shown in table 5.

Table 5: Allocation of Created Jobs

Region	*Percentage of Created Jobs*
Brisbane-Moreton	20
Darling Downs	4
South West	2
Central Qld/Fitzroy	60
North	6
Far North	2
North West	1
Rest of Australia	5

Percentage estimated from QMRM (1998) using Central Qld/Fitzroy as the main impacting area.

Assigning jobs to a specific spatial area is difficult when analysing a general freight rate reduction. To achieve this it was hypothesised that most affected mines would be in the Central Queensland /Fitzroy region. Therefore these regions were chosen as the impacting regions. Not surprisingly, Central Queensland/Fitzroy gains the bulk of job creation. Sixty per cent of all jobs created or maintained are in these regions. Brisbane, by virtue of its dominance as a financial and administrative centre, attracts 20 percent of new positions and the remaining 20 per cent are spread throughout the state and the Rest of Australia (5%).

The BJ estimates are considerably smaller in their economic impact than the Energy Economics estimates, because they produce total additional coal exports over the period of approximately 80 million tonnes. This makes a considerable difference but the BJ estimates, which should be regarded as being conservative, also indicate significant potential economic gains. The average annual benefits across the period are 367$M in output effects which translates into 86$M in regional income per annum, 161$M in net additions to GSP and 3033 jobs created or maintained. Post 2010, these averages rise to $572M (output), 133$M (income), 252$M value added and 4726 jobs maintained or created. Over the period 2002-2010, between 1.2 and 1.7 percentage points are added to GSP levels current at the start of the period.

3.0 Factoring in Freight Rate Reductions and Royalty and other revenue increases

The freight rate changes that will act as a catalyst to the increased coal production will also lead, in the short to medium term, to decreased rail freight revenues. The impact of these revenue reductions and their effect on the calculation of the economic impact of the freight reduction strategy will depend upon a number of economic and behavioural assumptions. For example, given the impressive nature of the potential gains (particularly under the Energy Economics scenario), decisions may be made to attempt to cover any funding shortfall by achieving operational or structural efficiencies within rail transport or by using existing capital and in a more intensive fashion. Alternately, there may be a political decision to provide QR with an increased budgetary allowance, in the short term to compensate for any loss of revenue. This later strategy has State budgetary implications and this would need to be factored into the calculation of net economic benefits from the freight reduction strategy. However, the inclusion of freight rate revenue losses into the economic modelling results is not straightforward and requires some l assumptions to be made:

- the extent of revenue shortfall, particularly where some of the shortfall is offset by internal efficiencies;
- the timing of revenue reduction, in light of the fact that contractual arrangements will hold freight rates fixed for a period of time after regulated access charges are officially introduced; and
- the offsetting revenue flows generated by increased throughput and increased royalty payments.

Another issue to be considered is the stage at which revenue loss considerations enter the modelling process. If the idea is simply that QR should be compensated from the gains of the project, then the compensation could be paid, at some later date, after the benefits have begun to accrue. However, who would pay this compensation? The economic benefits that accrue from the increased coal exports are spread over a range of individuals and industries with no one single beneficiary that could be identified as being responsible for compensation. In the case where budgetary allocations are diverted to QR to compensate for the shortfall, the source of compensation is more apparent. It is either the public, through increased taxes or levies, or the opportunity cost of projects foregone elsewhere in the State, if there is no adjustment made to the total revenue base. Both of these impacts are more immediate and, arguably should be included at the start of the modelling process to produce a net figure of exogenous spending and a subsequent net level of economic benefit. Complicating the issue further is consideration of the efficient resource usage and optimum rail freight policy. For example, if the current coal freight rates are optimum (i.e., reflect real service provision costs) then artificially lowering these costs, irrespective of the anticipated benefits, will produce economic loss (sub-optimal return on assets) that will need to be fully compensated to ensure efficient resource allocation. However, if the current freight rates contain deadweight loss elements (in excess of competitive supply costs), appropriate freight reductions and subsequent organizational changes to accommodate these changes, will produce economic efficiency gains for rail transport and the Queensland economy as a whole. In other words, the freight revenue losses would need to be discounted by the reduction in deadweight loss in the rail transport industry initiated by the reduction of above normal pricing. *It is certainly possible in some circumstances that this reduction in deadweight* *loss to the users of rail services and the Queensland economy may outweigh the loss of freight revenue*.

Overall, therefore, the issue of compensation for short-term rail freight revenue reduction is complex and there is a reasonable argument for not considering them at all in the modelling, certainly in their entirety, in the analysis. However, in keeping with the conservative approach to estimation used in this study, the results below are predicated on the assumption that freight rates revenue losses will incur some budgetary reallocation, which in turn will represent a front-end consideration of their impact on the net annual benefits of increased coal production.

