Carbon Price Impacts for Queensland

Queensland Treasury – August 2011

Queensland Government

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Executive Summary

This report is an assessment of the impacts of the Australian Government's *Securing a Clean Energy Future* (CEF) plan on the Queensland economy, Budget and Government-owned electricity generators (Gencos).

The analysis is based on the same underlying economic assumptions adopted by the Australian Treasury in its business as usual (BAU) and core policy (carbon pricing) scenarios (updated where appropriate to better align with the announced CEF plan). The same computable general equilibrium (CGE) model has also been used (i.e. Monash Multi Regional Forecasting model (MMRF))).

As such, the purpose of the assessment is to provide an indication of the impacts of carbon pricing for Queensland under the scenario in which the Australian Treasury assumptions hold over the decade to 2019-20, and possibly the longer term to 2049-50.

However, it is noted that there are a number of uncertainties in any complex modelling exercise. This means that the Australian economy could grow slower or faster than assumed, international conditions could change, and the economy's adjustment to carbon pricing may be more or less efficient than expected. However, it is Queensland Treasury's view that the adoption of the Australian Treasury assumptions is a reasonable approach to estimating the main-case impacts of carbon pricing.

Queensland Treasury's analysis also includes two modelling sensitivities that are not based on Australian Treasury assumptions.

In addition, the Queensland Government engaged Deloitte Access Economics to provide another analysis using a different CGE model. This report is also being made publicly available.

This report represents Queensland Treasury's assessment of the expected growth of the Queensland economy in the presence of a domestic price on carbon.

Key Findings

The introduction of a carbon price is estimated to have a relatively small economic impact for Queensland over the next decade, although impacts will increase over the longer term to 2049-50. Fiscal and Genco value impacts, however, will be material. In particular:

- gross state product (GSP) is estimated to be 0.4 per cent lower than it otherwise would have been by 2019-20, and 3.5 per cent lower by 2049-50. However, the growth of the Queensland economy is still expected to be strong, with average annual GSP growth (real) of 3.5 per cent to 2019-20;
- the net cost to the State budget is estimated to be between $251 and $360 million per year over the forward estimates period, totaling $1.2 billion to 2015-16;

- the reduction in the economic value of coal-fired Genco assets is estimated to be $1.1 billion ($640 million net of improvements in the value of gas and hydro assets); and
- total Queensland emissions are expected to be around 13 MtCO2-e lower by 2019-20, and 120 MtCO2-e lower by 2049-50.

Macroeconomic impacts

Queensland Treasury's modelling shows that, with and without a carbon price, the Queensland economy will grow strongly to 2019-20:

- total growth in Queensland GSP will be 41 per cent with carbon pricing, 0.4 per cent over lower than it would have been without carbon pricing. This indicates a very low carbon pricing impact on Queensland GSP over the decade;
- average annual growth in Queensland's real GSP to 2019-20 will be 3.5 per cent both with and without carbon pricing;
- employment is forecast to grow at 2.0 per cent per annum both with and without carbon pricing, with an extra 474,000 jobs expected over the period to 2019-20;
- real wages will rise by 1.5 per cent per annum to 2019-20 with carbon pricing, compared to 1.6 per cent per annum without carbon pricing.

Industry impacts are also expected to be relatively small to 2019-20:

- compared to BAU, coal industry output is estimated to be 1.5 per cent lower by 2019-20, and 7.9 per cent lower by 2049-50;
- the coal industry will still grow in absolute terms by 47 per cent by 2019-20, and 134 per cent by 2049-50.

Overall, Queensland regions will continue to see strong growth to 2019-20 with carbon pricing. The impact on output across Queensland regions is expected to range between 0.1 per cent (higher) and -1.1 per cent (lower) over this period.

While economic impacts are relatively modest over the next decade, these impacts are likely to gather force over the period to 2049-50. This reflects the underlying emissions-intensity of the Queensland economy. As the carbon price increases, and assistance for emissions-intensive trade exposed (EITE) industries unwinds, Queensland carbon pricing economic impacts start to exceed the national average:

- Queensland's GSP is estimated to be 3.5 per cent lower by 2049-50, which is higher than the national impact (GDP is estimated to be 2.5 per cent lower); and
- industry and regional impacts also increase over the period to 2049-50.

A summary of key macroeconomic indicators with carbon pricing is provided below.

Key macroeconomic indicators with carbon pricing

	2009-10 to 2019-20		2009-10 to 2049-50	
	Queensland	Australia	Queensland	Australia
	Per cent	Per cent	Per cent	Per cent
Average annual growth with domestic carbon action				
Real GSP/GDP	3.5	3.0	2.8	2.6
Employment	2.0	1.5	1.5	1.1
Real Wages	1.5	1.9	0.7	1.0
Real Investment	3.2	3.0	2.5	2.3
Cumulative growth with domestic carbon action				
Real GSP/GDP	41.0	33.8	204.9	177.9
Employment	22.0	16.5	82.0	57.2
Real wages	16.1	20.3	33.8	49.2
Real Investment	36.9	34.6	163.6	148.3
Cumulative deviation from BAU with domestic carbon action				
Real GSP/GDP	-0.4	-0.4	-3.5	-2.5
Employment	0.0	-0.1	-1.0	-0.1
Real wages	-1.3	-1.2	-5.1	-5.1
Real investment	-1.1	-1.1	-5.4	-4.7

The economic carbon pricing impacts estimated by Queensland Treasury above are based on Australian Treasury core policy assumptions. The use of different assumptions (including lower commodity prices and terms of trade) would result in more significant carbon price impacts. Conversely, higher commodity prices/terms of trade would lead to lower carbon pricing impacts.

Separate modelling by Deloitte Access Economics shows a different pattern of impact. Compared to the model used by Queensland Treasury, the Deloitte Access Economic model assumes:

- less flexible technological adjustment;
- slower labour market adjustment;
- greater impacts on the international competitiveness of Australian EITEs; and
- fewer international permits purchased in the shorter term (meaning more domestic abatement occurs, but at higher cost).

Taken together, these differences mean that short-term economic impacts are higher in the Deloitte Access Economics model. Over the longer term however, the results of the two models tend to converge. That is, the Deloitte Access Economics modelling shows GSP is likely to grow by around 38 per cent over the decade (a 2.8 per cent reduction in GSP with a carbon price). Deloitte Access Economics modelling shows total employment growth over the decade of 21 percent with a carbon price, compared to 22 per cent without a carbon price.

While Deloitte Access Economics modelling estimates a greater impact from adjustment in the short-term, higher growth for Queensland is forecast under the Deloitte Access Economics model in the longer term (compared to the Queensland Treasury modelling). Over the longer term, Queensland Treasury projects GSP will grow by an average of 2.8 per cent per year to 2049-50 with carbon pricing, while Deloitte Access Economics projects GSP growth of 2.9 per cent per year for the same period. A summary of the Deloitte Access Economics macroeconomic indicators is provided at Attachment 1.

There is a risk of greater short-term economic impacts, particularly if labour market and technological adjustment is slower than assumed by the Australian Treasury, or EITE shielding in the short to medium term does not effectively protect the international competitiveness of Queensland industries. Conversely, accelerated technological improvement or changed international conditions could lessen the adjustment burden. It is also noted that the CEF plan includes monitoring by the Climate Change Authority on indicative national targets and the Productivity Commission on the effectiveness and adequacy of EITE transitional assistance measures over the decade.

The DAE report "*The economic impacts of the Clean Energy Future Plan on Queensland (August 2011*)" is being published separately. It does not represent the views of Queensland Treasury, and is provided for information only by way of comparison.

Fiscal impacts

While there are some revenue benefits to the State Budget from the carbon price, net revenues are expected to fall by between $103 million and $168 million per annum. This is a reduction in total budgeted revenues of between 0.22 per cent and 0.34 per cent over the forward estimates period, largely driven by reductions in tax equivalents and dividends from Gencos (which includes both direct carbon impacts and other related market factors, such as lower demand). No material impact on royalties is forecast over the forward estimates.

The carbon price is expected to increase the overall cost of providing State Government services by $148 million in 2012-13, increasing to $198 million by 2015-16 (when the emissions trading scheme commences). This is an increase in total budgeted expenses of between 0.31 per cent and 0.4 per cent over the forward estimates period. In particular, electricity, gas and fuel costs (direct costs) are estimated to increase by around $25 million in 2012-13, and indirect costs (including escalation of grants and concessions) amount to around $123 million in 2012-13.

The net impact on the Queensland general government sector operating balance is $251 million in 2012-13, rising to $360 million by 2015-16. This equates to a cumulative impact of over $1.2 billion over the forward estimates period to 2015-16.

Summary fiscal impacts 2012-13 to 2015-16, without mitigating action

	2012-13 $M	2013-14 $M	2014-15 $M	2015-16 $M	Total $M
Revenues	(103)	(127)	(168)	(161)	(559)
Expenses	148	156	161	198	664
Operating Balance	(251)	(283)	(329)	(360)	(1,223)

These impacts are assessed without alternative policy measures, such as moving to more efficient, lower emissions building standards for new Government office accommodation. Future State Budgets will need to fully assess carbon pricing impacts in this context.

States must comply with the *Intergovernmental Agreement on Federal Financial Relations*, under which it was agreed that stamp duty will not apply to carbon trading activities, removing a possible revenue source to mitigate the fiscal impact of the CEF

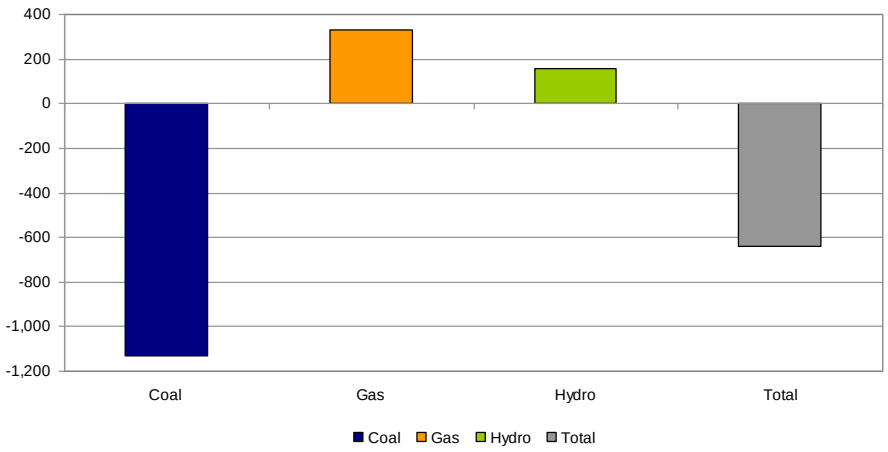
plan on Queensland. However, at this stage, it appears that carbon trading will be subject to Federal taxes (i.e. capital gains tax, company tax and income tax).

Generator impacts

The reduction in the economic value of the Queensland Government's coal-fired generation assets is expected to total $1.1 billion.

This is the result of lower generation levels due to coal-fired generation assets being displaced by gas-fired generation with lower emissions-intensity, and their inability to pass through the full carbon cost. In this regard, gas-fired and hydro assets are estimated to benefit from carbon pricing, increasing in economic value by $490 million. As a result, the net loss in economic value of Queensland Gencos is estimated to be $640 million.

Impact of CEF on the economic value of Genco assets ($ million)



It is estimated that National Electricity Market conditions will allow coal-fired generators to recover around 82 per cent of their carbon liability in 2012-13, and this is expected to decline to 76 per cent by 2020-21.

The impacts on the Gencos are highly sensitive to assumptions about the energy market. Specifically, a higher carbon price would further increase Genco losses, while higher gas prices/energy demand would mean the Genco losses are not as significant.

1 Introduction

On 10 July 2011, *Securing a Clean Energy Future: The Australian Government's Climate Change Plan* (the CEF plan) was released, outlining climate change measures agreed by the Multi-Party Climate Change Committee (MPCCC) and additional transition and abatement measures proposed by the Australian Government.

This report provides Queensland Treasury's assessment of the implications of the CEF plan for the Queensland economy, Budget and Government-owned electricity generators. The main-case analysis of carbon pricing impacts is based on the Australian Treasury's core policy scenario (updated where appropriate to better align with the announced CEF plan), and underlying economic assumptions. This is intended to provide a credible basis on which the results for Queensland can be considered alongside those estimated by the Australian Treasury.

In particular, the report canvasses:

- economic impacts, including on macroeconomic variables such as gross state product (GSP), and both industry and regional impacts;
- fiscal impacts on the general government sector, including changes to State revenues (such as royalties and dividends), and operating expenditure; and
- government-owned electricity generator impacts (Gencos).

The economic impacts presented in the report are predominantly based on internal modelling undertaken by Queensland Treasury's Office of Economic and Statistical Research (OESR) using the same Computable General Equilibrium (CGE) model as the Australian Treasury (the Monash Multi Regional Forecasting model (MMRF)). To provide an indication of carbon pricing impacts under assumptions that differ to those developed by the Australian Treasury, sensitivity analysis has also been undertaken. This includes Queensland Treasury modelling of the impact of global action alone, and lower commodity prices/terms of trade.

The economic analysis covers the period to 2049-50, with particular focus on the shorter term to 2019-20.

Fiscal impacts have been assessed by Queensland Treasury using the whole-of-Government financial information system, and the Australian Treasury's escalation estimates (which were produced from an economic model separate to MMRF). The fiscal estimates cover the forward estimates period to 2015-16.

The Genco modelling was undertaken by Queensland Treasury Corporation's Infrastructure Modelling Team using the electricity price impacts estimated by the Australian Treasury, and electricity demand forecasts produced by the Australian Energy Market Operator (AEMO).

In addition to the analysis presented in this report, Deloitte Access Economics (DAE) were engaged to undertake economic modelling using an alternate CGE model that incorporates different underlying assumptions about the way the economy will adjust to carbon pricing. This analysis is also available on the Queensland Treasury website.

1.1 Securing a Clean Energy Future Plan

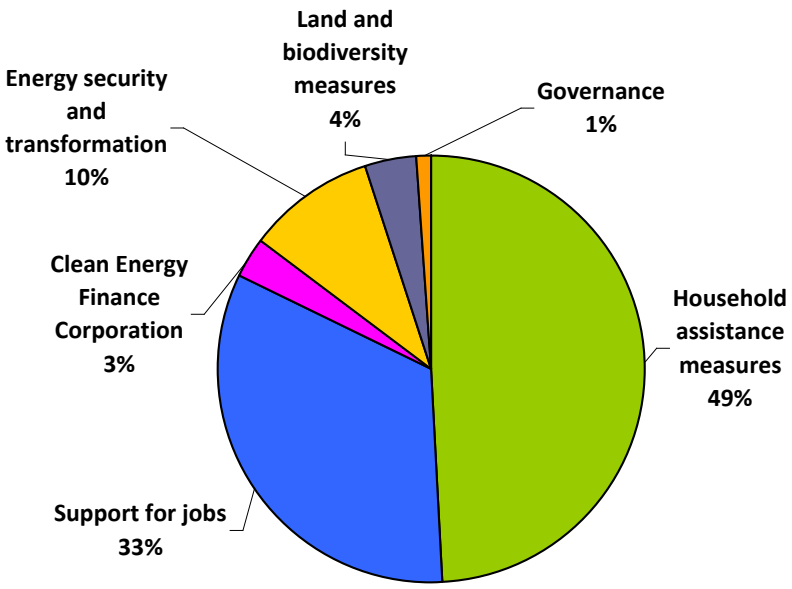
The CEF plan aims to deliver on the commitment that by 2020, Australia will reduce carbon pollution by 5 per cent from 2000 levels. This will require cutting expected pollution by at least 23 per cent in 2020.

