Economic consequences of some alternative Australian climate policies

Australian climate policy is at a cross-road. With a Federal election expected in May 2019, it is timely to assess the economic impacts of alternative domestic policy approaches proposed by the two major political parties. While the Coalition government seeks to meet its Paris Agreement commitment of 26-28 per cent emissions reduction by 2030 (relative to 2005), the Labor opposition has announced a higher target of 45 per cent emissions reduction over the same time frame, with the aim of reaching net zero emissions by mid-century.

BAEconomics has examined the economic impacts of adopting different domestic climate policies using the BAEGEM Computable General Equilibrium (CGE) Model. BAEGEM is a recursively dynamic CGE model of the world economy with a structure similar to that of GTEM.[1] BAEGEM simulates the inter-relationships between production, consumption, economic growth, flows of international trade and investments, constraints on production inputs, and greenhouse gas emissions (Mi and Fisher 2014). The world regions and production sectors covered in the current model disaggregation are presented in Table 1 and some key model assumptions are set out in Table 2.

Table 1: Regions and sectors in BAEGEM

	Regions		Sectors
1	United States	1	Crops
2	Canada	2	Livestock
3	Mexico	3	Forestry
4	EU27	4	Fishing
5	Russia	5	Thermal Coal
6	Rest of Europe	6	Metallurgical Coal
7	China	7	Oil and Gas
8	India	8	Oil refinery
9	Japan	9	Iron ore
10	Korea	10	Other mining
11	Australia	11	Food processing
12	Rest of Asia	12	Chemicals, rubber and plastics
13	Brazil	13	Manufacture of non-metallic mining products
14	Rest of Latin America	14	Other manufacturing
15	Middle East	15	Iron and Steel
16	North Africa	16	Non-Ferrous Metal
17	South Africa	17	Electricity
18	Rest of Africa	18	Construction
		19	Land Transport
		20	Air and water Transport
		21	Services

[1] GTEM, was the CGE model built by ABARE and used extensively for climate policy analysis by Commonwealth Government agencies in the late 1990s and the following decade (see Pant 2007).

Table 2: Overview of BAEGEM

Distinguishing Feature	BAEGEM
Solution Concept	Market equilibrium driven by supply and demand
Expectations/Foresight	Recursive dynamics
Representation of end-use sectors	There is one representative household and one government for each economy
Investment dynamics	Investment is driven by long-term GDP growth rates and investment return differentials between economies
Labour market flexibility	Not fully flexible, lower GDP growth rate will a trigger higher unemployment rate and a fall in real wages
Link between energy system and macro-economy	GDP sets the scale of economic activity in the model, which in turn drives the demand for each commodity in each segment of the world economy
Greenhouse gases covered	CO_2, CH_4, N_2O, HFCs, PFCs and SF_6
Emission sectors covered	Energy, Transport, Fugitives, Industry, Agriculture, Waste, LULUCF
Electricity production	Substitution allowed between Coal, Gas, Oil, Hydro, Nuclear, Wind, Solar, Biomass and Other Renewables
Technological Change/Learning	Learning-by-doing gradually reduces the average production costs of renewable technologies (except hydro), compared with conventional electricity technologies over the reference case
Integration costs	Increased investment in intermittent renewable electricity technologies incurs additional capital efficiency integration costs to firm generation from these sources. Firming costs are based on estimates in Lovegrove et al. (2018).
Thermal efficiency improvement for fossil fuel electricity generation	0.5 per cent per year over the reference case
Energy consumption	Substitution allowed between coal, gas, liquid fuel and electricity
Fuel consumption in transportation	Substitution allowed between coal, oil, gas, biofuel and electricity
Autonomous fuel efficiency improvement for transportation	2.5 per cent per year over the reference case
Autonomous energy efficiency in other sectors	0.5 per cent for developed economies, 1 per cent for developing economies over the reference case
Implementation of climate policy targets	Carbon prices, cap-and-trade, indirect taxes, regulatory targets, and combinations of the above

In our modelling we have analysed some policy scenarios using as a starting point the Australian Government's emissions projections released in December 2018 (Department of Environment and Energy 2018). One of the key features of the Department of Environment and Energy's most recent projections is their estimate of the extent to which Australia is likely to over-achieve on its Kyoto Protocol emissions reduction target. We have assumed that the Kyoto carryover estimated by the Department of Environment and Energy will be utilised to help meet future targets under the Paris Agreement.

