NRC·CNRC
Institute for Research in Construction

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construction innovation

Housing innovation at CCHT: Ten years of experiments on new technologies

Nearly a decade has passed since the Canadian Centre for Housing Technology was established on the NRC campus in Ottawa. With its state-of-the art twin research houses, built to R-2000 specifications and based on healthy living principles, CCHT was launched to help promote innovation and the adoption of successful technologies for housing.

Twin research houses at the Canadian Centre for Housing Technology

Over thirty new and emerging technologies have been assessed at CCHT under the rigorous experimental conditions the centre affords, thanks to the use of automated controls to simulate human occupancy and sophisticated instrumentation to collect data.

The versatile facility—one house is used to assess the new technology and the other as a reference—is an integral part of NRC-IRC's approach, which involves collaborating with industry to encourage innovation in construction. Operated as a partnership between NRC, Canada Mortgage and Housing Corporation, and Natural Resources Canada, CCHT has seen its research activity grow rapidly as it pursues its mandate to assess innovative housing technologies and their impact on construction, costs, comfort, energy use, and overall building performance.

CCHT's wide-ranging projects have produced some important results touching on issues such as combined heat and power generation, alternative energy sources, heating systems, and window and shading technology. Examples include:

Solid oxide fuel cell: The first fuel cell in Canada used in a residential application was assessed at CCHT. The test house was modified to allow heat from the fuel cell to be used for space and water heating, and electricity to be sent to and from the grid. This experiment showed how much energy could be generated by the fuel cell and determined how much was used by the house or exported to the electrical grid under different weather conditions.

Highlights

Earth energy – cogeneration experiment: A ground source heat pump supplemented by a natural gas-fired combined heat and power (CHP) unit was assessed and found able to efficiently supply a considerable share of the space and water heating loads for the test house as well as the vast majority of power requirements. Using this system, researchers were able to investigate multiple configurations and perform experiments to determine how to store and recover heat from the CHP.

Efficient furnace fan motor: CCHT assessed the energy-use impact of a furnace blower containing an electronically commutated motor. This device provided considerable electricity savings and had various impacts on the heating and cooling loads of the house. Results from the experiments were used to develop simulations of the energy savings for typical new and existing single and row houses.

Integrated HVAC systems: CCHT was used to try-out prototypes of advanced mechanical systems

Continued on page 11

Read *Construction Innovation* on the Web at **http://irc.nrc-cnrc.gc.ca/ci**

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2005 NATIONAL CONSTRUCTION CODES

BLUEPRINTS *for the future*

The National Building, Fire and Plumbing Codes of Canada and supplementary Guides are used as models for virtually all building and fire regulations in Canada. They are indispensable for officials, educators and construction professionals seeking to be at the leading edge of their professions. The 2005 editions contain new information to help you understand how to satisfy the Codes' provisions, are easier to apply to existing buildings, and more accommodating to innovation. Printed versions including the first revisions and errata are available in two practical formats—binder and soft cover. CD-ROM versions are also available to help you use the Codes more efficiently!

New CD-ROM release soon!

The following new publications will be released on the 2005 National Construction Codes and Guides CD-ROM on April 30th, 2008:

- User's Guide – NBC 2005, Structural Commentaries (Part 4 of Division B)
- 2006 Alberta Building Code
- 2006 Alberta Fire Code

For more information: www.nationalcodes.ca
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Commission sets priorities for the 2010 National Model Codes

In developing the 2010 National Model Codes, the Canadian Commission on Building and Fire Codes (CCBFC) has identified priorities that present complex technical challenges. This article, the third in a series, discusses one of the priority issues being addressed.

Fire safety at construction and demolition sites

Each year there are an estimated 480 fires reported at construction and demolition sites in Canada.

At the request of the CCBFC the Standing Committee on Hazardous Materials and Activities formed a task group to examine the issue of fire safety at construction and demolition sites. The standing committee reviewed the task group recommendations and identified three principle factors associated with fires at such sites: hot work operations (such as cutting and welding operations involving open flames or producing heat or sparks); inadequate protection of subject and adjacent property; and inadequate fire department access. In response, the standing committee is proposing technical changes to the 2005 National Fire Code of Canada to address the aforementioned factors:

Hot work operations

This type of operation was identified as one of the leading causes of fires at construction and demolition sites (11% of reported fires). The standing committee is recommending technical changes that would restrict the use of bitumen kettles on roofs. The new proposals would also require these kettles to be equipped with a tightly fitted metal cover and maintained with no excess residue.

