The energy efficiency of new housing has improved significantly over the years. Some housing surveys have shown that recently built housing is, on average, 13 per cent better in overall energy efficiency (mainly space heating and hot water usage) than the housing built about 15 years ago. Improvements to the energy efficiency requirements in building codes have been key to the overall reduction of energy use associated with housing and also to the reduction in the generation of greenhouse gases.

A survey of residential energy codes across Canada found that explicit requirements for energy efficiency exist only in British Columbia, Manitoba, Ontario and Quebec. The rest of the country uses the National Building Code (NBC), which has no significant energy-related requirements.

RESIDENTIAL REQUIREMENTS
Air-tightness is less regulated by the building codes. Although the building code has air and vapour barrier requirements, the overall air-tightness is not tested. Manitoba requires an NLA (normalized leakage area – a measure of airtightness) of 2.0 cm²/m² envelope area or less – a level that is met by more than 85 per cent of new houses surveyed.

To put the survey data in perspective, the study evaluated more than 4,300 new single-detached houses built between 2000 and 2005 across Canada, using data from the EnerGuide for Houses (EGH) database. House area, volume, air-tightness and construction characteristics were reviewed to create a set of archetypes for eight geographic areas, according to the availability of data. These EnerGuide walk-through evaluations provided some interesting insights into tract-built housing being built today.

- In Quebec and the Maritimes about 90 per cent of new houses comply with NBC ventilation system requirements, while compliance in the rest of Canada is much less (typically 20 to 60 per cent).

COMING UP...
Ontario recently introduced substantial changes to the Ontario Building Code. The insulation requirements are being phased in. The values shown in the Table 1 are those effective December 31, 2008. In addition to building envelope insulation levels, the Ontario code will require that natural gas and propane fired furnaces be at least 90 per cent efficient (AFUE).

The Ontario Building Code also requires that as of January 1, 2012, all new houses will have to be built to a standard that would at least meet an EnerGuide 80 rating.

In British Columbia the building code insulation standards are not being changed at this time, although provincial energy efficiency regulations have been changed. Gas and propane fireplaces have to be tested and labelled effective January 1, 2007. Gas and propane furnaces will have to be condensing gas furnaces (90 per cent AFUE) by January 1, 2008. Windows will have to have a USI value less than 2.0 W/m²K by January 1, 2009. [U = 1/R, so this is equivalent to an R-value of 2.85].

- Heat recovery ventilation (HRV) system use is predominant in the Atlantic provinces, where about 93 per cent of houses have HRV systems installed. On the other hand, in British Columbia barely two per cent of new houses have a dedicated heat recovery system.
- For the provinces in which natural gas is the primary space heating fuel (Ontario and west), either direct-vent (Saskatchewan, Alberta and British Columbia) or condensing furnaces (Ontario and Manitoba) constitute the majority of installed systems. Condensing gas furnaces are installed in 94 per cent of new Ontario houses. In Alberta that number drops to five per cent. In Quebec and the Maritimes, baseboard electric is the dominant heating system. In the Territories, flame retention head oil systems predominate.
- EGH survey values for air-tightness range from 1.9 ac/h at 50 Pa depressurization for Manitoba (Saskatchewan and Quebec are close behind), to 3.4 ac/h in Ontario and the Maritimes, to 4.3 ac/h for British Columbia and the Territories (Alberta was slightly better).
- Insulation within walls is typically 2x6 R-20 or equivalent (Ontario typically uses EPS clad 2x4 walls), except in British Columbia’s Lower Mainland where R-14 2x4 walls predominate in gas heated houses. Attics are typically R-40, except in Ontario and Quebec where the minimum requirement is slightly less. Basements are often insulated to R-12, although not always for the full height. Ontario requires only R-8 for the first two feet below grade, although full height insulation is being introduced in coming code changes. The NBC requires double glazed windows (NBC Sec. 9.6.6.6. and

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9.6.7.2). Electrically heated houses in Ontario require energy ratings (ERs) of 0 and -13 for fixed and operable windows respectively. Quebec requires a minimum RSI of 0.35, which is slightly higher than a standard vinyl framed slider.

In British Columbia the building code insulation standards are not being changed at this time, although provincial energy efficiency regulations have been changed. Effective January 1, 2007, gas and propane fireplaces have to be tested and labelled. Anecdotal surveys indicate that high performance windows (typically double glazed, low E coated, Argon filled) are commonly used in Saskatchewan, Manitoba, the Maritimes and Territories and are beginning to make inroads in the rest of Canada. Since windows can account for 25 to 50 per cent of the heat loss of a house (depending on house design, climate and window types) any improvement of window performance will have a significant impact on the home’s energy use, not to mention comfort.

Based on the EGH evaluations, the average new gas-heated house in British Columbia has a total energy use only slightly less than code minimum houses, suggesting that many houses there do not meet minimum code requirements.

The average new, gas-heated houses, in zone 1 of Manitoba, Ontario and Quebec used 88 to 93 per cent as much energy as the code minimum houses. Houses in Quebec’s zone 2 (surrounding Quebec City) were much better insulated and airtight. They used less than 83 per cent as much total energy as the code minimum house. If R2000 levels of energy efficiency were applied (equivalent to an EnerGuide 80 rating), the space heating energy use would be reduced by about 20 per cent in Quebec (zone 2) to 55 per cent in British Columbia (zone A).

Based on surveys of more than 800 new conventional and recently built R2000 houses, implementing a construction standard equivalent to EnerGuide 80 would decrease the total average energy consumption by about 36 per cent.

Ken Cooper, of SAR engineering ltd., is a building analyst, working primarily in the fields of residential monitoring and simulation. This report originally appeared in the September 2006 issue of Solplan Review. For more information e-mail solplan@shaw.ca.

### TABLE 2 VENTILATION SYSTEMS IN NEW HOUSES

<table>
<thead>
<tr>
<th><strong>Fuel</strong></th>
<th><strong>Code required</strong></th>
<th><strong>Number of Houses</strong></th>
<th><strong>Fans</strong></th>
<th><strong>HRV</strong></th>
<th><strong>Remarks</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>B.C.</td>
<td>All B/C B/C</td>
<td>252</td>
<td>20%</td>
<td>2%</td>
<td>Most zone A</td>
</tr>
<tr>
<td>Alberta</td>
<td>All NBC</td>
<td>114</td>
<td>9%</td>
<td>10%</td>
<td>Most zone 1</td>
</tr>
<tr>
<td>Saskatchewan</td>
<td>All NBC</td>
<td>114</td>
<td>25%</td>
<td>10%</td>
<td>Most zone 1</td>
</tr>
<tr>
<td>Ontario</td>
<td>All OBC</td>
<td>847</td>
<td>5%</td>
<td>7%</td>
<td>Most zone 1</td>
</tr>
<tr>
<td>Quebec</td>
<td>All NBC</td>
<td>1106</td>
<td>6%</td>
<td>10%</td>
<td>Repairs A &amp; B</td>
</tr>
<tr>
<td>Maritime</td>
<td>All NBC</td>
<td>1106</td>
<td>8%</td>
<td>6%</td>
<td>All Maritimes</td>
</tr>
<tr>
<td>Territories</td>
<td>All NBC</td>
<td>154</td>
<td>11%</td>
<td>6%</td>
<td>All Territories</td>
</tr>
</tbody>
</table>

Source: EGH database, houses built post 1999
* Regions defined by the Model National Energy Code for Houses
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