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CBEEDAC

enerInfo BUILDING

IN THIS ISSUE...

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CANADIAN Building Energy End-Use DATA AND ANALYSIS CENTRE
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HOUSEHOLD ENERGY EFFICIENCY - PART II

In a previous newsletter we reported on part of a CBEEDAC research study concerning environmental awareness and household energy efficiency. The focus of that part of the report was on the extent to which Canadian households have adopted "green" behaviour in regard to appliance choice and other appliance-related energy-saving activities. Specifically, using data from the 2003 Survey of Household Energy Use, the latest residential energy use data that are currently available in Canada (with a follow-up 2007 survey set to be released later this year), the report documented the market share of Energy Star appliances since their introduction in Canada in 2001. In addition, the proportion of Canadian households that could be considered "environmentally aware" in the sense of adopting such behaviour as using water-saving showerheads, cold water for washing clothes, a moisture detector in the clothes dryer or a programmable thermostat to control space heating was also identified.

In this issue of the newsletter we report on a subsequent part of that research study, which examined the extent to which this "environmental awareness" is reflected in household energy consumption. Perhaps somewhat surprisingly, the relationship between overall household energy efficiency and the use of energy-saving appliances and other appliance-based energy-saving behaviour is not straightforward. This has potentially important policy implications, suggesting that achieving reductions in household energy use may require much more than directing consumer choice in appliances to those that are the most energy efficient.

On a somewhat different note, this newsletter also includes information about a forthcoming workshop on empirical methods in energy economics that CBEEDAC is co-sponsoring.

Finally, we are excited to report that work on our new website, with complete access to CBEEDAC research reports, current and previous newsletters, and a metadatabase with full search functionality, is well under way. Full details will be included in our next newsletter.

Energy-Efficient Appliance Choices and Overall Household Energy Efficiency

David L. Ryan

To examine the relationship between appliance choice and household energy use we begin by defining energy efficiency as gigajoules of energy used per square foot of heated area for each household. Here, energy use refers to aggregate consumption of electricity, natural gas, heating oil, and propane, while the heated area excludes garages and/or heated foundation areas other than basements.

Based on the 2003 Survey of Household Energy Use, energy efficiency in Canadian households ranges from 0.0024 to 0.7758 gigajoules per square foot, with an average of 0.0786. Analysis by province shows that average energy efficiency is best (lowest energy use per square foot) in New Brunswick and British Columbia, and is generally worst in the Prairie provinces (especially Saskatchewan) and some of the Atlantic provinces (Nova Scotia and Prince Edward Island) where the need for heating – as reflected in heating degree days (HDD) – is generally higher.

To better illustrate the relationship between household energy efficiency, a continuous variable, and household characteristics or energy-efficient appliance choices, which are generally discrete, the energy use per square foot variable is divided into quartiles, with the lowest quartile referring to the 25% of Canadian households that are the most energy efficient.

Table 1 provides evidence on the relationship between household size and energy efficiency. While there is some evidence that larger households are less energy efficient, this effect does not appear to be overly strong. Over 28% of single-person households are in the most energy-efficient group, and this proportion generally decreases as household size increases, to just over 19% for households with 5 or more persons. However, for all household sizes, a relatively similar proportion of households is in the lowest two quartiles. In terms of other house or household characteristics that may be associated with energy efficiency, there was no clear trend of energy efficiency decreasing for households with a greater proportion of younger members, although energy efficiency generally increased as house size increased. The type of dwelling also influenced energy efficiency, with mobile homes being over-represented in the least efficient quartiles and duplexes being by far the most energy efficient, followed by low-rise apartments and single-detached houses, and then row or terrace houses. A greater proportion of rural households (38.6%) than urban households (22.2%) is in the most energy efficient quartile. Finally, households that heat running water using electricity appear to be more energy efficient than those that use natural gas or oil for this purpose.

Table 1: Quartiles of energy use per square foot

Household Size	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile
1	28.3%	19.9%	18.9%	33.0%
2	25.2%	24.7%	24.2%	25.9%
3	26.2%	26.9%	26.5%	20.5%
4	23.0%	26.8%	29.6%	20.7%
5 or more	19.2%	31.4%	31.3%	18.1%

Next we examine how energy efficiency is related to the appliance choices made by households. Table 2 shows the proportion of households that fall in each quartile of overall energy efficiency according to the total number of Energy Star (ES) appliances that are present, as well as to the adoption of other energy-saving behaviour.

