MEDIUM-TERM FORECASTS OF ENERGY USAGE: AN APPLICATION OF THE MMRF-GREEN TOPS-DOWN MODEL

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Overview of Project

- MMRF-Green model used to produce medium-term forecasts for greenhouse gas emissions and energy usage for Australian regions
- Variables forecasted include:
  - production by industry
  - emissions by major source
    - stationary energy sector, transport, non-combustion sources
  - energy usage by major source
- Forecast period, 1999 to 2020
What is MMRF-Green?

■ Dynamic Applied Regional General Equilibrium Model of Australia
■ Complete bottoms-up model of the Australian economy
  ◆ covers the six states and two territories
  ◆ recognising over 50 industries and their products in each region
  ◆ models each region as an economy in its own right
    ◆ region-specific prices
    ◆ region-specific consumers
    ◆ region-specific industries, etc.

What is MMRF-Green?

■ Equilibrium means that:
  ◆ households are utility maximisers and industries are cost minimisers
  ◆ prices equal costs
  ◆ demand equals supply for commodities and services, but not necessarily labour and capital

■ Features detailed emissions and energy accounting:
  ◆ emissions from combustion and non-combustion sources
  ◆ energy from all primary and secondary fuels
What is MMRF-Green?

- Emissions and energy usage driven by core economic variables:
  - volumes of fuels used by industry in each region (combustion emissions and energy usage)
  - output by industry (non-combustion emissions)
  - residential usage of fuels (residential emissions and energy usage)

What is MMRF-Green?

- Extensive scope for inter-fuel substitution
  - in electricity generation adopts the technology bundle approach used by ABARE
  - price-responsive substitution allowed for energy-intensive commodities used by industries
  - household usage of petroleum complementary to usage of vehicle services
  - exogenously imposed changes in technologies
Why Forecast?

- Forecasts required for planning:
  - Greenhouse gas targetting
    - Kyoto protocol
  - Guaging Australia’s future energy requirements
  - Planning development of public infrastructures
  - For businesses planning and resourcing large energy projects
  - Environmental planning requires long lead times

Methodology

- Large amount of information imposed
  - macro forecasts
  - assumptions for changes in industry technologies and household tastes
  - forecasts for the quantities of exports
  - assumptions for changes in industry technologies
    - efficiencies of energy usage
    - trends towards and away from certain fuels
    - renewables
Methodology

- Changes in policies exogenously imposed
  - Energy market reforms
  - Renewable energy targets
  - Energy efficiency requirements
  - Opening up of national electricity and gas market
- Large energy projects
  - electricity
  - oil, gas and coal
- Model traces out implications for structural variables, emissions and energy.

Assumptions - Macro variables

- Subdued business cycle through the decade to 2020
  - GDP growth average 3.0 per cent, c.f. 3.5 per cent between 1995 and 2000
- Unemployment reduced to around 5 per cent by 2010
- Real private consumption grows at same rate as real GDP
- Real investment growth higher than real GDP growth
- Exports and imports increase as a share of GDP
  - growth rates of almost 6 per cent
Assumptions - Technology and Tastes

- Tastes
  - favouring fruit, vegetables, dairy, cars and communications
  - against tobacco and petrol
- Intermediate input using technological change
  - favouring chemicals (including plastics), equipment (especially electronic), financial and property services, communications
  - against trade services and freight
- Primary factor saving technological change
  - moderate savings for agriculture, mining and food manufacturing
  - rapid improvements in utilities

Assumptions - Structure of Exports

- Poor export prospects:
  - Oil and gas
- Good export prospects
  - Most industrial commodities, including
    - Textiles, clothing and leather products
    - Petroleum products and other chemicals
    - Metal products
- Middle export prospects
  - Most agricultural commodities
Assumptions - Energy Policies

- Effects of Energy Market Reform (EMF)
  - 0.5 per cent per year improvement in factor productivity of generators

- Mandatory renewable energy target (MRET)
  - renewable electricity increases from 62 pj to 84 pj by 2010

- Generator efficiency standards
  - fuel efficiency of generators improves to reduce emissions by around 5 Mt in 2010

- Greenhouse Gas Abatement Programs (GGAP)
  - fuel efficiency of other emitters improves in line with proscribed schedule

- QLD government initiatives
  - promotes gas at the expense of coal for electricity in QLD

Baseline Forecasts for Industry Output

- Five fastest growing industries in our forecast
  1. Communication services
  2. Financial and business services
  3. Air transport
  4. Other manufacturing
  5. Other metal products

- Five slowest growing industries in our forecast
  1. Crude oil
  2. Oil-fired electricity
  3. Water transport freight services
  4. Building materials
  5. Electricity from renewable sources
Baseline Forecasts for Greenhouse Emissions

- Total emissions growth, 1.7 per cent per annum
  - 1.3 percentage points less than real GDP growth
  - fastest growing source is waste dumps
  - fastest growing area is the forestry sink (LCUF)
  - slowest growing is electricity emissions
    - emissions from the energy sector projected to grow by 1.4 per cent per year
- Growth in emissions from electricity slow
  - increased share of gas at the expense of coal
  - growth in fuel efficiency at 0.7 per cent per annum
  - all policies except for EMR reduce emissions

Conclusions: Strengths

- Very detailed
  - For Australia, forecasts are produced for up to 56 industries in each state, for emissions from all fuels and users plus emissions from non-combustion sources
- Flexible
  - Able to take on board a wide range of forecasts from specialist forecasting groups
- Consistent
  - Economy-wide framework where everything has to add up
Tops-down and Bottoms-up

- Tops-down
  - Detailed account of forces external to the energy sector
    - wages, required returns to capital
    - industrial, residential and government demands
    - foreign conditions

- Bottoms-up
  - Detailed account of forces internal to the energy sector
    - engineering specifics of individual plants

- Integration for policy analysis and forecasting?