What's the cost of carbon uncertainty?

THE IMPACT OF DELAYED INVESTMENT IN THE POWER SECTOR

Some studies and commentary have recently raised the issue of carbon certainty for the electricity sector. The uncertainty regarding whether a carbon price will be introduced in Australia means that investors in the power sector will delay decisions to invest in new baseload capacity. One study (Nelson et al, 2010[1]) provided an estimate of the cost of this uncertainty to LRMC as a proxy for electricity prices. This note provides more detailed analysis of this cost using Frontier's proprietary electricity market model: WHIRLYGIG. While the theory is correct, the cost involved depends largely on the requirement for new baseload investment, which is an empirical question. Alternative policies to encourage energy efficiency and renewable policies are significantly mitigating the cost of any uncertainty.

The problem with carbon uncertainty

As current policy stands, investors in the power sector are unsure when, or if, a carbon price will be introduced in Australia. This is critical to electricity investment: if a carbon price is introduced then investors will likely favour gas for new baseload capacity; if a carbon price is not introduced then coal will continue to be the most cost effective choice for baseload demand. Given that power sector investments are hugely capital intensive and long term, the potential cost of a wrong decision means that investors will delay investments in baseload capacity until there is policy certainty. Given the long lead time for making decisions about power sector investments (3-5 years) this means that uncertainty over policy will potentially affect the markets for several years: even when investors decide to build, capacity will not be available for several years.

Estimating the cost of uncertainty

The cost of uncertainty is an empirical question and depends on the need for new baseload capacity. The sooner that new baseload capacity is required (and the larger the requirement), the greater the cost of policy delay. The implication of this is that any other policy that reduces the requirement for new baseload generation capacity will reduce the cost of carbon uncertainty.

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1 Tim Nelson, Simon Kelley, Fiona Orton and Paul Simshauser, *Delayed carbon policy certainty and electricity prices in Australia* (2010), http://www.aglblog.com.au/wp-content/uploads/2010/07/Delayed-certainty1.pdf

Nelson *et al* provides a useful framework for estimating the cost of uncertainty by comparing estimates of long-run marginal cost (LRMC - as a proxy for price) for the following scenarios:

- "Certainty", which assumes that investors have carbon policy certainty and there is no delay to new baseload investment.
- "Uncertainty", which assumes that there is no carbon policy certainty until 2013. This means that any baseload investment (coal or CCGT gas) is delayed until 2018 at the earliest. In the interim, increases in demand must be met through investment in OCGT or running existing peaking/intermediate plant at higher capacity factors.

We assume that a carbon price is introduced from 2014 (when policy certainty is provided) and this is included in the LRMC estimates. Nelson does not include a carbon price.

Nelson relies on a simple cost model that determines the optimal mix between three options: Coal, CCGT Gas and OCGT Gas according to capacity factors and the load duration curve.

One limitation of the approach in Nelson is that it does not take into account the current stock of capacity. It assumes that the actual investment mix is optimal and does not take into account the current excess in baseload capacity. This approach overstates the requirement for new baseload investment, which overstates the estimated cost of uncertainty.

A second limitation (identified in Nelson as an area for further research) is that it only considers coal, CCGT and OCGT investment options, hence it does not consider the impact of the extended renewable energy target (eRET). Any policy that reduces the requirement for new baseload capacity will reduce the cost of carbon uncertainty. This includes the eRET, since it will drive increased investment in wind and renewables (directly). The intermittent nature of wind will also indirectly shift other investment decisions in favour of complementary peaking gas plant. The renewable growth driven by the eRET will largely meet the growth in demand in the next few years, which will mitigate any cost of carbon uncertainty. Various energy efficiency schemes will have the same effect, as will the Victorian 5% solar target.

Finally, a comparison of LRMC at a point in time will only reflect the impact on consumers at that time. This does not reflect the *average* cost of the delay (the resource cost). This average cost will be less than the LRMC, which will be driven by the marginal plant. If LRMC increases by more than the average costs, this means that existing generators may benefit from higher prices even though their costs do not increase. Where this occurs, this represents a transfer from consumers to existing generators, which is a cost to consumers but not a deadweight loss.

Modelling approach

For this note, we replicate the general approach of Nelson but extend it by applying Frontier's investment model: *WHIRLYGIG*. This model optimises total generation cost in the electricity market, calculating the least cost mix of existing plant and new plant options to meet load. This model is more complex than the model used in Nelson, as it considers all existing plant (including the current excess of baseload capacity), a broader mix of new investment options (beyond simply coal, CCGT and OCGT), and it includes all other regulatory constraints, including the effects of the eRET. It also allows the option of existing OCGT (peaking plant) temporarily operating at higher capacity factors to meet demand.

