INTEGRATE

Planning

PRE-PLANNING

BEFORE 2030 AND BEYOND LEED: Manitoba Hydro Place was conceived in 2002, a year before Architecture 2030 was founded and three years before Al Gore's Inconvenient Truth (2006) galvanized awareness of climate change. Recognizing LEED was not structured to prioritize major energy savings, Manitoba Hydro set ambitious goals for its new building to achieve 60% savings in an extreme climate using an integrated design process.

DESIGN + ENERGY + COST
To ensure the energy objectives were not compromised at the expense of cost and design, Manitoba Hydro developed a unique business model to keep Design, Energy/Sustainability and Cost in balance.

INTEGRATED DESIGN PROCESS

The Integrated Design Process (IDP) is a process-based solution to resolve the complexities inherent in contemporary architecture. The IDP manages the creative and pragmatic contribution of many individuals and teams to harmonize energy, materials, site, climate, construction, economics, culture and society. Face-to-face meetings in real time and space are key to the IDP.

Manitoba Hydro Place is the product of a formal IDP modeled on the C-2000 program developed by Natural Resources Canada (NRCan). Two full years were dedicated to design and development.

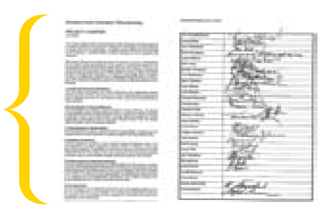
INTEGRATED DESIGN TEAM (IDP)

The first task of the IDP team begins with the Design Architect. Being a crown corporation, Manitoba Hydro endeavoured to involve the public from the earliest stages 8 design architect proponents presented their portfolio at a public lecture at the Winnipeg Art Gallery. KPMB was awarded the commission. To ensure a team unity, Manitoba Hydro engaged KPMB Architects to advise in the selection of: Smith Carter Architects and Engineers (Executive Architects), Transsolar (Energy Engineers), Halcrow Yolles w/ Crosieur Kilgour (Structural Engineers), AECOM nee Earthtech (Mechanical & Electrical Engineers), PCL (Construction Managers) & Hanscomb (Costing/Quantity Surveyors).

IDP KICK OFF - PROJECT CHARTER

The second task of the IDP is to confirm the core principle goals and to inspire ownership by everyone.

For MHP, the IDP began with an off-site kick-off Charette at Misty Lake in Manitoba. The major outcome was a three-page project charter signed by Manitoba Hydro's Project Executives and all IDT members. The Project Charter was a key tool in the IDP from conception to delivery. Advocate Architects (Prairie Architects) referred to it consistently, in every charette and meeting to ensure every design decision was measured against the charter and no goal was comprised in favour of another.



The Project Charter is a key tool in the IDP from conception to delivery.

SUPPORTIVE WORKPLACE:
healthy and effective contemporary office environment for 2000 employees adaptable to changing technology and workplace environment for present and future needs

WORLD CLASS ENERGY EFFICIENCY
TARGET – 60% ENERGY REDUCTIONS OVER THE MODEL NATIONAL ENERGY CODE BUILDING

SUSTAINABILITY
LEED GOLD LEVEL CERTIFICATION

SIGNATURE ARCHITECTURE
DESIGN TO CELEBRATE THE IMPORTANCE OF MANITOBA HYDRO TO THE PROVINCE AND TO ENHANCE DOWNTOWN

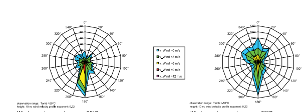
URBAN REGENERATION
STRENGTHEN AND CONTRIBUTE TO SUSTAINABLE FUTURE OF WINNIPEG'S DOWNTOWN

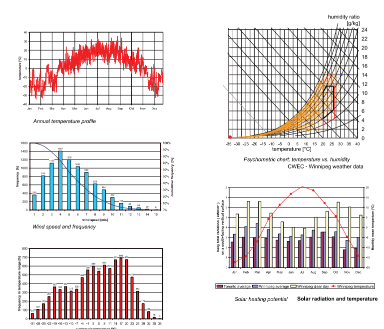
COST
COST-EFFECTIVE AND A SOUND FINANCIAL INVESTMENT

Form & Passive Energy

For Manitoba Hydro the climate became a significant driver for the project.

