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# **The Impact of LNG Export Expansion in QLD With special emphasis on the effects of increased gas prices**

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# The Impact of LNG Export Expansion in Queensland

With special emphasis on the effects of increased gas prices

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## Abstract

The large Queensland LNG projects currently under construction will begin production over the next two years. Exploiting previously unused reserves of coal seam gas, the LNG produced will be sold at an international price which far exceeds the current price of natural gas in Eastern Australia. The new exports of LNG will therefore boost Australia's exports and terms of trade, leading to increased real GDP and welfare for the national economy.

But this is only one part of the overall impacts of the new projects. Through competitive pressures, the price premium received for unconventional Queensland gas will lead to increased prices for gas throughout Eastern Australia. This will increase costs of production for energy-intensive industries. For those industries (and regions) which cannot pass on the cost increases, production will fall.

In this paper, using the Victoria University Regional Model (VURM), we report on simulations designed to provide a balanced assessment of the costs and benefits of the new LNG projects. Key findings are:

- During construction, the projects boost real GDP and national welfare, and have a positive impact on most industries and most regional economies;
- During the mature, production phase, the national impacts are marginal. Real GDP is stimulated slightly, while national welfare is hardly affected.
- Some industries gain production, particularly electricity-related sectors that benefit from favourable price-induced substitution effects. Other industries lose production, due to the adverse cost impacts of increased gas and electricity prices.
- Because some industries gain, while other industries lose, so some regions gain real GSP and employment (Queensland), while other regions lose (notably Victoria and South Australia).
- The projects will lead to higher CO<sub>2</sub>-e emissions, due to the stimulus to coal-fired electricity.

JEL Classification: C68 D58 F43 O40

Key Words: CGE modelling, Gas production, LNG exports, Australian economy

## 1. Introduction

What follows is an assessment of the economic impacts of two key developments in the gas market on the East Coast of Australia:

1. the construction and operation of three large LNG projects in QLD utilising gas generated, in part, from unconventional coal seam gas reserves in QLD; and
2. increases in the East Coast gas price to international parity for LNG.

Table 1 shows the three LNG projects, all of which are located around Gladstone and utilise coal seam gas in the Surat and Bowen Basins.

LNG Project	Estimated gas consumption (Pj per annum)	(Start-up)-(Full production)	Number of LNG trains	Total construction spend (\$m, 2013 prices)
QLD Curtis LNG	486	2014-2016	2	19,800
Gladstone LNG	446	2016-2018	2	18,000
Australia-Pacific LNG	514	2015-2017	2	24,700

Construction of the QLD Curtis project began in 2011 and is projected to be finished at the end of 2014. Construction of the other two plants has also commenced. It is assumed that the Australia-Pacific project will start up in 2015, and the Gladstone LNG plant in 2016.

It is assumed that when all of these projects are in full production, the gas price in the Eastern states (all states and territories other than WA and NT) will have risen to reflect linkages to international LNG prices. The current average price received by gas producers in the Eastern states is around \$4.50 per GJ. The average price in 2011 was around \$3.25 per GJ. It is estimated that the LNG-parity price in 2017 will be \$11.00 per GJ.<sup>1</sup> This estimate is for the “netback” price which excludes the cost of freight. For our modelling, we assume that the netback price is the producer price. Figure 1 shows our assumptions for the average producer price of gas in Eastern states with and without the QLD LNG expansion.

The increased gas price will increase the cost of gas fired electricity generation. Wholesale electricity prices in the National Electricity Market (NEM) will be affected over the course of the day when gas generation is the marginal supplier. At current prices, it is the marginal supplier during 6 hours per day. We assume that with the higher gas price, gas generation is the marginal supplier 1 hour per day. Based on this assumption and current generation prices, the increase in gas price initially increases the wholesale price of electricity by about 3.8 per cent in the NEM regions.

