Another Project Idea from ERG

At one time in the history of the ERG, short, concise issue papers were generated by ERGers covering a range of topics including the Vancouver Island gas pipeline, the advantages of establishing a public forum or council on energy issues, cogeneration potential in BC forest products industries, the cost of emissions reduction in the residential sector, and others. The intent was to bring issues to light and open up debate. Due to heavy work schedules and shifting employment opportunities, no new occasional papers have been generated in the last year. However, recently, at a meeting in the heart of Vancouver, the ERGers came up with a project that focuses on some rather specific energy issues in BC. The project is still in its fledgling state and is such that a lot of details cannot yet be released.

This new project will involve most of the present ERGers in one way or another. The issue focus has been determined and a set of possible alternative scenarios have been sketched out. A timeline for the completion of this basic analysis is established: by mid-April we'll have detailed sectoral scenarios, by the first week of May, runs will have been completed and by mid June, analysis will be done. If things work to plan, the next issue of ISTNEWS will describe the project and contain some of the results.

And what is the specific nature of this project? You recall that, in the last issue of ISTNEWS, we provided a description of a Ph.D. proposal, to wit, a contribution to the process of developing public policy by using an analytical framework and modelling tool to aid government and utility decision makers as they compare economic and environmental costs and benefits of energy/environment alternatives. Strategies focus on the minimization of CO₂ emissions in Canada.

The “surprise project” consists of a small extension to that proposal; testing the potential of a set of policy initiatives related to two issues.

1) BC CO₂ reduction potential, the prime driver of the scenarios to be run for residential, commercial and industrial sectors and

2) the lower mainland (Vancouver and the lower Fraser Valley) nitrous oxide (NOₓ) reduction potential. Since transportation technologies are the primary contributor to this emissions phenomenon, reduction of gas levels to 50% of the 1990 concentrations forms the primary scenario for this group. Since there are a few point sources of NOₓ in the industrial sector of the lower mainland, the industrial model will contain some emissions data related to this gas.

In essence, the project asks, What will a BC energy plan that meets specific emissions criteria for these two gases look like? Work is underway and the results may prove quite interesting! We hope to have something tangible by the summer. So, until the next issue ...

John Nyboer, Editor
Congratulations Alison!!

After tens, perhaps hundreds, of simulations, and multiple graphs explaining the significance of each one, Alison Bailie has joined the ranks of those who have received the coveted Masters of Resource Management Degree. Her project, entitled *Modeling Energy Policy in the Canadian Residential Sector with ISTUM-R: Carbon Dioxide Taxes in British Columbia, Ontario, and Quebec*, is described in more detail elsewhere in this edition of ISTNEWS. The project provides a good example of how a detailed end-use model like ISTUM-R can be used as a tool to investigate the impacts of various policies. Although the project covers the provinces with the largest population, Alison's work is being extended to cover Alberta, Saskatchewan, Manitoba, and the Maritimes. And who better to do this than Alison herself!

So, those of us who are members of the ERG say "Congratulations, Alison", and may your success spur on others of us who are still labouring under the awesome shadow of unfinished projects and theses! We won't mention names but successes will be reported in ISTNEWS as they occur. JN

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Present-day Progress on the Ph.D. Proposal

In the last issue of ISTNEWS, the New Years edition, I reported that the ERG team would undergo a concerted effort to complete a number of Master's level student projects which would culminate in an overarching Ph.D. thesis. Perhaps it is the way of many "best laid plans" couched in a flood of new year's enthusiasm, but movement on the Ph.D. front is slower than expected. I guess it is the nature of most Ph.D. theses - the sum total of the parts is far less than the whole. Each portion of the infrastructure depends on other parts and .... Well, it's actually a lot more work than was expected. This, in itself is not so bad. But, coupled with a number of other projects and "must do's" (like getting out yet another issue of ISTNEWS), the net effect can be a bit demoralizing.

On the other hand, the residential sector for Canada is complete and most of major industries have undergone detailed scrutiny, have been "cleaned up" and are ready for simulation. This, coupled with the fact that the winter session at SFU is complete and the rest of the ERG team has more time to focus on their project work, suggests that some lost time may be made up in very short order. As is typically the case in most detailed end-use analysis, the availability of detailed production and consumption data is scarce. Data are just hard to come by. Stay tuned for further announcements! JN

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Residential Sector and CO₂ Emissions: What Else is New?