Analysis of Winnipeg's climate revealed a great potential for passive solar heating during Winnipeg's long winter. Combined with strong gusting southerly winds, this solar potential helped Transsolar illustrate to the design team that the local environment was an energy resource that would help in achieving the ambitious goals for 60% energy reduction. These potentials used in part with geothermal storage and proven passive design techniques helped the IDT narrow down the forms appropriate for the site.





Design Charettes

Design Charrettes represent key milestones in the IDP. Manitoba Hydro Place involved 5 design charettes in the first few months of the project.

YEAR 1. SCHEMATIC DESIGN KICK-OFF

Each consultant presented Top 10 lists of what they wanted to achieve in this building. Form and massing options were selected for exploration.

Charrettes 2 and 3: 15 OPTIONS were generated for evaluation and testing. The glass office tower/podium was identified as the most efficient typology to optimize Winnipeg's abundance of sunlight and to ensure maximum access to natural light and views. 3 options were then selected for further development. Transsolar ran these through analysis software to test passive efficiencies, daylighting and local climate impact through CFD Wind Analysis modeling.

CHARRETTES 4 AND 5. ENERGY MODELING
The 3 options were submitted for office program analysis, design refinement and schematic level costing. Each option was modeled using TRANSYS to affirm energy targets and passive potentials. Each option was vetted through the charter goals.

But it was actually in the casual meals and gatherings that occurred around the day long charettes that the majority of enlightened conversations took place, summary sketches drawn, strategies and schemes developed and technical details ruminated over. During one of these discussions, Thomas Auer mused about rotating one of the splayed tower schemes, Option 5A, so that the stacked atria faced due south to capture solar and wind energy. Option 5A 'rotated' became scheme 5C, and finally simply 'C' dubbed the COMFORT TOWER and ultimately the winning concept.

YEAR 2: DESIGN DEVELOPMENT

For half a year bi-weekly IDP sessions were alternated between Winnipeg and Toronto and served as intense co-ordination meetings involving all disciplines. The overall goal was to optimize the COMFORT TOWER SCHEME to ensure it would hit each Project Charter goal without compromise. As concepts were proposed, the Architectural Team would assess the needs of the proposed system and finesse the design to achieve the integration of performance and aesthetics. Large-scale features, such as the Solar Chimney, the Double Facades and the South Wintergardens, were rigorously tested, vetted and pushed to ensure seamless tie-in to the building systems.

Natural Ventilation

PROVIDE 100% FRESH AIR, 24/7, YEAR ROUND

NATURALLY DRIVEN DISPLACEMENT VENTILATION MINIMIZES THE NEED FOR A FORCED AIR CIRCULATION SYSTEM.

In the final design, double façades were integrated into the east and west tower elevations to act as buffers from the extreme climate while allowing fresh air to be drawn passively into the building. Automated louver shades within the cavity control glare and heat gain. Motorized exterior operable windows open and close in response to light and temperature, while manually operated vents provide fresh air access for all users.

Three types of double façade window vents were analyzed to ensure ventilation efficiencies to minimize heat gain to the interior: horizontal axis-flaps, parallel-extension window and opposed vertical axis flaps. As ventilation in the simulation was driven primarily by the stack effect, results were most favourable for the horizontal axis flaps because of the high difference between inlet and outlet. Air enters the double façade at the bottom windows, flowing along inside the façade cavity, where it is heated by passive solar gains, then escapes out the top vent.

The three six-storey stacked south atria, or Wintergardens, act as THE LUNGS, working in combination with THE SOLAR CHIMNEY, passively treating fresh outdoor air before it enters the building. Each South Wintergarden features a 23m tall WATER CURTAIN composed of mylar ribbons and treated water, that conditions the air before entering the raised access floor.

Heating

Cooling

BUILDING ENVELOPE AS A BIODYNAMIC CLIMATE RESPONSE SYSTEM

The greatest savings are in heating demand. Reduction in heating demand for Manitoba Hydro Place is largely due to the high-performance curtain wall design with combinations of double façades and triple glazed curtainwall.