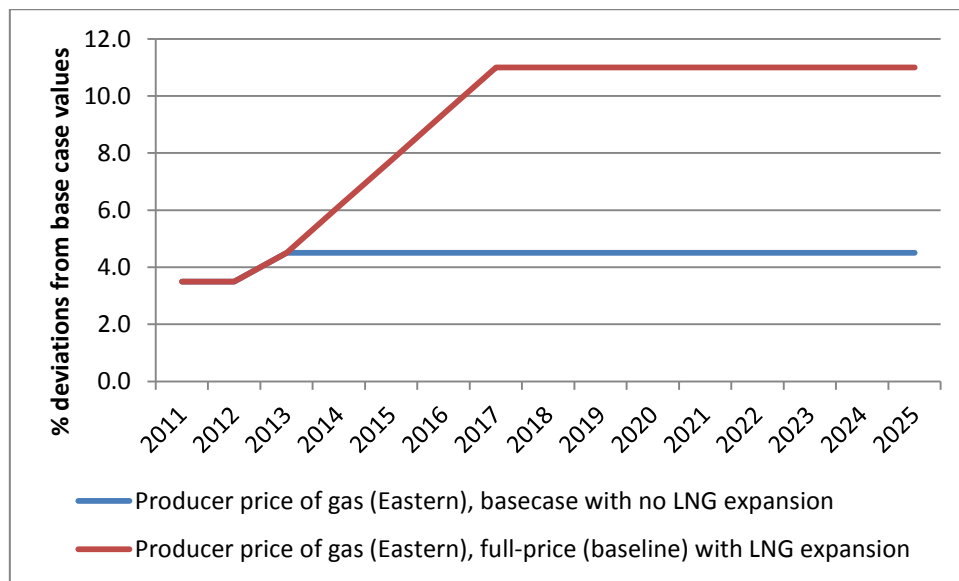
The analysis is undertaken using the Victoria University Regional Model (VURM), which is based on the Monash Multi-Regional Forecasting model (MMRF). The impacts of the QLD LNG projects are computed using VURM by comparing two projections running from 2011 to 2025. The first

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<sup>1</sup> This estimate is based on data from the Deloitte Access Economics report, *Gas market transformations – Economic consequences for the manufacturing sector*, published in July 2014. Deloitte presents a number of scenarios, with different variations in gas price across states. The estimated LNG-parity price used in this report includes some minor adjustments to take account of more recent information which suggests that the Deloitte central estimate might be a little high. This price is applied to all gas produced in all Eastern states.

projection is a hypothetical base case which excludes the direct and indirect effects of the suite of LNG projects. The second projection (labelled full-price (baseline)) deviates from the first in response to the QLD LNG expansion and subsequent shift to international parity pricing. All results are reported as deviations away from base case values. For sensitivity purposes, at the end of this note we also report a simulation in which the gas price increases from the current average price of \$4.50 per GJ to \$7.75 per GJ, which is half the increase assumed in the full-price (baseline). We refer to this simulation as the low-price (baseline).