In the first instance we have modelled two alternative policy commitments. The first policy scenario is one in which a Paris target of a 26-28 per cent reduction in emissions is achieved by 2030 compared to the base year of 2005, allowing the Kyoto carryover to be utilised. In this scenario renewable energy generators contribute 36 per cent of Australia's electricity by 2030. In the second policy scenario Australia undertakes a 45 per cent reduction in greenhouse gas emissions compared to the 2005 base year, again allowing for the use of the Kyoto carryover and in addition a 50 per cent renewables target is imposed on the electricity sector. It is assumed that under both policy scenarios all other countries with a Paris contribution (including the United States) meet those targets. The projected global carbon price in 2030 given that all Paris contributions are honoured is around $US42.00.

Under either policy scenario the Australian economy must adjust as more emissions intensive activities make way for industries that are less greenhouse gas emissions intensive. In some cases such adjustments are technically difficult and therefore expensive. For example, at present it is not practical to control the methane emissions from livestock grazed on native pasture land and as a consequence the marginal cost of abatement is very high for that activity. In other activities the projects approved under the Coalition Government's Emissions Reduction Fund show that, up to a certain point, emission reductions can be achieved by, for example, terrestrial sequestration of carbon, for around \$A13-14/tCO_2e abated. The modelling chooses the least cost way of meeting the specified abatement targets subject to the constraints on renewable energy generation in the electricity sector. Either policy option will result in some cost in terms of output foregone (GDP) because the economy is being forced to adjust away from the trajectory it is on. This adjustment will in turn affect employment and real wages. The level of the costs of adjustment will depend, among other factors, on the ambition of the abatement target chosen. The marginal abatement cost for the economy, as a whole, is non-linear, that is, the marginal abatement cost curve becomes steeper as more abatement is undertaken.

Meeting a 26-28 per cent reduction target is projected to mean that by 2030 the Australian economy would be around $A19b smaller in terms of GDP than it otherwise would have been.[2] This is equivalent to saying that the economy grew at a rate of 2.8 per cent per year over the decade to 2030 compared to a rate of 2.9 per cent a year.

To achieve a 45 per cent target is more costly in terms of projected output change. Expressed in terms of the impact in 2030, of the more stringent target, the economy is projected to be $A144b smaller than it otherwise would have been in terms of loss in GDP. This is equivalent to the economy growing at around 2.3 per cent per year over the decade to 2030 compared to a rate of 2.9 per cent.

[2] Unless otherwise stated all results are presented in real $A 2016.

Cumulative GDP losses (discounted to net present value terms using an assumed social discount rate of 2.6 per cent) are estimated to be A$69 billion and A$472 billion over the decade to 2030 depending on whether less or more stringent abatement targets are adopted.

As a practical matter, governments will choose a range of policy instruments to meet a given emissions reduction target. Possible options could include mandated renewable targets in the electricity sector, subsidies for given abatement activities, regulations such as fuel efficiency standards for vehicles and many others. The implicit domestic carbon price (for the final tonne abated) in 2030 under the alternative scenarios is around $A90 and $A300 for the 26-28 per cent and 45 per cent scenarios respectively. The implication is that there are large gains to be achieved by participating in international emissions trading if such a scheme could be successfully negotiated and implemented under the Paris Agreement.

In BAEGEM the labour market is not fully flexible with some adjustment taken up by a change in employment but with the major share of adjustment accounted for by changes in the real wage rate. In other words, a negative shock to output will result both in some loss of jobs and a reduction in real wages. With a 26-28 per cent emissions reduction target average real yearly income for a full-time worker is projected to be around $A2000 lower than it otherwise would have been in 2030. At the same time this scenario is projected to result in an economy with around 78000 fewer full-time jobs. With a 45 per cent reduction target the projected fall in real annual wages is around $9000 per year by 2030 together with a loss of around 336000 full-time jobs, illustrating the extent of the economic adjustment required by the economy to reach the more stringent target.

Wholesale electricity prices for Australia as a whole are projected to be higher than they otherwise would have been by 2030 under both policy scenarios. When the intermittent renewable electricity penetration level exceeds around 30 per cent, firming and integration costs start to rise sharply (assuming that current reliability standards are maintained in the various electricity grids across Australia). Under the reference case the wholesale electricity price is projected to be $81/MWh in 2030. This is projected to rise to $93/MWh under the 26-28 per cent scenario and to $128/MWh under the 45 per cent scenario.

This analysis is part of an ongoing research project being undertaken by BAEconomics. Further results from this work will be released as they become available and as the policy options become more clear.

References

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