Protection of a construction or demolition site and adjacent properties

The standing committee is recommending new provisions that require measures to be put in place to protect not only the subject building from the fire but also any adjacent building or facility that could be impacted. The methods of protection are left to the discretion of the contractor, in consultation with the authority having jurisdiction. The Code already provides some guidance on fire protection methods that could be employed: active methods such as sprinklers, water curtains, and passive methods such as gypsum board sheathing, and temporary fire curtains.

The methods of (fire) protection are left to the discretion of the contractor, in consultation with the authority having jurisdiction.

Fire department access to demolition and construction sites

The standing committee is recommending that fire department access routes to these sites be maintained at all times, that a means be provided to allow firefighters to perform their duties on all levels above and below the first storey, and finally, that provisions be made to use existing elevators, hoists or lifts to assist fire fighting personnel in reaching all levels of a building.

The proposed changes were submitted to public review last fall (see *Construction Innovation*, September 2007). All comments received will be reviewed by the standing committee this Spring before making final recommendations to the CCBFC. If approved by the CCBFC, the recommended changes will be incorporated in the 2010 National Fire Code of Canada.

Status report on the updating of the MNECB

The CCBFC has approved the updating of the Model National Energy Code for Buildings (MNECB) 1997 (see *Construction Innovation*, September 2007) and has charged the newly created Standing Committee on Energy Efficiency in Buildings with this task. The standing committee held its first meeting December 17–18, 2007, at which time it developed a work plan and established task groups to proceed with the updating.

Questions?

If you are interested in receiving more information regarding these tasks or other national code development work, please contact:

Canadian Codes Centre
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First Revisions and Errata to 2005 National Construction Codes Now Available!

The following Revisions and Errata have been issued and are now available to Code users who purchased the printed and CD-ROM versions of the 2005 National Construction Codes:

- First Revisions and Errata to the National Building Code of Canada 2005;
- First Errata to the National Fire Code of Canada 2005;
- First Revisions and Errata to the National Plumbing Code of Canada 2005;
- First Errata to the User's Guide – NBC 2005, Structural Commentaries (Part 4 of Division B).

The revisions were approved by the Canadian Commission on Building and Fire Codes. Information updates are also included to facilitate the use of the codes. Code users should contact their local authority having jurisdiction to find out if these revisions and errata apply in their province or territory.

The revisions and errata have been prepared as a set of tables, which can be downloaded from the Internet at http://irc.nrc-cnrc.gc.ca/pubs/codes/revisions_e.html.

Clients who purchased a publication on CD-ROM will be prompted with an option to download the revisions and errata which, if they accept, will then be automatically incorporated into their document.

For further information, please contact NRC-IRC's Publication Sales Department:

Tel.: 1-613-993-2463 or 1-800-672-7990
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New product evaluations

Company	Product Name	CCMC #	Description
Boise Building Solutions Manufacturing LLC, Timber and Wood Products Division	BCI Prefabricated I-Joists	13300R	I-joists
Intertape Polymer Corp.	FLEX-GARD™ Aspire, PermaGuard™, PermaGard™, and Dri Shield™ II	13292R	Sheathing, membrane, breather-type
PGI Fabrene Inc.	Air-Gard® ULTRA	13294R	Sheathing, membrane, breather-type
PGI Fabrene Inc.	Air-Gard® EXTRA	13295R	Sheathing, membrane, breather-type
PGI Fabrene Inc.	Air-Gard Ultra (Air Barrier Material)	13298R	Air barrier materials
Huntsman International (Canada) Corporation	Rubinate FC3345	13296R	Binder for waferboard or strandboard
Tuff Industries Inc.	Tufdek 60	13293L	Polyvinyl chloride roofing and waterproofing membrane

For further information on the performance, usage and limitations of these products, as well as for other reports and listings by CCMC, see the Web Registry of Product Evaluations located at **http://irc.nrc-cnrc.gc.ca/ccmc/regprodeval_e.shtml**.