**Figure 1: Producer price of Gas (Eastern states)**



## 2 Full-price (baseline)

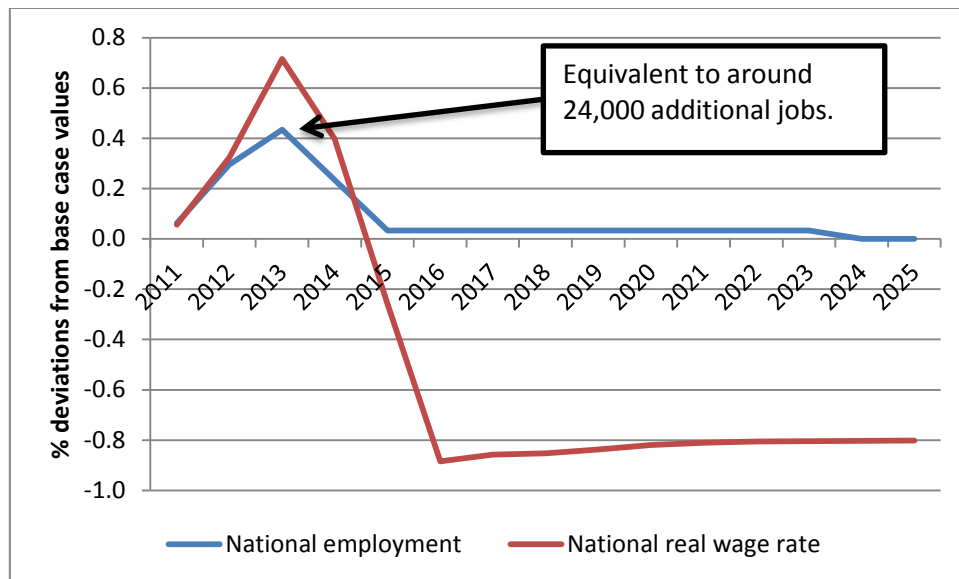
### National macroeconomic effects

***Construction of the new LNG facilities stimulates national employment, but when building is complete, the direct stimulus ends. In the long-run, the new LNG production has a negligible impact on employment, but lowers the real wage rate***

The explanation of macro effects begins with the impacts on the national labour market. Figure 2 shows percentage deviations away from base case values in national employment (persons employed) and in the national real wage rate.

During the construction phase, and particularly the peak construction years (2012-2014), national employment rises due to the LNG-project construction. In the peak year, around 24,000 additional jobs are created nationally. In effect, during this period building the LNG facilities lowers the national unemployment rate below what it otherwise would be.

**Figure 2: Effects on the national labour market**



Over time, however, the initial employment gains fall away. Construction, which is labour intensive, is replaced by production, which is capital intensive. But on top of that the increased gas prices have an adverse impact on production and employment in gas-intensive sectors, particularly in manufacturing. With an unchanged national real wage rate, on balance these forces would yield a reduction in national employment. In our modelling, we assume that employment does not fall below its base case value, by allowing the national real wage rate to be lower.<sup>2</sup> As a consequence, as shown in Figure 2, in the long-run the impact on the national labour market of the new LNG production is revealed as a lower real wage, rather than as a change in employment.

***The LNG projects have positive and negative impacts on real GDP. On the positive side is the expansion in LNG export volumes and a beneficial impact on the nation’s terms of trade. On the negative side is the increase in energy prices in Eastern states. On balance, the LNG projects are expected to increase real GDP, but only by a small amount.***

Figure 3a shows percentage deviations away from base case values in real GDP. Figure 3b shows the same information expressed as absolute changes (\$m, 2013 prices) away from base case values. The solid line shows the overall impact. Initially, because of the LNG construction real GDP increases by around 0.3 per cent relative to its base case level (i.e., its level without the new LNG projects). This increase dissipates over time, with the long-run impact being an increase of around 0.1 per cent.

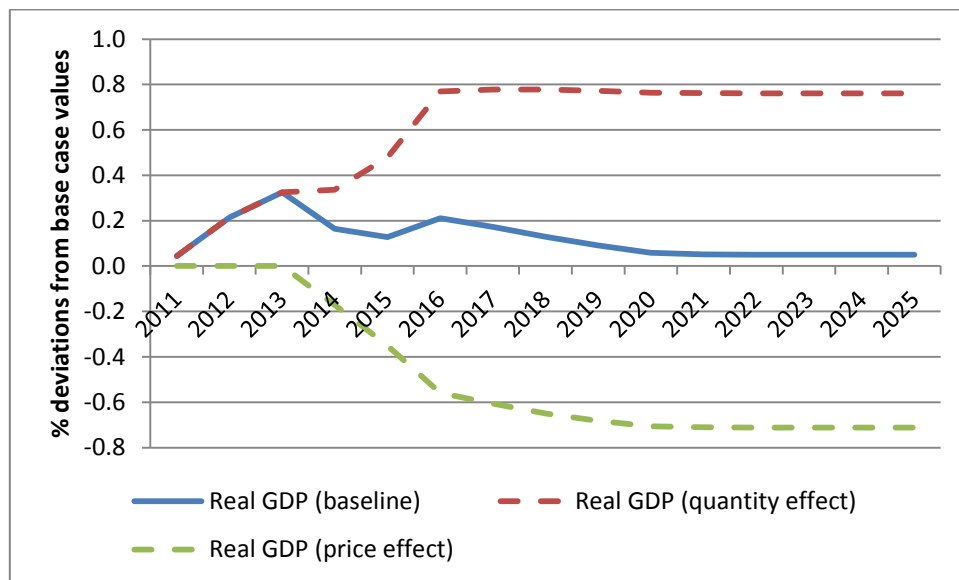
The outcomes for real GDP reflect the balance of two offsetting forces. The expansion in LNG exports at the high global price results in a terms-of-trade increase for the economy. This tends to reduce the real cost of capital, leading to increased capital and increased real GDP. We call this the