The first step in reducing the heating load of the building was to reduce the amount of heat lost out of the facades. A traditional approach would be to increase the amount of opaque areas and add more insulation. This however was counter to the approach of drawing more daylight into the building and providing the users with direct access to it. By introducing the ideas of buffer facades on the dominant east west faces, and by expanding these buffer zones out to become wintergardens on the south facade, the building envelope becomes a biodynamic climate responsive system, actively mediating between the user and the exterior environment.

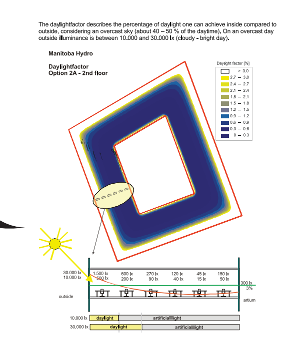
Interstitial temperatures within the façade have exceeded expectations for their impact on extending the natural ventilation season as well as reducing heat loss through the facade. For example, on a cold but sunny day, temperatures within the interstitial space can reach over 30°C (86°F) with outdoor air temperatures of -20°C (-4°F).
Heating requirements for the tower during the winter of 2009/10 have been measured to be 44 kWh/m2/per year. This is a significant reduction compared to a typical Winnipeg heating load of > 250 kWh/m2/a and is reflective of a high-quality building envelope, thermal massing, collection of passive solar heat gain, and other design considerations. Once the ground-source heat loop is commissioned, the energy usage for heating is expected to meet its target set at 15.2 kWh/m2/a.

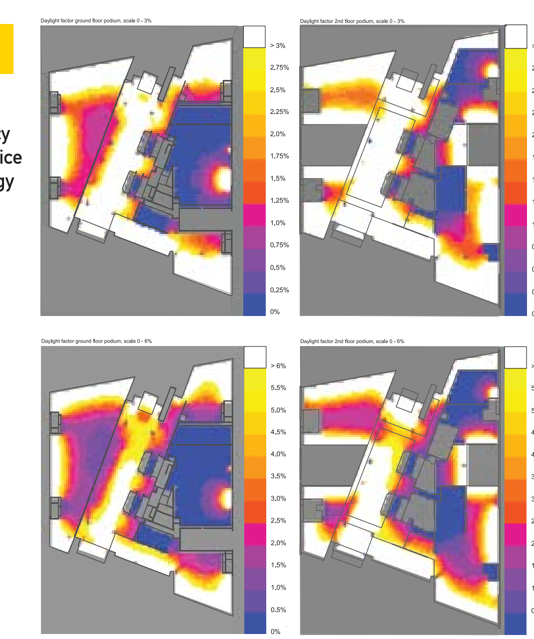
Daylight

DAYLIGHT REPRESENTS 30% OF A BUILDING'S ENERGY CONSUMPTION.

The combination of high-quality glazing, a tall, narrow office floorplate, automatic electric lighting controls, and high efficiency lamps projected 65% energy savings for office lighting. Preliminary data for lighting energy in the building supports this projection.

The following chart indicates lighting load for a typical floor, and illustrates the reduction for both daylight control and occupancy sensors for each fixture.





REDUCE

- Solar Loads
- Lighting through Controls
- Cooling Loads
- Utility Consumption
- Mechanical Plant Size

South Wintergarden study of exterior at mechanical bench.

BY LEVERAGING INFORMATION TECHNOLOGY
to monitor and control the building, while enabling the individual user control of their immediate environment, a more responsive and productive work environment is created.

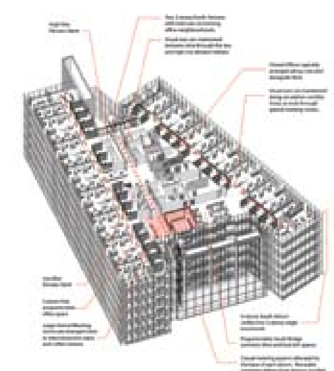
The Building Management System (BMS) combined with prevailing conditions (temperature, radiation, wind, precipitation…) is a key component for achieving integration between the actual building and the individual systems for conditioning/ventilation. It is also critical for verifying and optimizing energy targets and for observing building performance in close detail to allow fine tuning of systems as required.

