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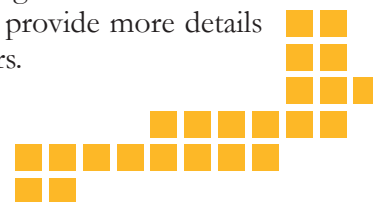
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## We're Back and the Beer's in the Fridge!!

After a summer hiatus while we were waiting for renewal funding to be put into place, CBEEDAC is back in full operation. Of course, not having funding in place is never sufficient to stop research, and we have been busy on that front, although with less graduate student participation than usual. Indeed, the title of this article refers to research recently completed by CBEEDAC researcher Denise Young, which is explained in more detail in a full-length article in this issue. Denise's article has a catchy title, and the extensive media coverage that she received in the days immediately following its release revealed what an effect such a title can have. Of course, Denise's article is not really about beer; rather it concerns the practice of many Canadian households - perhaps as well as those in other countries - of not disposing of inefficient appliances when a new, certainly more energy-efficient, replacement appliance is purchased. The particular practice that Denise examined concerns retention and continued use by households of old refrigerators when a new model is purchased. The implications of such behaviour are clear - estimates of energy consumption reductions from introduction and adoption of energy-efficient technology that fail to take these behavioural responses into account are likely to be severely over-estimated. Perhaps a catchy title that helps push the message of the need to consider the interaction of energy-efficient products and consumer behavioural responses is just what is needed.

In view of the length of the article, there is no space for a "People" section in this issue, but it will return next time. In short, graduate student Samuel Gamtessa presented joint work with David Ryan concerning the EnerGuide for Houses (EGH) database that we have previously described at a conference in Florence in June, while David Ryan presented subsequent work on modelling household retrofit behaviour using the EGH data at a conference in Houston in September. We hope to provide more details of these and other studies in subsequent newsletters.



# The Cost of Beer Fridges

## D. Young

How much does a cold beer cost? For people who keep chilled beverages in a ‘beer fridge’, the cost may be higher than they realize. Especially if the ‘beer fridge’ is an old one. A recent CBEEDAC study looks at the prevalence and characteristics of ‘secondary refrigerators’ in Canada, and examines the characteristics of households who operate more than one refrigerator.\*

It is not uncommon in Canada for a household to use more than one refrigerator. In fact, about 30% of the households responding to the 2003 Survey of Household Energy Use (SHEU-2003) conducted by Statistics Canada on behalf of Natural Resources Canada’s Office of Energy Efficiency (OEE) indicated that they used two or more refrigerators. While some of the

‘secondary’ refrigerators, often referred to in general parlance as ‘beer fridges’ were new, energy efficient models, many of them were older energy inefficient models that were kept in the house after purchasing a new refrigerator. Table 1 depicts the age distribution of the subset of secondary refrigerators from the SHEU-2003 survey for which it is possible to determine whether or not the secondary refrigerator had formerly been the household’s primary refrigerator.

It is worth noting that (i) many of the secondary refrigerators are old, and (ii) as might be expected, most secondary refrigerators that had formerly been the household’s primary refrigerator are particularly old (almost 55% are more than 20 years old).

**Table 1: Age Distribution of Secondary Refrigerators (SHEU, 2003)**

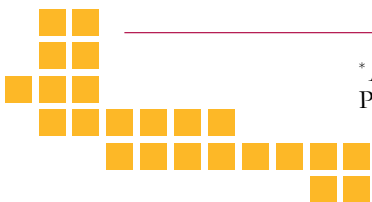
Approximate Age in years	Former Primary Refrigerator		Other	
	Number	Percent	Number	Percent
1 to 3 years	1	0.5	116	13.1
4 to 5 years	2	0.9	49	5.5
6 to 10 years	16	7.3	205	23.1
11 to 15 years	32	14.7	167	18.8
16 to 20 years	48	22.0	135	15.2
21 to 25 years	42	19.3	60	6.8
26 years or more	77	35.3	155	17.5
TOTAL	218	100.0	887	100.0

What are the implications of the observed patterns in the ages of these secondary refrigerators? Due to technological improvements, older refrigerators use much more energy than new ones. In fact, a full-size refrigerator built in the 1970s uses more than 5 times as much energy as the best small Energy Star® models that are currently available on the market. Table 2 presents energy use figures for a variety of vintages of refrigerators. A typical refrigerator built in 1975 uses about 1580 Kilowatt hours of electricity per year. A

search of compact refrigerators on the OEE website (<http://www.oee.nrcan.gc.ca/energystar/english/consumers/refrigerator-search.cfm>) shows that many current models with volume capacities in the 4.5 to 6.4 cu.ft. range use less than 300 kilowatt hours per year and often cost less than \$30 per year to operate.

Clearly, there have been substantial improvements in the energy efficiency of refrigerators over the past 3 decades. And if an older-model secondary refrigerator is used to keep beverages refrigerated year

\* A more detailed account of this study is available in Young, D. (2008), “Who Pays for the ‘Beer Fridge’?: Evidence from Canada”, *Energy Policy*, 36, 553-560.