The key element of the CEF plan involves putting a price on carbon pollution to create incentives to reduce greenhouse gas emissions, and promote investment in clean energy. Under the carbon price, around 500 of the biggest polluters in Australia will need to buy and surrender a permit for every tonne (t) of carbon pollution they produce. A carbon price will not apply to agricultural emissions, or emissions from light on-road vehicles.

The carbon price will be fixed like a tax from 1 July 2012 to 30 June 2015, starting at $23/t (nominal) and rising at 2.5 per cent a year (real terms). From 1 July 2015, an emissions trading scheme will be introduced, and the carbon price will be set by the market.

As shown in Figure 1, revenue received through the CEF plan will be used to fund assistance measures for households (i.e. tax cuts and increases in pensions, allowances and benefits) and emissions-intensive trade exposed (EITE) industries (i.e. free permits). In this regard, the CEF plan has been developed with the aim of being revenue neutral (as opposed to other measures such as the GST).

Figure 1: Australian Government MPCCC-agreed CEF plan expenditure



Note: Only includes MPCCC agreed measures.

Source: Australian Treasury (July 2011), *Securing a Clean Energy Future: The Australian Government's Climate Change Plan*.

1.2 Queensland emissions

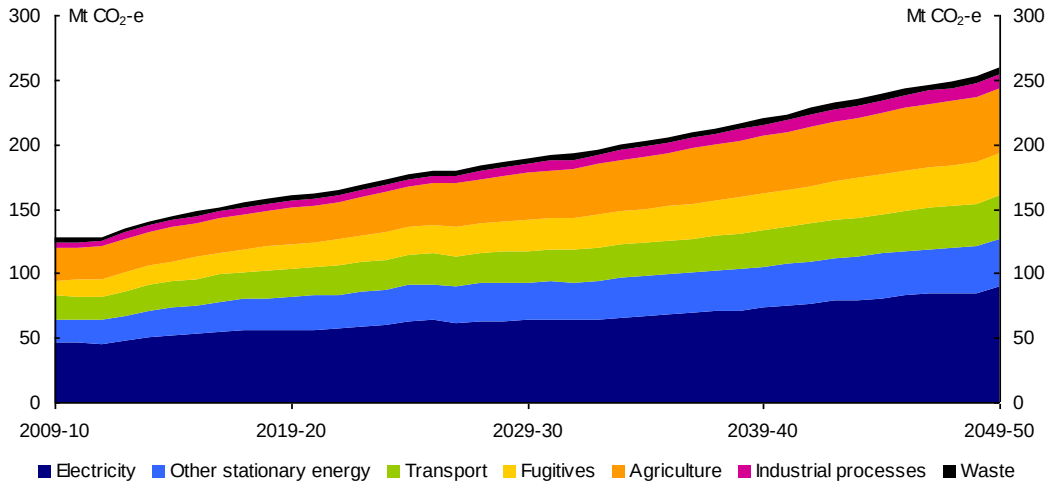
Achieving meaningful greenhouse gas reductions in Queensland will be a difficult task and not without costs, particularly over the longer term. Queensland has a rapidly growing, dispersed population, and an energy-intensive economy that is heavily reliant on fossil fuel energy sources, both for domestic and export industries.

However, not addressing climate change also poses potential costs to Queensland's economy and industrial structure.

The *Garnaut Climate Change Review* (2008), which was the first extensive assessment of the impacts of climate change on the Australian economy, found that the economic costs of unmitigated climate change would be far higher than the costs of mitigation. For Australia, and particularly Queensland, climate change could severely affect agriculture, infrastructure, biodiversity and ecosystems (Garnaut, 2008). The Garnaut Review estimated that Queensland would be the State most affected by unmitigated climate change, reducing Queensland's GSP by about 10 per cent by 2100, compared with 6 per cent for the rest of Australia.

Queensland has one of the highest per capita greenhouse gas emission levels in the world and is responsible for 30 per cent of Australia's carbon emissions, while having only 20 per cent of the national population. Based on current trends, Queensland's greenhouse gas emissions are projected to more than double by 2050.

Figure 2: Queensland Emissions by sector



N.B. This chart does not include emissions from land use change or offsets from forestry

Source: Office of Economic and Statistical Research Modelling

Queensland's industrial structure is relatively more emissions-intensive than other parts of Australia due, to some extent, to the contribution of manufacturing industries such as alumina and aluminum production, petroleum refining, and energy extraction.

Historically high emissions from land clearing have also contributed to Queensland's per capita emissions significantly exceeding the national average, although emissions from land clearing are continuing to decline due to recent land clearing restrictions. However, these gains are expected to be offset by significant growth in emissions from stationary energy, driven by population growth and increasing residential electricity demand.

2 Economic Analysis

2.1 Australian Treasury modelling

The Australian Treasury has calculated the impacts of a carbon price at the national, industry, household and, to a lesser extent, state level, using CGE modelling.

This involved consideration of a range of different scenarios under which action is taken by both Australia and the world to reduce greenhouse gas emissions.

In particular, the domestic core policy and high price scenarios considered respective reductions in greenhouse gas emissions of at least 5 per cent and 25 per cent below 2000 levels by 2020, and 80 per cent below 2000 levels by 2050 for both scenarios.

Two international global action scenarios were also developed to model the path of the Australian economy before accounting for the impacts of a domestic price on carbon. The medium and ambitious global action scenarios respectively assume the world takes action to stabilise greenhouse gas concentration levels at 550 ppm (used in the core policy scenario) and 450 ppm (used in the high price scenario) by around 2100.

The domestic core policy and high price scenarios assume that Australian emissions will face different prices (starting at A$20 and A$30 respectively) from 1 July 2012, increasing at a fixed rate each year (5 per cent plus inflation) before the introduction of an emissions trading scheme on 1 July 2015.

The modelling takes into account carbon price exclusions for light passenger and commercial vehicles, agriculture, forestry (in terms of mandatory liability for emissions), decommissioned mines, legacy waste and emissions of synthetic gases.

2.1.1 Key Australian Treasury results

Key results from the Australian Treasury's core policy modelling are summarised below.

Economic growth	• GDP reduced by 0.3 per cent to 2019-20, and 2.8 per cent by 2049-50.
Inflation	• Increase in headline CPI of 0.7 per cent in 2012-13 and further increase of 0.2 per cent in 2015-16. • Total impact on headline CPI of 0.9 per cent over the next four years (driven by higher electricity, gas and fuel prices).
Employment	• For more than 95 per cent of the economy, employment changes (up or down) of less than 1 per cent by 2019-20.

The current Australian Treasury modelling found more modest economic impacts than the previous Carbon Pollution Reduction Scheme (CPRS) modelling undertaken in 2008, which estimated a 1.1 per cent reduction in GDP by 2019-20.

The difference is primarily due to a lower carbon price, slower emissions growth, and the inclusion of global action in the business as usual (BAU) scenario.

Under the CPRS, the effective domestic price of carbon (real) was forecast to be around $40/t at the end of 2019-20, however a domestic carbon price of around $29/t is expected under the CEF plan. The lower carbon price is the result of updated modelling assumptions including a higher terms of trade and exchange rate.

The higher assumed terms of trade (30 per cent higher compared to CPRS modelling) and exchange rate have the effect of reducing the domestic price of carbon, which is set internationally (from the flexible trading period).

With regard to baseline emissions growth, the carbon price modelling assumes BAU emissions rise to 679Mt by 2019-20, compared with 774Mt in the CPRS modelling. Given the mitigation target is the same under both schemes, the abatement effort required under the CEF plan is significantly lower (95Mt). The difference in BAU emissions growth is primarily the result of lower global production growth (due to lower assumed demand for energy/emission-intensive goods and services).

In addition, the carbon price modelling is undertaken in the context of greater global climate change action (given the increase in countries making pledges to undertake mitigation action since 2008). This is assumed to have the effect of increasing the availability of international permits, and lowering the cost of domestic mitigation.

2.1.2 Australian Treasury - Queensland analysis

With regard to the state analysis, only high level GSP growth rates were released by the Australian Treasury. In addition, a lower-level analysis of electricity pricing across each jurisdiction, including pool price and retail electricity price impacts, was also provided.

Gross State Product

Without a carbon price, the Australian Treasury projects that Queensland's GSP will grow at an average annual rate of 3.6 per cent per annum to 2019-20. This is just behind Western Australia and the Northern Territory, with annual average GSP growth rates of 4.3 and 3.8 per cent respectively.

Comparatively, under the core policy scenario, the Australian Treasury's modelling indicates that Queensland's GSP would be reduced by 0.3 percent compared to BAU in 2019-20 (in line with 0.3 per cent for all of Australia), and by 3.7 per cent in 2049-50 (compared to 2.8 per cent for all of Australia). It is estimated the Queensland economy will still grow by 3.5 per cent per year through to 2019-20.

Electricity prices

The impacts of carbon pricing on wholesale electricity prices were modelled by the Australian Treasury. Under the core policy scenario, the cost of carbon pricing on existing fossil fuel power plants results in an average increase of $18 per megawatt hour (MWh) to wholesale electricity prices over the period from 2012-13 to 2016-17. This is primarily due to the deployment of cleaner, more expensive technologies.

In relation to retail electricity prices, the Australian Treasury estimates that prices in Queensland will be 10 and 20 per cent higher under the core policy and high price scenarios respectively over the five years to 2017, when compared to BAU.

2.2 Queensland Treasury modelling

To assess the economic impacts of the Australian Government's CEF plan for Queensland, modelling was undertaken by OESR in Queensland Treasury.

The modelling results presented in this section are based on the best efforts of OESR to:

- Replicate the modelling scenarios and underlying assumptions used by the Australian Treasury in its report *Strong Growth, Low Pollution: Modelling a Carbon Price* (July 2011) (based on all publicly available information). This is intended to provide a credible basis on which the results for Queensland can be considered alongside those estimated by the Australian Treasury.
- Where relevant, update modelling assumptions to better align with the announced CEF plan. Key updates include the carbon price (starting at $23/t), industry coverage, and compensation arrangements.

It is noted that a number of CEF plan implementation details are yet to be released (i.e. through regulations made under the *Clean Energy Bill 2011*).

The tables below provide a comparison of key core policy national results produced by OESR and the Australian Treasury. The results are broadly similar, with some differences expected to result from updated OESR core policy modelling assumptions (as highlighted above).

Table 1: Key national macroeconomic results from OESR and the Australian Treasury

	GDP reduction in 2020 per cent	GDP reduction in 2050 per cent	GNI reduction in 2020 per cent	GNI reduction in 2050 per cent
Commonwealth Treasury Modelling	0.3	2.8	0.5	4.7
OESR Modelling	0.4	2.5	0.6	4.2

Source: Office of Economic and Statistical Research Modelling

Considerations in interpreting the Queensland Treasury modelling results presented in this section are outlined in Attachment 2.

2.3 Queensland without domestic action

The results in this section represent the expected growth of the Queensland economy in the absence of domestic climate change action, but in the presence of global action, and are based on Australian Treasury BAU modelling assumptions. In this regard, it has been assumed that, despite the actions of other countries to constrain greenhouse gas emissions, there would be no general trading restrictions on Australia if no similar climate change action is taken.

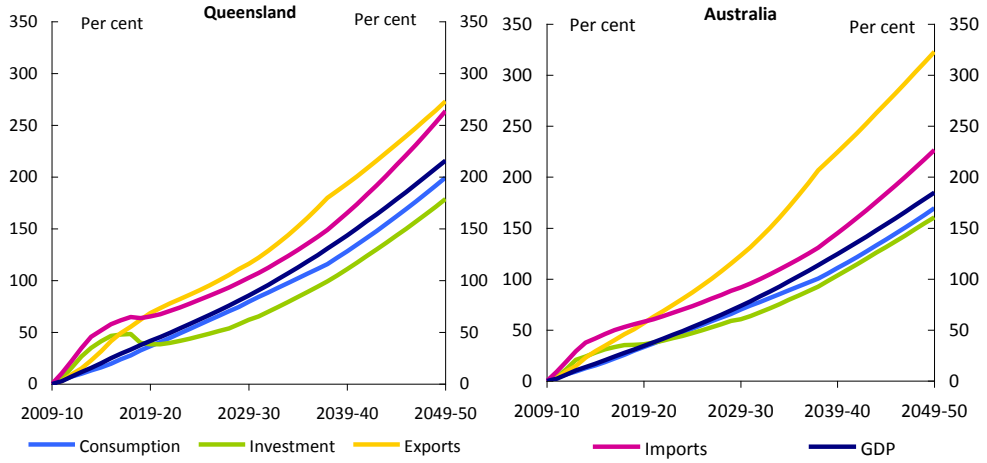
Overall, this analysis shows the growth profile for Queensland's economy and industries is largely similar to the Australian Treasury's findings for Australia.

Like Australia, Queensland is expected to experience significant economic, employment and population growth over the period to 2049-50. At the same time, structural change (particularly the increasing importance of the services sector) is estimated to result from sustained income growth, changes in consumer preferences and technological advancement.

2.3.1 Macroeconomic indicators

Figure 3 shows key macroeconomic indicators for Queensland and Australia under a BAU scenario, where no domestic action on climate change is taken.

Figure 3: Key macroeconomic results (real cumulative per cent change)



Source: Office of Economic and Statistical Research Modelling

Queensland's GSP is estimated to grow by 42 per cent to 2019-20, and nearly 216 per cent to 2049-50 (compared with GDP growth for Australia of around 34 per cent and 185 per cent respectively over the same period). Further, average annual growth in Queensland's real GSP and gross state income (GSI) is expected to be higher than national growth rates over every decade to 2049-50.

Table 2: Average annual growth in headline indicators (per cent)

	Queensland		Australia	
	Real GSP	Real GSI	Real GDP	Real GNI
2009-10 to 2019-20	3.5	3.5	3.0	3.1
2019-20 to 2029-30	2.7	2.4	2.6	2.2
2029-30 to 2039-40	2.8	2.6	2.6	2.2
2039-40 to 2049-50	2.6	2.7	2.4	2.5
2009-10 to 2049-50	2.9	2.8	2.7	2.5

Source: Office of Economic and Statistical Research Modelling

For household consumption and investment, Queensland growth rates are forecast to be marginally above those for Australia by 2019-20, with this trend becoming more pronounced by 2049-50.

Figure 3 also shows a fast ramp up of Queensland investment in the early years in response to strong global demand for exports (particularly mineral resources), followed by a corresponding period of significant export growth. As a result, Queensland exports initially grow at a faster rate than Australian exports (cumulative growth is estimated to be 69 and 57 per cent respectively to 2019-20), however this trend is reversed over the period from around 2027-28 (although strong growth is still expected). By 2049-50, although cumulative growth in Queensland exports is estimated to be significant (273 per cent), the cumulative growth in Australian exports over the same period is estimated to be higher (323 per cent). The substantial growth in the national export industry

includes the impact of Western Australia's growing export industries (e.g. high value iron ore).