<sup>2</sup> This assumption is based on the idea that in the long-run national employment is determined by demographic factors such as birth and death rates and international migration patterns which are unaffected by the existence or otherwise of the new LNG facilities.

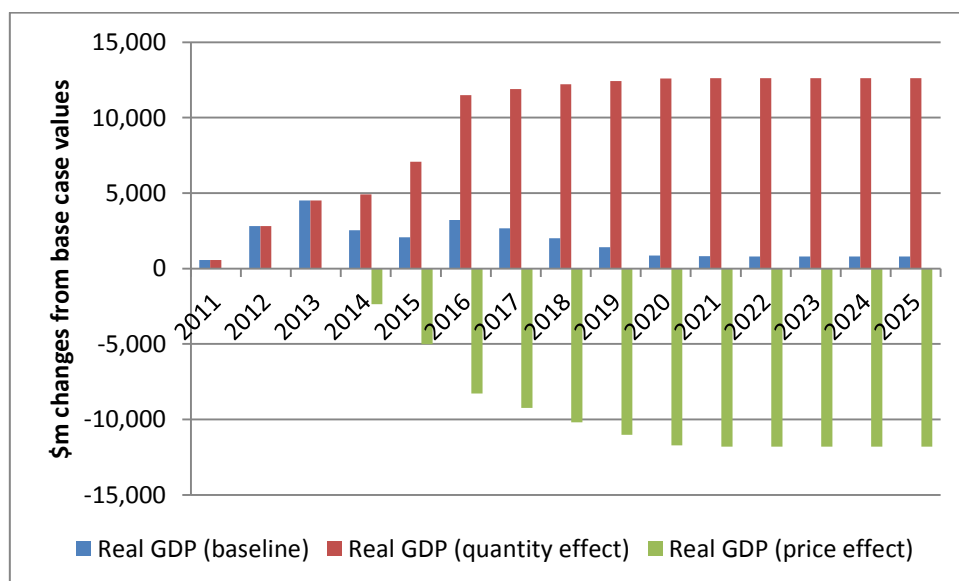
quantity effect. It is shown in Figure 3 by the upper dashed line. By 2020, the quantity effect adds around 0.8 per cent to real GDP. The annual increment persists thereafter.

Offsetting this, though, is the increase in gas prices for domestic use. The increase gas price allows for larger than normal profit for the local gas producers, but it also raises the cost of production for gas-using industries. Many of these industries cannot pass on these increases, and so cut production. Thus for these industries the increase in cost of gas means reduced production, employment and capital utilisation, resulting in a loss of real GDP for the economy generally. In Figure 3, this adverse price effects is shown by the lower dashed line. By 2020, the price effect subtracts around 0.6 per cent from real GDP.

