Feature Article:

National Climate Change Process Update

By Roberto D’Abate

Subsequent to the signing of the 1997 Kyoto Protocol, federal, provincial and territorial Ministers of Energy and Environment initiated the National Climate Change Process (NCCP), in April of 1998. The NCCP was mandated to develop a national implementation plan to respond to Canada’s commitment to the Protocol.

As part of this process, the NCCP created 16 stakeholder committees, called Issue Tables. Each Table provided expert and detailed input, in the form of Foundation and OPTIONS Papers, to the identification and analysis of greenhouse gas reduction opportunities, as well as the challenges and benefits of the various options open to Canada (see the NCCP website for more details on the NCCP, http://climatechange.gc.ca).

NCCP mandated the Analysis and Modelling Group (AMG) to address issues related to data, analytical and modelling needs. The AMG’s focus rests with ensuring the coherency of data for analysis, providing an analytical framework for consistency and comparability of the methods used, and directing the “roll-up” of analyses and modelling of various implementation scenarios, combinations of different measures and options identified by the Issue Tables.

NCCP and ERG

Since April of 1998, several Issue Tables have employed the services of ERG members for a variety of studies and activities, namely the Forest Sector Table.

Kyoto Protocol Brief

The Kyoto Protocol aims at reducing a basket of anthropogenic, greenhouse gases (GHG) concentrations that result in global climate change: CO₂, N₂O, CH₄, CFCs and HCFCs, PFCs, and SF₆. The signatory members include all industrialised countries, including most Central and Eastern European countries, and Argentina. These participants have made legally binding agreements to reduce their GHG by an average of 5%, below 1990 levels, over the period of 2008 to 2012 (Canada’s target was set at 6%).

The Protocol is much broader than previous agreements in that it includes provisions for emission changes resulting from forest practices and land use changes. The Protocol also allows for emissions trading between nations and consideration for developing countries (Clean Development Mechanism and Joint Implementation).

For more information on the Kyoto Protocol visit the following sites:

http://www.iisd.ca/climatechange.htm
http://www.cop3.de/
NCCP Update cont’d…

In July, the ERG’s Canadian Integrated Modelling System (CIMS) was among the two models selected (the other was MARKAL) by the AMG to model the integrated “roll-up” analysis of energy supply and demand in industry. The CIMS team will integrate the analyses of the energy and emissions impacts and the respective abatement costs of the various measures outlined in Issue Tables’ OPTIONS papers. They will subsequently determine the interactive effects of a combination of measures from various Issue Tables and analyse variations on measures and incentive packages of different scenarios requested by the AMG (different energy prices, carbon permit trading scheme, tax incentive, etc…).

The analysis provided by the CIMS and MARKAL teams will comprise only part of the overall energy/environment/economy picture required to fulfill the AMG’s mandate. A macro-economic model will combine these analyses with the Agriculture and the GHG Sinks Tables analyses to determine the overall economic impacts both regionally and nationally.

Why CIMS?

CIMS possesses many of the qualities sought by the AMG. These qualities, among others, include technological detail by major fuel use, comprehensive coverage of the major energy demand and supply components, broad national coverage, macroeconomic feedbacks, and most importantly, the flexibility to analyse various policies. In addition, the behaviourally realistic CIMS can provide complementary results when compared with the techno-economic optimisation produced by MARKAL.

Reducing Greenhouse Gas Emissions from BC’s Transportation Sector

by Rose Murphy

This summer, I completed a contract with the BC Ministry of Environment, Lands and Parks; Environment Canada; and the Clean Air Research Fund which involved investigating the cost and potential of a range of measures for reducing GHG emissions from BC’s Transportation Sector.

In order to meet the objectives of this project, a transportation model for BC was developed within the Canadian Integrated Modelling System (CIMS) housed at ERG. The transportation component of the National Energy Modeling System (NEMS) of the U.S. government was used as a template for incorporating the most up-to-date research on behavioural aspects of transportation related decisions into the model.

Eight measures affecting personal transportation and three measures affecting freight transportation were evaluated for the purpose of this study. All of the measures were evaluated in terms of their annual CO2 emission reduction potential over a forecast period extending from 1995-2015. The personal transportation measures were also evaluated in terms of average annual cost per tonne of CO2 reduced. Results were presented separately for the GVRD.

