



IN THIS ISSUE...

Energy Efficiency and Energy-Saving Behaviour in Multifamily Rental Dwellings

Building Services

CBEEDAC, sponsored in part by Natural Resources Canada via the National Energy Use Database Initiative, is housed at the University of Alberta.

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enerInfo Building is published three times per year by the Canadian Building Energy End-Use Data and Analysis Centre (CBEEDAC) at the University of Alberta.

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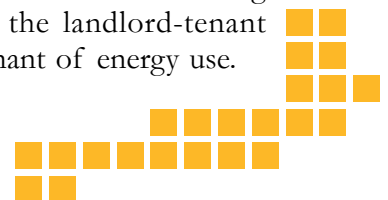
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Rental Dwellings:
Does it Matter Who Pays for Energy?

An important consideration when renting a dwelling concerns who pays for energy costs. In some situations, the renter will receive and be expected to pay utility bills directly. In others, particularly in multi-unit dwellings where energy usage is not separately metered for individual units, energy costs are paid by the landlord, with an average energy charge implicitly included in the rent. Potentially, this latter situation gives rise to perverse incentives, where renters may choose to use energy inefficiently as they do not pay directly for any excessive consumption. What is not widely known is how much of this potential is realized, that is, whether and to what extent energy consumption and choices regarding energy efficiency differ when someone else pays the energy bills.

These issues are the focus of an ongoing research study by CBEEDAC researchers Denise Young and Lucie Maruejols which is reported in this newsletter. Data from the 2003 Canadian Survey of Household Energy Use (SHEU03) used in this study show that in Canada the person who uses energy (tenant) is often not the same as the person who pays for the energy (landlord): nearly 25% of the occupants of multifamily dwellings in Canada do not pay directly for their own electricity consumption, 75% do not pay directly for their own natural gas consumption, and 35% to 40% do not pay directly for the energy they use for space and water heating. In addition to energy consumption behaviour, the authors also examine differences in the adoption of energy-saving habits and energy-saving appliances when the energy consumer (the tenant) and the person who chooses the equipment in the dwelling (the landlord) is not the same.

As some preliminary results reported in this newsletter reveal, energy consumption and energy efficiency behaviour do often differ according to who pays for the energy, but this aspect of the landlord-tenant relationship is not necessarily a significant determinant of energy use.



Energy Efficiency and Energy-Saving Behavior in Multifamily Rental Dwellings

Denise Young and Lucie Maruejols

Potential barriers to achieving energy efficiency improvements in rental accommodations arise from the differences in, or split, incentives faced by (i) landlords who usually select the major appliances and heating systems that are put in place; and (ii) tenants who decide on how intensively to use electricity and other types of purchased energy (such as natural gas or oil). To further complicate matters, in some cases the tenant pays for utilities, while in others the landlord pays. While separate metering is often feasible for electricity use, the choice of who pays for space and water heating is often determined by the technology in place, as central systems - using natural gas or oil - often preclude the possibility of separate metering across units in multifamily dwellings.

Split incentives affect many aspects of energy use in rental dwellings. First, the amount of energy consumed is expected to be higher when a landlord pays the utilities than when a tenant does, since in the former case the energy price for the tenant is effectively zero. Second, the landlord (in the situation where major appliances are included with the rental unit) and the tenant (in the case of smaller appliances) might be tempted not to buy energy-efficient appliances if they are

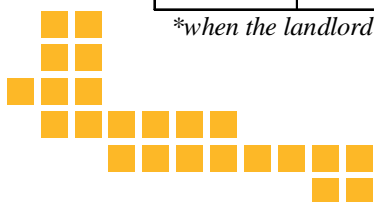
not ultimately responsible for paying for the energy used, as they would bear the extra purchase cost but would not benefit from any reduced energy consumption. Third, split incentives might also affect a variety of landlord and tenant practices with respect to energy saving. Tenants might not adopt energy saving attitudes, such as using programmable thermostats, or using cold water when washing clothes, when they don't pay for utilities. Similarly, landlords might not be willing to undertake energy-saving building retrofits when tenants pay for utilities.

As a preliminary step towards examining the effect of these differing incentives on energy use and on adoption of energy efficient appliances, several measures of energy efficiency are compared across dwellings where a landlord pays for a given utility and dwellings where a tenant pays for that utility. Table 1 shows average energy consumption, measured in gigajoules per square foot of heated area, for different types of multifamily dwellings and for different types of energy used. The energy consumed in owner-occupied dwellings is also included as a point of comparison. Shaded cells represent cases where average energy consumption is found to be higher in dwellings where the landlord pays the corresponding bill.

Table 1: Average Energy Use (gigajoules of energy per square foot of heated area)

Average energy use	Duplexes and row, terrace or double houses			Low-rise apartments			Total			
	Owned	Occupant pays	Landlord pays	Owned	Occupant pays	Landlord pays	Owned	Occupant pays	Landlord pays	Total Rented
Electricity	.029739	0.0346	0.0484	.040252	0.0423	0.0716	.032267	0.0400	0.0653	.045691
			+39.86%			+69.34%			+63.29%	
Natural gas	.031329	0.0646	0.0879	.040673	.129062	.117079	.033576	0.0730	0.1111	.088869
			+36.01%			-9.29%			+52.28%	
Oil	.004952	.062939	.045562	.004805	.251593	.226846	.004917	0.1337	0.1906	.170845
			-27.61%			-9.84%			+42.57%	
Total *	.066044	0.0635	0.0871	.085730	0.0694	0.1483	.070778	0.0674	0.1351	.096414
			+37.06%			+113.51%			+100.61%	

*when the landlord pays at least one of the bills (electricity, natural gas or oil)





The percentages provided in Table 1 indicate the average amount of extra energy consumed per square foot by a household in a rented dwelling that is not responsible for utility payments when compared to a household in a rented dwelling that directly pays these bills. The electricity usage problem appears to be more pronounced in low-rise apartments (LRA) than in duplex/double, row, and terrace (DDRT) housing. In DDRT-type dwellings, consumption of both electricity and natural gas is higher by 35% to 40% when landlords pay for utilities. In both categories of dwellings, consumption of electricity in those that are owner-occupied is similar to electricity consumption in those that are rented where tenants pay for the utility; but for other types of energy (natural gas or oil), consumption in owner-occupied dwellings is lower than in rental dwellings.