Table 2: ES appliances, Energy Saving Behaviour and Energy Efficiency

Appliance/Activity	Energy Use per Square Foot			
	Lowest Quartile	2nd Quartile	3rd Quartile	Highest Quartile
Number of ES appliances : 0	28.2%	22.2%	22.1%	27.5%
Number of ES appliances : 1	24.6%	24.4%	23.9%	27.1%
Number of ES appliances : 2	23.5%	26.2%	26.1%	24.2%
Number of ES appliances: More than 2	19.7%	31.3%	32.2%	16.8%
Front-loading washing machine	26.7%	28.4%	30.7%	14.2%
Use cold water for washing clothes	29.2%	27.8%	23.4%	19.6%
Moisture detector in clothes dryer	22.3%	29.9%	26.8%	21.0%
Dry dishes in dishwasher with heat off and/or door open	26.3%	28.2%	25.2%	20.2%
High efficiency furnace	15.2%	31.2%	30.0%	23.6%
Programmable Thermostat (PT) – one or more	21.7%	29.9%	28.6%	19.8%
PT that is programmed	20.5%	31.7%	29.6%	18.2%
Temperature of largest heating area varies	25.2%	26.8%	25.3%	22.7%
Water-saving showerhead	25.2%	27.7%	25.0%	22.0%
Use some Compact Fluorescent Lights (CFL)	22.7%	27.7%	26.3%	23.2%
Use some fluorescent lights	23.5%	27.5%	25.7%	23.4%
Use some halogen lights	25.6%	25.7%	26.2%	22.5%
Only use incandescent lights	26.6%	19.1%	22.7%	31.6%
Have central air conditioning	18.5%	30.4%	31.6%	19.6%

Somewhat counter-intuitively, a greater proportion of households with no ES appliances fall in the most energy-efficient quartile than is the case for households with one or more such appliances. In fact, in terms of representation in this lowest quartile of energy use per square foot, those households with only a single ES appliance appear to be more energy efficient than those with a larger number of ES appliances. Similarly, some appliances that would typically be viewed as associated with energy savings sometimes appear to be used by households that are overall energy efficient, but in other cases they are used by households that are not energy efficient. In contrast, activities typically not associated with energy savings – such as having only incandescent lights – are more often observed in energy-efficient households than would be expected, although a large proportion of such households are also found in the most energy-inefficient category.

Overall these results suggest that the simple act of using energy-efficient appliances, or of adopting some forms of energy-efficient behaviour, is not sufficient in itself for a household to be energy efficient. Indeed, many of the most energy-efficient households do not have or have not adopted the energy-efficient appliances and behaviour considered here.

A regression-based approach that allows the effects of other factors to be held constant mainly confirms these data-based findings. In part these results may reflect the non-random selection of households that adopt these types of appliances. For example, if a household is already energy conscious, the additional energy savings that they might obtain from using an ES appliance rather than an alternative may be less than for other households that are unaware of their energy usage. Alternatively, households adopting various energy-saving appliances may decide that in view of the energy savings being achieved, they can afford to be less careful with energy use in other areas. These self-selection and rebound-type effects remain as interesting topics for future research.

CBEEDAC CO-ORGANIZED CONFERENCE

Last year, along with the Surrey Energy Economics Centre (SEEC) from the UK, and the Centre for Energy Policy and Economics (CEPE) at the Swiss Federal Institute of Technology in Zurich (ETH), CBEEDAC helped co-organize the first International Workshop on Empirical Methods in Energy Economics (EMEE08), which was held in Zurich, Switzerland. This two-day workshop, in which each paper presenter had an extended time to explain their paper, followed by an assigned discussant and then general discussion, proved to be very successful. Several CBEEDAC researchers participated in the workshop: **David Ryan** presented "Residential Energy Efficiency Programs, Household Characteristics and Energy Consumption", **Denise Young** presented "The Effect of Time-Saving Technologies on Households and Household Energy Use", and **Junaid bin Jahangir** presented "The Effect on Consumers of Electricity Market Restructuring in Alberta". In addition, **Mark Maxson** acted as a discussant for a paper on home energy audits.

In August 2009, the second of these workshops (EMEE09) will be held in Jasper, Alberta, in Canada. Submissions are currently under review in order to determine the program for the workshop, although there is still space for poster presentations for others who may be interested in presenting their empirical research in energy economics in this format. Although the workshop is deliberately kept on a small scale (less than 50 participants) to encourage active participation by all attendees, there are also still opportunities to participate in this year's workshop, especially - but not solely - for those who may be interested in acting as discussants. Further information, including contact details, is available on the workshop website: **http://www.economics.ualberta.ca/EMEE09.cfm**

PEOPLE

After an extended period of working without an executive director, CBEEDAC has been fortunate to welcome **Lucie Maruejols** to take over this role. Lucie joined CBEEDAC in February after completing her M.Sc. in economics from the University of Montreal.

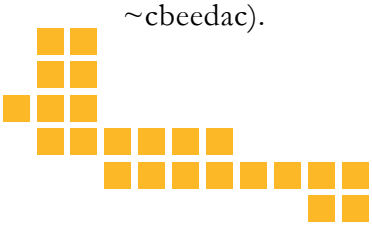
This winter, a number of graduate students have contributed to CBEEDAC research activities. **James Lin,** a PhD student in the Department of Economics returned to work on energy efficiency in commercial buildings. **Cal Schafer**, who entered the MA program in Economics last September with interests in the area of natural resources and public expenditures, is assembling electricity prices across Canada. **Hang Gao**, who started her masters program in economics and finance in September, and who is interested in working in a bank or financial institution after she graduates next year, is currently analyzing energy demand elasticities for the residential sector. **Qilin Wang**, who came to Alberta to undertake an MA in economics after completing his BA at Queen's University, is helping on a project related to the now discontinued EnerGuide for Houses program.

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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