The figure below shows the average annual cost or benefit per tonne of CO2 reduced in the year 2010 for the personal transportation measures evaluated (benefits are shown as negative numbers). These measures included an efficiency standard (Eff Std), an efficiency feebate (Eff Fb), a fuel switching standard (FS Std), a fuel switching feebate (FS Fb), a measure to encourage mode shifting from passenger vehicles to public transit (PV/PT), a measure to encourage a shift from single occupancy vehicles to high occupancy vehicles (S/HOV), a measure to promote demand reduction within the GVRD (Dem Red), and a gasoline tax (Gas Tax). Please note that the results presented here are for a specific set of assumptions. For more information on these assumptions as well as other aspects of this study, please contact the ERG.
Assessing Cogeneration Potential In GVRD Commercial Buildings

By Jeremy Higham

The British Columbia (BC) provincial government is currently evaluating technologies to reduce CO₂ emissions in order to honor commitments under the Kyoto Agreement. Adoption of distributed cogeneration, to provide heat and power in Greater Vancouver Regional District (GVRD) commercial buildings could reduce net CO₂ production and may cost less than other supply options. Cogeneration is the combined production of heat and power. With this technology, heat from electrical generation is used for various thermal applications including space heating, water heating, and cooling. It is not economical to transport heat over long distances. Therefore, cogeneration units need to be located close to thermal users and would be distributed throughout the electrical grid in or near commercial buildings.

When heat and power are produced separately (which is the norm), heat from electrical generation is vented off and wasted. In addition, technological evolution has lead to greater efficiency in small-scale electrical generators, such as those that could be employed in cogeneration applications in commercial buildings. Consequently, cogeneration is likely more fuel-efficient and less CO₂ polluting than separate heat and power systems.

Because cogeneration is more fuel-efficient it may ultimately cost less than other technologies that will be considered as new electrical generation supply options. In North America, electricity markets are transforming from utility based monopolies into competitive markets where numerous generators sell into an organized marketplace or power pool. The advent of unrestricted competition will force utilities and independent power producers to adopt least cost technologies to generate new supply. Competitive markets will nonetheless be subject to environmental regulation and quite possibly some form of CO₂ emission control. Ultimately, electricity generators will pay for regulated environmental costs and winners in a new electricity market will be those with the lowest total costs.

Natural gas is an inexpensive and abundant, low CO₂ emitting fuel. On a cost basis, natural gas-fired electricity generation technologies are very competitive in meeting new capacity demand. Currently, electric utilities consider electrical generation from combined cycle gas turbines (CCGT) to be the most likely option to provide incremental increases in electrical generation to GVRD commercial building markets. However, small-scale, natural gas fired cogeneration emits even less CO₂ than CCGT.

Study Objectives

The purpose of this study is to assess the market competitiveness and greenhouse gas reduction potential of distributed cogeneration of heat and power in the commercial building sector in the GVRD in a competitive electricity market structure. The primary objectives of this study are to determine:

1. If small-scale natural gas cogeneration in commercial buildings in the Greater Vancouver Regional District (GVRD) is a cost-effective technology under competitive market conditions.

2. If adoption of these cogeneration systems, in lieu of investment in a new, large scale, combined cycle generating station, will reduce atmospheric emissions and help to attain provincial GHG emission reduction targets.

TransAlta Leads the Way

TransAlta Utilities of Alberta is currently the Canadian leader in implementing cogeneration projects with a total of 1230 MW in construction. The largest cogeneration development in Ontario (535 MW) will supply electricity and thermal services to Dow Chemicals, Bayer, Nova, Sunoco, Shell, Montell, Imperial Oil and Sarnia Hydro. A total of 480 MW of cogeneration construction in Alberta will supply Suncor and Dow Chemicals. Finally, a total of 215 MW in Saskatchewan will meet the needs of Husky Oil.
Autonomous Energy Efficiency Index
By Dean Luciuk

The effect of technological evolution on energy consumption, when energy (and other input) prices are held constant, is also referred to as the price-independent determinant of energy use. Energy modelers frequently use the term “autonomous energy efficiency index” (AEEI) to describe this effect on energy demand. The AEEI indicates changes considered to be autonomous in that they are independent of changes in energy price. AEEI is generally assumed to represent the trend in technological energy efficiency, although in this analysis it is shown that its value (at least as usually estimated) can also be influenced by structural changes of the economy and various policy instruments that are themselves price-neutral.

For more information contact Dean Luciuk (dean_luciuk@transalta.com).

Discreet Choice is Coming to a CIMS near you…
Kevin Washbrook is researching road pricing elasticities by income and destination, using discrete choice experimental methods.

Kevin’s goal is to develop a clearer idea of the dynamics of this potentially powerful yet highly controversial transportation demand management tool, so that it can be incorporated into regional planning. His motivation is making the Lower Mainland a better place to live for his new little buddy, Kev junior. Ideally, this research will help to improve the behavioral realism of ISTUM’s Transportation model by moving us down the path of incorporating empirically adequate parameters for mode choice.

So What is an ERG Anyway?
1. An extremely slow moving sand dune that overwhelms anything in its path (An analogy for a certain model perhaps?),
2. A infinitesimally small unit of energy equal to 1e-07 joule,
3. The sound one makes when asked to use CIMS.

Announcements

Congratulations to Rob Lockhart for successfully defending his MRM project. With some modifications to his thesis, Rob should complete all requirements for his degree this semester! Rob’s moves on to a few months of travel and exploration, eventually settling down in Toronto.

Two other graduate researchers, Jeremy Higham and Dean Luciuk, are both nearing completion of their respective research papers, and will defend their work before this semester is complete.