

High-performance buildings reaching new heights

By Christopher Guly

From a new federal administrative centre on the West Coast, to a regional-level operations hub in Ontario, to a new downtown Winnipeg high-rise for a major utility, Canadian buildings are reaching new heights in performance and sustainability through ground-breaking architectural design.

Harnessing in Winnipeg

When it opens later this year, Manitoba Hydro's new head office building in downtown Winnipeg will not only be one of the world's most energy-efficient large-scale buildings - aiming for a Leadership in Energy and Environmental Design (LEED®) Platinum standard - but could also bring new life to the provincial capital's largely moribund urban core.

The project, which began in 2002, was a huge integrated design undertaking involving architects and engineers from several firms, including Kuwabara Payne McKenna Blumberg (KPMB) Architects of Toronto, which handled the design; Winnipeg-based Smith Carter (Architect of record); and Prairie Architects Inc. of Winnipeg, which helped select the site and design team while coordinating the integrated urban design (IDP) process, including the LEED®-related documentation, led by Architect **Dudley Thompson, MRAC.**

Manitoba Hydro had its own hands-on team led by Vice-president Tom Gouldsbrough and project energy advisor Tom Akerstream.

Thompson says that 10 two-day IDP sessions were held over an 18-month period, during which the team brainstormed on designs in real time.

Manitoba Hydro set a goal to achieve a 60-per-cent reduction below the Model National Energy Code Building for the 64,800-square-metre headquarters.

"At that scale, it's never been done in such an extreme climate," explains **Bruce Kuwabara, FRAIC**, the 2006 recipient of the RAIC

Gold Medal for Architecture and a partner in KPMB Architects.

Of all cities with a population over 500,000, Winnipeg is the coldest on the planet. But in the summer, it can get well above 35°C - more than 70 degrees higher than it gets during the winter.

To achieve the 60-per-cent target, the building was designed to maximize its passive energy gains.

"In Winnipeg, that means solar, because it gets more sunlight than any other Canadian city," says Kuwabara, adding that "counter-intuitively" the city also experiences unusually strong southerly winds.

With all of that available sunshine, international climate-engineering firm Transsolar focused on using daylight to reduce the lighting loads of the

building and identified the potential of creating a hybrid ventilation system that would rely on a passive system of operable windows.

Occupying a full city block, the form and massing of the building are driven by solar and wind energies with a design that operates in three seasonal modes (winter, summer, shoulder).

The 23-storey, \$188-million building includes a three-storey podium base that contains some



Manitoba Hydro Building: Above - North view, day. Page 13: Top - Atrium; Bottom - North view, night

street-related retail space, one level of underground parking, and an 18-storey office tower and two-storey mechanical penthouse above.

Inside, the floor plate is divided into smaller precincts organized around a series of stacked six-storey atria. The atria connect to office floors, and stairs support vertical circulation "to maximize face-to-face communication and collaboration between people and departments," according to the project description.



ARCHITECT: KUWABARA PRINE WOKEMBA BLUMBERG ARCHITECTS; SMITH CARTER AND PRINCE ARCHITECTS; PHOTOGRAPHY: WIRUWU AN, AG+H



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Two towers converge at the north and splay open to the south in the form of a capital A to capture maximum sunlight and strong southerly winds unique to the city's climate.

Transsolar fashioned the space within the splay as a double wall, partitioned into the stacked atria that act as solar collectors, and, combined with a six-storey solar chimney, perform as the "lungs" of the building, providing it with maximum fresh air. A geothermal system maintains a constant 20°C temperature in the concrete slabs year-round.

"It's the cumulative effect of the radiant cooling and heating in the slabs, with the 100-per cent fresh air, plus a very high-performance building envelope, which is almost entirely glass, that creates a high level of comfort," says Kuwabara.

Essentially, the chimney is "the fan that passively drives the operation of the building," says Thompson.

In the form of a tall, thin slab, the chimney intersects the north end of the building at the main entrance where large canopies prevent wind-tunnel effects for pedestrians at street level. During the summer, warm air enters the flue and is exhausted out of the building. In winter, the warm air is drawn downward to heat the garage in the basement.

Inside the building at ground level, a three-storey atria or "street" runs along the solar axis to connect the north and south entrances to the urban fabric of the city.

Maximum use of daylight is achieved through triple glazing on lower-level surfaces, while the north and south atria have double façades. The double façade has an inner single- and an outer double-glazed wall with a buffer of air in between. The temperature between the two walls fluctuates naturally for most of the winter months, maintaining the performance of a triple-glazed façade.

Though the buffer zones are configured in the winter for thermal insulation and fresh-air heating (in the case of the south atrium), their configuration changes with the seasons. (Heating and cooling has been separated from the ventilation function.)

Thompson points out that Transsolar designed the building to operate without a heating or cooling system for at least one-third of the year.

The shades and windows are motorized on the outside. On the inside, the single-glazed windows are manually operated.

Kuwabara says the building has also been designed so that the windows cannot be opened when the temperature outside drops well below freezing.