In relation to employment, Queensland is forecast to see higher growth in the number of people employed over the periods to 2019-20 and 2049-50 than Australia. Queensland is estimated to see an increase of 474,000 people employed in Queensland to total 2.6 million people by 2019-20 (growth of 22 per cent). By comparison, an increase of around 1.8 million people employed in Australia is expected by 2019-20 (growth of 17 per cent).

Over the period to 2049-50, the number of people employed in Queensland is forecast to total 4.0 million people, compared with 16.9 million people employed in Australia over the same period. From 2009-10, this represents growth for Queensland and Australia of 84 and 57 per cent respectively.

2.3.2 Growth in industries

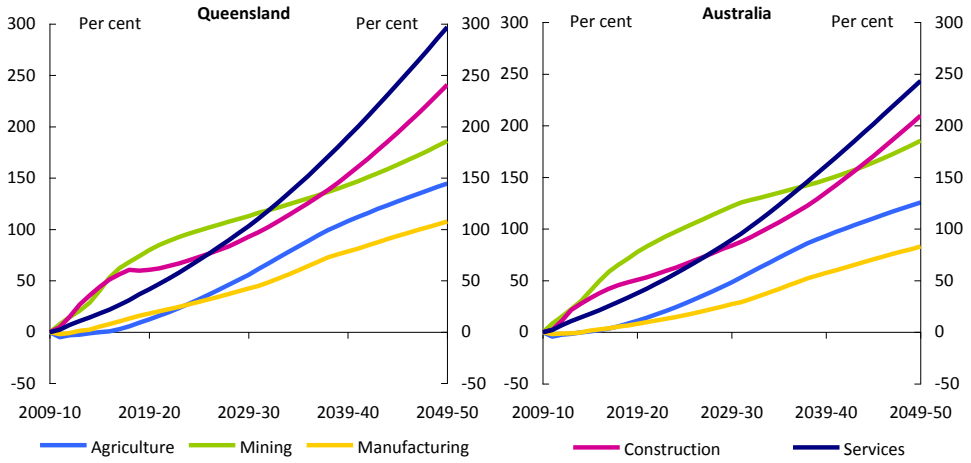
Figure 4 shows industry growth rates for Queensland and Australia without climate change action over the period to 2049-50.

Overall, the shape of industry growth curves for Queensland and Australia are broadly similar, with strong growth in mining and construction expected to 2019-20 (80 and 61 per cent respectively for Queensland). In relation to mining, output growth for Queensland's gas industry is expected to be substantial (i.e. more than 500 per cent to 2019-20).

By 2049-50, growth in all Queensland industries is expected to be above that for Australia.

Growth in output from Queensland's services sector is expected to be significant, increasing by nearly 300 per cent by 2049-50 (compared with growth of around 243 per cent for Australia). As a result, the services sector is expected to constitute a greater proportion of the Queensland economy over time. This is consistent with Australian Treasury modelling that suggested significant services sector growth would result from increasing demand due to a more prosperous Australia and its surrounding region.

Figure 4: Industry growth
(cumulative per cent change in real value added)



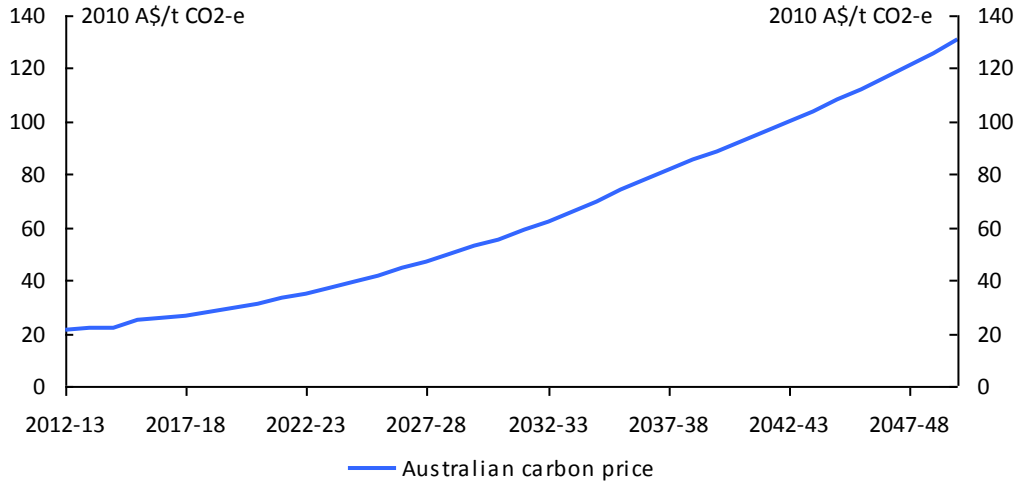
Source: Office of Economic and Statistical Research Modelling

2.4 Queensland with domestic action

The results in this section represent the growth path for the Queensland economy in the presence of domestic and global climate change mitigation action. The results are based on Australian Treasury core policy modelling assumptions (updated where necessary to better align with the Australian Government's announced CEF plan).

The assumed carbon price is shown in Figure 5, which suggests a substantial increase in the real ($2010) carbon price from $21/t in 2012-13 to approximately $29/t in 2019-20, and $131/t in 2049-50.

Figure 5: Carbon price path (real)



Source: Office of Economic and Statistical Research Modelling

2.4.1 Macroeconomic indicators

The impact of carbon pricing on GSP and other key macroeconomic indicators is shown in Table 3. In particular, carbon pricing is estimated to result in Queensland's total real GSP growth being 0.4 per cent lower by 2019-20, and 3.5 per cent by 2049-50

(compared to BAU). By comparison, carbon pricing impacts at the national level are broadly similar to 2019-20 (0.4 per cent is expected to 2019-20), while the impact on GDP by 2049-50 of 2.5 per cent is less than the GSP impact for Queensland.

Table 3: Change to key macroeconomic indicators with carbon pricing (cumulative per cent deviation from BAU)

	2019-20		2049-50	
	Queensland Per cent	Australia Per cent	Queensland Per cent	Australia Per cent
Real GSP/GDP	-0.4	-0.4	-3.5	-2.5
Real GSI/GNI	-0.4	-0.6	-4.7	-4.2
Employment	0.0	-0.1	-1.0	-0.1
Real wages	-1.3	-1.2	-5.1	-5.1
Real investment	-1.1	-1.1	-5.4	-4.7

Source: Office of Economic and Statistical Research Modelling

The modelling clearly indicates that, with carbon pricing, Queensland economic and employment growth is still expected to be strong (see Table 4 below). Queensland's real GSP is expected to total $359 billion by 2019-20 (compared to $361 billion without carbon pricing), and $777 billion by 2049-50 (compared to $805 billion without carbon pricing). While total employment is not expected to be significantly impacted by carbon pricing, there are likely to be compositional shifts in industry employment (discussed further below).

Table 4: Absolute GDP/GSP and employment growth

Without carbon pricing

	Real GDP ($'000 billion)		Employment ('000 people)	
	Queensland	Australia	Queensland	Australia
2009-10	255	1,291	2,150	10,766
2019-20	361	1,735	2,625	12,550
2049-50	805	3,679	3,954	16,945

With carbon pricing

	Real GDP ($'000 billion)		Employment ('000 people)	
	Queensland	Australia	Queensland	Australia
2009-10	255	1,291	2,150	10,766
2019-20	359	1,727	2,625	12,538
2049-50	777	3,589	3,913	16,924

Source: Office of Economic and Statistical Research Modelling

Table 5: Change to key macroeconomic indicators with carbon pricing (cumulative per cent change)

	2019-20		2049-50	
	Queensland Per cent	Australia Per cent	Queensland Per cent	Australia Per cent
Real GSP	41.0	33.8	204.9	177.9
Employment	22.0	16.5	82.0	57.2
Real wages	16.1	20.3	33.8	49.2
Real investment	36.9	34.6	163.6	148.3

Source: Office of Economic and Statistical Research Modelling

Over the period to 2019-20, average annual GSP growth is expected to be 3.5 per cent both with and without carbon pricing. Average annual employment growth is also estimated to be the same both with and without carbon pricing (2.0 per cent per annum).

Over the period to 2049-50, average annual GSP growth is expected to be 2.8 per cent with carbon pricing, and 2.9 per cent without carbon pricing. This is marginally higher than estimated average annual GDP growth for Australia of 2.6 per cent with carbon pricing, and 2.7 per cent without carbon pricing.

Table 6: Average annual growth in headline indicators

	2009-10 to 2019-20		2009-10 to 2049-50	
	Queensland	Australia	Queensland	Australia
Without domestic action				
Real GSP/GDP	3.5	3.0	2.9	2.7
Real GSI/GNI	3.5	3.1	2.8	2.5
Real Consumption	3.2	2.9	2.8	2.5
Real Wages	1.6	2.0	0.9	1.1
Employment	2.0	1.5	1.5	1.1
With domestic action				
Real GSP/GDP	3.5	3.0	2.8	2.6
Real GSI/GNI	3.4	3.0	2.7	2.4
Real Consumption	3.1	2.9	2.7	2.4
Real Wages	1.5	1.9	0.7	1.0
Employment	2.0	1.5	1.5	1.1

Source: Office of Economic and Statistical Research Modelling

Overall, the modelling shows that the carbon pricing impact on key Queensland macroeconomic variables is broadly consistent with the expected impact on national macroeconomic indicators to 2019-20. Queensland's cumulative GSP growth to 2019-20 is estimated to be 41 per cent, compared to cumulative GDP growth for Australia of 34 per cent over the same period.

Although the impacts on GSP/GDP resulting from carbon pricing are the same for Queensland and Australia to 2019-20, the effect on Queensland's real GSI is forecast to be slightly lower than the impact on Australia's GNI to 2019-20. Much of the difference between GDP/GNI impacts is explained by international trade in carbon permits, which is not captured in GDP results.

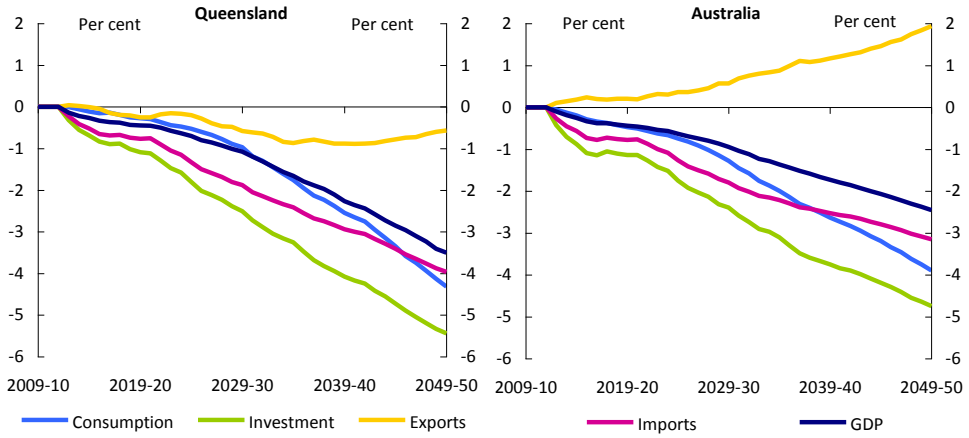
The macroeconomic results to 2019-20 differ from previous modelling (i.e. in relation to the CPRS) suggesting that Queensland would be disproportionately impacted by domestic action on climate change, given the prevalence of highly emissions/energy intensive industries.

The difference is primarily due to the fact that the results in this section are based on Australian Treasury core policy assumptions, which do not separately model the impacts of global climate change action (i.e. lower demand for Queensland exports), given global action is included in the BAU scenario. OESR sensitivity modelling indicates that Queensland is likely to be much more affected by global action than Australia (see section 2.5 below).

In addition, part of the difference between current and CPRS modelling results can be explained by compensation for Queensland EITEs (particularly those that are relatively less emissions-intensive than the industry average). However, it is noted that some uncertainty still surrounds the practical application of Australian Government assistance measures, particularly as the Productivity Commission begins to review the announced arrangements from 2017-18.

Over the period to 2049-50, macroeconomic impacts for both Queensland and Australia are estimated to be more pronounced as the carbon price substantially increases to around $131/t ($2010). By 2049-50, carbon pricing impacts across all Queensland macroeconomic indicators are estimated to be higher than national indicators. In particular, the impact on Queensland GSP by 2049-50 is 3.5 per cent, compared to 2.5 per cent for Australia. This reflects the unwinding of EITE assistance and reduced EITE competitiveness, and Queensland's underlying emissions-intensive industry structure.

Figure 6: Change to key macroeconomic variables (cumulative per cent deviation from BAU)



Source: Office of Economic and Statistical Research Modelling

As expected, Figure 6 shows that emissions-intensive Queensland exports are expected to be more affected by domestic carbon pricing than national exports. However, based on Australian Treasury assumptions, overall impacts on Queensland exports are estimated to be relatively insignificant (0.3 and 0.6 per cent lower by 2019-20 and 2049-50 respectively compared to BAU), with national exports expected to benefit from carbon pricing (1.9 per cent higher by 2049-50 compared to BAU). This is due to the estimated depreciation of the exchange rate, making Australian exports relatively more competitive. One of the key factors expected to impact the exchange rate is the flow of domestic income overseas through the purchase of foreign carbon permits.

However, as noted above, the impact of global climate change action on exports has not been separately identified in these results.

The modelling results indicate that carbon pricing is expected to have a negligible impact on Queensland employment to 2019-20, with an additional 474,000 jobs expected by 2019-20 with carbon pricing.

Real wages are projected to be lower by around 1.3 per cent by 2019-20 than otherwise expected without carbon pricing, and 5.1 per cent lower by 2049-50. This is broadly in

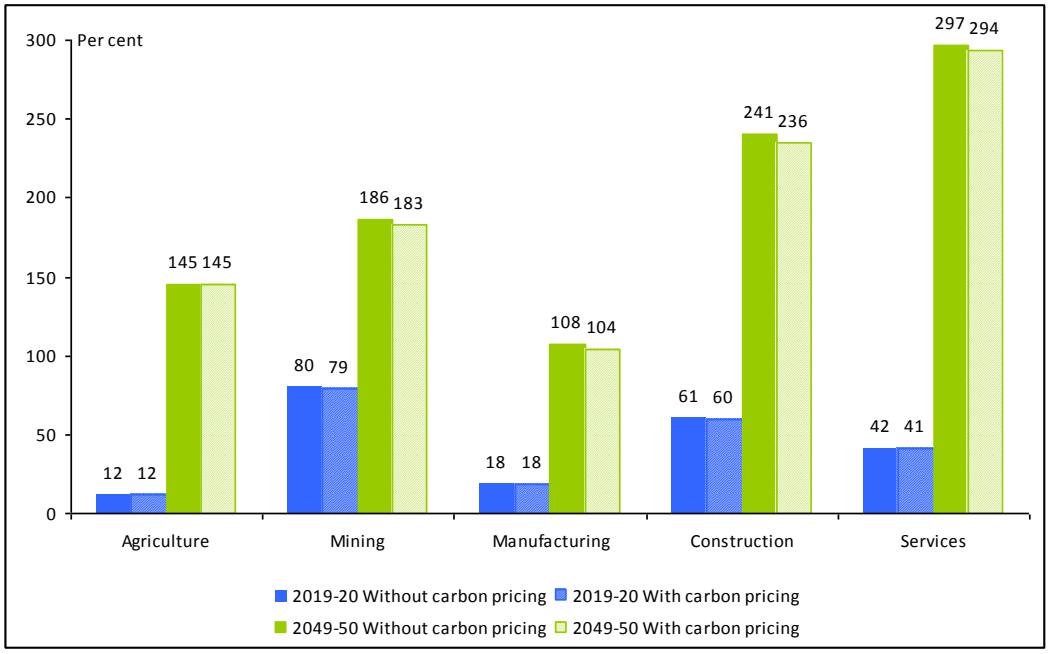
line with impacts on wages growth for Australia of 1.2 per cent by 2019-20, and 5.1 per cent by 2049-50.

