

**A Multi-Sectoral, Multi-Household, General Equilibrium Model to Assess
the Impact of a Carbon Price on the Australian Economy**

By

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*Dedicated to my mother, Nanda Liyanaarachchi
and father, Gaspe Ralalage Chandrasiri
who toiled to educate and guide me in the right path.*

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Abstract

Australia ratified the Kyoto Protocol in 2007 and became legally committed to a reduction of greenhouse gas emission levels of 8 percent below 1990 levels. In order to achieve this target, the Australian government announced a tax of \$23 per tonne of CO₂-e as a starting carbon price which commenced from 1 July 2012. The economic implications of this carbon price have been projected by the Australian Treasury using a suite of Computable General Equilibrium (CGE) models and various other sector specific models. However, the present study shows an alternative possibility of projecting such impacts using a less complex, but more descriptive CGE model of the Australian economy titled A3E-G. With an explicit tax, the A3E-G model is capable of handling endogenous substitution among energy inputs and alternative allocations of resources among energy and capital. The A3E-G model has been calibrated using an Environmentally-extended Social Accounting Matrix (ESAM). The ESAM is one of the first SAMs constructed for carbon price modelling in Australia.

The A3E-G model is used to analyse the macroeconomic, sectoral and household effects of three alternative carbon prices (\$10, \$23 and \$35) to achieve emission reduction targets for the Australian economy. The policy experiments reveal that high carbon emission cuts are possible at higher carbon prices. A carbon price of \$23 reduces GDP by 0.6 percent and real consumption by 0.17 percent and increases the consumer price index by 0.71 percent in the short-run. This policy increases energy prices, especially electricity prices by 24 percent in the short-run and 9 percent in the long-run. The employment impacts of the policy reveal intermediate production, transport workers and labourers and related workers are seriously affected by the carbon price as there is a reduced employment level of 1.37 and 0.98 percent respectively.

Household impacts are found to have a proportional to progressive tax incidence in the short-run and a progressive tax incidence in the long-run. These results are due mainly to the differences between the ownership of factors of production by various household groups. The revenue recycling simulations show an increase in economic efficiency and household welfare without increasing emissions. All compensation policies tend to increase household welfare (measured as utility change and equivalent variation) towards higher income groups.

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Glossary

A3E-G	Economy-Energy-Emission CGE model
ABARE	Australian Bureau of Agricultural and Resource Economics
ABS	Australian Bureau of Statistics
ANA	Australian National Accounts
ANZSIC	Australian New Zealand Standard Industrial Classification
ASNA	Australian System of National Accounts
CCAP	Change in Capital
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium Model
CO ₂ -e	Carbon Dioxide equivalent
CPRS	Carbon Pollution Reduction Scheme
CPI	Consumer Price Index
DCCEE	Department of Climate Change and Energy Efficiency
ESAM	Environmentally-extended Social Accounting Matrix
ETS	Emissions Trading Scheme
GDP	Gross Domestic Product
GEMPACK	General Equilibrium Modelling Package
HES	Household Expenditure Survey
IEA	International Energy Agency
IO	Input-Output
IPCC	Intergovernmental Panel on Climate Change
LES	Linear Expenditure System
MPCCC	Multi Party Committee on Climate Change
NGGI	National Greenhouse Gas Inventory
ROW	Rest of the World
SAM	Social Accounting Matrix
SSA	Systematic Sensitivity Analysis
UNFCCC	United Nations Framework Convention on Climate Change