He explains that inside the double-wall buffer zones, the windows are also equipped with motorized horizontal shades. When in certain positions, they act as "light shelves" that "bounce" light deeper into the building.

The south atria also feature a water wall that adjusts the humidity levels in the building. This 24-metre-tall water feature comprises about 280 tensioned Mylar ribbons with conditioned water running down each ribbon. Chilled water dehumidifies the air in the summer and warm water humidifies in the winter.

Almost all – 92 per cent – of the building material reclaimed from existing buildings on the site, including Douglas fir, was recycled for other uses.

Once occupied, Manitoba Hydro's new downtown headquarters will accommodate 2,000 employees currently dispersed at 12 offices throughout the city.

In fact, the consolidation in the urban core was a condition former Winnipeg mayor **Glen Murray, Hon. MRAIC** (currently president and CEO of the Canadian Urban Institute) set for construction of the new headquarters for the energy utility, which acquired Winnipeg Hydro in 2002.

"The idea was to bring people together on an urban site," says Architect Kuwabara.

He explains that Manitoba Hydro could have opted for a self-contained monolithic structure complete with a large food court to keep employees inside. But the goal was to get people out of the building and onto the streets of downtown Winnipeg, patronizing retail shops and restaurants – and even living in the area.

High-performance buildings

"Most developers are looking for a return payout in a much shorter period of time, but you can't think like that," says Kuwabara.

"Over 60 years, the benefits of sustainability far outweigh capital or operating costs."

The new building is expected to save the Crown Corporation about \$15 million in annual operating costs, including an estimated \$7 million in annual lease costs by amalgamating the dozen satellite offices under one roof.

"Manitoba Hydro was so involved in this project," says Kuwabara, "and from the very beginning, they placed the user - the employees - as the central figure in the life of the building."

Making adjustments for reality

Over on the West Coast, Parks Canada can now boast having one of the country's most advanced environmentally sustainable buildings with a new marine-support operations and administrative centre for

Gulf Islands National Park Reserve in British Columbia.

Located on Vancouver Island in Sidney, B.C., the three-storey facility made history shortly after it opened in late 2005 when it was awarded a LEED® Platinum rating and became the first Canadian building to achieve this level of sustainability, and the first federal building to achieve the LEED® Gold or higher standard suggested by Public Works and Government Services Canada.

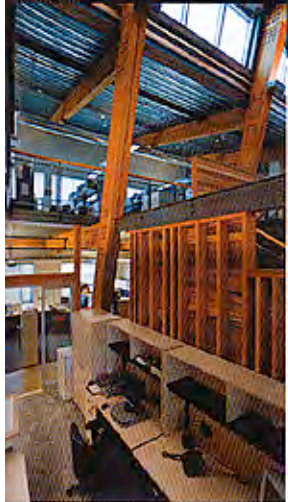
In 2007, the Operations Centre was awarded the RAIC's first Award of Excellence in the "Green Building" category.

"The project clearly demonstrated an architectural design approach to the integration of sustainable design principles, executed at a high level in all categories: site planning, water efficiency, energy efficiency and renewable energy, conservation of materials and resources, and indoor environmental quality," said architect Neil Munro, FRAIC, a member of the RAIC's awards jury.

On an annual basis, the building is designed to save 75 per cent in energy costs and achieve 49 per cent in energy-intensity savings.



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Gulf Islands National Park Reserve, clockwise from top: South elevation at dusk; Southeast elevation; cross-view

"One building can't turn everything around, but it can make a big difference," observes Kuwabara.

"Bringing 2,000 people into downtown Winnipeg at this moment in time is going to have a huge benefit in terms of urban revitalization.

"It will cause a lot of complaints when people start paying for parking or don't like riding buses, but that's part of urban change. A lot of younger people from Manitoba Hydro will live downtown because of the building."

And employees will have plenty of opportunities to socialize at work. Most of the office space is open-concept and the atria can be used for staff meetings.

The building is organized into three-storey "workplace neighbourhoods." Two of them are served by one of the south atria - the so-called lungs of the building that form part of the natural ventilation system.

Ultimately, Manitoba Hydro's new head office achieves five objectives, according to Kuwabara.

It creates both a supportive workplace environment for the employees and sustainable

design that will lead to a 60-per-cent reduction in energy use and, at a minimum, a LEED® Gold rating - if not the goal of a LEED® Platinum designation.

The project was also able to develop signature architecture integrated throughout the building at different scales, from street level to the roof.

It also attained a high level of urban design integration to revitalize the downtown and a cost-effective building design that provides Manitoba Hydro with benefits in terms of comfort, operations and maintenance.

As Kuwabara told the German magazine *XIA Intelligente Architektur* earlier this year: "The integrated design process was essential to achieve our creative breakthroughs and innovation. The tools to model and explore alternatives had to be sophisticated to address advanced concepts, including daylight autonomy, radiant cooling and heating, geothermal systems, operable windows and hybrid ventilation, and high-performance curtain wall and building envelope design."

Manitoba Hydro has also established a 60-year financing framework.