This modelling outcome is the result of the assumption that real wages will adjust over time to bring labour markets into equilibrium. Further, the modelling assumes that labour is perfectly mobile across the economy (see Attachment 2).

2.4.2 Growth in industries

Figure 7 shows that, despite carbon pricing, all Queensland sectors will continue to see significant growth over the period to 2049-50, albeit at lower levels than otherwise expected. This suggests only relatively small changes to the structure of the Queensland economy, noting however that these modelling estimates do not separately identify impacts from global action on climate change.

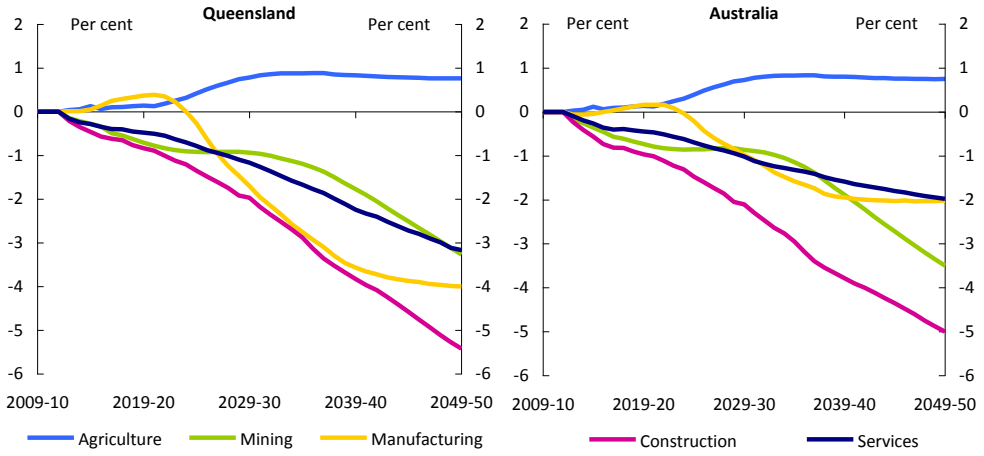
Figure 7: Aggregate industry activity, real value added (cumulative per cent change, real value added)



Source: Office of Economic and Statistical Research Modelling

Figure 8 shows the impact of carbon pricing at a broad sectoral level for Queensland and Australia, with all sectors expected to be impacted to varying degrees over the period to 2049-50. Agriculture is the exception in this forecast given its exclusion from the CEF plan.

Figure 8: Change to industry activity, real value added (cumulative per cent change from BAU, real value added)



Source: Office of Economic and Statistical Research Modelling

It is noteworthy that Queensland's mining sector is forecast to be less affected by carbon pricing than Australia. This can be explained, in part, due to the relatively lower emissions intensity of Queensland coal mines. However, lower output for Queensland of 0.7 and 3.3 per cent by 2019-20 and 2049-50 is still expected (compared with 3.5 per cent for Australia by 2049-50).

A full set of industry output results is provided at Attachment 3.

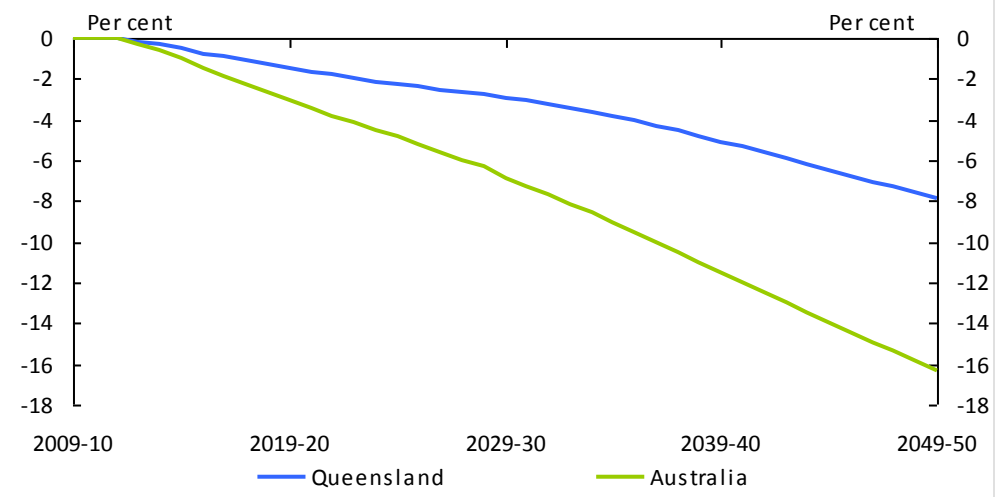
Queensland Coal Industry

Direct emissions from the coal industry mainly arise from fugitive emissions embedded in coal seams and, to a lesser extent, from its use of fuel (mainly diesel). Emissions for coal produced in Queensland are approximately 0.067 tonnes CO2-e per tonne of coal produced. At a carbon price of $23/t this would raise production costs by around $1.50/t for the average mine.

Queensland mines are significantly less 'gassy' than the Australian average (as measured by emissions per dollar of output). This mainly reflects the higher share of open cut mining in production from Queensland mines.

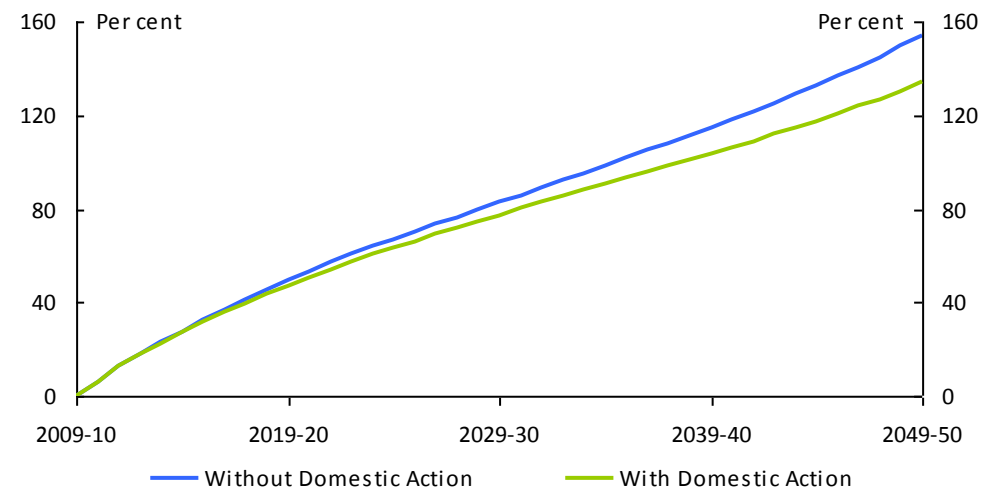
Figure 9 shows that coal output is projected to be lower by around 1.5 per cent by 2020, relative to BAU. Figure 10 provides cumulative growth for Queensland coal industry activity and illustrates that, while coal industry activity will be impacted by domestic carbon pricing, growth is still projected to be strong over the period to 2049-50.

Figure 9: Change to coal industry activity
(cumulative per cent change from BAU, real value added)



Source: Office of Economic and Statistical Research Modelling

Figure 10: Queensland coal activity
(cumulative per cent change, real value added)



Source: Office of Economic and Statistical Research Modelling

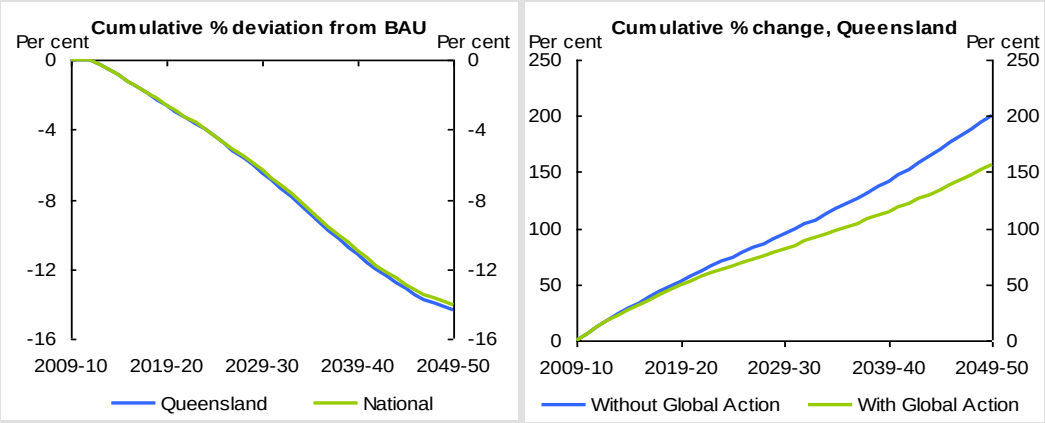
Further, the results show that the Queensland coal industry is significantly less affected than the Australian coal industry. This is primarily due to the lower concentration of fugitive emissions from coal mining in Queensland, and hence, a lower carbon price impost on production. While this reflects emissions data in the National Greenhouse Gas Inventory (NGGI), the high degree of variability in fugitive emissions from mine to mine may introduce a significant level of uncertainty about future emissions. Hence, results should be treated with some caution, particularly given the rapid expansion of coal production in Queensland. It should also be noted that the modelling does not include any assistance measures for the coal industry and, as a result, estimates may slightly overstate the impact of carbon pricing in the years 2011-12 to 2016-17 when the Australian Government's assistance package for gassy coal mines is in operation.

Impact of global action on the Queensland coal industry

As noted above, global action is included in the BAU scenario and, as a result, the impacts of global action alone are not shown in the results presented above.

OESR has estimated the impact of global action on Queensland's coal industry through reduced global demand for coal. The results, shown in Figure 11 below, indicate that global action is likely to have larger implications for the Queensland coal industry than domestic action, which reflects the export focus of Queensland coal production. In particular, global action is projected to result in Queensland coal industry output being 2.6 per cent lower by 2019-20, relative to a scenario with no global action. That is, in addition to this, domestic carbon pricing would result in coal output being lower by 1.5 per cent by 2019-20.

Figure 11: Change to coal industry activity



Source: Office of Economic and Statistical Research Modelling

Deloitte Access Economics – Industry Snapshot

As well as the general equilibrium industry modelling undertaken by OESR, Deloitte Access Economics undertook a commercial oriented review of carbon price risks to key Queensland industries. A summary of Deloitte Access Economic's findings is below.

Coal sector

- The Queensland coal sector is heavily dominated by the production of coking coal for export. The key long-term global driver for coking coal is growth in rapidly industrialising Asian markets, which is resulting in strong demand for steel-making raw materials.
- Global demand conditions are supportive at present, and this is expected to continue over the longer term. However, even without a carbon price, it is likely that not all proposed projects would proceed, given other commercial factors and variables.
- While the fugitive emissions profile for prospective coal projects is not known, on the basis of current production and cost factors, there does not appear to be substantial risk of large reductions in capacity investments. Rather, it is the demand side factors over the longer term that are most critical.
- The analysis has generally been conservative. It has used a carbon price of $100/t for its scenarios, and this is not likely to be reached until well past 2030. In addition, it has modelled relatively high emissions intensities for coal production.
- New developments may be higher (or lower) cost than the existing cost structure (noting the industry argues they will be higher). In addition, the relatively high coal prices at present may bring forward unexpected new international supply. These are factors that have not been modelled because of their uncertainty.

LNG

- A number of very large LNG projects are expected, committed and under construction in Queensland, however the industry has yet to commence production.
- While carbon emissions from LNG production vary by project, prices are expected to be above long-run marginal costs for most facilities, and LNG projects are likely to remain profitable (particularly given assistance to the industry covering 50 per cent of annual carbon emissions). This aligns with recent project announcements.
- The ability for Australian producers to pass on additional carbon price costs to overseas customers is expected to be extremely limited (especially given the long-term nature of supply contracts). Overall, the impost of the carbon price is likely to be fully absorbed by producers.
- The carbon price is unlikely to have a substantial adverse impact on the Queensland LNG sector and its forward investment plans. Other commercial issues, including technical supply issues with CSG and escalating costs of production, are likely to be far more significant investment factors for the sector.

Road transport

- Road transport is the dominant form of transporting most freight in Queensland and Australia, principally in the non-bulk and time-sensitive freight task. The sector is characterised by low profit margins, mainly driven by the high level of competition between operators and relatively low entry barriers.
- On the basis of available cost information across the sector, a carbon price applying to the fuel inputs of heavy road transport operators is unlikely to add considerably to their overall cost structure. Average cost increases range from $83 per year (light commercial vehicles), $200 per year (rigid trucks) and $1,800 per year (larger articulated trucks).
- Any potential cost impacts should also be considered in the context of changes in the price of fuel. The additional costs from a carbon price are likely to be within the scale of fuel price increases already observed in the market over recent years.
- For smaller operators which dominate the industry, the commercial impacts could be more pronounced as they tend to have fewer avenues for reducing overheads and securing network efficiencies.
- This is likely to drive some network efficiencies within a wider and integrated 'door to door' network, as opposed to small freight companies or owner operated trucks. This has been a trend in the industry over some years with the emergence of vertically integrated freight companies. This may lead to further consolidation in the industry.

Agriculture

- The Carbon Farming Initiative is likely to deliver additional opportunities for agricultural producers to generate new sources of revenue, and reduce their emissions intensity. As the agricultural sector generates a significant proportion of emissions, the opportunities for carbon sequestration and adoption of less emissions-intensive land use patterns may deliver significant benefits for the sector.
- While the sector is characterised by a large number of family operated farms, industry production is concentrated in larger commercial farms.
- These larger enterprises may also have greater ability to generate tradable carbon credits, especially early in the commencement of the scheme when carbon offset markets in Australia are still being developed. There are likely to be some upfront capital investments required to secure the emissions abatements necessary to obtain certified credits. Such investments are more likely to be undertaken in larger agribusinesses.
- Over time, the most cost effective abatement practices (should they prove commercially viable) may filter down into smaller farms as they become more widely accepted and possibly involve lower costs and risks.

Tourism

- More price sensitive domestic holiday makers may be influenced by increased costs of domestic air travel. International travel is relatively unaffected by the carbon price, as is light vehicle travel. The planned aviation fuel increases may have significant impacts on small businesses that use light air or helicopters.

See the Deloitte Access Economics report for more detailed analysis.

2.5 Queensland with domestic action – sensitivity analysis

As well as the updated core policy scenario, the OESR modelling includes two non-Australian Treasury based modelling sensitivities, namely:

- *Global action* – that is, the impact of global action alone, given the core policy analysis shows the combined impact of global and domestic climate change action; and
- *Lower commodity prices* – that is, the impact of carbon pricing on Queensland's economy in the event that international commodity prices (and Australia's terms of trade/exchange rate) are lower over the period to 2019-20 than assumed under the core policy scenario.

2.5.1 Global action

The impact of global action to reduce greenhouse gas emissions on Queensland and Australia has been assessed by removing the level of global action assumed by the Australian Treasury from the BAU scenario.