Well, my efforts of the past two and a half years, in particular the many working evenings and weekends of the last three months, are finally paying off. This month I will graduate from the Resource and Environmental Management program of Simon Fraser University with a Masters degree in Natural Resources Management (MMR). One of the requirements of this degree is a research project. The title of my project, *Modeling Energy Policy in the Canadian Residential Sector with ISTUM-R: Carbon Dioxide Taxes in British Columbia, Ontario, and Quebec*, pretty much sums up the research. However, for those interested, and to fill in some space, here is the project's abstract.

**ABSTRACT**

Issues involving energy supply and demand relationships, such as the costs of reducing anthropogenic greenhouse gas emissions, have led to increased interest in models that portray the relationships both within and between these two factors. Currently, these models fall into two categories, top-down or bottom-up. The two model types produce extremely different cost estimates of carbon dioxide reductions; top-down models generally claim that reductions will be very expensive while bottom-up models indicate that reductions will be very cheap. Top-down models link energy demand to macro-economic factors, such as GNP, fuel prices, and income levels, in econometric functions. By excluding the effects of potential technological innovation, these models may overestimate reduction costs. Bottom-up models calculate, based on an end-use modeling format, the total energy consumption by the attributes of the technologies that provide energy services. However, since bottom-up models often lack behavioral parameters, these models exclude the full costs of technology change to individual consumers. The Intra-Sectoral Technology Use Model for the Residential sector (ISTUM-R) is an attempt at a hybrid model for policy analysis that overcomes some
of the limitations of both top-down and bottom-up modeling philosophies. The model is based on the technological detail and functioning of bottom-up models but it also allows behavioral parameters to influence technology purchases.

This research project used ISTUM-R to simulate how carbon dioxide taxes will change technology purchase decisions made by residential consumers in British Columbia, Ontario, and Quebec. Much of the work required by the project focused on disaggregating relevant energy services for each region and, subsequently, collecting the required data. The project included nine model runs to test ISTUM-R's ability, as a hybrid model, to represent the energy demand in the residential sector and to identify the costs of reducing carbon dioxide. Four base runs, frozen efficiency, natural change, economic potential, and technological potential, indicate how ISTUM-R functions under a variety of input assumptions. The five carbon dioxide runs each represent a different level of tax: $12, $24, $36, $48, and $96 per tonne of carbon dioxide emitted. The taxes affect both energy prices, based on carbon dioxide emitted during primary conversion and processing, and technology operating costs, due to combustion of fossil fuels.

The study produced several important policy-related results including (1) an estimation of the costs to residential consumers of reducing carbon dioxide emissions, (2) the relative importance of fuel switching compared with energy efficiency improvements in reducing carbon dioxide emissions, and (3) the reduction levels required by each province in order to achieve an overall reduction level at the lowest total cost. The model results indicated the total cost of achieving various levels of carbon dioxide reductions. Further analysis can now be aimed at comparing this cost to the estimates from top-down and bottom-up models. The technology detail provided by ISTUM-R showed whether consumers would react to the carbon dioxide taxes by fuel switching or by energy efficiency improvements. Based on the provinces modeled, energy prices, technology costs, and behavioral assumptions in this study, residential consumers will generally fuel switch with only limited improvements in energy efficiency. Finally, the model runs indicated large differences between provinces in the relationships between carbon dioxide taxes and carbon dioxide emissions. Due to its large supply of hydro-electricity, Quebec has the greatest potential to reduce carbon dioxide through fuel switching. Since fuel switching tends to be less expensive than energy efficiency improvements, it is cheaper to reduce emissions in Quebec than in either British Columbia or Ontario. The study used these results to determine the carbon dioxide reductions required by each province such that overall carbon dioxide levels would be reduced by 20% of 1988 levels by 2008 at the lowest total cost.