In essence, the estimated annual loss in rail freight, discounted by additional royalty and other payments and with allowances made for existing contractual arrangements, is deducted from the estimated increase in exogenous income (value of increased coal exports) prior to these estimates being used in the model. Almost certainly, this process overstates the importance of the freight revenue reduction issue and understates the net economic benefits from the reform process. However, there seems no practical way of deducting these costs ex-poste because there is no single net beneficiary. *It should also be noted that no allowance is made for the net benefits of reduced deadweight loss in the Queensland rail transport sector*.

**Table 6: Economic Impacts from Freight Induced Coal Export Production with Potential Freight revenue Losses Factored in
$A Million**

Energy Economics Estimates	*Output ($M)*	*Regional Income ($M)*	*Value-added ($M)*	*Jobs created or maintained **
Annual average for period 2002-2010	1038	241	457	8578
Post 2010 annual average	1518	353	668	12538
Total % point contribution to GSP 4.20% to 4.7.00% on 1998 GSP over period 2002-2010.				
Barlow-Jonker Estimates				
Annual average for period 2002-2010	-75	-18	-33	-621
Post 2010 annual average	28	7	13	237
Total % point contribution to GSP –0.03% on 1998 GSP over period 2002-2010				

Source: Estimated from QMRM (1998)

*Full-time job equivalents and adjusted for anticipated productivity increases in direct coal jobs

** A full annual listing 2002-2010 is shown in appendix 2

When the estimates associated with the Energy Economics predictions are amended to allow for full freight revenue recovery, the results are lower but still significant. For example, as the data in table 6 show, there is predicted a period annual average impact of 1038 $million in output, an additional 241 $million in regional income, over 457 $million in net additions to GSP and over 8500 jobs supported or created. The combined impact of value added aggregated over the period 2002-2010 is still sufficient to raise, by itself, the 1998/99 GSP figure by 4.2 to 4.7 percentage points.

However, the economic impacts associated with the Barlow-Jonker estimates become marginal, and negative, when freight revenue reductions considerations are included in the analysis. The annual averages 2002-2010 are of the order of -75 $million in output impacts, -18 $million in regional income and annual changes in GSP of -33 $million and the potential loss of 621 jobs. The negative signs here indicate that the State economy would be worse off after the reform than if the status quo were maintained. After 2010, the project will record a small annual surplus of 28 $million (output), 6.68 $million (income), 12.65 $million value-added and 237 FTEs.

3.1 Conclusion

Overall, the significance of the project is dependent upon which set of external consultants have correctly modelled the output response of the black coal industry, the method and timing of compensation to QR for reduced freight rate revenues on existing output levels, and the importance placed upon generating microeconomic reform in the rail transport industry. Often the accuracy of economic models is overstated. However, any massive expansion of coal exports (Energy Economics) will bring large benefits to the State's economy irrespective of which modelling technique is used to quantify it. The issue of modelling becomes much more important when smaller coal increases are predicted (Barlow-Jonker). The model used here suggests that, where compensation is required, the project becomes marginal at the lower end of the increased output predictions and may even lower State GSP.

One further point yet to be considered is that of potential displacement of exports from other States. The most likely to be affected is New South Wales and some estimates place the annual loss by 2010 at 4 million tonnes. In this report, estimates of economic benefit have been confined to those impacting directly on State (Queensland) GSP. The modelling did however identify some Rest of Australia benefits (for example, approximately 5% of the employment benefits estimated from the modelling occurred outside of Queensland). Clearly, if some of the additional exports of Queensland coal were achieved by displacing exports of NSW coal this would impact on New South Wales GSP, as well as lowering the net potential benefits to Australia as a whole. The relative importance of the displacement effect is an empirical question and without, the use of detailed modelling of the New South Wales coal industry, is unable to be fully considered here. Moreover, the net welfare aspects of displacement are also difficult to estimate because, even if displacement did occur, it would be from a more efficient producer gaining at the expense of a less efficient producer. In short, the National effects of the Queensland rail transport reform would be diminished if any displacement of coal exports from other states occurred but they would still be significant because the bulk of the increased Queensland coal exports would be new orders rather than displacement of existing orders. As well, the Rest of Australia effects that would flow from the anticipated expansion of the Queensland coal industry would offset some of the NSW loss.

Finally, it should also be remembered that these production increases are achieved purely by policy changes and do not require seed funding, green field development or preliminary infrastructure development. They are based purely on an assessment of the benefits of increasing the cost competitiveness in the State's largest export industry. They may, however, require additional production costs, principally by placing strain on existing infrastructure. There is also a possibility that some crowding out of other economic activity in the State may take place. However, if the Energy Economics estimates are accurate, the size of the predicted economic benefits is so large as to make such possible cost increases relatively unimportant. The extent of benefit is therefore crucially determined by the accuracy of production expansion increases, the actions of rival suppliers and factoring in the overall impact on State revenues. Notwithstanding, the estimates of increased production shown in this report indicate the considerable potential for increased sales within the coal industry from reductions in input costs. The major policy question is to determine the best means of achieving these cost reductions.