**Figure 3a: Effects on real GDP (percentage deviations)**



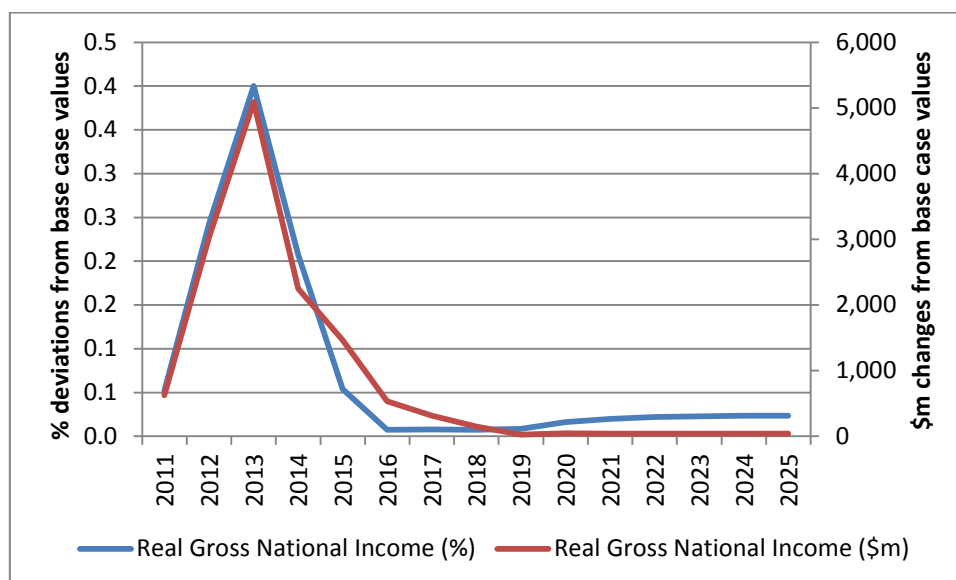
**Figure 3b: Effects on real GDP (\$m changes)**



**The effects of the new LNG facilities on real Gross National Income (GNI), our preferred measure of national welfare, are a little smaller than the effects on real GDP. Over the longer-term, the modelling indicates that the new projects have virtually no impact on GNI.**

Real GDP is a measure of real income produced at the national level. Real Gross National Income (GNI) is a measure of real income accruing to Australians, and is hence our preferred measure of national welfare. As shown in Figure 4, the new LNG projects improve national welfare during the construction phase, primarily because of employment generation. However, during the mature production phase, the impacts on national welfare are negligible. Over the longer-term, what is gained from the beneficial terms of trade effects and increased profit for the LNG industry is effectively lost by reduced real income from labour and reduced profit elsewhere.

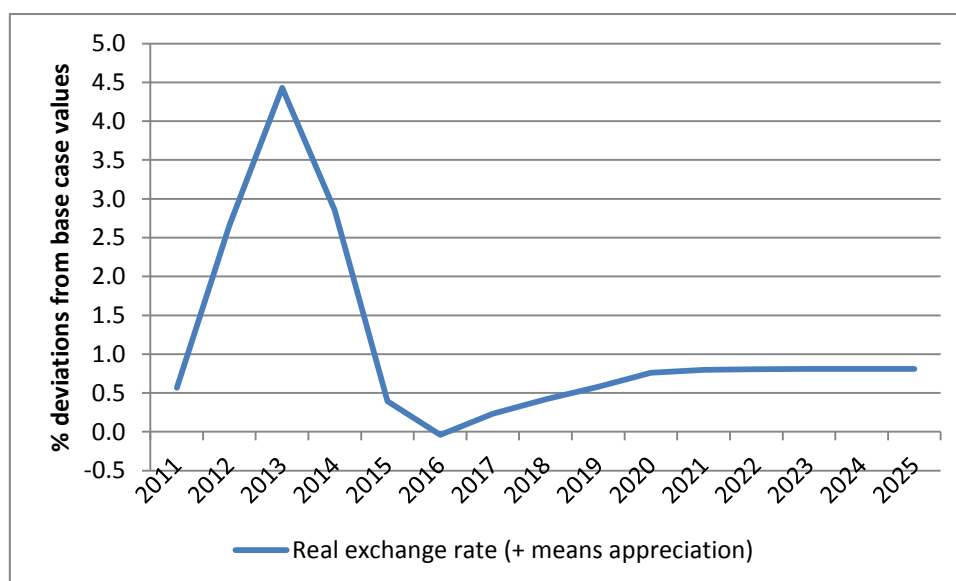
**Figure 4: Effects on real Gross National Income (% and \$m changes)**



The final national macroeconomic variable that we report results for is the real exchange rate. As shown in Figure 5, construction of the new LNG facilities causes the real exchange rate to appreciate significantly. We assume the projects are financed primarily from foreign savings. Thus the construction spending requires significant inflow of foreign capital which leads to real appreciation. Thereafter, the real exchange rate remains above its base case value. This is a typical *Dutch-disease* outcome, with a surge in new exports crowding out traditional exports via appreciation of the real exchange rate.



