By: Nic Rivers, Matt Horne & Margo Dennis

Researchers at EMRG have spent the last 10 years developing and applying the CIMS (formerly ISTUM) model to analyse environmental and economic consequences of different policy strategies. CIMS is one of the few in the world of energy models that attempts to bridge the gap between top-down aggregate energy models that are behaviourally realistic but are unable to represent individual technologies, and bottom-up disaggregate energy models that model individual technologies explicitly but are not behaviourally realistic. CIMS is considered a hybrid model – it represents individual technologies explicitly, but also attempts to account for consumer behaviour in determining which technology will be used to meet a certain need. In occupying this unique position on the energy modeling spectrum, CIMS is able to provide useful insights to decision makers about the potential consequences of different decisions.

Because of its unique structure, CIMS needs behavioural information upon which to base predictions of competitions between technologies. For example, the choice of mode of transportation, shell retrofits in homes, and boiler types in industry are driven by more than just the financial costs of the technology. Just what intangible attributes influence choice in these sectors? To what degree might subsidies or information campaigns encourage adoption of energy efficient technology?

These are precisely the kind of questions that can be answered by a tool called discrete choice analysis. Discrete choice modeling is a well-developed avenue of...
consumer research that has been used extensively in transportation, residential, and recreation applications to predict individual and market behaviour in response to changes in observable attributes of alternatives.

To develop a discrete choice model, the analyst observes a consumer choose among alternative technologies from a choice set and notes the attributes (cost, size, colour, speed, and efficiency) of both the chosen technology and the un-chosen one(s). By observing many choices for multiple consumers and different attribute levels for the technologies, the analyst is able to construct a model in which the relative importance of each attribute is calculated. The analyst then has criteria on which to predict the market share of a technology with any different combination of attribute values. Policies that change the value of an attribute (for example, a carbon tax changes the cost of driving a car relative to taking a bus) can be modeled to determine their likely effect on market shares of technologies.

Traditionally, discrete choice models have been used to predict the effect of a policy on the penetration of just one type of technology (e.g. different types of houses). Such a model is not as useful to decision-makers if it is not placed in the context of the whole economy. Different technologies are not chosen in a vacuum from the rest of the choices consumers make, and simulating them like that doesn’t make sense. By integrating discrete choice models of technology choice into CIMS, the benefits of using behaviourally realistic models (discrete choice models) can be multiplied with the benefits of using an integrated energy economy model (CIMS) to produce a comprehensive model more useful to decision makers.

Three of EMRG’s newest researchers, Margo Dennis, Matt Horne, and Nic Rivers, are in the process of collecting data to develop discrete choice models, which will be used to set behavioural parameters in the appropriate nodes in CIMS. They are looking at critical energy technology decisions in the residential, transportation, and industrial sectors, respectively. More on their progress will follow in our spring newsletter!

By: Mark Jaccard

On October 6 - 8, 2002, Vancouver was host for the first time to the 22nd annual North American Conference of the International Association of Energy Economics. As program chairman, Mark Jaccard worked intensively on this conference for the past 18 months and was greatly relieved to have finally completed the assignment. The conference was well attended (250 participants) with excellent plenary sessions, lots of concurrent sessions to fit the diversity of interests, and opportunities for "intense discussions" in the foyer and bar. One small disappointment was that two keynote speakers cancelled at the last minute in order to have lunch with the Queen - enough to turn Mark into an anti-monarchist (if he wasn't already!). The substitute speakers were excellent, however, so the Queen was forgiven.

The International Association of Energy Economics was created during the energy crisis days of the 1970s. Membership has grown over the years to 3,500 members from over 60 countries today. Members are senior and middle management in energy companies, public servants, consultants and academics. The association also produces The Energy Journal, which is the top academic journal in our field. Mark is a member of the editorial board.

The annual conferences bring together industry, government and academia to exchange and debate major issues in energy economics and policy. This year's conference included plenary sessions on energy security, offshore oil development issues, lessons from California's electricity fiasco, Canada-US natural gas trade, North American energy policy, trends in energy regulation and the potential contribution of fossil fuels to a sustainable energy future.

One concurrent session was of particular interest to EMRG because it focused on discrete choice modelling of energy decision making - our latest research focus. The session was chaired by Tim McIntosh of Natural Resources Canada and included Ken Train of Berkeley, Dean Mountain of McMaster and our very own co-researcher, Ken Tiedemann. A paper co-authored by Mallika Nanduri was presented by her colleague Jean-Francois Bilodeau.
By: Maggie Tisdale

Over the past 8 months we have been working on making CIMS capable of addressing the ancillary effects associated with climate policy. With the guidance and expertise of Bob Caton at RWDI West, and cooperation and funding from Environment Canada CIMS now has the capability to estimate the anthropogenic changes in conventional air pollutants that are associated with GHG-targeted policies. The conventional pollutants included in the model are sulphur oxides (SOx), oxides of nitrogen (NOx), volatile organic compounds (VOCs), carbon monoxide (CO), and particulate matter (total, <10 microns and <2.5 microns diameter).

The potential for climate policies to affect the emission of conventional pollutants can have important ramifications for both human and natural systems. Unlike GHGs, which are uniformly mixing gases, conventional pollutants are more localized in their effect. In the lower mainland, the smog we see on a sunny day is one tangible consequence of conventional pollutants. In fact, the effect of local air pollution is considerably more tangible and immediately felt than that of climate change. Because both groups of pollutants are linked strongly to the combustion of fossil fuels, a common assumption is that by targeting GHG reduction with climate policies, a reduction of conventional pollutants will follow. Current research is addressing this assumption, and pays close attention to the synergies and antagonisms that climate policy can have for local air pollution.