The results show that Queensland is more adversely impacted by global action than the rest of Australia, with Queensland GSP and GSI lower by 0.2 and 0.4 per cent respectively by 2019-20, compared to minimal impacts on GDP/GNI indicators for Australia.

Global climate change action is expected to reduce demand for Queensland's emission-intensive exports (particularly coal), leading to flow on impacts for investment and employment.

Importantly, these impacts will be in addition to the core policy carbon pricing impacts outlined in section 2.4. That is, by 2019-20, the total impact of global and domestic climate change action on GSP/GDP is estimated to be -0.6 and -0.4 per cent for Queensland and Australia respectively.

Table 7: Headline impacts from global action (cumulative per cent deviation from no action)

	2019-20		2049-50	
	Queensland Per cent	Australia Per cent	Queensland Per cent	Australia Per cent
Real GSP/GDP	-0.2	0.0	-1.9	-0.9
Real GSI/GNI	-0.4	0.0	-4.0	-2.1
Real wages	0.2	0.1	-1.3	-1.4
Real investment	-1.0	-0.2	-5.2	-3.3
Employment	-0.4	0.0	-1.2	-0.1

Source: Office of Economic and Statistical Research Modelling

Further, by 2049-50, the adverse impacts of global climate change action on both Queensland and Australia are expected to increase, with GSP/GDP expected to be lower by 1.9 and 0.9 respectively.

The impact on Queensland GSI is also estimated to be higher by 2049-50 (-4.0 per cent), and nearly double the impact for Australian GNI. As noted above, GNI captures international trade in carbon permits (which is not captured in GDP results).

Global climate action also is expected to reduce Queensland investment over the longer term (5.2 per cent lower by 2049-50, compared to 3.3 per cent lower for Australia).

2.5.2 Lower commodity prices

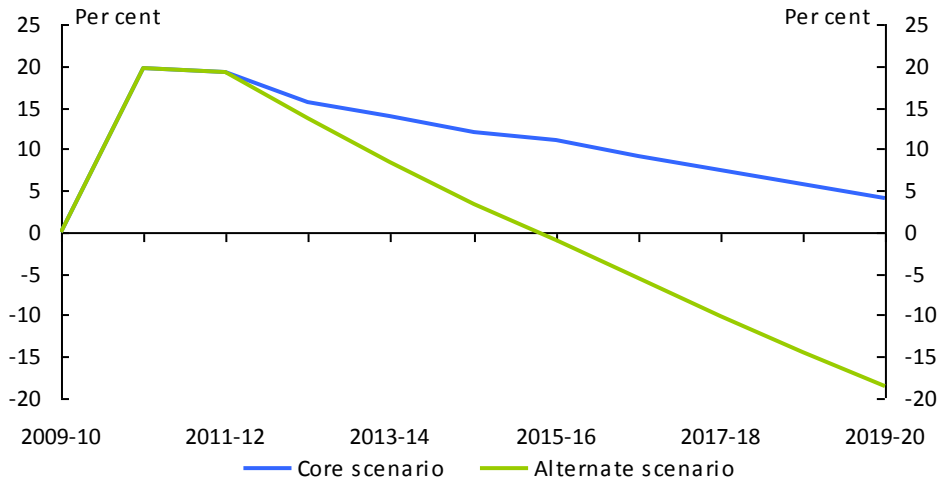
The impact of carbon pricing has been assessed under the scenario in which commodity prices and, as a result, Australia's terms of trade/exchange rate, are lower to 2019-20 than assumed under the core policy scenario.

The core policy modelling results take into account the current historically high levels of Australia's terms of trade and exchange rate. As noted above, this will have the effect of reducing the domestic price of carbon, which is set internationally from the flexible trading period. As such, assumptions around Australia's terms of trade and exchange rate will significantly affect the overall level of carbon pricing impacts on the Queensland and Australian economies.

Although the core policy scenario assumes that Australia's terms of trade and exchange rate will decline over time, the rate of decline is assumed to be relatively slow (see Figure 12). As a result, a sensitivity analysis has been undertaken to assess the impact of a more rapid terms of trade decline, such that average historical levels are returned to by 2019-20. This is assumed to occur through a decline in international demand for key commodities (i.e. coal and gas) and hence lower commodity prices.

The terms of trade assumptions for this alternative scenario and the core scenario are provided below in Figure 12.

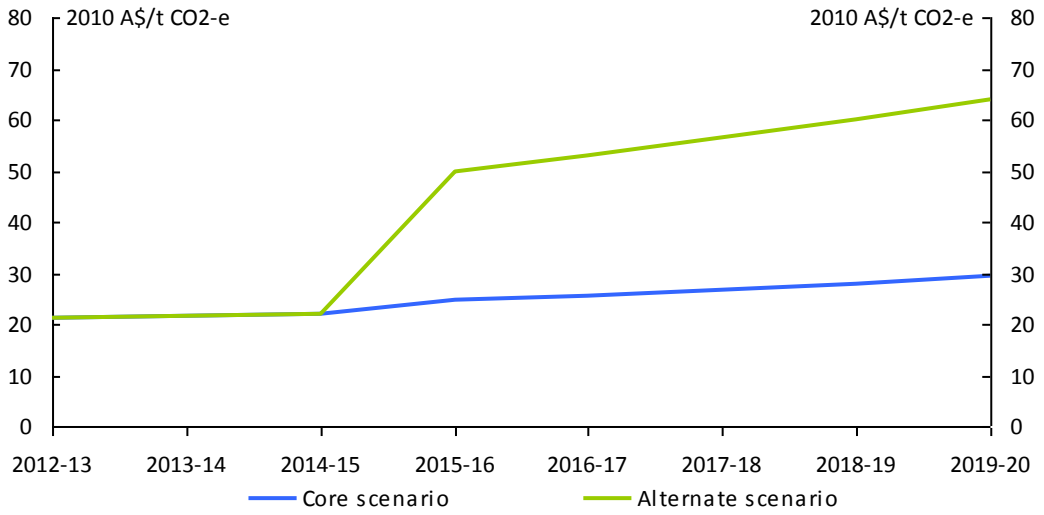
Figure 12: Terms of trade



Source: Office of Economic and Statistical Research Modelling

As shown in Figure 13 below, the assumed changes to commodity prices and foreign demand result in the significant depreciation of the exchange rate, and an increase in domestic carbon prices, relative to the core policy scenario. In particular, the real domestic price of carbon ($2009-10) is estimated to increase from around $29/t to over $60/t in 2019-20.

Figure 13: Carbon prices



Source: Office of Economic and Statistical Research Modelling

Key macroeconomic results for the core and lower commodity prices (alternative) scenarios are provided in Table 8 below. For Queensland and Australia, GSP/GDP impacts are expected to double by 2019-20, with growth estimated to be 0.8 per cent lower. Queensland investment is also expected to be more adversely impacted by 2019-20 (-1.9 per cent).

Table 8: Headline results, core and alternative scenarios (cumulative per cent deviation)

	Core policy scenario		Lower commodity prices	
	Queensland Per cent	Australia Per cent	Queensland Per cent	Australia Per cent
Real GDP	-0.4	-0.4	-0.8	-0.8
Real GNI	-0.4	-0.6	-0.7	-1.0
Real wages	-1.3	-1.2	-1.8	-1.7
Real investment	-1.1	-1.1	-1.9	-2.1
Employment	0.0	-0.1	0.0	-0.2

Source: Office of Economic and Statistical Research Modelling

2.6 Queensland regions with domestic action

Using the Australian Treasury core policy assumptions, the regional impacts of carbon pricing have been assessed by further disaggregating the state-level general equilibrium modelling results[1]. There are some limitations associated with disaggregation, which mean the results outlined in this section should be treated with some caution, particularly over the longer term (i.e. after 2019-20). Limitations include:

- while the methodology accounts for regional variations based on demographic factors, local/external drivers of industry demand, and construction activity, it is not possible to capture all regional variations through the general equilibrium modelling (such as the impacts of individual mine or factory closures). This is likely to lead to a discrepancy between actual and modelled carbon pricing impacts, particularly in those regions where economic activity is concentrated in only a few industries/businesses;
- determining the level of private investment by statistical division, and the probability of specific projects occurring over the projection period, is unlikely to be exact; and
- the data available to underpin regional analysis is typically poor, with industry level estimates subject to high standard errors.

Table 9 shows the impact of carbon pricing on Queensland statistical divisions.

Table 9: Impacts of carbon pricing on statistical division activity output (cumulative per cent deviation from BAU)

	2019-20	2049-50
Brisbane	-0.1	-2.5
Gold Coast	-0.5	-3.2
Sunshine Coast	-0.6	-3.3
West Moreton	0.1	-0.4
Wide Bay Burnett	-0.3	0.8
Darling Downs	-0.2	1.8
South West	-0.1	2.6
Fitzroy CentralWest	-0.6	-8.2
Mackay	-1.1	-5.7
Northern	-0.6	1.7
Far North	-0.1	1.1
North West	-0.3	-2.1

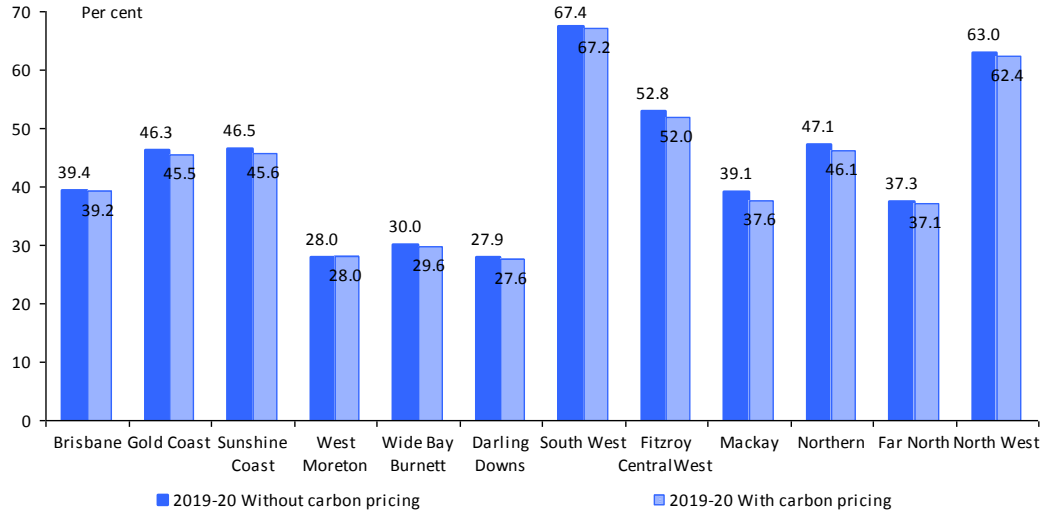
Source: Office of Economic and Statistical Research Modelling

Over the period to 2019-20, the impact of carbon pricing on output across Queensland regions is expected to range between 0.1 per cent (higher) and -1.1 per cent (lower).

[1] This regional module has been developed using similar methods used to produce OESR's regional employment projections (see OESR, 2010, Queensland Employment Projections by Industry and Statistical Division 2009-10 to 2011-12). Available at http://www.oesr.qld.gov.au/subjects/economy/labour/index.php

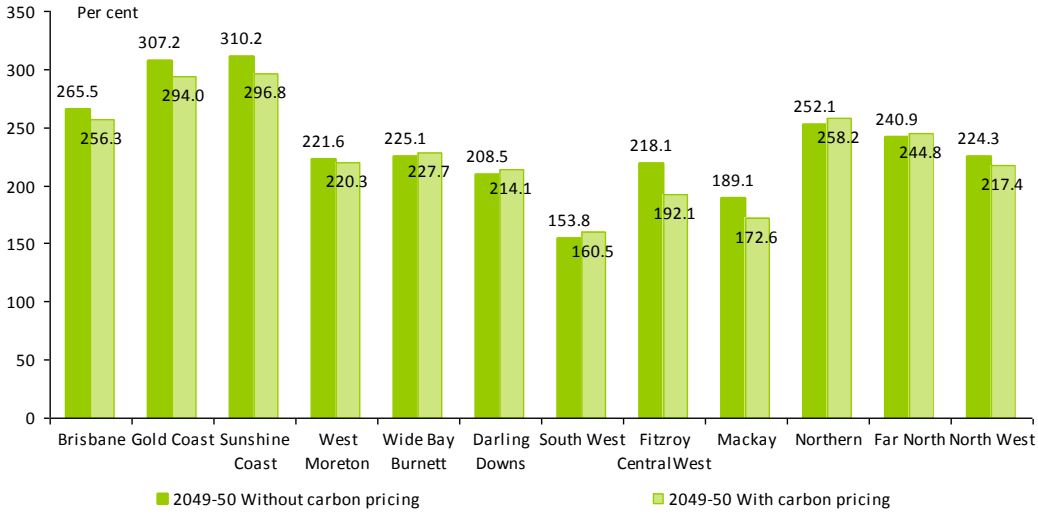
Overall, impacts are expected to increase over the period to 2049-50. However, strong growth is still expected across Queensland regions with and without carbon pricing (as shown in Figure 14 and Figure 15).

Figure 14: Growth in statistical division activity to 2019-20 (cumulative per cent change from 2009-10)



Source: Office of Economic and Statistical Research Modelling

Figure 15: Growth in statistical division activity to 2049-50 (cumulative per cent change from 2009-10)

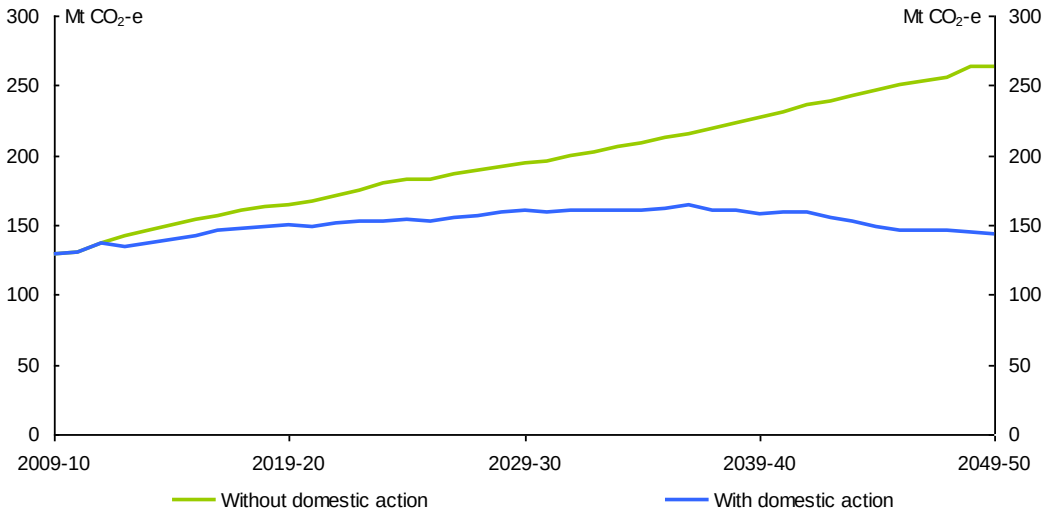


Source: Office of Economic and Statistical Research Modelling

3 Queensland Emissions Abatement

As a result of carbon pricing, total Queensland emissions are expected to be around 13 $MtCO_2$-e lower than BAU by 2019-20, and 120 $MtCO_2$-e lower by 2049-50. Following the introduction of a carbon price, total emissions are expected to remain relatively stable at 151 $MtCO_2$-e by 2019-20, and 144 $MtCO_2$-e by 2049-50 (Figure 16).