2006 Alberta Building and Fire Codes Soon Available on CD-ROM!

The CD-ROM version of the 2006 Alberta Building and Fire Codes will be released on **April 30th, 2008**. Hundreds of technical changes have been incorporated in these editions since the last publication of the Codes in 1997. To facilitate the use of the new objective-based approach, the Code provisions will be linked to **objectives** (statements that describe the overall goals that the Code provisions are intended to achieve) and to **functional statements** (statements that describe conditions that help satisfy the objectives). User's Guides comprising the application and intent statements for the Codes will be released at a later date.

Main Features

- Links allowing easy navigation between various Parts of the Codes
- Code provisions viewable by Section
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- Alberta-specific changes are indicated
- Automatic updating with revisions to the 2006 Codes

The 2006 Alberta Building and Fire Codes on CD-ROM will be available for $240 and $170 respectively.

To order the CD-ROM version of the 2006 Alberta Building and Fire Codes, please visit NRC's Virtual Store on or after April 30th at www.nrc.gc.ca/virtualstore.

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Water mains: the importance of inventory and failure data

As water mains age, they deteriorate. The most common measures of deterioration are the frequency of water main breaks, frequency and nature of water quality failures; and loss of hydraulic capacity. The rate of deterioration can vary widely, as it depends on the pipe material (see sidebar), installation practice, quality of installation, and environmental and operational conditions.

In planning the renewal of deteriorated water mains, the questions that need to be answered are:

- What is the remaining service life of specific pipes?
- Which criteria should be used to replace or rehabilitate a pipe?
- What is the optimal timing for renewal?
- What budget allocations should be planned for the short, medium and long term to maintain an acceptable level of service?

The collection and organization of inventory and performance data today is greatly facilitated by the availability of GIS (geographical information systems) and GPS (global positioning systems).

Essentially, planners want to know which pipes to renew, when and how, subject to service levels and budget constraints. To answer these questions, data on the network must be collected and analyzed.

What data to collect

Water main data comprise two broad categories: inventory and performance. Inventory data include items such as pipe diameter, material, installation date, length, geographical coordinates, presence and type of service connections. Performance data include failure history, such as date, location along the pipe and mode of structural failure; results of hydraulic tests; and information about the observed condition of the inner surfaces of the pipes.

The collection and organization of inventory and performance data today is greatly facilitated by the availability of GIS (geographical information systems) and GPS (global positioning systems). Small municipalities that cannot afford to purchase such systems can employ simple procedures for data collection and use spreadsheets to store and organize essential information.

How to use collected data

In order to make decisions regarding the optimal scheduling of water main renewal, it is necessary to make predictions about the expected deterioration and residual service life of the mains. Such predictions are based on historical performance trends gleaned from available data. In other words, an understanding of past performance enables better estimation of future performance. The analyses involved are not too different from those conducted by insurance companies to establish premiums for life and property insurance policies.

Recently, software tools have been developed that enable water utilities to perform such data analyses. A general understanding can be gained through case studies; however, each water utility must base its predictions on the analysis of its own data so that it can prepare short-, medium- and long-term plans and make renewal decisions that are appropriate for its network.

In the current reality of "infrastructure deficit" and diminishing budgets, collection of data for proper planning is a necessary first step in the right direction.

It is well known that the performance of the same type of pipe can vary significantly depending on local conditions. This, to continue the insurance analogy, is similar to the fact that two identical cars driven by the same person could carry substantially different insurance premiums in two different postal codes.

In the last 15 years, NRC-IRC has been involved in research related to the performance of and decision support for buried infrastructure (water and sewer mains). Researchers have observed that while some water utilities are proactive and use advanced tools and methods to collect, organize and analyze data, many do not. In the current reality of "infrastructure deficit" and diminishing budgets, collection of data for proper planning is a necessary first step in the right direction.

Specific questions can be directed to Dr. Balvant Rajani at 613-993-3810, fax 613-954-5984, or e-mail balvant.rajani@nrc-cnrc.gc.ca.

Municipal water main inventories have different proportions of pipe materials, depending on material availability as well as on the judgement of water engineers on the suitability of a specific pipe material to local conditions.

