**Canadian Centre for Housing Technology News**

Issue 1, Fall 2010

*Welcome to our first e-newsletter highlighting research from Canada's unique, world-class housing technology facility. Our goal is to provide you with updates on our latest projects and publications at least twice per year.*

*If you would like to subscribe to this e-newsletter visit: http://www.ccht-cctr.gc.ca/eng/subscribe.html. Feel free to circulate the newsletter to others who would benefit from this information.*

## About CCHT

The Canadian Centre for Housing Technology (CCHT) is a partnership between the National Research Council of Canada (NRC), Natural Resources Canada (NRCan), and Canada Mortgage and Housing Corporation (CMHC). Since its launch in 1998, CCHT has supported manufacturers in their product research and development, and brought insight to builders and homeowners alike. With its twin R-2000 house facilities (a Reference House and a Test House) and accompanying InfoCentre on the NRC campus in Ottawa, CCHT has been the assessment site for more than 40 housing-related technologies, ranging from compact fluorescent light bulbs and high-performance windows to innovative natural gas-fired engines and fuel cell technologies.

## Highlights

### *Does running your gas fireplace in winter cost you energy?*

According to the 2007 NRCan Survey of Household Energy Use, almost a quarter of all homes in Canada have a gas-burning fireplace. When a fireplace is operated in close proximity to a house's central thermostat, it can cause the setpoint temperature of the thermostat to be satisfied and furnace operation will be reduced. As a result, the fireplace ends up essentially replacing the furnace as the main source of heat in the home. Unfortunately, not only is the fireplace usually less efficient than the furnace, but many gas fireplaces only direct heat to the room that they are located in – and can leave other rooms cooler in the process.

During the past two winters, CCHT researchers have used the twin houses to measure the impact of operating a gas fireplace on energy consumption and on room temperatures. Project results show that operating the fireplace for 6 hours in the evening required 144 MJ of natural gas per day for the fireplace. It reduced furnace gas consumption by 40%, and resulted in an average increase in total energy consumption for heating of 36 MJ/day (12.5%) during the experiment. In addition, the temperature in the second floor bedroom, furthest away from the fireplace, dropped by up to 2°C in the evening.

In another experiment, the fireplace was controlled 24 hours per day by a dedicated thermostat, set 2°C above the house setpoint temperature during the experiment. Under thermostat control, the fireplace consumed 249 MJ of natural gas per day, on average, and reduced furnace natural gas consumption by 59%. This resulted in

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an average increase in total heating system energy consumption (for both furnace and fireplace) of 38 MJ/day (9.8%). Because of the near continuous operation of the fireplace, temperatures in the bedrooms on the second floor of the house were 1 to 2°C cooler, on average, than the rest of the house.

Consumption with and without fireplace operation on sample winter days is shown in the figure below. The pilot light alone consumed 38 MJ/day (equivalent to 440 watts operated continuously), when the fireplace was not in operation. However, the pilot light released some heat into the home and reduced furnace operation, resulting in an average increase of 18 MJ/day (5.0%) in total energy consumption for heating.

While other models of fireplace and other house layouts would likely give different results, this experiment highlights the potential for a gas fireplace to increase home energy use, and reduce room temperatures.

This project was funded by Canada Mortgage and Housing Corporation. The full project report is available at http://www.ccht-cctr.gc.ca/eng/projects/fireplace.html