Figure 16: Queensland Emissions

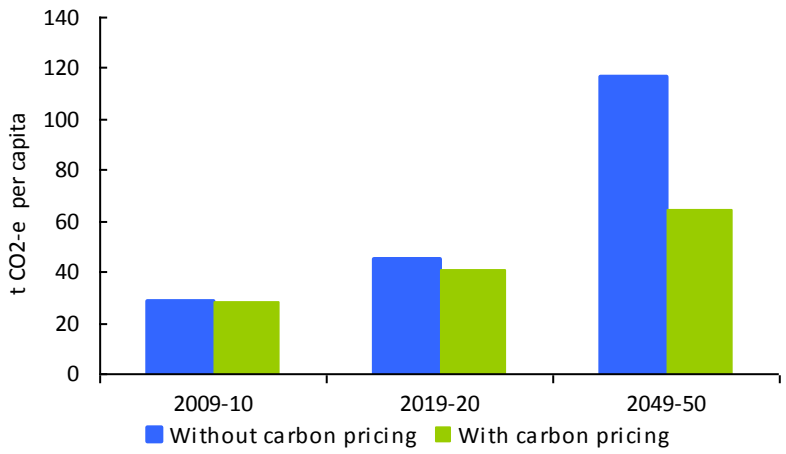


N.B. This chart does not include emissions from land use or offsets from forestry

Source: Office of Economic and Statistical Research Modelling

The table below shows the reduction in per capita emissions with the introduction of carbon pricing. By 2049-50, emissions are estimated to be around 64 tCO_2-e/per person, compared with around 116 tCO_2-e/person without carbon pricing (Figure 17).

Figure 17: Queensland Per Capita Emissions (cumulative deviation from 2010)



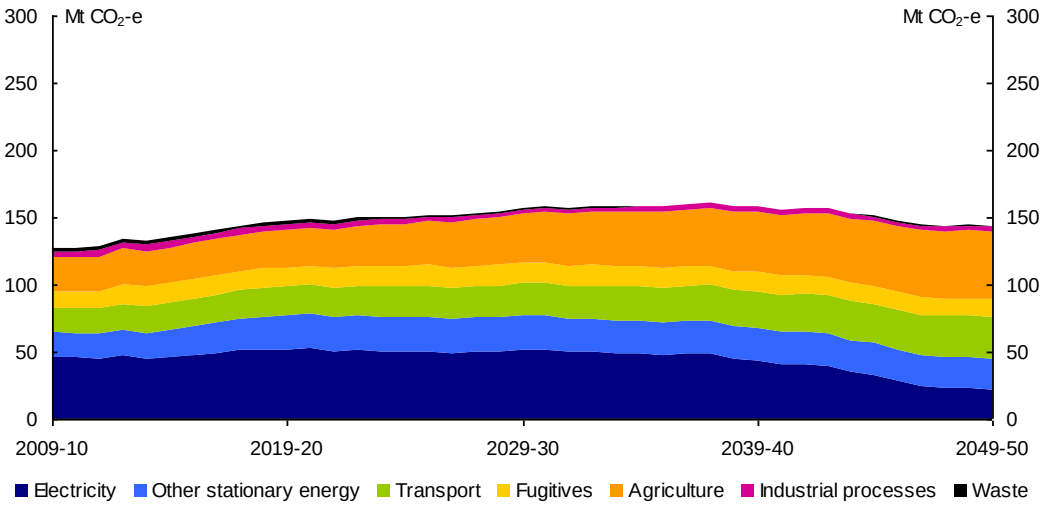
Source: Office of Economic and Statistical Research Modelling

Like Australia, a significant proportion of Queensland emissions abatement will be achieved through the purchase of foreign permits. This is expected to result in a large

flow of domestic income offshore, significantly contributing to the forecast decline in the terms of trade, exchange rate and real income over the period to 2049-50.

Figure 18 and Table 10 below show changes in emissions across key sectors with the implementation of carbon pricing. As expected, much of the reduction in Queensland emissions will come from the energy sector.

Figure 18: Queensland Emissions by sector (carbon pricing)



Source: Office of Economic and Statistical Research Modelling

Table 10: Emissions by source, with and without domestic carbon pricing

		Without domestic action		With domestic action	
	2009-10	2019-20	2049-50	2019-20	2049-50
	Mt $C0_2$-e	Mt $C0_2$-e	Mt $C0_2$-e	Mt $C0_2$-e	Mt $C0_2$-e
Energy	93.9	122.7	193.0	112.6	88.6
Electricity generation	46.0	56.1	89.7	51.9	21.5
Other stationary energy	18.2	25.9	36.1	24.7	22.7
Transport	17.9	21.6	33.8	21.5	31.5
Fugitives	11.7	19.1	33.4	14.5	12.9
Agriculture	25.8	28.2	50.6	28.2	50.8
Industrial processes	4.2	5.6	10.6	4.2	3.5
Waste	3.0	3.4	5.3	1.7	0.6
All sectors	127.0	159.8	259.5	146.7	143.5

N.B. This table does not include emissions from land use or offsets from forestry

Source: Office of Economic and Statistical Research Modelling

For 2011-12, gas-fired generation is forecast to account for around 20 per cent of Queensland on-grid electricity generation. Because of its lower emissions intensity (relative to coal), the introduction of a carbon price is expected to see gas-fired generation's market share increase substantially. Queensland Treasury modelling indicates that, from 2011-12 to 2019-20, the output from gas-fired generators more than doubles and its share of Queensland on-grid generation increases to over 30 per cent. This increase contributes to the steady decline in the average emissions intensity of Queensland generation output over the same period.

4 Fiscal Analysis

4.1 Net fiscal impact – 2012-13 to 2015-16

The carbon price is expected to increase the overall cost of providing State Government services by between 0.31 and 0.4 per cent, and reduce net revenues by between 0.22 and 0.34 per cent.

This combined impact results in an estimated negative impact on the Queensland general government operating balance of around $251 million in 2012-13, rising to $360 million in 2015-16.

Table 11: Summary Fiscal Impacts Update

	2012-13 $M	2013-14 $M	2014-15 $M	2015-16 $M	Total $M
Revenues	(103)	(127)	(168)	(161)	(559)
Expenses	148	156	161	198	664
Operating Balance	(251)	(283)	(329)	(360)	(1,223)

These fiscal projections assume continued delivery of services on a BAU basis, and do not factor in any new or changed activities in response to the introduction of the carbon price.

In this respect, the potential carbon cost incurred (or avoided) will be a key consideration when Government makes future policy and program choices. As such, the potential financial benefits of this form of assessment, and action in mitigating carbon cost, are not yet able to be quantified and have not been factored into this analysis. These are matters for further consideration by the Government in making its policy choices and framing its budgets within a carbon constrained economy. It is also noted that the purpose of putting a price on carbon is to provide a signal which creates incentives to reduce carbon-intensive activities.

The analysis of opportunities to reduce emissions and, following implementation of the carbon price, reduce costs, is a continuation of previous efforts by the Government to seek opportunities to reduce its carbon emissions, including through the Queensland Government's *ClimateSmart 2050 – Queensland Climate Change Strategy*.

The fiscal projections outlined in this section adopt the Australian Government's core policy scenario assumptions. If the sensitivities to this scenario (as considered in Section 2: Economic Impacts) are to have any impact on the Queensland economy, and therefore the State fiscal position, this is expected to largely occur beyond the 2012-13 to 2015-16 period (which is the focus of this fiscal assessment). Fiscal projections exclude potential financing costs associated with changes in cash flows.

States must comply with the *Intergovernmental Agreement on Federal Financial Relations*, under which it was agreed that stamp duty will not apply to carbon trading activities, removing a possible revenue source to mitigate the fiscal impact of the CEF plan on Queensland. However, at this stage it appears that carbon trading will be subject to Federal taxes (i.e. capital gains tax, company tax and income tax).

4.2 Revenues

The decrease in total revenues of between $103 million and $168 million over the period 2012-13 to 2015-16 is the result of a range of partially offsetting impacts on the State's revenue sources. This is a decrease of between 0.22 per cent and 0.34 per cent on total Budgeted revenues which rises from $46.5 to $48.8 billion over this period.

4.2.1 Indirect revenue impact

The introduction of a carbon price is expected to indirectly impact a wide range of Queensland's revenue sources that have linkages to inflation and/or economic activity.

The fiscal projections assume that taxation revenue will be slightly lower in each year of the forward estimates. Economic activity is lower than previously forecast, which will have impacts across a broad range of taxes, and will more than offset anticipated increases in revenue from those fees and charges that increase in line with inflation. The net reduction in taxation is expected to reach almost $20 million by 2015-16. This equates to less than 0.2 per cent of total taxation revenues, which is proposed to reach $13 billion by 2014-15.

GST revenue is expected to be between $60 and $80 million stronger in each year, as increased prices are expected to more than offset the impact of the carbon price on economic activity. This equates to less than 1 per cent of total GST revenues, which are expected to still rise steadily to around $10 to $11 billion per annum during this period.

A range of other revenue items (e.g. goods and services) that are indexed in line with increases in inflation, and certain payments from the Australian Government that have components which are indexed to inflation, are also expected to increase. The total increase is expected to be in the order of $60 million in 2013-14, increasing to around $70 million in 2015-16.

4.2.2 Royalties

With the introduction of a carbon price, it is expected that non-coal fired electricity generation sources will provide a greater proportion of the increase in electricity production than would have otherwise been the case. Accordingly, it is anticipated that the amount of coal required by power stations will be lower than had previously been forecast, with commensurately lower levels of royalty revenue being collected on this coal. It is estimated that this equates to approximately $15 million of royalty revenue over the period 2012-13 to 2015-16, which totals around $3.5 billion per annum.

The carbon price is not expected to materially impact international coal exports within the period out to and including 2015-16. Consequently royalties from these sales are not expected to be impacted.

The reasons for this are:

- around 80 per cent of emissions from existing coal mines come from coking coal mines and, given that coking coal prices are expected to remain much higher than they have been for almost all of the past decade, it is difficult to envisage the carbon price being significant enough to have an impact within the forward estimates; and
- Queensland mines are, in general, considered to have relatively low levels of emissions, and those existing mines that have emissions above 0.1 tonnes of CO_2 per tonne of saleable coal threshold will be able to access the $1.3 billion Coal Sector Jobs Package for up to 80 per cent of their fugitive emissions exposure.

4.2.3 Dividends and tax equivalent payments

The State Government owns significant electricity generation assets through its two Gencos CS Energy Limited and Stanwell Corporation Limited.

The carbon price will have substantial implications for the electricity generation sector, and will fundamentally change the relative cost efficiency of different technologies based on their emissions profiles. Queensland's overall portfolio of generation assets is potentially significantly less competitive in the energy market under the carbon price. This is projected to have a significant impact on the profitability of the State's electricity generating corporations.

Consequently, the revenues that these corporations provide to the Budget to fund other government services, is projected to significantly decline. Compared to the projections included in the 2011-12 State Budget, over the period 2012-13 to 2015-16, returns to Government from its investment in the electricity generation sector are forecast to decline by between $157 million and $276 million per annum. This is a decline on total dividend and tax equivalent payments from Government-owned corporations of between 13 and 17 per cent over this period.

The revised outlook for Gencos financial performance reflects the carbon price and other associated electricity market impact. It is significantly sensitive to the assumptions adopted for demand, new entrants, carbon prices, gas prices and operating cost impacts for the Gencos. More information on the Gencos is outlined in Section 5.

4.3 Expenses

The increase in total expenses of between $148 and $198 million over the period 2012-13 to 2015-16 is the result of a range of direct and indirect impacts on the cost of delivering government policies and programs. This is an increase of between 0.31 and 0.4 per cent on total Budgeted expenses.

4.3.1 Energy cost impact (electricity, gas, fuel)

The primary direct impact on Government activities will be an increase in the cost of energy: principally electricity, gas and fuel.

Directly incurred electricity and gas costs comprise approximately 0.5 per cent of the overall cost of delivering general government sector policy and services. The total Budgeted expense for 2012-13 is $48 billion and direct electricity and gas costs in that year, before the impact of the carbon price, are estimated to comprise approximately $245 million.

Australian Treasury modelling indicates that, as a result of the carbon price only, retail electricity prices could increase by approximately 10 per cent in 2012-13, and gas prices could increase by 9 per cent. This will increase the cost of these energy sources to the State Government by about $25 million in that year.

The largest electricity and gas consumers are in the policy and service delivery areas of Health, Education, Public Works, Transport and Main Roads and Community Safety. These agencies collectively account for over 80 per cent of these energy costs of the general government sector.

The vast bulk of general government sector direct fuel usage (i.e. on-road use by vehicles less than 4.5 tonnes) falls outside of the areas targeted for carbon cost and therefore will not be directly impacted. Overall, fuel use within the relevant types and categories is estimated to be approximately 8 million litres per annum.

The estimated direct cost increase to the general government sector from fuel usage is estimated to be approximately $0.5 million rising to $0.65 million over the period 2012-13 to 2015-16.

4.3.2 Grants, subsidies and concessions

Some State Government grants, concessions and subsidies are expected to be impacted, either directly (e.g. through flow through of electricity or fuel costs) or indirectly (e.g. through indexation for CPI or other relevant cost indexes). These payments support the provision of services in the areas of Communities, Disability Services, Child Safety, Education, Health, Public Transport and Regional Transport.

The cost impact is estimated to be about $56 million in 2012-13 rising to $80 million by 2015-16. Total grants expense during this period is budgeted to be around $10 billion per annum.

4.3.3 Other operating expenses

Other operating expenses comprise the non-labour costs of providing general government sector goods and services. Excluding the specific direct energy costs estimated above, overall operating expenses are forecast to be impacted by the carbon price related increase in the CPI. Other operating expenses for the general government sector are budgeted to be around $9 billion per annum over the period from 2012-13 to 2015-16, and are projected to increase by $43 million and $54 million over the period (0.5 to 0.6 per cent).

4.3.4 Asset related cost impacts

Economic modelling has been undertaken to estimate the potential impact on asset prices as a result of the carbon price. This indicates that, for non-residential construction activities, costs may increase by between 0.7 per cent and 0.8 per cent over the period 2012-13 to 2015-16. This result is a combination of increased input costs, partially offset by a reduction in forecast economic activity, leading to less demand and therefore reduced upwards price pressure.

Application of this cost impact factor to forecast general government sector capital acquisitions (of between $5.2 and $6.9 billion per annum) results in total capital costs potentially increasing in aggregate by about $162 million in total over the period 2012-13 to 2015-16.

The depreciation and maintenance expense for the general government sector of between $3.4 and $3.7 billion per annum over the period from 2012-13 to 2015-16 is projected to increase by approximately $22 million, rising to $29 million, over this period.

5 Government-Owned Generator Analysis

CS Energy Limited (CS Energy) and Stanwell Corporation Limited (Stanwell) are Queensland's Government-owned electricity generators (Gencos). Table 12 sets out the generation assets of the Gencos by megawatts (MW) of capacity and fuel type.

The Gencos own or control around 57 per cent of Queensland National Electricity Market (NEM) connected generation.