The use of cast iron pipes commenced in the early 19th Century as urban water distribution networks developed. Until the early 1900s most pipes were made of pit cast iron. Thereafter, manufacturing technologies improved: spun cast iron in the 1920s, ductile iron in the early '60s. New materials were introduced as well: steel in the '40s, pre-stressed concrete in the late '40s, asbestos cement in the '50s, poly(vinyl chloride) (PVC) in the '70s, and polyethylene (PE) in the late '80s.

Study comparing high-performance windows yields strategies for reducing heating and cooling loads

More and more high-performance windows are being manufactured and installed in houses today. In 2002, 24% of glazing units manufactured in Canada contained at least one low-emissivity (low-e) coating, and since January 2007, all new houses in Ontario are required to have windows with a U-factor of 2.0 or lower.

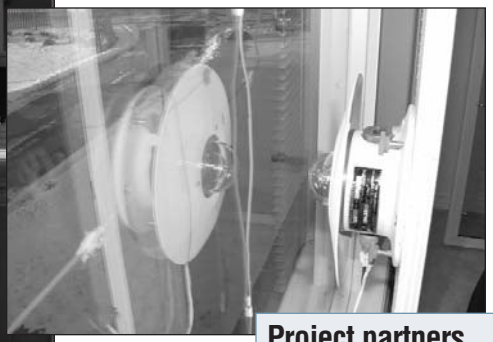
This requirement is most often met by using low-e double-pane glazing. There is a great deal of attention focused on achieving high energy performance, but one must remember that not all windows are created equal. While low-e coatings improve the thermal performance of windows, they vary greatly when it comes to solar performance.

Glazing available on the market ranges from those products that have low solar heat gain to those that have high solar heat gain. Low solar heat gain (LSG) glazing allows only a small portion of the available solar energy into the house, while high solar heat gain (HSG) glazing transmits a large percentage of the available solar energy.

One would expect an HSG product to be most beneficial in winter, when the heat provided by the sun reduces the demands on the furnace. By contrast, in summer, one would expect an LSG product to allow less solar heat into the house, thus reducing the cost of cooling. Since changing the windows each spring and fall is not a practical option, knowing which type of glazing produces the best year-round energy performance and cost savings would be useful information for Canadian homeowners to have.

To determine which type of low-e coating (LSG or HSG) would produce this kind of performance, NRC-IRC researchers compared the glazing in twin side-by-side houses at the Canadian Centre for Housing Technology (CCHT) in Ottawa during both summer and winter. One house was fully glazed with LSG glazing and the other with HSG glazing.

Changing the windows in the CCHT Test House in preparation for the experiment



To measure the incident solar radiation getting through the window, a pyranometer is mounted on the inside.

The Canadian Centre for Housing Technology is operated as a partnership between NRC, Canada Mortgage and Housing Corporation, and Natural Resources Canada.

Project partners

Pilkington North America and Natural Resources Canada

Savings depend largely on the type and cost of fuel used for heating. The higher the cost of heating the greater the benefit from reducing the heating loads through the use of HSG windows.

The experiment showed that differences in the way the two types of glazing managed solar gains had a much larger influence on the energy performance of the house than the small differences in their U-factors. The results from the experiment

Continued on page 9

High-performance windows

Windows with improved thermal performance through the use of high-quality framing materials, coatings and spacers, and low-conductance gas fills.

U-factor
A measurement of the rate of heat transfer through the window, typically measured in W/m²K. A low U-factor is desirable, since it indicates low heat loss. U-factor is the inverse of R-value.

Low-e coating
A thin metallic layer applied to the surface of the window glazing to reduce heat transfer through the glazing.

HOT2000™
An energy analysis and design software created by Natural Resources Canada for determining the energy performance of low-rise residential buildings.

Photoluminescent stairwell installations facilitate evacuation from office buildings