## *Shedding light on the energy performance of today's gas fuelled heating systems*

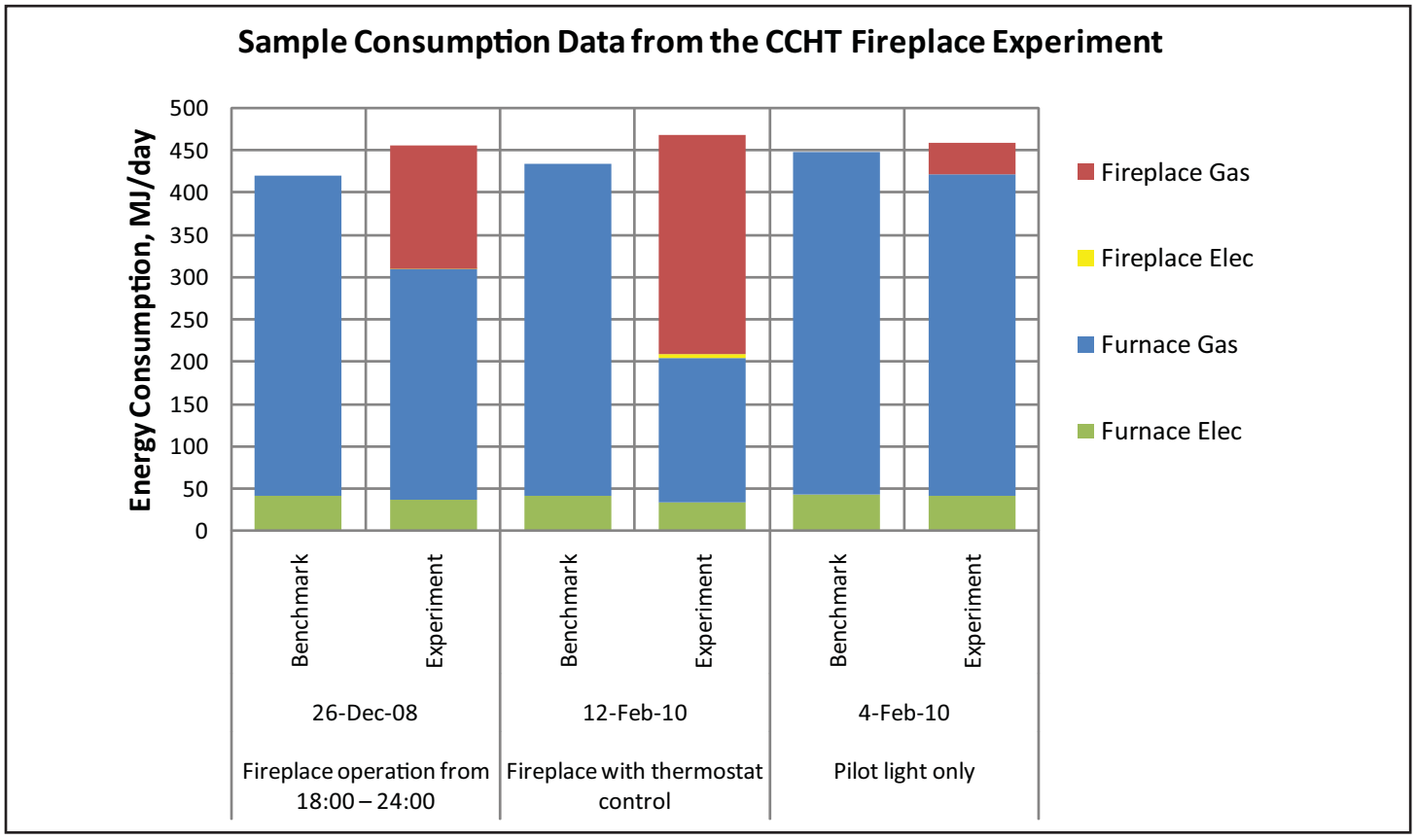
Gas fuelled forced air space heating systems are market dominant in many areas of Canada. While gas fuelled furnaces are the most common option, combination systems have become increasingly more prevalent, and Integrated Mechanical Systems (IMS) have become a third option.

How does the energy performance of these systems compare? This is a difficult question to answer. Efficiency ratings can not easily be compared as each product is tested to a different standard. These standards set different operating conditions, and may include tests on the overall system or only on its individual components.

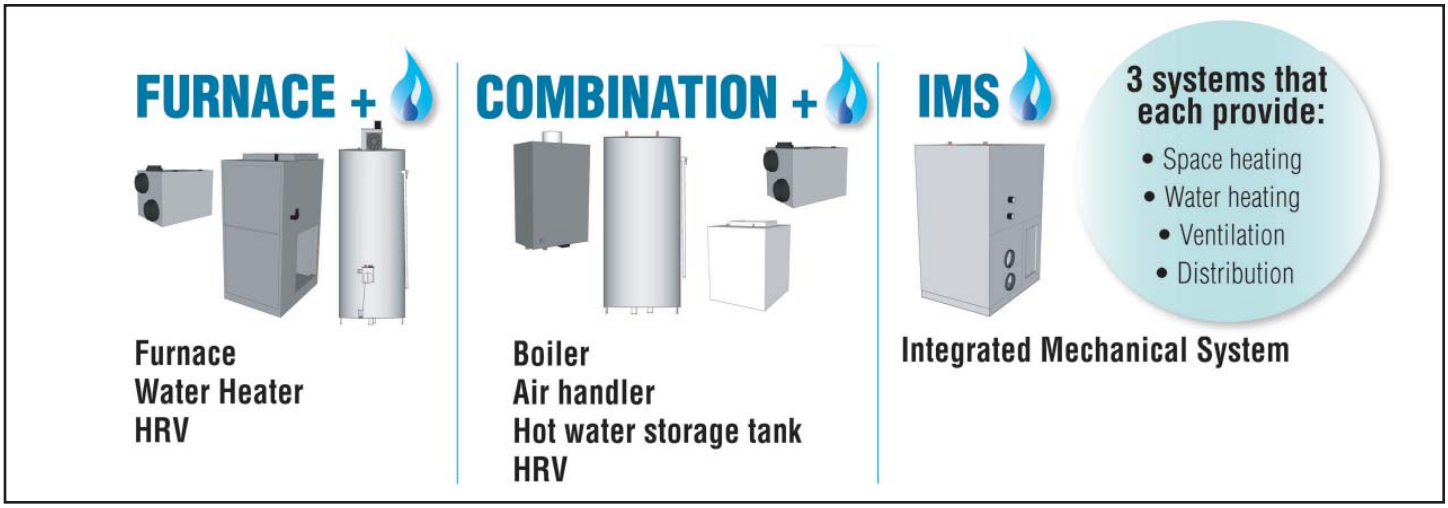
Enbridge Gas Distribution wanted to find out. They recognized that the CCHT was an ideal place to fairly compare different systems. At the CCHT, systems could be tested under virtually identical space heating, hot water, and ventilation loads. Comparative data could be gathered during cold winter conditions, shoulder seasons, and the summer. These results could be extrapolated over a known year of load data to compare annual energy performance.

