Impact of a Carbon Penalty on Electricity Generation

- ***Messages for stakeholders***

Overview

Electricity generation members of the Electricity Supply Association of Australia (ESAA) engaged ACIL Consulting to conduct an economic study into the effects of a carbon impost or penalty on electricity supply. Independently, National Economics (NIEIR) checked the impact of the impost on electricity prices and on subsequent electricity demand.

As input to the modelling, ACIL assumed a carbon impost on electricity generation of $10 and $30 per tonne of carbon dioxide emitted from electricity generation. The impost can be seen as a carbon tax or the cost of an emissions permit. These values are seen as reasonable indicators of the cost of carbon in a carbon constraint world.

ACIL modelled the carbon impost as a cost on fossil fuel in the dynamic National Electricity Market (NEM), and for the non-NEM States, the local electricity market. Power station dispatch was determined by the resultant pool price and involved both existing and potentially new plant (mainly gas) and anticipated or known limitations on interconnectors (interstate electricity transfers). The model compared the business as usual scenario with the carbon impost scenarios for 2010 and 2015 in order to nominally account for short-term impacts (2010) and longer term impacts (2015).

In part, a study objective was to determine the impact on net revenue for generators and potential compensation needed to restore overall net revenue of the sector. Allocation of potential compensation to individual businesses was determined using greenhouse gas emission permits distributions using selected allocation formulae based on national emissions grandfathering (based on actual emissions or actual generation) and state-based grandfathering (based on actual State emissions).

The study was limited to electricity supply and did not examine issues of carbon abatement opportunities outside of the sector, nor the redistribution of the additional government revenue or any windfall gains within the sector.

Nevertheless, assuming that a $10 and $30 carbon price impost is realistic, the model output provides very significant insights into market behaviours, impacts on customers, and sectoral opportunities for reducing emissions.

What does the study show?

As expected the study shows different impacts on stakeholders, who were defined as internal stakeholders (generators and retailers) and external stakeholders (governments and customers).

Some of the key stakeholder messages are:

- A carbon impost is a cost of fuel that is passed on through the electricity pool to retailers and hence customers. The impact is large with pool prices increasing by some 14% for the $10 case and 53% for the $30 case (or $1.2 billion and $4.6 billion respectively).

- Because costs are passed on through the pool to retailers and customers to the extent allowed for by market forces, the impact on generators is a decline in net revenue of $603 million for the $10 case and $700 million for the $30 case (or 11% and 13% respectively) in 2010.

- Since fossil fuels have different emissions per unit of electricity generated, the more carbon intensive businesses will see a greater reduction in net revenue than less carbon intensive businesses. Renewable energy generators with no emissions will see net revenue gains and low carbon intensity generators such as gas-based generators, can see net revenue gains, but this will depend on the impact on total electricity demand and how coal-fired generators are positioned in the market.

- A $10 carbon impost has little impact on electricity demand or on the dispatch order of generation plant, with brown coal generators remaining the lowest cost plant, certainly within the 2010 timeframe. By 2015, demand is further reduced over business-as-usual and more fuel switching to gas (largely due to growth) occurs.

- A $30 carbon impost has a somewhat greater impact on demand, particularly where electricity is used in energy intensive industries, such as aluminium smelters. However, it has a very significant impact on the merit order of dispatch with black coal generation (and some gas generation) being cheaper than brown coal generation. As a result, the impact on all coal-based business will be significant, but brown coal generators suffer very large generation reductions and hence impact on net revenue. Gas-based businesses have very much improved net revenue gains, while hydro-based business makes very large windfall gains.

- Since demand impact is relatively modest, even at the $30 carbon impost and coal will continue to provide the bulk of base load (with gas gaining for shoulder and peak loads), the reduction in sectoral greenhouse gas emissions is relatively modest (3% for the $10 case and 9% for the $30 case in 2010 and 3% and 8% respectively in 2015).

  Thus, as expected, emission reduction within the sector comes at a high cost. Whether or not greenhouse reduction opportunities at less than $10 or $30 are available elsewhere in the economy remains to be seen, but the fact remains that at these prices, few opportunities exist within the generation sector.

- Thus regional impacts vary significantly as a result of net revenue loss with Victoria's Latrobe Valley suffering the most, followed by the NSW coal-based regions. But other coal-based areas are also affected.

  Regional or state impacts are not just limited to areas with coal-based generation. For instance, without full revenue recycling by Governments, the impact on Tasmania's energy intensive businesses will be large if Tasmania is part of the NEM (as Tasmanian

generators take advantage of the prevailing market price).

- Compensation equivalent to the sector's overall net revenue loss does not adequately compensate the net revenue losers. In fact, because there are significant net revenue winners, up to three times the sector's net loss in compensation is needed to neutralise the net revenue loss of individual businesses.