Modelling results

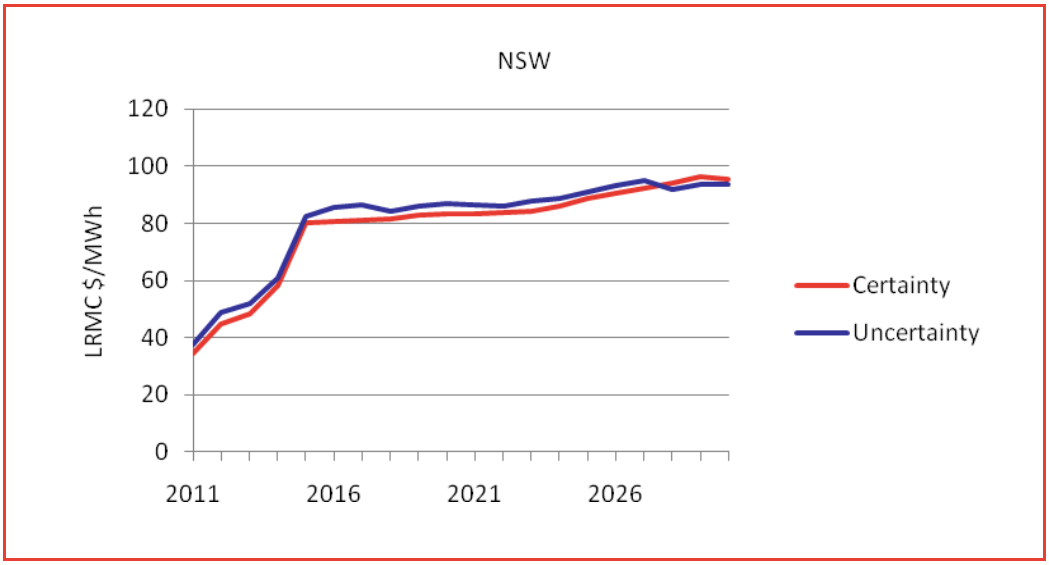
Nelson estimated that the cost of delay would be an increase in LRMC of $8.60/MWh (13%), or $3.97/MWh (6%) where additional energy efficiency policies were in place.

The more detailed modelling conducted for this note using *WHIRLYGIG* suggests that the requirement for new baseload investment is much less than suggested in Nelson. In the "Certainty" scenario, New CCGT investment is required from 2015 in some regions. This means that the cost of delay (in terms of the increase in LRMC) is $3.40/MWh in NSW, or 4.1%. This is without taking into account the benefits of energy efficiency measures, which would further reduce this cost. This does not include the Victorian 5% large scale solar target, which would further reduce any cost of uncertainty.

As discussed, this is a point in time estimate, though the LRMC eventually reverts to the same level as the "Certainty" case. A chart of NSW prices is provided in Figure 1.

The actual increase in resource costs (as opposed to LRMC) is closer to 0.3% over the modelling period. This suggests that much of the increase in LRMC is actually a transfer to existing generators as opposed to a resource cost.

Figure 1: LRMC in NSW



Source: Frontier Economics

Conclusions

The theory that carbon policy uncertainty will lead to higher electricity costs is sound, though the degree of cost increase is an empirical question. The modelling above only considers delay policy uncertainty until 2013. Further delays would increase the cost of uncertainty. On the other hand, any policy to reduce the requirement for new baseload - energy efficiency measures or technology specific policies such as the eRET - reduces the cost of uncertainty.

Firstly, there is currently an excess supply of baseload capacity in the NEM, which mitigates the cost of carbon uncertainty. Our detailed modelling reveals that this reduces (or delays) the cost of carbon policy uncertainty.

Secondly, policies to encourage new renewables (eRET), other technology specific policies (the Queensland Gas scheme, NSW GGAS, the Victorian large scale solar target) and various energy efficiency measures will further reduce any cost of carbon price uncertainty.

Finally, the LRMC (as a proxy for electricity price) will rise by more than the actual cost increase. While LRMC provides a measure of cost to consumers, this does not represent the cost of the policy uncertainty since some of the benefit of higher prices would be a transfer to existing generators.