Enbridge Gas Distribution wanted to find out how the performance of NY Thermal Inc.'s IMS (trade name: Matrix 100V) compared to that of traditional systems. They contracted Natural Resources Canada's CanmetENERGY to conduct the analysis at the CCHT. This led to an Enbridge and NRCan (through the Program for Energy Research and Development) co-funded project that compared the performance of the following three systems:

- Furnace+ consisting of: a 94% Annual Fuel Utilization Factor (AFUE) condensing natural gas furnace (CSA P.2), a power-vented natural gas water heater with an energy factor (EF) of 0.60 (CSA P.3) ; and an HRV with a Sensible Recovery Efficiency (SRE) of 69% at 0°C (CSA C439)




***Sample daily consumption data from the fireplace experiment.***




- Combination+ consisting of: a 90% Annual Fuel Utilization Factor (AFUE) boiler (CSA P.2); an air handler; a hot water storage tank; and a heat recovery ventilator with a Sensible Recovery Efficiency (SRE) of 69% at 0°C (CSA C439)
- IMS with CSA P.10 ratings as follows: Overall Thermal Performance Factor (OTPF) 0.91, Annual Electrical rating (AE) 1826 kWh/year, 89% Composite Space Heating Efficiency (CSHE) , an 0.81 Water Heating Performance Factor (WHPF), and integrated heat recovery ventilation with a Sensible Recovery Efficiency (SRE) of 60% at 0°C

### *Results*

Over the course of a year at the CCHT, with all systems equipped with electronically commutated blower motors (ECM), the IMS would use the least energy: 7% less than the tested furnace based system, and 14% less than the tested combination based system. Looking at seasonal performance, the IMS would use the least energy for 310 days of the year, while the furnace based system would use the least energy on the coldest 55 days of the year, and the combination system would use the most energy on all days of the year. The difference between the Combination+ and IMS performance is partially a result of the intelligent IMS control varying the water loop temperature and fan speed to gain efficiencies at lower space heating loads. Results from this comparison therefore show that the IMS is an energy saving alternative to typical residential systems currently being installed in Canadian houses.

For more information on this project, see the Research Summary on Integrated Mechanicals Systems located at the bottom of this page: http://canmetenergy.gc.ca/eng/buildings_communities/hvac_energy_systems/integrated_mechanical_systems.html.

## *CCHT's website goes 2.0*

CCHT's website was recently updated to meet the federal government's new common look and feel standards for the internet. In addition to new project descriptions and an updated publications list, the revamped website also features a new video tour of the CCHT. Check it out at www.ccht-cctr.gc.ca.

# Upcoming projects

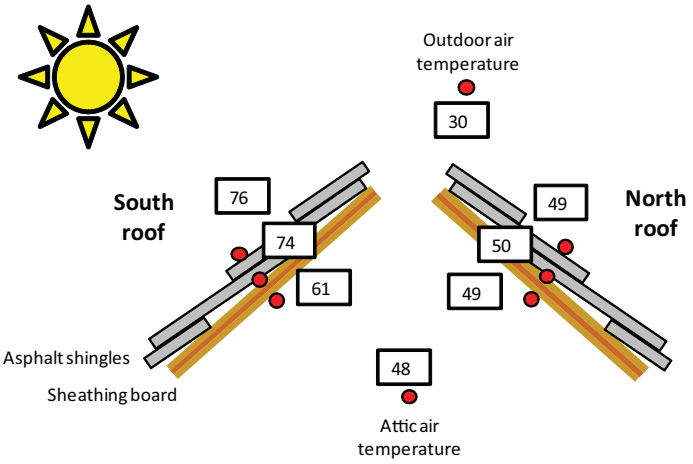
## *SUNRISE – Nanotechnology to produce highly efficient solar cells*