References

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Appendix 1 Generation of the Multi-Regional Model.

Figure 1. Regional Technical Coefficients Matrix

A^R = the technical coefficients matrix for each of R regions

A^R_{11}	….	A^R_{1j}
…	….	…
A^R_{i1}	….	A^R_{ij}

Figure 2. The Multi-Regional Technical Coefficients Matrix

A = Multi-Regional Technical Coefficients Matrix constructed as a diagonal matrix. In this case it comprises a 224X224 for the 7 regions (including the ROA)

A^1	0	0	0
0	A^2	0	0
0	0	A^3	0
0	0	0	A^n

Figure 3. Inter-Regional Trade Coefficients

C = the multi-Regional trade table and is constructed by splicing together
The individual regional trade matrices, and again forms a 224X224 matrix (7 regions)

$C\wedge^{R}_{1}{}^{R}_{1}$	$C\wedge^{R}_{1}{}^{R}_{2}$	….	$C\wedge^{R}_{1}{}^{R}_{j}$
$C\wedge^{R}_{2}{}^{R}_{1}$	$C\wedge^{R}_{2}{}^{R}_{2}$	….	$C\wedge^{R}_{2}{}^{R}_{j}$
….	….	….	….
$C\wedge^{R}_{ji}{}^{R}_{1}$	$C\wedge^{R}_{ji}{}^{R}_{2}$	….	$C\wedge^{R}_{i}{}^{R}_{j}$

Where $C^{R}{}_{1}{}^{R}{}_{2}$ = the trade vector for a set of n inputs between region 1 and region 2 and

And $c_1{}^{R}{}_{1}{}^{R}{}_{2}$ = the ratio of imports of an input from Region 1 to Region 2 compared to the total level of that imports of that input to Region 2. The final form of C is obtained by converting the trade vector to a diagonal matrix for computation[10]

[10] See, Guild, 1997 pp. 9-11 for further explanation of this procedure.

$$\begin{bmatrix} c_1^{R_1R_2} \\ \cdots\cdots \\ c_n^{R_1R_2} \end{bmatrix}$$

Whereas the single-region IO system is

$(I\text{-}A)\ X = Y$, solved as $X = (I\text{-}A)^{-1}\ Y$

The multi-regional system is:

$(I\text{-}CA)\ X^* = Y^*$, solved as $X^* = (I\text{-}CA)^{-1}\ Y^*$

Where I is the identity matrix, X* is the vector of regional outputs, and Y* is the vector of regional final demands. The final model can then be used for State–wide, regional and Queensland/Rest of Australia policy simulation.

Appendix 2

Table 1

Energy Economics

		Output	Income	V.Added	Jobs
	2002	456	106	201	3762
	2003	1040	242	458	8585
	2004	1121	261	494	9260
	2005	1110	258	489	9163
	2006	1542	359	679	12732
	2007	1624	378	715	13407
	2008	1694	394	746	13986
	2009	1846	429	813	14245
	2010	1916	445	844	15818
Average for period		1372	319	604	11330
Post 2010 annual average		1916	445	844	15818
Total period contribution to GSP		5.5% to 6.1%			

Table 2

Barlow-Jonker

		Output	Income	V.Added	Jobs
	2002	187	43	79.70	1543
	2003	187	43	79.70	1543
	2004	280	65	119.55	2355
	2005	280	65	119.55	2355
	2006	374	87	159.40	3087
	2007	374	87	159.40	3057
	2008	467	109	199.25	3734
	2009	467	109	199.25	3734
	2010	572	133	252.	4726
Average for period		367	86	161	3033
Post 2010 annual average		572	133	252.	4726
Total period contribution to GSP		1.2-%-1.7%			

Table 3

Allowing for Freight Revenue Reductions and Increased Royalty and other revenues

Energy Economics

		Output	Income	V.Added	Jobs
	2002	404	94	178	3338
	2003	850	198	324	7018
	2004	840	195	370	6933
	2005	726	169	320	5997
	2006	1104	257	486	9115
	2007	1195	278	526	9864
	2008	1272	296	561	10506
	2009	1441	335	635	11896
	2010	1518	353	669	12538
Average for period		1039	242	458	8578
Post 2010 annual average		1518	353	669	12538
Total period contribution to GSP		4.2 to 4.7			

Table 4

Barlow-Jonker

		Output	Income	V.Added	Jobs
	2002	106	25	47	877
	2003	-96	-22	-42	-791
	2004	-96	-22	-41	-769
	2005	-191	-45	-86	-1603
	2006	-191	-45	-84	-1581
	2007	-191	-45	-84	-1581
	2008	-88	-20	-39	-725
	2009	-88	-20	-39	-725
	2010	28	7	13	237
Average for period		-75	-18	-33	-621
Post 2010 annual average		28	7	13	237
Total period contribution to GSP					

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