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CBEEDAC

enerInfo BUILDING

IN THIS ISSUE…

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CANADIAN Building Energy End-Use DATA AND ANALYSIS CENTRE
commercial • residential • institutional

CBEEDAC NEWS

Each year, in conjunction with its sponsors, CBEEDAC undertakes a number of research projects on issues related to energy end-use in the residential, commercial, and institutional sectors in Canada. In keeping with our objectives, these projects often involve assembling relevant energy end-use data, or possibly supplementing data that are already available, as well as empirical analyses of the resulting datasets.

While overseen by CBEEDAC staff, the projects themselves typically involve graduate student researchers, either working as research assistants, or as full participants who become co-authors of the studies in which they are involved. For the most part, these student researchers are enrolled in Masters or PhD programs in economics, although some students from other disciplines have been involved in CBEEDAC projects, and the opportunities for this type of involvement are expected to expand. As a result of this extensive use of graduate student assistance, at any one time a number of different research projects are underway. In this newsletter we provide a brief summary of just some of the projects that are currently being undertaken.

As the brief synopses on the next pages indicate, the research that we undertake at CBEEDAC is quite varied, ranging from assembling current data on energy consumption for water purifying and pumping, to acquiring past data on location-specific energy prices, evaluation of alternative ways of quantifying uncertainty in cost-benefit analyses, determination of possible improvements that can be made to various assumptions embedded in energy end-use models, and assessment of the impact on consumers of electricity industry restructuring in Alberta.

More complete details of some of these projects and their outcomes will be provided in later issues of this newsletter.

A Sampling of Current CBEEDAC Projects

Domestic Hot Water Energy Consumption

Many water-consuming appliances are becoming more efficient in their consumption of both energy and water. For example, new front-loading washing machines tend to use considerably less water, and less energy is directly required to operate them. However, they also use less indirect energy, since less water means that less energy is required to purify and pump the water to where it is to be used, and less energy is required to heat the water prior to its use in the washing machine. Consequently, future cost-benefit analyses of proposed minimum energy performance standards need to incorporate these potential energy and water savings. The objective of this project is to assemble information that would be necessary for such analyses, namely the amount of energy required by Canadian water purifying plants and pumping stations to produce and deliver water to consumers, as well as some indication of the extent to which this differs in different regions.

Energy Prices

Within Canada, the main datsets that contain individual energy consumption information for households are the 1993 and 1997 Survey of Household Energy Use (SHEU), with another household energy use survey pertaining to 2003 data having been undertaken but not yet released. For commercial buildings, individual building energy consumption information for 2000 is available in the Commercial and Institutional Building Energy End-Use Survey (CIBEUS). Along with information on characteristics of buildings and their occupants, these surveys collected information on energy consumption that was used for particular purposes, as well as energy consumption that was attributable to the use of specific fuels.

These data sets have been used in several studies that CBEEDAC has undertaken. They facilitate analysis of energy use and possible energy savings associated with particular activities or devices, and can be used in the determination of the extent of energy efficiency gains that might be realized. While they have proven invaluable in these applications, a missing component concerns energy prices. Information on energy expenditures was not collected in these surveys, so that average prices cannot be computed. In assessing the likelihood of making retrofits or installing various energy savings devices, one of the key elements would be expected to be the cost savings associated with these devices, at least relative to the energy costs currently incurred.

The objective of this project is to determine energy prices - particularly for electricity and natural gas - that can be used with the data contained in these surveys, which are specific to cities or to agglomerations such as Census Metropolitan Areas. Initially the emphasis is on commercial prices in 2000, which can be used with the CIBEUS data, but it is also planned to assemble prices that can be used with the 1997 SHEU data and with the forthcoming SHEU 2003 data. Ideally we plan to obtain both marginal prices (on which decisions are based) as well as average prices (to convert consumption into expenditure), both measured in after-tax terms.

Uncertainty in Cost-Benefit Analysis

Under the terms of Canada's Energy Efficiency Act, proposed minimum energy performance standards (MEPS) on selected appliances undergo a regulatory impact analysis. By necessity, such analysis is based on various assumptions about what may occur in terms of such factors as appliance usage, rate of discounting of future costs and benefits, etc. Consequently, there may often be a quite large amount of uncertainty concerning the net present value (NPV) of a proposed MEPS. One method of dealing with this uncertainty is to conduct some form of sensitivity analysis, such as by recalculating the NPV using different values of key variables. For example, the discount rate used in the analysis may be 7%, but to determine the sensitivity to this factor, the NPV would be recalculated alternately using rates of 5% and 10%.

The objective of this project is to review, in the context of realistic applications, alternative methods that have been used in these types of analyses to deal with the uncertainty that is inherent in the calculations, and to determine if there is a particular method that is more effective and/or appropriate. This analysis will include evaluation of software that can be used to help understand the effect of the underlying uncertainty.