Alison Bailie, REM Graduate

Community Energy Planning, Linking Energy and Municipal Planning

In many northern European countries, municipalities utilize energy service and distribution technologies which provides them greater autonomy over these services and increases energy utilization efficiency. Community Energy Planning focuses on the use of decentralized energy technologies, efficiency improvements, and changes to the urban form that will result in lower energy consumption, reduced reliance on fossil fuels, improved environmental quality, greater local control and self-reliance, and more livable communities. Application of this principle to various BC communities forms the basis of another ERG project.

British Columbia is composed of diverse communities that vary in size, density, growth rate, economic base and climatic conditions. The study proposes to disaggregate BC communities into representative archetypes and identify alternative energy technologies and community planning strategies that are most appropriate for consideration by each archetype. Case studies will be presented in which alternative scenarios of technological and structural evolution are simulated. The inputs are parameters that can be influenced through planning and policy (e.g.; urban density, transportation policies, fuel switching, building codes etc.). The outputs are per capita energy consumption and CO2 emissions over a twenty year period, as well as a measure of the percentage of energy supplied locally. The base case will represent a “natural evolution”, i.e.; what is likely to happen given existing policies, institutional structures and market trends. The alternative will be a community energy plan that incorporates a mix of supply and demand side measures enacted through a mix of planning, regulation, and market instruments. The results from each archetype will be extrapolated to indicate the aggregate impact on the province.
The study will illustrate how alternative technologies and strategies translate into quantitative results, but it will also look at the qualitative impacts on local development and sustainability objectives. It explicitly recognizes the interrelationships among energy planning, economic development and environmental quality. The results provide useful input to policy formulation processes including: grid and mains extensions, the formation of municipal utilities for district heating and cooling, transportation policies, zoning, emission standards, market incentives and community development initiatives.

Lee Failing, REM Masters Student

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M. Jaccard Participates in IPCC Conference, Milan, Italy

The Intergovernmental Panel on Climate Change (IPCC), jointly established by the United Nations Environment Programme (UNEP) and the World Meteorological Organization (WMC), carries out periodic scientific, technical and socio-economic assessments of various issues related to climate change. Working Group III of the IPCC will assess the socio-economics of the impacts and response options to climate change. This includes analyzing greenhouse gas emissions scenarios. The Workshop, set for April 27-29, 1994 in Milan, Italy, will include discussions related to top-down / bottom-up modelling issues.

Mark Jaccard of the Energy Research Group was invited to act as a discussant responding to the session focused on an overview of the bottom-up methodology. Dr. Jaccard, presently the Chair of the BC Utilities Commission and the Director of the Canadian Industrial Energy End-use Database and Analysis Centre (CIEEDAC) at Simon Fraser University, has been actively involved with both end-use, bottom-up modelling and with research on climate change issues in Canada. He was co-author of the COGGER report (Canadian Options for Greenhouse Gas Emissions Reductions), an analysis of progress made in Canada in response to the greenhouse gas issue.

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What's Going On?

The ISTUM-PC user group is open to all, is growing and includes ERG, BC Hydro, Natural Resources Canada (NRCan), the Ontario Ministry of the Environment and Energy, and the Saskatchewan Energy Conservation and Development Authority.

Most of the ERGers are involved with the completion of their program-required projects, much of which is directly related to John Nyboer's Ph.D. thesis. Time constraints faced by the Saskatchewan Energy Conservation and Development Authority, who recently sponsored an ISTUM workshop, have engaged ERG to do a rapid analysis of Saskatchewan's industrial sector, to be completed before the end of April.

The ERGers began an exciting new project focused on emissions-related issues relevant to the BC energy scene this month. The nature and scope of this project will be the theme of the next ISTNEWS, due to be published July, 1994.

On April 5, John Nyboer presented an introduction to the structure and function of ISTUM to Willis Energy Services, Ltd. in Vancouver. This presentation will be followed up with a workshop on ISTUM on April 23, 25, and 26. For more information contact John Nyboer (see below) or Alison Bailie (291-3068, e-mail: bailie@sfu.ca). This will be the fourth ISTUM workshop offered through the ERG since its inception three years ago.

And finally, congratulations to Mark and Ingrid Jaccard Sochting in the birth of their first daughter and fourth child, Sigbrit Jaccard Sochting. Sigbrit was born 4:00 am, April 15.

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