Preliminary regression results (not shown), where other factors - such as the physical characteristics of a dwelling, the types of equipment in use, and occupant characteristics - are taken into consideration when explaining electricity consumption, lead to a similar conclusion: the total amount of *electricity* consumed per square foot of heated area increases significantly when the landlord rather than the tenant pays for it. However, this result does not hold for energy use for particular purposes. For example, total energy use or total electricity use in a dwelling does not appear to be significantly influenced by whether the landlord or the tenant pays for *heat*. Significant characteristics that influence energy and electricity consumption include the type of energy used for water and space heating, along with the types of major equipment in the dwelling.

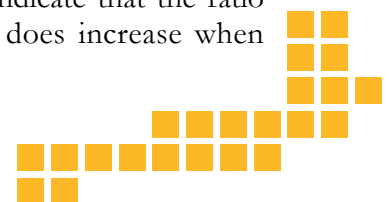
Table 2: Appliance Choice in Rented Dwellings

	Row, terrace, duplexes or double house		Low-rise apartment		Total	
	Occupant pays	Landlord pays	Occupant pays	Landlord pays	Occupant pays	Landlord pays
<i>Number of Energy Star® appliances in the household</i>						
Total number	1.10	0.55	0.72	0.43	0.83	0.46
Housework	0.34	0.16	0.27	0.09	0.29	0.11
Heating or cooling	0.12	0.01	0.00	0.00	0.04	0.00
Entertainment	0.64	0.39	0.45	0.34	0.50	0.35
<i>Ratio of Energy Star® appliances in household</i>						
Total number	.15	.09	.11	.07	.12	.08
Housework, cooling and heating	.11	.04	.08	.03	.09	.04
Entertainment	.18	.12	.14	.11	.15	.11
<i>Number of small appliances in the household</i>						
Small appliances / adult	3.66	3.06	3.33	3.11	3.43	3.10

Regarding the choice of appliances, Table 2 shows the average number of Energy Star® labelled appliances in multifamily rental dwellings, their average share among the total number of appliances, and the average number of small appliances per adult in the dwellings. Major appliances and heating/cooling systems are typically chosen by the landlord and remain in place when tenants move in and out. Smaller appliances (essentially entertainment systems) are typically chosen by the tenants and will move along with them if they change residences. Contrary to expectations, the sample statistics indicate that the

number and ratios of Energy Star® products chosen by the landlord are not lower when tenants pay for electricity, so that split incentives do not appear to play a role. This may possibly be driven by pressures for landlords in areas with high vacancy rates to attract tenants by making their properties more attractive through the provision of an energy-efficient set of appliances.

Preliminary regression analysis (not shown) confirms that who pays for *electricity* does not affect a landlord's choice of energy-efficient technologies. The regression results also indicate that the ratio of Energy Star® products does increase when





Multifamily dwellings (Cont'd)

landlords pay for *heat* compared to when tenants pay for heat. In short, landlords are more likely to buy Energy Star® products for housework, heating and cooling when they are paying for heat, but whether they or their tenants pay for electricity does not affect their choice of appliances. An analysis of the age of the heating system and of the hot water tank also shows that this equipment tends to be older when tenants pay for heat and newer, and likely more efficient, when landlords pay for the heat. However, this only seems to be the case for LRA dwellings, and not for major appliances such as fridges or stoves.

The statistics presented in Table 2 suggest that tenants do choose fewer Energy Star® products when the landlord is paying for electricity, but preliminary regression analysis does not provide evidence that having the landlord pay the bill significantly influences their choice of Energy Star® small appliances. Rather, it is the family structure and the number of appliances owned (which provides information regarding how much 'technology is used in the household) that determines whether the ratio of Energy Star® small appliances is low, moderate or high. The fact that a landlord pays for either electricity or heat does not influence the ownership of Energy Star® products by tenants. This is probably because tenants will keep these appliances with them when they switch

from tenancy to home ownership, for example, and will have to pay for the electricity used by their appliances at that time.

In summary, from the above overview of various aspects of energy use in multifamily rental dwellings, it appears that the level of energy use and the adoption of efficient appliances are affected by whether or not the agent that uses the energy (the tenant) pays for it. However, preliminary regression analysis suggests that this aspect of the landlord-tenant relationship is not always a significant explanatory factor for energy use. Instead, it seems that it is often the choice of energy source - electricity, natural gas, or oil - and the technology for space heating and water heating (which are fixed in the short run) that determine both the choice of having the landlord or the tenant pay for utilities (separate metering or not) and the level of energy consumption in a dwelling. For long-run improvements in energy conservation, the choice of the energy type used in the dwelling and the possibility for separate metering in multi-family buildings can be important factors.

Evidence of the effect of split-incentives on renovation decisions and on the adoption of other energy saving practices will be presented in a future issue of this newsletter. Complete details on these results and the methods used will be available in a future CBEEDAC report. To read our current and previous reports, please visit www.cbeedac.com.

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