Electricity Restructuring and Consumers

The aim of this project is to evaluate the effects on consumers of the restructuring that occurred in the electricity industry in Alberta from a wide perspective, taking account of the changes that would have been expected to occur in the market, and in electricity prices, if restructuring had not occurred. In addition to evaluating the extent to which the electricity price increases that were observed following restructuring can be attributed specifically to the effects of restructuring, this approach will provide a baseline to which the restructuring that did take place can be contrasted. In particular, it will permit comparisons with alternative scenarios that might have been adopted instead of the particular form of restructuring that did occur. It is also planned to consider the impact of restructuring on energy efficiency behaviour, and in particular on whether and to what extent fuel switching, retrofits, or conservation measures have been induced.

Water Heating Energy Demand Model Assumptions

In this project, particular assumptions embedded in the residential end-use model (REUM) at Natural Resources Canada are to be revisted. Since data in the REUM model are processed through a bottom-up approach and divided into sub-components, such as energy demand and efficiency, heating system stock, etc., various assumptions are incorporated within each component.

Here attention is to be focused on the determination of water heating energy demand for personal use and base load requirements. Based on a review of the literature and available data sources in Canada and the United States, the specific objective is to identify improvements in water-heating technology over the last 15 years as well as potential future improvements, and hence determine whether the existing REUM assumptions within this component remain valid, or if (and how) they should be altered to better reflect more current evidence.

Energy-Efficient Commercial Buildings

Commercial buildings in Canada exhibit a wide range of energy efficiencies. Owners of less energy-efficient buildings have many options for increasing energy efficiency, such as energy saving strategies (e.g. lower thermostat settings) and the incorporation of more energy efficient technologies via retrofits. Nevertheless, it is unlikely that all buildings will be able to achieve the same level of energy efficiency as the most energy efficient buildings.

In this project a stochastic production frontier approach is used with the Commercial and Institutional Buildings Energy Use Survey (CIBEUS) data set to help evaluate which types of buildings and building owners have the highest potential for energy savings. This approach recognizes that rather than one efficient building that others might try to emulate, there is a range of buildings that are efficient given building, building owner, and occupancy characteristics. These efficient buildings define an efficient frontier to which other buildings can be compared, allowing a determination of the energy efficiency gains if buildings were to emulate others somewhere on the frontier rather than if they were to attempt to imitate some specific building. This analysis facilitates identification of buildings with the highest potential for energy savings, thereby providing information about appropriate targeting of energy efficiency programs.

GRADUATE RESEARCH

In the fall of 2004, CBEEDAC welcomed two new employees, ***Jian Wang*** and ***Alan Puongpienr***. Jian is a business graduate from Simon Fraser Unversity, B.C. and is currently completing an MA in Economics with research interests in energy, health and international trade. Alan graduated from Queen' University with a B.A. honours degree in Economics and has started an MA in Economics at the U. of A.

Summer research assistant, Mike Lockerbie is attending Penn State, PA to pursue a PhD in Finance. Carolina Aquilar is in the final stage of completing her MA in Economics studying OPEC cartel behaviour.

Junaid Jahangir, who was earlier associated with the Centre while he completed his MA in Economics, is once again involved with the Centre's activities as he begins work on his PhD dissertation which concerns aspects of the restructuring of the electricity industry in Alberta.

After completing his MA in Economics earlier in 2004, ***Chris Hughes*** continued with his work at CBEEDAC on various projects concerning energy efficiency in commercial buildings. However, the allure of the commercial world finally proved too great and Chris has left the Centre to take an Edmonton-based position with ATCO Electric. Congratulations Chris.

BUILDING BYTES

Geoexchange, earth energy systems, or geothermal heat pumps are an emerging energy efficient alternative to fossil fuel powered space and water heating systems for both residential and commercial building applications. Information resources on energy efficiency, purchase considerations, installation, cost comparisons, and maintenance can be obtained from numerous sources in Canada and the U.S including:

Canadian GeoExchange Coalition:
http://www.geo-exchange.ca/en/home.html

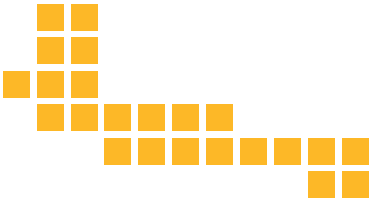
Natural Resources Canada:
http://oee.nrcan.gc.ca/publications/infosource/pub/home/M91-2-41-2002E.pdf
Manitoba Hydro:
http://www.hydro.mb.ca/saving_with_ps/geothermal_energy_savings.shtml
U.S. DOE:
http://www.eere.energy.gov/femp/technologies/eep_groundsource_heatpumps.cfm
Geothermal Heat Pump Consortium:
http://www.geoexchange.org/publications/add.htm

BUILDING SERVICES

CBEEDAC has the expertise to provide services to the building sector in the area of data storage and analysis. For more information regarding these services, on becoming a sponsor of CBEEDAC, or about the services provided by other Data and Analysis Centres contact CBEEDAC or see our Web site (www.ualberta.ca/~cbeedac).

CBEEDAC reports are available online in PDF format.

If you house and/or collect data that could become a valuable addition to Canada's Building Energy End Use information system please consider contacting the Centre with your data information.



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