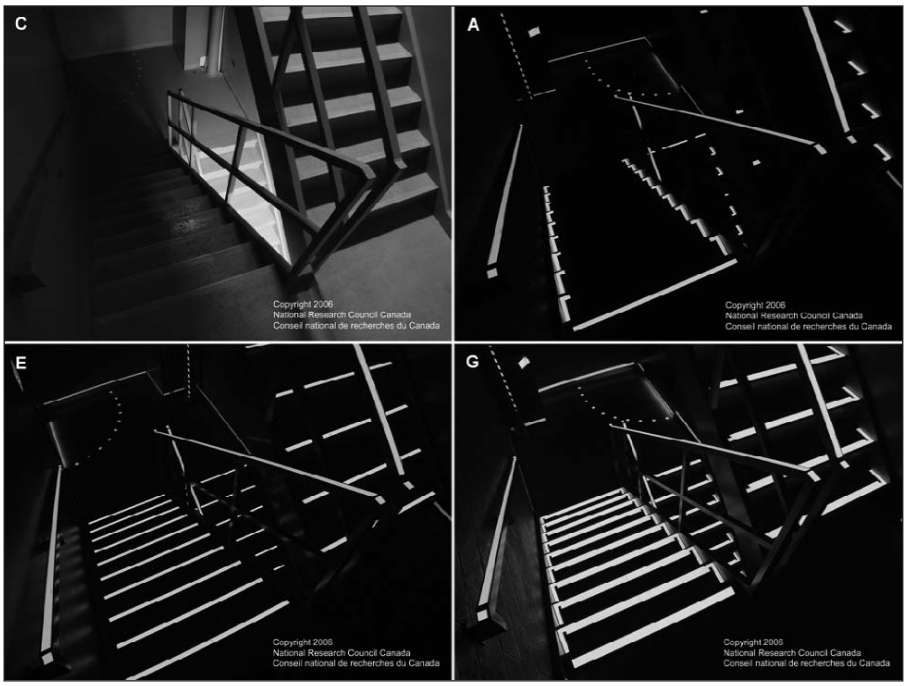
In 1993 when a bomb exploded in the underground garage of the World Trade Center (WTC) in New York, thousands of occupants had to evacuate in complete darkness, as the generators providing power to the emergency lighting were destroyed. In response to that event, photoluminescent paint was applied in the WTC stairwells to guide occupants out of the building in an emergency.

The installation of this photoluminescent material was put to the test on September 11, 2001, and proved to be useful and reassuring to at least one third of the survivors interviewed. Following the events of September 11th and the blackout of August 2003, New York City passed a by-law, in 2005, making photoluminescent marking mandatory in all new and existing high-rise commercial buildings.

Today the use of photoluminescent material (PLM) systems in buildings is gaining acceptance in North America as a valuable safety feature. The material is installed as a continuous marking along the means of egress and glows in the dark when the power fails or when the lighting is obscured by smoke, helping occupants find their way to safety.

The American Society for Testing and Materials (ASTM), New York City, and the International Organization for Standardization (ISO) have all published installation standards for PLM systems, but the installations proposed have never actually been tested by occupants evacuating a building. The standards differ from each other in terms of the location and quantity of material deemed to ensure a safe evacuation.

To remedy this absence of data and identify what constitutes a suitable installation, NRC-IRC fire researchers, in collaboration with Public Works and Government Services Canada, conducted an experiment in a 13-storey high-rise office building with four identical windowless stairwells, housing over 4,000 occupants. They tested the effectiveness of three different PLM installations and compared them to a stairwell under emergency lighting conditions and no markings (see table below).



Photoluminescent material installations used in study

An evacuation drill was carried out with no advance warning to occupants regarding the day and time of the exercise. The number of occupants who used each of the four stairwells during the evacuation drill was similar, and all stairwells quickly became densely populated, which meant that the evacuation movement was slow. Data were

Stairwell	Type of marking (see photos)	Description of requirement
C	None (mean lighting level of 37 lux)	Meets NBC requirement for emergency lighting
A	L-shaped marking at edges of each step plus marking of handrail	New York City Local Law 26 for existing buildings (without the handrail marked)
E	Continuous 25-mm marking across each step plus marking of handrail	New York City requirement for new buildings
G	L-shaped marking and 50-mm marking across each step plus marking of handrail	Suggestion made by New York City, Department of Buildings (responsible for reviewing current PLM installations in NYC buildings)

obtained by using video cameras positioned inside the stairwells and through a questionnaire distributed to occupants following the evacuation.