**Figure 5: Effects on the real exchange rate**



### National industry effects

**As a result of the LNG projects, some industries gain production, but others lose production. Industries that gain most are associated with the production of electricity in Eastern markets – electricity becomes cheaper relative to gas and users re-balance their energy requirements in favour of electricity. Industries that lose most are energy intensive manufacturers unable to easily pass on the increased cost of energy.**

Figure 6a shows percentage deviations in production for four industries that increase production at the national level due to the new LNG projects. Three are electricity related, the other is construction services. Electricity (supply and generation, including from more expensive gas) is stimulated by fuel substitution effects in the manufacturing, commercial and residential sectors as users substitute away from gas towards relatively cheaper electricity for process and space heating. The other industry is construction services. The entire construction stimulus in the early years is due to the building of the new LNG facilities.

A notable omission from Figure 6a is the national gas industry.<sup>3</sup> Gas production for conversion to LNG expands enormously in QLD. However, this is offset by reduced gas production elsewhere. Because of the higher price, use of natural gas across the Eastern states falls, except for use in electricity generation. Gas production in WA and NT, primarily for export, also falls. Traditional exports, including exports of LNG from WA and NT are unfavourably affected by a projected strengthening of the real exchange rate due to the surge in QLD LNG exports (see Figure .5).

<sup>3</sup> In the VUMR model, LNG and natural gas production are combined activities. LNG production and the production of natural gas for urban and industrial use is undertaken by the same industry, labelled "Gas".

**Figure 6a: Sample of industries that gain production at the national level**

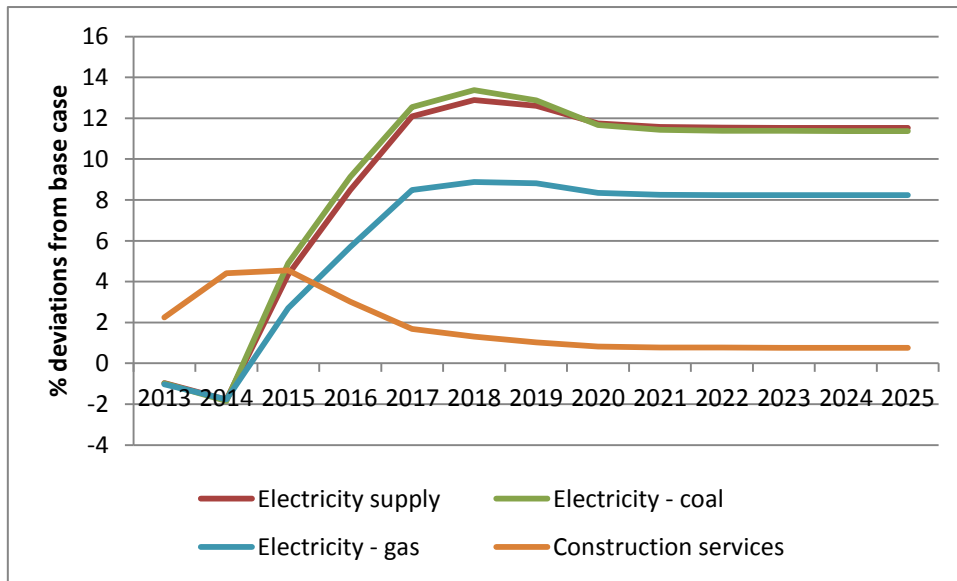
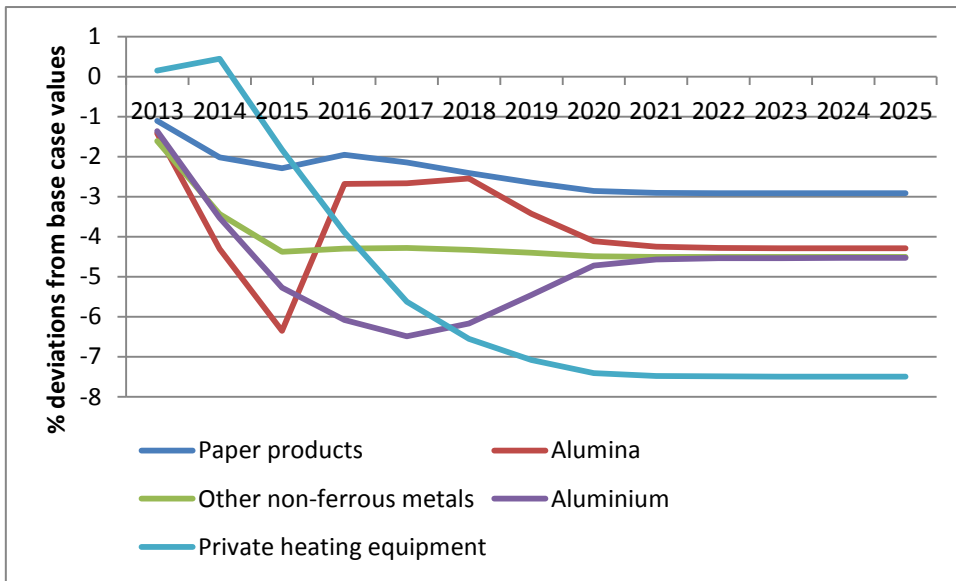