Table 12: Genco owned or controlled generation assets by megawatt (MW) of capacity

CS Energy			***Stanwell***		
	MW	**Fuel**		**MW**	**Fuel**
Kogan Creek	750	Coal	Stanwell	1,400	Coal
Callide B	700	Coal	Tarong	1,400	Coal
Callide C (Unit 4)	420	Coal	Tarong North	443	Coal
Gladstone*	800	Coal	Collinsville	195	Coal
Wivenhoe	500	Pump-storage	Swanbank E	385	Gas
			Mica Creek^	325	Gas
			Hydro Plants	153	Hydro
			Mackay	30	Distillate
Total capacity	3,170		Total capacity	4,331	

* Available capacity after allowing for the Interconnected Power Pooling Agreement with the owners of the plant.
^Not connected to the NEM

81 per cent of Genco capacity is coal-fired, almost 10 per cent is gas-fired, 7 per cent is pump-storage and 2 per cent is hydro-electric. Because the Genco capacity is predominantly emissions intensive coal-fired generation, the introduction of a carbon price under the CEF plan will have a negative impact on their future earnings and economic value.

The CEF plan comes at a time when the Gencos are experiencing difficult market conditions more generally. The short to medium term outlook is poor for the merchant generation sector with suppressed wholesale electricity pool prices, capacity oversupply, ramp-gas based generation due to the development of the coal seam gas to LNG industry and the presence of vertically-integrated electricity retailers in the market.

Under the CEF plan, Queensland is expected to incur these losses to forecast tax equivalents, dividends and asset values without any compensation.

5.1 Economic Impacts

Modelling has been undertaken to assess the impact of the CEF plan on the economic value of the Gencos. The modelling has employed the Australian Energy Market Operator's (AEMO) low economic growth forecasts as the base for Queensland electricity demand growth. These have been used because, in recent years, the low economic growth forecasts have been the most accurate predictor of electricity demand growth in Queensland.

These forecasts have been adjusted upwards to incorporate expected demand growth associated with additional LNG industry development and mining projects above what AEMO has factored into its forecasts. For other NEM regions, AEMO medium economic growth forecasts of maximum demand and total energy are used.

The Australian Treasury modelling indicates that the CEF plan will increase retail electricity prices by 10 per cent on average over 2013-17. This additional increase in retail electricity prices is expected to reduce the rate of energy demand growth in Queensland. This is because the increased cost of electricity is likely to induce a price effect on energy consumption (whereby electricity consumers will reduce their consumption in response to the higher prices). This consumer response has been factored into the demand growth forecasts. The sensitivity of demand to electricity prices (or own price elasticity) is published by AEMO.[2]

Gas prices are also an important input into the market modelling because they are a key determinant of the market share of gas-fired generation. This has an impact on the valuation of the Gencos because additional gas-fired generation would be expected to displace some coal-fired generation. The assumption underpinning the gas prices is that there will be adequate gas for both domestic supply and the export oriented LNG developments.

The Renewable Energy Target (RET) of 20 per cent by 2020 is incorporated into the market forecasts. It is modelled as a reduction in the demand that needs to be met with generation from conventional generator technologies (as the proportion of demand that will be met by renewable generation increases).

It is noted that over the period to 2020, the forecast carbon price is insufficient to support the deployment of large scale renewable energy. Over this period, the RET will continue to be the primary mechanism through which renewable energy generation is supported in the NEM. The costs of the RET have been factored into the Australian Government's BAU scenario, with the forecast increase in retail electricity costs due to carbon in addition to those attributable to the RET.

The key determinant in assessing the performance of the Genco coal-fired generators under the CEF plan is their ability to pass through the cost of the carbon. Pass through is the proportion of the carbon price the generators are liable for that is captured in the pool price, and can then be passed through to end users.

The Genco fleet generally has a carbon intensity greater than 0.90 t/CO2-e per MWh (sent out), which is higher than the current market average carbon intensity. It is estimated that the coal-fired generators will be able to pass through around 82 per cent of the expected carbon price (on a sent out basis) in 2012-13, and this is expected to decline to 76 per cent by 2020-21. Across generators the pass through rate differs, with the pass through rate being lower for the less efficient plant.

5.1.1 Economic values

The economic value of the Gencos is estimated by applying the assumptions (outlined above) to derive the net present value of the Gencos. The impact attributable to the

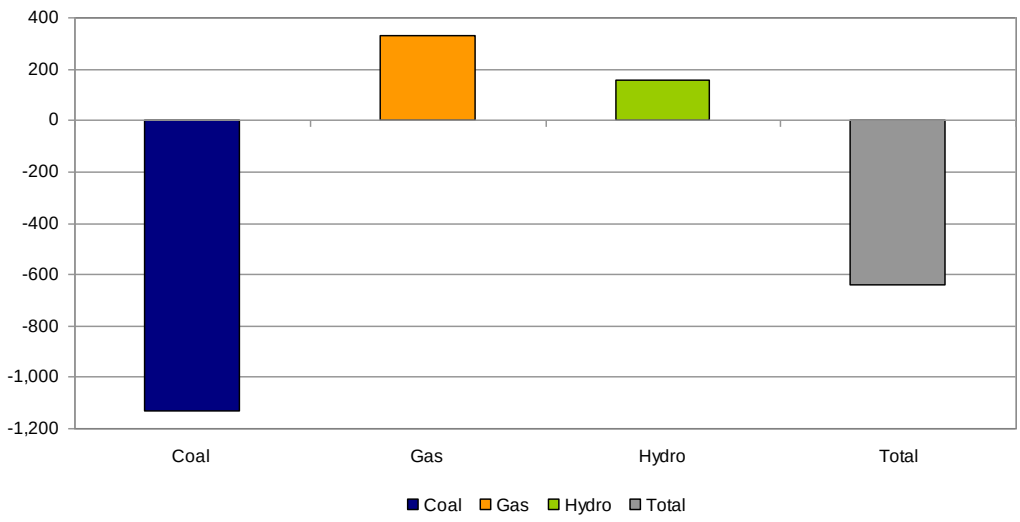
[2] AEMO, Electricity Statement of Opportunities 2010, pp 81-82.

CEF plan is derived by comparing the economic value with no carbon price and the value if the CEF plan is implemented. Under this approach, generators (such as gas-fired and hydro-electric plant) that benefit from the CEF plan can increase in value, while emissions intensive coal-fired generators will reduce in value.

Figure 19 displays the results of the economic value modelling for the Gencos under the CEF. The CEF plan reduces the value of the coal-fired generation assets by $1.1 billion which represents around a 30 per cent decrease in economic value. This result reflects the inability of the coal-fired generators to fully pass through the carbon price and an overall reduction in their level of generation.

In contrast, the value of the gas-fired assets increases by $333 million and the other assets, which includes the hydro-electric generators, increases by $158 million. However, despite the increase in some asset values, the overall net impact is a loss in economic value of $640 million.

Figure 19: Impact of CEF on the economic value of Genco assets ($ million)



5.1.2 Sensitivity of economic value estimates

The economic value estimates are sensitive to changes in the assumptions underpinning them. To illustrate this sensitivity, economic values have been estimated under a higher carbon price scenario. Table 13 displays the overall loss in economic value compared to the estimate under the CEF.

Table 13: CEF economic value and higher carbon price scenario ($ million)

Assumption	Economic value	Change from CEF
CEF	(640)	NA
Higher carbon price	(850)	(210)

The higher carbon price scenario considers the possibility that the carbon price that is necessary to achieve the required level of abatement will be higher than that forecast under the CEF. This scenario assumes a carbon price trajectory of $25/t CO2-e starting price and then $40/t CO2-e by 2019-20 in 2010-11 dollars.

The higher carbon price brings forward changes in the generator merit order that disadvantage the coal-fired generators and also increases the carbon costs they are unable to pass through. The outcome is an increase in the loss of economic value by over $200 million with a total loss in economic value of $850 million.

Alternatively there are potential upside risks for the economic value estimate. One possibility is that future demand is higher than forecast. Under this scenario the higher demand would be expected to increase prices because of a demand-supply imbalance in the short to medium term. Therefore, the Gencos would be able to both increase their generation and access higher wholesale electricity pool prices. Eventually new generation would enter the market in response to the high prices and the price benefit the Gencos were receiving would diminish.

Another possibility is that gas prices turn out to be higher than forecast and as a result generation from gas-fired generators is lower for the same level of energy demand. Under this scenario the Gencos would benefit through increased generation levels which would improve their earnings and flow through as a positive impact on economic value.

5.2 Accounting values

The prospect of a carbon price under the CEF can also affect the accounting valuations of the Genco assets. For accounting valuations, any asset impairment (loss in value) is assessed against the criteria of the relevant Australian Accounting Standards. As part of this process an assumption about the introduction of a carbon price will be factored into the calculations.

The Gencos are currently working closely with the Queensland Audit Office (QAO) in respect of the asset impairment testing, including on the final assumptions to be used for the purpose of financial valuation in light of the proposed CEF.

The 2010-11 Annual Reports for CS Energy, Stanwell and Tarong Energy Corporation (Tarong) are expected to record substantial asset impairments, which will take account of the impact of non carbon market factors and the possible introduction of a carbon price.[3]

5.3 Dividends and equity injections

The reduction in earnings caused by the CEF limits the ability of the Gencos to contribute dividends to the State Government. The expected reduction in future dividend payments is set out in Chapter 4.

The deterioration in the outlook for Genco earnings also reduces the capacity of their balance sheets. Depending on the extent of this reduction and what is deemed to be an appropriate capital structure, this deterioration in financial position may require the State to provide equity so as to mitigate the impact on the financial position of the Gencos. This has potential implications for the overall balance sheet of the State.

[3] Prior to 1 July 2011 there were three Gencos. The three Gencos were restructured into two Gencos that commenced operations on 1 July 2011. The original three Gencos are required to prepare financial accounts for 2010-11.

6 Household Analysis

6.1 Australian Government estimated household impacts

The Australian Government estimates that the carbon cost will add $9.90 per week to household expenditures (around 0.7 per cent to CPI in 2012-13). Key components of the Australian Government's estimated increase in household bills is as follows:

- 10 per cent increase in electricity prices in 2012-13 ($3.30 per week);
- 9 per cent increase for gas ($1.50 per week); and
- less than 0.5 per cent for food (less than $1 per week).

The Australian Government has excluded light vehicle use from the carbon price, meaning households will not pay increased fuel prices.

The Australian Government's CEF plan included a range of taxation and other measures to assist in mitigating impacts particularly for lower income households, through a combination of:

- assistance through increased pensions, allowances and family payments; and
- changes to income tax, specifically increasing the tax free threshold from $6,000 to $18,200 in 2012-13 (with an increase in the marginal tax rate) and a further increase in the tax free threshold to $19,400 in 2015-16.

The Australian Government estimates that these arrangements will mean 100 per cent of low income households will be more than compensated for increased costs associated with carbon pricing.

Table 14: Income definitions and proportion of households receiving assistance

Household adjusted taxable income	Single	Couple without children	Couple with children	Single parent	Households	Receiving some assistance
	$'000	$'000	$'000	$'000	Per cent	Per cent
Low (less than)	30	45	60	60	34	100
Middle (between)	30-80	45-120	60-150	60-150	40	97
High (above)	80	120	150	150	26	74

Source: Australian Government, 2011

6.2 Estimated Queensland household impacts

The assessment below considers the major services provided by the State Government which will be directly affected by the introduction of a price on carbon.

6.2.1 Impact on Queensland household electricity prices

Using the Australian Government's estimated 10 per cent increase in retail electricity prices due to carbon pricing, the average Queensland electricity bill would increase by $190 next year as a result of carbon pricing. This estimate is based on an average household in Queensland using around 7882kwh per year, with an electricity bill of $1,900 in 2011-12.

Further, on 11 May 2011, the Government announced the implementation of a new electricity pricing framework and set of tariff structures to commence from 1 July 2012. The Queensland Competition Authority is currently developing the new methodology and tariff structures.

In addition, the Government announced the intention to implement an inclining block tariff (IBT) for residential customers on Tariff 11. With this work underway, the Queensland Competition Authority is due to provide a draft report including estimated prices for 2012-13 by the end of March 2012, and a final report by the end of May 2012.

6.2.2 Impact on bulk water prices

Electricity costs represent less than 2 per cent of the overall costs of operating the South East Queensland Water Grid. These costs are not material to overall operation of the Grid within the announced price path.

6.2.3 Impact on public transport fares

Increased electricity costs are estimated to add around $5 million to the cost of providing passenger rail services in 2012-13. Public transport fares in South East Queensland are already subject to a price path to improve the cost reflectivity of public transport services. The additional electricity costs have been factored into the fiscal estimates outlined in Chapter 4, and the costs will be absorbed by the government.

6.2.4 Impact on other fees and charges

Other fees and charges will be escalated in line with CPI, consistent with the Government's existing policy approach.

Attachments

Attachment 1 – Key Deloitte Access Economics results

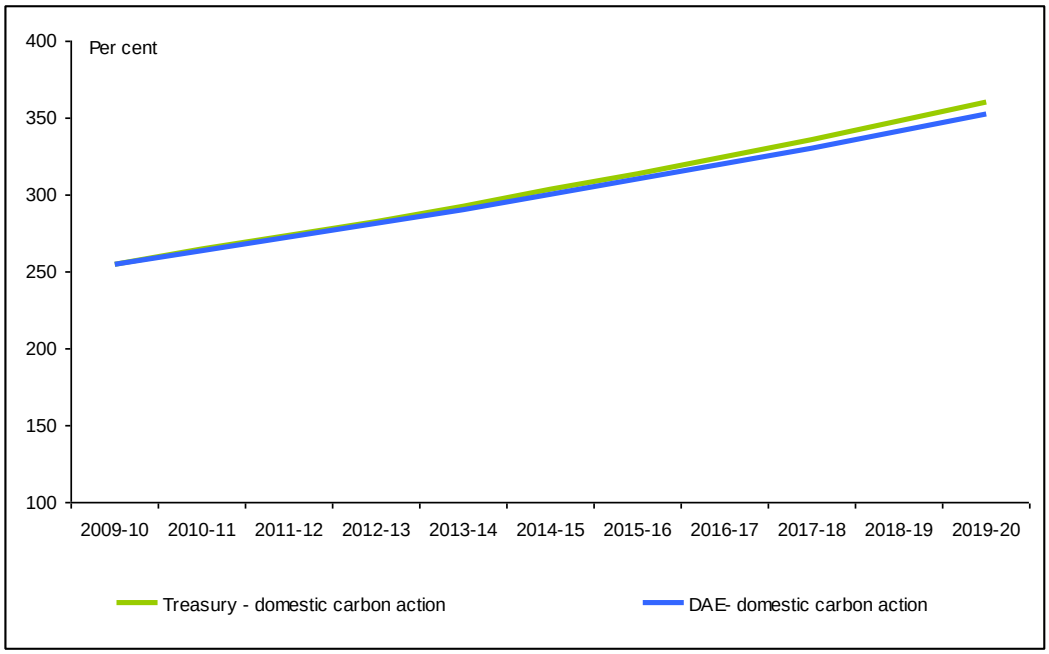
Key Deloitte Access Economics macroeconomic indicators with carbon pricing

Deloittes Access Economics

	2009-10 to 2019-20		2009-10 to 2049-50	
	Queensland	Australia	Queensland	Australia
	Per cent	Per cent	Per cent	Per cent
Average annual growth with domestic carbon action				
Real GSP/GDP	3.3	2.8	2.9	2.7
Employment	1.9	1.3	1.7	1.1
Real Wages	1.1	1.3	1.4	1.6
Real Investment	2.7	2.9	3.5	3.4
Total growth with domestic carbon action				
Real GSP/GDP	38	32	218	181
Employment	21	14	94	60
Real wages	12	14	74	86
Real Investment	30	34	298	286
Deviation from total business as usual growth, with domestic carbon action				
Real GSP/GDP	-2.8	-2.2	-4.1	-3.8
Employment	-0.8	-0.6	-0.5	-0.5
Real wages	-3.9	-3.1	-4.5	-4.2
Real investment	-5.9	-5.0	-5.1	-5.3

While Deloitte Access Economics modelling estimates a greater impact from adjustment in the short-term, higher growth for Queensland is forecast under the Deloitte Access Economics model in the longer term (compared to the Queensland Treasury modelling).