- Allocating compensation to net revenue losers based on a formula approach is possible. In the main, allocating compensation on the basis of state-based generation provides for more equitable distribution than nationally-based allocation approaches.

Figures supporting the summary

- The short run impacts (2009-10) of a $\$10/tCO_2$ and $\$30/tCO_2$ impost will be a reduction in demand from 228 TWh to 222 and 217 TWh respectively, reflecting the demand impact of higher pool prices. These demand impacts put back electricity growth by about three years.

- There is minimal merit order change for the $\$10/tCO_2$ case but under the $\$30/tCO_2$ case, black coal replaces brown coal, with black coal generation actually being larger than for the $\$10/tCO_2$ case, despite a greater reduction in demand.

- The $\$10/tCO_2$ case shows little change in the loading of interconnectors but as would be expected from the merit order change, the $\$30/tCO_2$ changes loading significantly, with imports into Victoria from both NSW and SA.

- Generators fuel and variable O & M costs nationally would rise from $3.3 billion to $5.1 billion and $8.7 billion respectively for $\$10/tCO_2$ and $\$30/tCO_2$ case with the greatest impact falling on brown coal costs.

- However, total pool revenue would also rise from $8.6 billion to $9.8 billion and $13.2 billion respectively for the $10 and $30 case, despite the fall in demand.

- Resulting net revenue would decline from $5.3 billion to $4.7 billion for the $\$10/tCO_2$ case and $4.6 billion for the $\$30/tCO_2$ case. Although demand is reduced more for the $\$30/tCO_2$, cost recovery is greater due to improved peak price recovery in the pool, roughly equilising net revenue in both cases. These total net values hide impacts on individual generators which are discussed in detail in the report.

- Greenhouse gas emissions reductions amount to 6.5Mt in 2009-10 for the $\$10/tCO_2$ case and 17.8 Mt for the $\$30/tCO_2$ case. These amounts are comparatively small given the very large impact on electricity prices.

- The long run impacts (2014-15) showed:

  - dispatch reduction from 257 TWh to 251 TWh and 245 TWh for the $\$10/tCO_2$ and $\$30/tCO_2$ with the Victorian brown coal generators falling from 69.5 TWh to 40.7 and 30.9 TWh respectively, about a 5% increase in gas generation for the $\$30/tCO_2$ case, but

an actual drop of 5% for the $10/tCO_2$ case. Black coal share will increase.

- variable generation costs would increase from $3.9 billion to $5.9 billion and $9.7 billion respectively.

- pool revenue will rise from $11.3 billion to $12.7 billion and $16.5 billion respectively.

- net generation revenue would fall from $7.4 billion to $6.9 billion for the $10/tCO_2$ case and $6.8 billion for the $30/tCO_2$ case.

- greenhouse gas savings would amount to 6.3 Mt and 16.9 Mt respectively, including a Victorian reduction of 17.2 Mt for the $30/tCO_2$ case (offset by increased emissions from black coal and gas).

- Due to cost pass-through, potential compensation or allocation of emissions permit requirements overall is not large, amounting to 2009-10 requirements of $600 million for the $10/tCO_2$ case and $690 million for the $30/tCO_2$ case. Potential compensation values for 2014-15 would be $490 million and $570 million respectively.

- The above industry-wide values hide a great deal of micro-economic detail about real winners and losers. Specifically for the short run impacts (2009-10):

  - Victorian brown coal generation would fall from 45 TWh to (a modest reduction) 43 TWh for the $10/tCO_2$ case but to 32 TWh for the $30/tCO_2$ case.

  - Victorian generators would see a net revenue fall from $1.4 billion to $1.1 billion and $0.7 billion respectively.

  - gas generation net revenue would rise from $570 million to $623 million and $985 million respectively.

Where to from here?

Electricity generators are examining the ACIL report and complex spreadsheets containing the information in detail. This may result in additional micro-economic modelling. Individual businesses can use the data in analysing additional scenarios, including the impact on demand and pool prices resulting from imposed retail licence conditions, such as in NSW and Queensland.

The study report will certainly assist in better understanding of the policy implications of a carbon impost on electricity supply and the way costs are passed on to retailers and customers. The report provides insights into regional impacts and individual business impacts and the need for compensation or redistribution of the additional revenue gained by government. However, the study did not assess redistribution effects directly, nor did it examine potentially cheaper abatement opportunities outside of the generation sector.

Given the high cost impact of a $10 and $30 carbon impost on generation businesses and customers and the relatively modest reduction in the sector's emissions, an economy-wide

study may find more cost-effective abatement opportunities in sufficient quantity to reduce overall emissions more effectively.

ESAA and its members are considering what further studies are needed to address some of the complex issues related to working within a carbon constraint economy.