Figure 6b shows percentage deviations in production for five industries that are projected to reduce their production nationally as a result of the new LNG projects. All of these industries operate in the manufacturing and commercial service areas, and are energy intensive. With gas and electricity prices rising, their costs rise and, to the extent that they cannot pass on the increased costs, their production falls. The industry shown as experiencing the largest fall in production (almost 8 per cent of base case level) is labelled *Private heating equipment*. This industry produces the services of heating equipment (including ovens) for residential and commercial use. As the price of heating fuel rises, so users of private heating equipment shift their technologies towards more fuel efficient appliances.

**Figure 6b: Sample of industries that lose production at the national level**

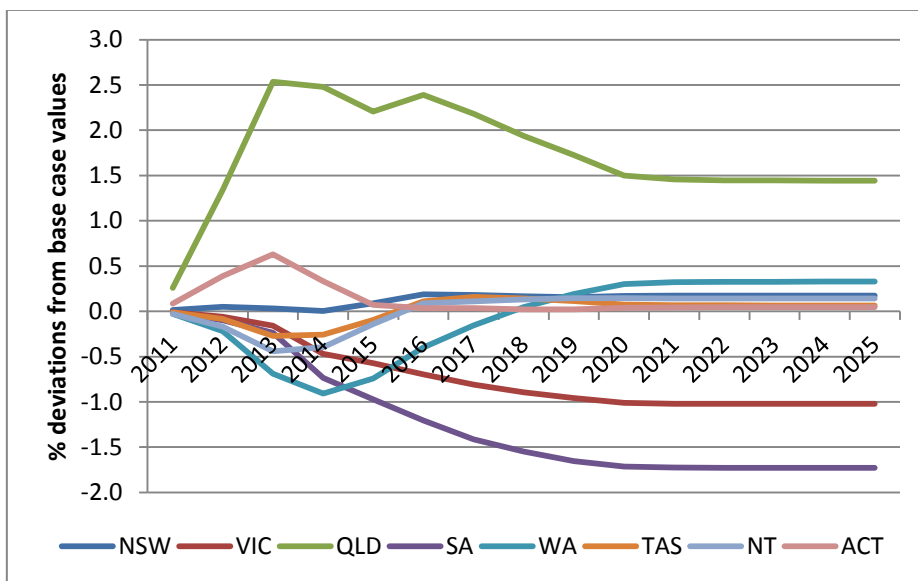


### State and Territory effects

*In regional terms, QLD is the only beneficiary of the new LNG projects. The economies of VIC and SA are expected to contract a little due to the adverse effects of the increased energy prices and the downturn in demand for their gas production. GSP trajectories for the other states (including NSW) are relatively unaffected.*

Figure 7 shows percentage deviations in real GSP for each of the state economies due to the new LNG projects. Recall from Figure 3 that real GDP (the sum of real GSPs) is up slightly relative to its base case value.