The results showed that:

- Stairwell E was the most appreciated by occupants for its clear identification of each step; this stairwell also obtained the most positive response in terms of comfort and safety.
- Stairwell G also obtained good ratings, but because it uses more than twice the amount of material, it is a less attractive option from a financial point of view.
- In terms of density and speed of movement, the behaviour of the evacuating occupants was similar in all four stairwells: in all cases, the crowd was dense and evacuation was slow.
- Neither the PLM nor the reduced lighting appeared to play a role in the speed of movement.
- The use of the handrail by over 80% of the evacuees confirmed the value of the team decision to mark the handrails with PLM.
- Visibility of the landing and mid-landing location was a problem for some occupants in all of the stairwells. Ways to solve this problem are now being discussed.

Based on the study results, the team is now developing a guide for the installation of PLM wayguidance systems for all federal office buildings.

For more information about this study, please contact Dr. Guylène Proulx at 613-993-9634, fax 613-954-0483, or e-mail guylene.proulx@nrc-cnrc.gc.ca. You can also visit these Web sites: http://irc.nrc-cnrc.gc.ca/pubs/fulltext/nrcc49230/ and http://irc.nrc-cnrc.gc.ca/pubs/rr/rr232/.

Advances in Low-Rise Residential Buildings: Achieving Excellent Performance Through a Systems Approach

Building Science Insight 2008

How can low-rise residential buildings be designed to optimize occupant satisfaction?

Designers and builders need to ensure adequate performance of building systems in order to meet occupants' expectations for energy performance, comfort and well-being.

This coming fall and winter, NRC-IRC will present our latest research that you can apply to the design and construction of low-rise buildings. BSI 2008 will address the important roles that ventilation and heating systems, high-performance windows, fire-resistant components, acoustic separations and liveable basements play in forming an integrated system to achieve high-performance low-rise buildings.

The seminar will be presented in English and French in fifteen cities across Canada.

For more information on this seminar, or to find out how to register, see the next issue of *Construction Innovation* or check the NRC-IRC Web site at http://bsi.gc.ca.

Study comparing high-performance windows yields strategies for reducing heating and cooling loads

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were then used to fine tune a HOT2000™ computer model, which was in turn used to compare the performance of the LSG and HSG windows as well as that of a conventional double-glazed clear glass air-filled window for various locations across the country.

While both the LSG and HSG windows provided greater energy cost savings than the conventional windows, the HSG window produced the best overall energy cost savings for Ottawa and all the Canadian locations that were modelled. For these locations, when the HSG and LSG windows were compared to the conventional window, the savings in combined heating and cooling costs were between 13% and 17% for the HSG window and between 8% and 10% for the LSG window.

Savings depend largely on the type and cost of fuel used for heating. The higher the cost of heating the greater the benefit from reducing the heating loads through the use of HSG windows. However, the LSG windows were the most effective at reducing cooling loads during summer, when utilities are most likely to experience peak demands for electricity.

The results suggest that an effective approach to reducing both heating and cooling energy using window technologies may be to combine the use of HSG glazing with shading strategies. NRC-IRC researchers plan to explore the performance of different commercially available shutters and shades in 2008 (see related article in *Construction Innovation*, December 2007).

Specific questions about this project can be directed to Marianne Manning at 613-991-0967, fax 613-998-6802, or e-mail marianne.manning@nrc-cnrc.gc.ca.

What we're hearing

Forum examines emerging trend in green construction: Net Zero Energy Home Construction

Increasing concern over climate change has people thinking about ways to reduce greenhouse gas emissions. One recent event where the subject was front and centre was a forum called "Getting to zero: Defining the path to Net Zero Energy Home Construction." First held in Ottawa and second in Toronto in Spring 2007, the forum examined this emerging trend in home construction and where it might fit in residential housing. Attendees included Canadian and U.S. builders, developers, government officials, utilities representatives and building product manufacturers.

A Net Zero Energy Home (NZEH) is a home that uses existing renewable energy sources (including passive and active solar, solar photovoltaic and geothermal technology) and proven energy conservation techniques to supply at least as much power to the electrical grid as it consumes. In other words, the net amount of electrical energy purchased for the home over a year is zero.

Panel discussions at the forum examined Canadian perspectives on NZEH, technical considerations in NZEH deployment and design, and how the NZEH concept is gaining momentum in Ontario. New and emerging approaches to NZEH, such as "net zero cost", "net zero electricity" and "zero utility peak demand" were also a hot topic. Zero utility peak demand, in particular, attracted attention because it is achievable in cold climates, such as those found in Ontario. It stipulates that the house produces energy equal to the amount supplied by a utility during peak times.

