Impact of Carbon Prices on Wholesale Electricity Prices and Carbon Pass-Through Rates in the Australian National Electricity Market.

Phillip Wild, William Paul Bell, and John Foster

School of Economics,

The University of Queensland

Executive Summary

Policies to abate carbon emissions have a range of economic impacts. Of central concern to governments has been the impact of such policies on the price of electricity. Fast rising electricity prices are politically damaging because they tend to affect low income groups disproportionately but rising electricity price also provides an incentive to reduce carbon emissions. Australia is an interesting case study in this regard, having introduced a relatively high \$23/tCO_2 carbon price in 2012. In this article we examine what effect the carbon price will have on wholesale electricity prices.

In this article, we have reported on a detailed investigation of the 'pass through' impact of carbon pricing on the wholesale price of electricity. To address this issue, a model of the national electricity market is required that contains many realistic features of what is a complex, networked system. Such features include intra-regional and inter-state trade, realistic transmission network pathways and the competitive dispatch of all generation with price determination based upon marginal cost and transmission branch congestion

characteristics. In order to capture these linkages, we used an agent based model of the Australian National Electricity Market (NEM), incorporating a Direct Current Optimal Power Flow (DC OPF) solution algorithm to determine optimal dispatch of generation plant, power flows on transmission branches and wholesale prices.

There are a number of broad conclusions. First, Tasmania experienced much more modest growth in average wholesale electricity prices as the carbon price level increases. For the mainland states, Queensland consistently had the lowest average wholesale prices, followed by South Australia and New South Wales. Victoria consistently has the highest average wholesale prices.

For all states, we found that there was less than complete pass-through of the carbon price into average wholesale prices. We found significant variability in carbon pass-through rates across states and at different carbon prices. These results raised fundamental questions about the efficacy of using one single aggregate measure of carbon pass-through, such as the Average Carbon Intensity (ACI) rate that has been proposed in the standard clause provision in 'Over The Counter' (OTC) market transactions. Instead, incorporating regional differences in carbon pass-through rates in the design of OTC hedge products would not only give these products a spatial context but would produce more efficient price signals. This latter outcome would arise because the differential impacts of carbon prices associated with regional differences in generation fuel-mix and age of plant, installed generation capacity constraints, transmission infrastructure servicing regional demand and transmission constraints would be included more generally in the wholesale electricity price determination process. Furthermore, the principles considered in the article could be readily extended to either a gross pool energy-only wholesale market structure or a net pool market structure based

around a combined day-ahead and real time balancing market as well as to longer horizon capacity market structures.

With regard to the robustness of our results, modelling based on past behaviour can, of course, never fully capture real events in the future. However, the modelling methodology has enabled us to create realistic scenarios that we would expect to hold up well for a number of years provided the generation structure does not change too much. Early indications support this – our estimates of increases in state level and NEM level electricity price rises, computed before the introduction of carbon pricing in July 2012, are very close to the actual outcomes and superior to the Australian Commonwealth Treasury's estimate of the NEM electricity price rise (state estimates were not available).