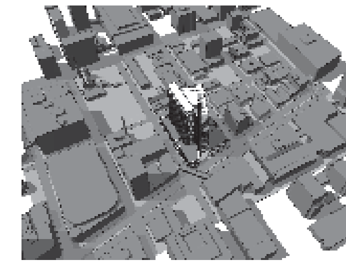
A comprehensive collection of meters and sensors is installed throughout Manitoba Hydro Place. The metering list includes: main utility meters and a variety of sub-meters for lighting, plug loads, water heating, HVAC energy, and tenant spaces. In addition, plant systems can be monitored for overall efficiency. These meters are tied into web-based energy management software for storage and analysis.

With over 25,000 observation points, more than a major medical complex, the BMS for Manitoba Hydro Place is unique, and multi-valent. Among its many functions, it:

- Enables employee feedback through custom web based computer interfaces to control aspects of lighting and solar shading
- Monitors local climate using two on-site weather stations
- Uses climate data to adjust set-points automatically (slab temperatures, operable window positions, shade positions, etc.)
- Acts as a central hub to other system control computers for lighting and solar shading, permitting autonomous operation for these specialized systems.

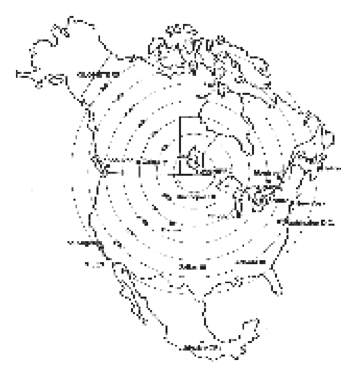
An in-depth measurement and verification plan (to IPMVP standards) was developed by the Building Energy Management Engineer. The plan will utilize the hundreds of sub-metering points collected by the BMS to devel



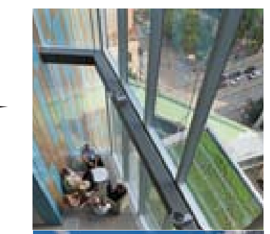


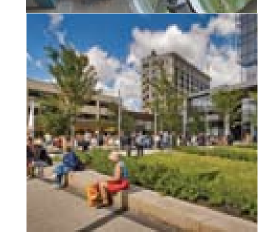
The building form, orientation and iconic massing capitalize on Winnipeg's extreme climate energy potential while simultaneously creating a new public destination for the city. The towers are set back on the podium to minimize shadow impact on existing public pace on Portage Avenue, the city's main historic street. The Solar Chimney marks the main entrance on Portage Avenue and a large canopy at the south mitigates gusting winds to create a pedestrian friendly zone. The siting of the south end of the building on a 21 degree angle (aimed directly south) to capture prevailing winds and solar energy resulted in open space for a new urban park. Inside the podium, a Public Galleria serves as both a public sheltered route through the site and indoor event/gathering space.

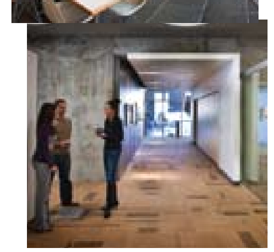
Communication



Neighbourhoods







THE HUMAN FACTOR

Supporters of sustainable design often argue for the economic benefit of even small increases in employee productivity, citing that annual salaries are typically larger than the capital cost of the entire building.
A comfortable and collaborative workplace was essential for productivity but more importantly to create a sense of well-being for the corporation's greatest asset, its employees.

Personal control was a large factor in the increased perception of comfort. At Manitoba Hydro Place everyone has access to the façade and receives natural lighting 80% of normal office hours. Occupants control their personal environments, using operable windows, task lighting, and shading devices. Displacement ventilation is deployed via a series of occupant controlled floor grilles, allowing users control of their immediate work environment while immersing them in a pool of 100% fresh air.

In combination with transit incentives, 90% of employees living in the suburbs are leaving their cars at home and reporting enjoying meeting their colleagues, inside and out of the office. For Manitoba Hydro Place, foremost was the creation of a highly supportive, comfortable and healthy work place that would eclipse considerations of productivity by fostering community and instilling civic pride.