Cumulative growth in GSP, Queensland Treasury and Deloitte Access Economics ($2009-10, billion)



Over the longer term, Queensland Treasury projects GSP will grow by an average of 2.8 per cent per year to 2049-50 with carbon pricing, while Deloitte Access Economics projects GSP growth of 2.9 per cent per year for the same period.

Attachment 2 – Interpreting the results

Key considerations in interpreting the Queensland Treasury macroeconomic results presented in this report, and produced by CGE modelling more generally, are discussed below.

Global action

Like the Australian Treasury modelling, the OESR BAU scenario incorporates global action. As a result, the impact of global action is not explicitly captured in the deviation from BAU results. This is an important consideration given previous modelling exercises (including 2008 CPRS modelling) have generally excluded global action from BAU scenarios. Further, the modelled level of global action implies the availability of relatively low-cost international permits (therefore lowering the cost of domestic action).

Global action (in combination with assistance for EITEs), will also limit the carbon-leakage effect, whereby imposing a carbon price in Australia in advance of its adoption by major international competitors impacts trade in emissions-intensive goods.

Smooth adjustment

There are some limitations associated with the model assumptions that there will be a smooth, long-run transformation of the economy. Further, the model assumes investor behavior is derived from current, rather than future, expectations.

In practice, the transformation of the economy, including investment and technology changes, is likely to be more 'lumpy'. As a result, there may be differences between the modelling results and the actual timing and/or short-term level of carbon pricing impacts.

In this context, the modelling results should be viewed as reasonable expectations of average carbon pricing impacts over time.

Employment

In considering the modelled impacts on employment resulting from carbon pricing, it is important to note the modelling assumes that real wages will adjust over time to bring labour markets into equilibrium, and labour is perfectly mobile across industries and regions. This means that carbon pricing impacts are felt in the short-run through changes to employment, and in the long-run through lower growth in real wages (noting growth is still expected).

Technology

The OESR modelling results incorporate technology development assumptions broadly in line with those used by the Australian Treasury. It is noted that changes to this assumption could significantly impact modelled carbon pricing impacts.

LNG

The modelling results represent the best efforts of OESR to reflect a stylised development of the liquefied natural gas (LNG) industry in Queensland. However, there are a number of limitations associated with the LNG modelling, which could mean Queensland carbon pricing impacts are under-estimated to some extent.

Determining the extent to which a domestic carbon price is already encompassed in planned LNG developments, and how the development of the domestic/export LNG industry will impact the coal seam gas industry, is difficult. Further, the modelling results do not capture the changes to industry production (and increased emissions) that are likely to occur when Queensland LNG production develops to service an export market.

Impact of complementary measures

The modelling results do not show economic impacts associated with other abatement policies or complementary measures, given these are incorporated in the BAU scenario. For example, the Australian Government's Renewable Energy Target, which is designed to ensure that 20 per cent of Australia's electricity supply will come from renewable sources by 2020, has already contributed significantly to retail electricity prices in Queensland.

Attachment 3 – Industry output with domestic action

Cumulative % change from 2009-10 (With domestic action)

	Queensland		Australia	
	2019-20	2049-50	2019-20	2049-50
Sheep and cattle	10	95	10	95
Dairy cattle	2	86	0	92
Other animals	15	154	14	141
Grains	15	181	15	126
Other	21	174	18	179
Agricultural services and fisheries	7	200	7	166
Forestry	13	187	5	137
Coal	47	134	44	112
Oil	1	-73	1	-73
Gas	519	679	99	136
Iron Ore	-1	0	104	403
Non-ferrous ore	89	266	92	273
Other	97	296	90	274
Meat products	9	148	12	142
Other food	7	136	3	113
Textiles, clothing and footwear	-29	62	-34	35
Wood products	13	161	2	123
Paper products	2	103	-7	66
Printing	21	191	14	149
Refinery	-1	125	-6	98
Chemicals	9	39	11	8
Rubber and plastic products	9	83	7	48
Non-metal construction projects	18	132	5	98
Cement	43	166	33	131
Iron and steel	57	145	42	94
Alumina	50	-11	55	15
Aluminium	1	-11	0	-13
Other metals	72	64	73	54
Metal products	14	94	4	65
Motor vehicles and parts	-35	53	-38	35
Other	-14	73	-20	58
Electricity supply	*27*	104	16	80
Gas supply	17	108	26	176
Water supply	19	149	21	110
Construction	59	222	49	194
Trade	36	217	30	178
Accommodation and hotels	24	167	21	140
Road transport: passenger	28	233	22	191
Road transport: freight	41	260	38	228
Rail transport: passenger	16	559	10	423
Rail transport: freight	43	317	62	334
Water transport	35	216	31	194
Air transport	11	376	4	304
Communication	52	406	56	320
Financial	41	346	39	258
Business	63	487	53	357
Ownership of Dwellings	30	172	32	164
Public	37	291	32	245
Other	36	190	33	163

Cumulative % deviation from BAU

	Queensland		Australia	
	2019-20	2049-50	2019-20	2049-50
Sheep and cattle	0.2	0.5	0.2	0.4
Dairy cattle	0.0	1.6	0.0	1.9
Other animals	0.3	1.0	0.2	1.5
Grains	0.1	0.5	0.2	0.4
Other	-0.1	0.1	0.0	0.3
Agricultural services and fisheries	0.3	2.2	0.2	1.9
Forestry	0.0	-0.4	-0.1	-0.1
Coal	-1.5	-7.9	-3.1	-16.3
Oil	-0.1	-0.2	0.0	-0.1
Gas	0.0	1.0	-1.3	-6.4
Iron Ore	-2.2	-2.7	0.9	8.2
Non-ferrous ore	-0.6	-3.6	-0.3	-3.3
Other	0.8	4.8	0.8	4.8
Meat products	0.4	1.3	0.1	1.2
Other food	-0.1	0.6	0.0	2.1
Textiles, clothing and footwear	0.4	4.8	0.7	6.8
Wood products	0.1	0.0	-0.2	0.6
Paper products	0.8	-0.6	0.2	-0.7
Printing	0.1	-0.5	0.0	1.5
Refinery	-0.4	-5.2	0.3	-4.6
Chemicals	1.6	-1.1	1.5	-1.3
Rubber and plastic products	0.2	-1.5	0.5	0.2
Non-metal construction projects	-0.7	-0.8	-0.8	0.6
Cement	-0.8	-5.9	-1.0	-5.7
Iron and steel	10.6	-2.0	-0.4	-22.4
Alumina	-0.3	-48.8	1.6	-39.6
Aluminium	0.6	-45.0	0.1	-50.0
Other metals	-0.1	-7.2	-0.1	-6.8
Metal products	0.2	-3.4	-0.2	-3.0
Motor vehicles and parts	0.9	2.3	0.8	5.1
Other	0.0	3.5	-0.1	4.5
Electricity supply	-4.5	-12.2	-4.4	-15.0
Gas supply	-1.8	3.9	-0.9	6.3
Water supply	-0.5	-2.7	-0.3	-1.8
Construction	-0.8	-5.4	-1.0	-5.0
Trade	-0.3	-2.2	-0.3	-1.3
Accommodation and hotels	-0.4	-3.9	-0.5	-3.1
Road transport: passenger	-0.3	-1.4	-0.4	-0.7
Road transport: freight	-0.5	-1.4	-0.4	-0.2
Rail transport: passenger	0.3	10.1	0.0	11.3
Rail transport: freight	-0.5	2.2	0.0	3.9
Water transport	-0.1	-1.7	-0.1	-1.0
Air transport	-0.4	-0.5	-0.3	0.2
Communication	-0.4	-3.5	-0.3	-2.6
Financial	-0.2	-1.3	-0.2	-0.7
Business	-0.3	-1.8	-0.2	-0.2
Ownership of Dwellings	0.0	-3.7	-0.1	-3.5
Public	0.1	-0.9	0.0	-0.4
Other	-0.4	-4.8	-0.5	-3.9

Glossary

abatement – reduction of greenhouse gas emissions, or enhancement of greenhouse gas removal from the atmosphere by sinks.

asset impairment – unexpected decline in the service utility of a capital asset, such as a factory, property or vehicle.

book value – the value at which an asset is carried on a balance sheet.

bottom-up modelling – a detailed, sector specific model, often with engineering detail. This report uses bottom-up models for the electricity generation, transport and land use change and forestry sectors.

business as usual scenario (BAU) – assume no change to the ongoing operations of an entity regardless of external forces.

capital acquisitions – funds used to purchase or upgrade physical assets such as property, industrial buildings or equipment. This type of outlay is made to maintain or increase the scope of current operations.

capital structure – the composition of an entity's liabilities i.e. financed through debt or equity.

capital-intensive – requiring more assets (i.e. equipment and machinery) than labour to produce a given amount of output.

carbon dioxide (CO_2) – a naturally occurring gas. It is also a by-product of burning fossil fuels and biomass, other industrial processes and land use changes. It is the main greenhouse gas that affects anthropogenic changes to the earth's temperature.

carbon dioxide equivalent (CO2-e) – a standard measure that takes account of the different global warming potentials of greenhouse gases and expresses the cumulative effect in a common unit.

Carbon Pollution Reduction Scheme (CPRS) – the Carbon Pollution Reduction Scheme (CPRS) was a cap-and-trade emissions trading scheme developed by the Australian Government to reduce Australia's greenhouse gas emissions.

carbon price – the cost of releasing greenhouse gases into the atmosphere (also known as an emission price).

carbon-leakage – an increase in global emissions, arising from the relocation of emission-intensive production activity in response to the introduction of a carbon price.

clean energy – see renewable energy.

climate change – a change of climate attributed directly or indirectly to human activity that alters the composition of the global atmosphere and is in addition to natural climate variability over comparable time periods.

complementary measures – material or good whose use is interrelated with the use of an associated or paired good such that a demand for one generates demand for the other

Computable General Equilibrium (CGE) model – a CGE model is a whole-of-economy model that captures the interactions between different sectors of the economy.

concessions – designed to assist low income earners to reduce the cost of regular household bills, access to essential services and maintain a healthy active lifestyle. Concessions are available to eligible holders of a concession card such as seniors, people with a disability, carers, veterans, sole parents, widows and students.

carbon permit – the right to release a specified quantity of greenhouse gas under an emissions trading scheme (also known as an emission permit).

demographic factors – socioeconomic characteristics of a population expressed statistically, such as age, sex, education level etc.

depreciation expense – a method of allocating the cost of a tangible asset over its useful life.

dividend – a taxable payment declared by an entity's board of directors and given to its shareholders out of current or retained earnings.

economic value – the amount (of money or goods or services) that is considered to be a fair equivalent for something else based on the asset's ability to generate income.

emission – release of greenhouse gases into the atmosphere.

Emission-intensive, trade exposed (EITE) industries – Industries that either export or compete against imports (trade exposed) and produce significant emissions in their production of goods

emissions trading scheme – a scheme that creates a market for emission rights by limiting the total amount of emissions. Market participants then buy and sell rights to emit greenhouse gases.

emissions-intensity – the ratio of emissions to output. Emission intensity can refer to both emissions per unit of sectoral output (such as the emission-intensity of electricity generation) and the emissions per unit of economy-wide output (which usually refers to GDP). Also called carbon intensity.

equilibrium – state of the world where economic forces are balanced and in the absence of external influences the (equilibrium) values of economic variables will not change. It is the point at which quantity demanded and quantity supplied are equal.

exchange rate – rate at which one currency may be converted into another.

forward estimates – representation of the financial performance of a public entity over the next five financial years (inclusive of the current financial year).

fugitive emissions – greenhouse gases released in the course of oil and gas extraction and processing, through leaks from gas pipelines, and as waste methane from black coal mining.

general government sector – comprises all government units including all subsidiary entities but excluding Government-owned corporations.

gross domestic product (GDP) – the total market value of all final goods and services produced in an economy.

gross national income (GNI) – this reflects changes in GDP, the terms of trade and international income transfers. It is measured as GDP less net taxes on production and imports, less compensation of employees and property income payable to the rest of the world, plus the corresponding items receivable from the rest of the world.

gross state product (GSP) – the total market value of all goods and services produced in a particular state or territory.

inflation – rise in the general level of prices of goods and services in an economy over a period of time.

inputs – resources such as raw materials, energy, information, or finance that is put into a country's economy.

legacy waste – waste deposited in landfill before 1 July 2012.

megatonne (Mt) – one million (10^6) tonnes.

megawatt hour (MWh) – a unit of energy equal to one million watt hours.

mitigation – a human intervention to reduce the sources of, or enhance the sinks for, greenhouse gases.

net present value – the difference between the present value of the future cash flows from an investment and the amount of investment.

obsolescence – a loss in the utility of an asset due to the development of improved or superior equipment, but not due to physical deterioration.

operating balance – the net result of an entity's accounts once all revenues and expenditure items are taken into account.

parts per million (ppm) – equivalent to 1 milligram of something per litre of liquid. Usually describes the concentration of something in water or soil.

perfectly mobile – the absence of any barriers to international movements of either capital or labour.

policy scenario – a projection of the future path of the global and Australian economy if policies to reduce emissions are introduced.

pollution – the contamination of soil, water, or the atmosphere by the discharge of harmful substances.

price effect – the impact of price changes on a market or economy.

real terms – nominal value refers to a value expressed in money terms (that is, in units of a currency) in a given year or series of years. By contrast, real value adjusts nominal value to remove effects of price changes over time.

renewable energy – a source of energy that is not depleted by use. Renewable technology includes hydro, biomass, solar, wind and geothermal sources

renewable generation – see renewable energy

renewable sources – see renewable energy

retail electricity price – price of electricity charged to end-user customers.

tax equivalent payments – payments tantamount to income tax that a public authority or business unit (if a legal entity) would be liable to pay under the *Commonwealth's Income Tax Assessment Act 1997*.

tCO_2-e – measurement of amount of carbon dioxide emissions per tonne of output.

terms of trade – the ratio of the price of an economy's exports to the price of its imports. If the ratio rises, the terms of trade improve.

vertically-integrated – form of business organization in which all stages of production of a good, from the acquisition of raw materials to the retailing of the final product, are controlled by one entity.

wholesale electricity prices – price of electricity charged to intermediaries in the supply chain who then ultimately on-sell these services to the end-user (customer).

[1] Many definitions have been sourced from the Australian Government's *Strong Growth, Low Pollution: Modelling a Carbon Price* (July 2011).