Although the NZEH approach is common in many countries such as Japan and Germany, it is just beginning to catch on in Canada and the U.S. According to Forum participants, there are still significant barriers to be overcome, including difficulties in financing NZEH construction, a lack of incentives to convert conventional homes to NZEHs, a lack of unified building labels and guidelines, and difficulties in moving NZEHs on the re-sale market.

To learn more about NZEH and about the forums, see the Net Zero Energy Home Coalition Web site at www.netzeroenergyhome.ca, or contact Mr. Gordon Shields at (613) 823-8079 or gshields@magma.ca. You can also visit http://www.cmhc.ca/en/inpr/su/eqho/index.cfm for information about a related Canada Mortgage and Housing Corporation program called EQuilibrium.

Recent international conference explores new vision and value in construction

Revaluing Construction—Crossing Boundaries 2007, organized jointly by CIB and the host country Denmark, was the third in a series of conferences to explore ideas about realizing the greater potential of the global construction industry by taking a more holistic approach.

Central to this approach is the notion of stakeholdership and the question "Who is impacted by construction?" In many development projects, convention affirms the importance of the client/owner almost exclusively. However, it can be argued that construction only realizes its greater value by balancing commercial interests with a range of other concerns and impacts, where the need for commercial success is met by concerns for process efficiency, the environment, sustainability and impact on quality of life.

CIB (International Council for Research and Innovation in Building and Construction)

http://www.cibworld.nl/website/

Conference participants shared information on country-specific efforts to enhance innovation in the construction industry, and presentations explored the ways in which this greater value is realized. In some cases, the challenge is overcoming linguistic and cultural barriers. In others, the application of building information modelling technologies (BIM) to the planning and pre-construction phases is a key success factor, enabling all parties to better visualize the project, develop a shared understanding of objectives and work to resolve issues prior to construction.

The *ManuBuild Project* is an example of such efforts. This project is exploring the value-added potential of industrialized construction, engineering a shift from "craft and resource based construction" to an open building manufacturing system. Certainly, for the project's 24 partners (from 10 European countries) the open system approach means sharing critical information, knowledge and even intellectual property, where productivity, innovation and quality are at stake. *ManuBuild* seeks to reduce construction costs, build-time and workplace accidents, while increasing productivity and the quality of life of clients (http://www.manubuild.org).

For more information about this conference, go to the proceedings, available free at http://www.rc2007.org/, or contact James Crawford at 613-993-0482, fax 613-941-0822, or e-mail james.crawford@nrc-cnrc.gc.ca.

What we're hearing

Canadian Society of Civil Engineering releases sustainability guidelines

In July 2006 the Canadian Society for Civil Engineering (CSCE), the Institution of Civil Engineers (U.K.), and the American Society of Civil Engineers signed a *Protocol for Engineering a Sustainable Future for the Planet*, which articulated the continuing commitment of these organizations to sustainable development, and recognized the major role that civil engineers have in meeting the United Nations Millennium Development Goals (go to http://www.un.org/millenniumgoals/). It also committed the signatories to produce a sustainability action plan.

The CSCE's response, *Entrusted to Our Care: Guidelines for Sustainable Development*, was recently released. It calls for greater participation by civil engineers in the development process; more involvement with social, health, environmental and economic issues; and a stronger role in advocating sustainable development.

This document identifies eight priorities that the civil engineer should endeavour to promote: the natural environment, financial and economic sustainability, green construction, human resources, social regulatory and health concerns, ethics, participation by others, and implementation. It is available at http://www.csce.ca/SustainableDevelopment.aspx.

The Institution of Civil Engineers has also recently released its corresponding plan *Sustainable Development Strategy and Action Plan for Civil Engineering*, which is available from the ICE Web site at www.ice.org.uk.

Housing innovation at CCHT: Ten years of experiments on new technologies

Continued from cover page

designed to integrate space heating, heat recovery ventilation and water heating into one space-saving unit to achieve high levels of energy efficiency and performance. The trial of these prototypes assisted manufacturers in dealing with the integration of these new technologies into the house energy system.