*Semiconductors Using Nanostructures for Record Increases in Solar-cell Efficiency*, or SUNRISE, is CCHT's newest venture. Project partners include: National Research Council of Canada Institute for Research in Construction (NRC-IRC) and Institute for Microstructural Sciences (NRC-IMS), University of Ottawa, Université de Sherbrooke, Cyrium Technologies Inc. and OPEL Solar, Inc. In the final stages of this project, optimized highly efficient solar cells using nanotechnology will be installed in a solar concentrator to boost solar intensity up to 500 times. The concentrator will be installed next to the CCHT Reference House in late 2010 and used to provide electricity to the home. For more information on this project, please visit SUNRISE'S website at: http://www.photonics.uottawa.ca/SUNRISE/ .

***A solar concentrator will be used to provide electricity to the CCHT Reference House in late 2010 as part of the SUNRISE project.***

## Did you know?

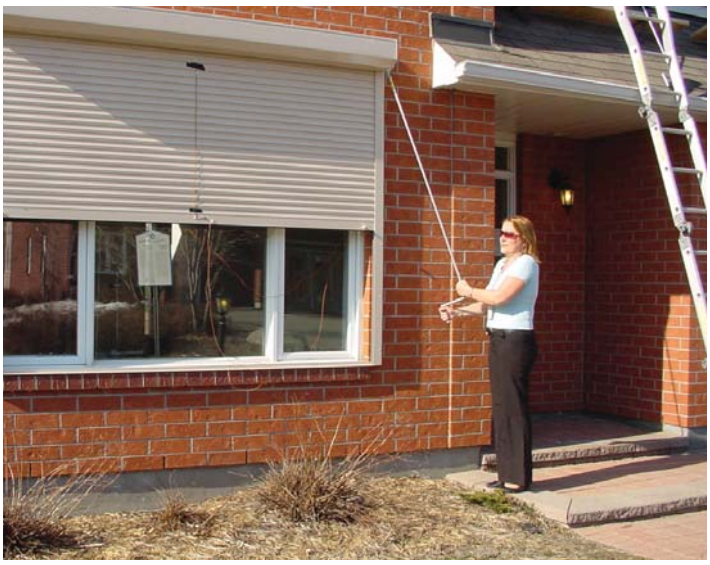
Did you know that on a sunny summer day, the temperature of asphalt shingles can exceed 70°C? The snapshot below shows the CCHT Test House roof temperatures (°C) at 2 pm on August 13th, 2009. On this sunny summer day, the outdoor temperature was 30°C, but the surface of the shingles on the south side of the roof reached a temperature of 76°C. As a result, the air in the attic was heated up to 48°C. It's a good thing the attic is insulated with RSI 8.6 (R49) insulation to help keep this heat out of the home!




***Roof temperatures (°C) in the CCHT Test House at 2pm August 13th, 2009.***

## Recently Completed Projects

- **Effective solar shadings of residential windows**
  http://www.ccht-cctr.gc.ca/eng/projects/solar_shadings.html
- **Desiccant cooling**
  http://www.ccht-cctr.gc.ca/eng/projects/desiccant_cooling.html
- **Climate Energy hybrid system**
  http://www.ccht-cctr.gc.ca/eng/projects/hybrid_system.html



***An experiment in the CCHT twin houses showed that exterior roll shutters provide substantial cooling energy savings on sunny summer days.***

## CCHT Partners:

CMHC SCHL

NRC·CNRC

Natural Resources Canada | Ressources naturelles Canada

CanmetENERGY | CanmetÉNERGIE

*The CCHT's mission is to promote and accelerate the development of innovative technologies and their acceptance in the marketplace. We partner with industry leaders to help them reach their development goals by providing a side-by-side assessment in our full scale field facility that aims to validate and improve the performance, quality, affordability, and environmental sustainability of innovative Canadian housing technologies.*

*CCHT can be an extension of your organization, helping to optimize your technology's performance. Contact us today to discuss how the CCHT can help you with your research and development objectives.*

*For more information, visit the CCHT website at www.ccht-cctr.gc.ca or contact Marianne Armstrong at 613-991-0967 or marianne.armstrong@nrc-cnrc.gc.ca*

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