**Table 2: Age Distribution (Percentage) of Appliances when Replaced**

Vintage	Energy Use (kWh/year)	Typical GHG Emissions - % of a tonne			
		Quebec	Ontario	Alberta	Br. Columbia
1975	1580	negligible	42%	140%	negligible
1985	1060	negligible	28%	94%	negligible
1990	940	negligible	25%	83%	negligible
1995	730	negligible	20%	65%	negligible
2000	710	negligible	19%	63%	negligible

Source: Canadian Appliance Manufacturers Association: Major Appliance Industry Trends & Forecast (2005) Mississauga: Electro Federation of Canada

round, it may be costing more to keep beer cold at home than people realize. Beyond these out-of-pocket expenses for the owners of secondary refrigerators, there may be other costs related to their use. Depending on how electricity is generated, there can be environmental implications as well. Table 2 provides information on the GHG emissions that can be attributed to the use of refrigerators by vintage and a selection of Canadian locations. Finally, to the extent that wide-spread use of secondary refrigerators increase the demand for electricity, their use may be costly to electrical utilities if they are facing capacity constraints.

One of the major ‘sources of supply’ of secondary refrigerators comes from former primary refrigerators that a household decides to keep after purchasing a new model. It is therefore of interest to see whether or not there are any particular characteristics that are associated with a household’s decision to hold on to and continue to use an old refrigerator even though they have bought a new one. There are several factors that one might expect to influence this decision.

For example, households with higher incomes are less likely to be worried about the costs of operating both a new (and probably energy-efficient) refrigerator as well as an older more costly model. Large households will likely have a greater need for refrigerated storage space than smaller households. Those living in an owner-occupied dwelling are more likely to own their appliances, and will therefore have more of a say in what will happen to the original refrigerator once a new one is purchased. Those living in larger dwellings

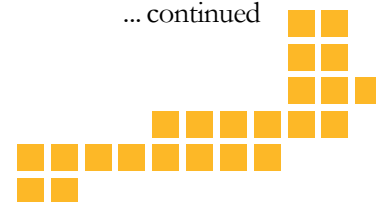
will have more available space in which to keep an extra refrigerator.

Information on these and other factors available in the SHEU-2003 survey were used as explanatory variables in a ‘binary choice’ statistical model of the decision to keep an old refrigerator when a new one is purchased. The results indicate that income, dwelling-type, location and whether or not a household lives in an owner-occupied dwelling are significant factors in this decision. These statistically significant results are summarized in Table 3.

The findings show that households in the province of Québec are about 10% more likely to hold on to their old refrigerators (the marginal effect on the probability of keeping the old refrigerator when a new one is purchased is 0.0972 for the Logit model and 0.1088 for the Probit model) than those in the base group living in British Columbia.

Furthermore, compared to the base group of households with annual incomes below \$20000, those in the \$20000 - \$59999 range tend to be about 10% more likely to keep an old refrigerator for secondary use. Although the sign and magnitude of the estimated coefficient (and therefore, also, the estimated marginal effect) for households with income in the \$60000-\$79999 range is similar to those for the \$20000 - \$59999 range, the coefficient was statistically insignificant. Those in the highest income range are about 5% more likely than those in the \$20000 - \$59999 range to keep a secondary refrigerator.

... continued



**Table 3: Selected Binary Choice Model Results**

Variable	Logit Model		Probit Model	
	Coefficient	Marginal Effect	Coefficient	Marginal Effect
Quebec	.6456* (.3397)	.0972	.3767* (.1995)	.1088
Annual Income Dummies				
\$20000-\$39999	.6457** (.3126)	.0981	.3827** (.1723)	.1114
\$40000-\$59999	.6175* (.3352)	.0977	.3649* (.1865)	.1094
\$60000-\$79999	.5839 (.3593)	-----	.3280 (.2026)	-----
\$80000 or more	.8701** (.3481)	.1406	.5053*** (.1963)	.1533
Dwelling type / dwelling ownership dummies				
Low-rise apartment	-1.2532** (.5786)	-.1224	-.7184** (.2945)	-.1457
Owner-occupied	1.7096*** (.5661)	.1521	.8842*** (.2676)	.1703

<sup>a</sup>Values in parentheses are standard errors; <sup>b</sup> marginal effects are calculated at the sample averages and are shown only for significant variables; <sup>c</sup>\*\*\* significant at 1%, \*\* significant at 5%, \* significant at 10%

Other significant factors include the type of dwelling and whether or not the residence is owned by a household member. Compared to households living in single-detached dwellings, those in low-rise apartments are about 12 to 15% less likely to keep an old refrigerator, possibly due to space constraints. Also, when a residence is owner-occupied, there is a 15 to 17% higher probability of continuing to use an old refrigerator after the purchase of a new model than if a household lives in rented accommodations.

Several programs are currently in place that could be of benefit to households who decide that using their old energy-inefficient secondary refrigerator is too costly. One option may be to simply forego the convenience of the extra storage space for refrigerated items. An-

other is to opt for a newer (and possibly smaller) modern appliance that costs less to run. Canada's EnerGuide<sup>®</sup> and Energy Star<sup>®</sup> programs provide consumers with an easy way to gather information on the best models available in terms of energy efficiency. In some jurisdictions, financial incentives are available to encourage the purchase of energy efficient models, while in others, refrigerator round-ups, usually sponsored by local electric utilities, are available. These reduce the time and monetary costs associated with environmentally safe disposal of older models.

Of course, for households where the extra storage space of a secondary refrigerator is only needed occasionally, a cost-saving strategy would be to simply unplug the fridge during periods where it isn't needed.

## 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](http://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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