Stay tuned for a report of our findings on this hot topic!

---

Can Carbon Sequestration help Canada meet Kyoto?

By: Averil Lamont

By carbon dioxide sequestration, we refer to the capture of CO₂ emissions from power plants that burn fossil fuel, followed by long-term storage in saline aquifers. If CO₂ can be prevented from entering the atmosphere and returned to underground sites, it would enable electricity generators who burn fossil fuels to reduce emissions without having to switch to cleaner energy sources. The cost of these technologies varies depending on technology type and which study one reads; one could expect an added cost of 5¢ to 6¢/kwh from plants so equipped.

Four cost scenarios were analyzed in CIMS to determine the impact that different assumptions for CO₂ sequestration might have on Canada’s ability to reduce greenhouse gases to the levels necessary to meet the Kyoto Protocol. Each cost scenario incorporated various levels of the key uncertainties in carbon sequestration: geological feasibility, environmental and social impacts, and economic trajectories for the future costs of the sequestration technologies.

The following applications of sequestration technologies were examined based on data availability:

- a post-combustion, amine-based, absorption stripping process for a coal-fired power plant,
- a post-combustion, amine-based, absorption stripping process for a natural gas combined cycle plant (NGCC),
- a pre-combustion, physical solvent-based, absorption stripping process for an integrated gasification combined cycle facility (IGCC), and
- a pre-combustion, physical solvent-based, absorption stripping process for both IGCC and NGCC that creates hydrogen as an output.

All technologies include the cost of both transporting captured carbon dioxide to the saline aquifer and costs for long-term storage of CO₂ within the aquifer.

Results were obtained for the time frame of the Kyoto Protocol (i.e., 2008 to 2012, averaged to 2010), and the time frame of the CIMS model (i.e., 2030). Differences between scenarios of CO₂ sequestration did not have as great an impact on the cost of meeting Kyoto as was originally expected. This appears to be due to other technologies, such as wind power and small-hydro power, capturing more of the market share where the costs of carbon sequestration technologies are relatively higher. However, analysis continues and more detailed results will be available in December 2002.

‘Clearing the air’ around climate policy

By: Maggie Tisdale

Over the past 8 months we have been working on making CIMS capable of addressing the ancillary effects associated with climate policy. With the guidance and expertise of Bob Caton at RWDI West, and cooperation and funding from Environment Canada CIMS now has the capability to estimate the anthropogenic changes in conventional air pollutants that are associated with GHG-targeted policies. The conventional pollutants included in the model are sulphur oxides (SOx), oxides of nitrogen (NOx), volatile organic compounds (VOCs), carbon monoxide (CO), and particulate matter (total, <10 microns and <2.5 microns diameter).

The potential for climate policies to affect the emission of conventional pollutants can have important ramifications for both human and natural systems. Unlike GHGs, which are uniformly mixing gases, conventional pollutants are more localized in their effect. In the lower mainland, the smog we see on a sunny day is one tangible consequence of conventional pollutants. In fact, the effect of local air pollution is considerably more tangible and immediately felt than that of climate change. Because both groups of pollutants are linked strongly to the combustion of fossil fuels, a common assumption is that by targeting GHG reduction with climate policies, a reduction of conventional pollutants will follow. Current research is addressing this assumption, and pays close attention to the synergies and antagonisms that climate policy can have for local air pollution.

Stay tuned for a report of our findings on this hot topic!
Bringing in New Talent

Paulus Mau

Paulus is the first graduate from the Environmental Science program at SFU to join EMRG as a Masters Student. While completing his undergraduate degree, he worked as a consultant for BC Hydro’s Power Supply division. During his time there, he was involved in a wide spectrum of activities: from developing databases to implementing an Environmental Management System to training field staff. From this experience he became interested in sustainable environmental decision making with simulation modeling on energy issues (and hence here he is at EMRG!).

Prior to his time at Hydro, Paulus spent two years as a part time genetic research assistant. He also did a co-op term at UBC Forest Products Biotechnology developing non-chlorinated paper bleaching methods, an internship at MacMillan Bloedel Research investigating integration of waste paper into linerboard manufacturing and an internship at Agriculture Canada where he was farming apples for a summer.

Jimena Eyzaguirre

Jimena comes to us from Global Change Strategies International (GCSI), an environmental policy consulting firm based in Ottawa. Her work as a researcher there focused on domestic and international climate change policy, including research areas such as linkages between clean air and climate change, options for a domestic emissions trading scheme in Canada, implications of tri-national emissions trading under NAFTA, and climate change capacity building in Nigeria.

Jimena holds a Bachelor’s degree in environmental geology and a Master’s degree in geology, specializing in upper mantle petrology. After completing her MSc she participated in the Young Canadian Leaders for a Sustainable Future programme (funded by DFAIT and implemented by the International Institute for Sustainable Development) and discovered a new career path. She worked as a Research Associate at the Center for Sustainable Development of the Americas in Washington DC for six months where she focused on climate change policy in Latin America.

Born and partly raised in Peru, Jimena feels compelled to somehow contribute to the challenge of working towards sustainability in developing countries, a large part of which requires securing sustainable energy futures and the right policy choices. She hopes to learn more about using CIMS as a policy tool.

Correspondence
EMRG News
Simon Fraser University
School of Resource and Environmental Management
8888 University Drive
Burnaby, BC, Canada V5A 1S6
Phone: (604) 291-3068     Fax: (604) 291-5473
E-mail: emrg@sfu.ca

Congratulations to Averil Lamont (nee Sheppard) who was married August 10, 2002 to Grant Lamont at Sooke Harbour House on Vancouver Island. The EMRGers wish you and Grant all the best in your life together!