Solar shading of windows: Significant energy savings were found in experiments involving both a standard internal venetian blind system routinely opened in the winter during daytime and closed during nighttime, and an external shading device covering the south facing windows day and night during the cooling season.

Comparison of window glazing technology: Windows with low solar heat gain (LSG) low-e glazing and others with high solar heat gain (HSG) low-e glazing were assessed side-by-side during the winter and summer, with noteworthy results (see related article on page 7 of this issue).

Thermostat set-back and set-forward: A series of experiments demonstrated that setting back the thermostat during the heating season produced significant savings. Setting it forward during the summer appeared to be more problematic because of long recovery times. Simply setting the thermostat 2°C higher in summer resulted in large savings.

Energy-efficient lighting: CCHT was used to assess the energy impact of compact fluorescent lighting, including lighting energy savings, the reduction in space cooling (benefit) and the increase in space heating (penalty).

Greywater heat recovery: An in-house standard test was developed to allow manufacturers to quantify energy savings for drainwater heat recovery devices. Products subsequently tested proved effective in reducing the amount of energy needed to produce hot water.

Heating by solar concentrator: An experiment is currently underway to assess a solar concentrator system that focuses the sun's energy and converts it to heat for space and water heating. The system contains a thermal storage unit that makes energy available when solar energy is not available.

These and many other experiments demonstrate the value of CCHT to companies, utilities and agencies striving to advance housing technology, and to homeowners and society generally in the form of positive contributions to the environment, sustainability and health and wellness.

CCHT continues to actively seek industry clients and partners for the assessment of housing innovations. For additional information about the projects presented here and other projects, visit www.ccht-cctr.gc.ca.

Specific questions can be directed to CCHT Research Manager Mike Swinton at 613-993-9708, fax 613-998-6802, or e-mail mike.swinton@nrc-cnrc.gc.ca.

Upcoming events

APRIL

4-7

65th Canadian Home Builders' Association National Conference. Whistler, BC. http://www.chba.ca/conference/index.php

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Housing Awards – Best Practices in Affordable Housing. Show your initiative – Apply today for a 2008 Housing Award. Applications must be received at CMHC's National Office by 5:00 p.m. local Ottawa time, April 18, 2008. http://www.cmhc-schl.gc.ca/en/inpr/graw/hoawpr/index.cfm

MAY

20-22

eSim 2008 – The Bi-Annual Conference of the International Building Performance Simulation Association – Canada. Quebec, QC. NRC is an organizer of this conference. http://www.esim.ca/2008/home.htm

30-June 2

Federation of Canadian Municipalities (FCM) Annual Conference & Expo. Quebec, QC.* http://www.fcm.ca/english/events/conferences.html

JUNE

2-5

NFPA World Safety Conference & Exposition. Las Vegas, NV. http://www.nfpa.org/categoryListWSCE.asp?categoryID=1059

10-12

Building Enclosure Science and Technology. Minneapolis, MN. http://www.thebestconference.org/

16-18

PAQS 2008–Construction in Challenging Environments. Edmonton. http://www.paqs2008.com/papers.php

24-26

World Wind Energy Conference, Kingston, ON. http://wwec2008.com/

AUGUST

17-20

American Public Works Association Public Works Congress and Exhibition. New Orleans, LA. http://www.apwa.net/meetings/congress/2008/

SEPTEMBER

21-25

SB08 Melbourne–World Sustainable Building Conference. http://www.SB08melbourne.org

OCTOBER

13-17

Association for Preservation Technology International (APT). Montreal. http://www.apti.org/conferences/conference-future.cfm

NOVEMBER

4-5

Construct Calgary + HomeBuilder and Renovator Expo. Calgary.* http://www.constructcalgary.com/

5

Expo-Contech, Montreal.* http://www.contech.qc.ca/eng/index_batiment.php

19

Expo-Contech, Quebec, QC.* http://www.contech.qc.ca/eng/index_batiment.php

DECEMBER

3-5

Construct Canada. Toronto.* http://www.constructcanada.com/index2008.htm

* *You are invited to visit the NRC-IRC booth for more information about our research expertise.*

This calendar does not include all events scheduled to take place during this time frame. For a more complete listing, see the Web version of "Upcoming events" at http://irc.nrc-cnrc.gc.ca/events_e.html

construction *innovation*

http://irc.nrc-cnrc.gc.ca

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