**Figure 7: Effects on real Gross State Product (GSP)**



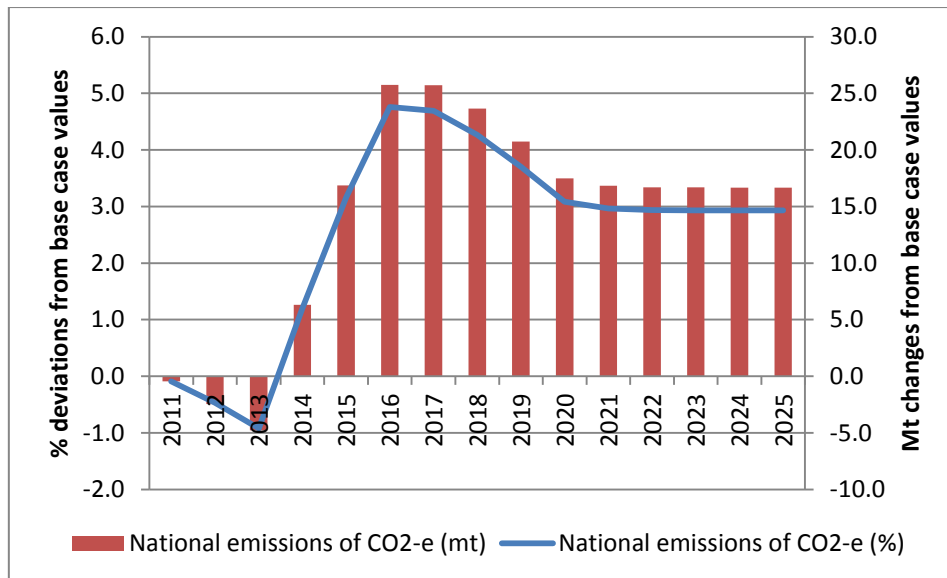
The gain in real GDP for QLD in the longer term is projected to be around 1.7 per cent of base case GDP. The GDP losses for conventional-gas producing SA and VIC are projected to be respectively 1.0 per cent and 1.6 per cent of base case values.

### Effects on national emissions of Greenhouse gases

*With the use of electricity (primarily from coal) up, emissions of Greenhouse gas rises due to the new LNG projects.*

Figure 8 shows percentage and absolute (Mt) deviations in national emissions of CO<sub>2</sub>-e (greenhouse) gas. The story here is clear. In effect, domestically, the new LNG production and consequent increase in domestic gas price crowds in emission-intensive generation from coal. Thus nationally greenhouse gas emissions rise by around 3.2 per cent of base case level. This is equivalent to around 16 Mt of CO<sub>2</sub>-e.

**Figure 8: Effects on Australia’s greenhouse gas emissions**



### 3. Low-price (Baseline) compared to full-price (Baseline)

There is some uncertainty about the future international LNG price. The price assumption for the full-price (Baseline) is shown in Figure 1. To gauge the sensitivity of the modelling to changes in that assumption, we have simulated an alternative Baseline in which the price rises from the current average price of \$4.50 per GJ to \$7.75 per GJ, which is half the increase assumed in the full-price (baseline). Figure 9 shows percentage deviations in real GDP implied in both simulations. In the years to 2018, the absolute difference in results is relatively small, with the full-price (baseline) being less stimulatory than the low price (Baseline). The difference is magnified in the long-run. Roughly, with half the price increase, we get nearly twice the increase in real GDP.

This rule follows for most of the other results. For the long-run, in the low price (Baseline) scenario relative to the full-price (Baseline) scenario the sign of the deviations is the same but the magnitude of the deviations is roughly doubled.

**Figure 9: Real GDP effects Full price and Low price**

