Manitoba Hydro’s New Corporate Headquarters

Vision:

Meet Business Needs

Energy Efficient/Sustainable

Signature Architecture

Maximum Benefit to Downtown Winnipeg

Cost Effective
## Manitoba Hydro Downtown Office Building

### LEED Scorecard

<table>
<thead>
<tr>
<th>Sustainable Sites</th>
<th>Possible Points</th>
<th>Materials &amp; Resources</th>
<th>Possible Points</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Total Project Score</strong></td>
<td>51/61/13</td>
<td><strong>LEED™ Scorecard of 3/25/08</strong></td>
<td><strong>Possible Points</strong></td>
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<tr>
<td><strong>Credit</strong></td>
<td><strong>Points</strong></td>
<td><strong>Credit</strong></td>
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<tr>
<td>51</td>
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<td>1</td>
<td>Site Selection</td>
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<tr>
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<td>Redevelopment of Contaminated Sites</td>
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<tr>
<td>1</td>
<td>Alternative Transportation: Public Transportation Access</td>
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<td>Alternative Transportation: Mode Share</td>
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<tr>
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<td>Alternative Transportation: Automobile Parking Capacity</td>
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<td>Reduced Site Disturbance</td>
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<td>Reduced Site Disturbance: Development Footprint</td>
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<td>Stormwater Management, Retention and Quantity</td>
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<td>Landscape &amp; Exterior Design to Reduce Heat Islands, Non-Rooftop</td>
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<td>Light Pollution Reduction</td>
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<td><strong>41</strong></td>
<td><strong>Water Efficiency</strong></td>
<td><strong>16</strong></td>
<td><strong>Indoor Environmental Quality</strong></td>
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<td>Water Efficient Landscaping, Reduce by 50%</td>
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<td>Innovative Water Management Technologies</td>
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<td>Low-Emitting Materials, Adhesives &amp; Sealants</td>
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<tr>
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<td>Low-Emitting Materials, Carpet</td>
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<td>Low-Emitting Materials, Composite Wood</td>
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<td>Indoor Chemical &amp; Pollutant Source Control</td>
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<td>Indoor Chemical &amp; Pollutant Source Control</td>
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<td>1</td>
<td>Daylight &amp; Views, Daylight 75% of Spaces</td>
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### Credit Details
- **Credit 1**: Site Selection
- **Credit 2**: Redevelopment of Contaminated Sites
- **Credit 3**: Alternative Transportation: Public Transportation Access
- **Credit 4**: Alternative Transportation: Mode Share
- **Credit 5**: Alternative Transportation: Automobile Parking Capacity
- **Credit 6**: Reduced Site Disturbance
- **Credit 7**: Stormwater Management, Retention and Quantity
- **Credit 8**: Landscape & Exterior Design to Reduce Heat Islands, Non-Rooftop
- **Credit 9**: Light Pollution Reduction
- **Credit 10**: Water Efficient Landscaping, Reduce by 50%
- **Credit 11**: Innovative Water Management Technologies
- **Credit 12**: Water Use Reduction
- **Credit 13**: Low-Emitting Materials, Adhesives & Sealants
- **Credit 14**: Low-Emitting Materials, Paints
- **Credit 15**: Low-Emitting Materials, Carpet
- **Credit 16**: Indoor Chemical & Pollutant Source Control
- **Credit 17**: Daylight & Views, Daylight 75% of Spaces
- **Credit 18**: Daylight & Views, Views for 80% of Spaces

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Canada Green Building Council
Requirements for Achieving a Green, Power Smart Building

Vision
Performance Goals
Integrated Planning
Integrated Design Process
<table>
<thead>
<tr>
<th>CLIENT</th>
<th>Manitoba Hydro</th>
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</thead>
<tbody>
<tr>
<td>DESIGN ARCHITECT</td>
<td>Kuwabara Payne McKenna Blumberg Architects</td>
</tr>
<tr>
<td>ARCHITECT OF RECORD</td>
<td>Smith Carter Architects and Engineers</td>
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<tr>
<td>CLIMATE ENGINEER</td>
<td>Trans Solar Energietechnik</td>
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<tr>
<td>ADVOCATE ARCHITECT</td>
<td>Prairie Architects</td>
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<tr>
<td>CONSTRUCTION MANAGER</td>
<td>PCL Constructors</td>
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<tr>
<td>STRUCTURAL ENGINEER</td>
<td>Halcrow Yolles / Crosier Kilgour</td>
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<tr>
<td>MECHANICAL &amp; ELECTRICAL ENGINEERS</td>
<td>Earth Tech Canada</td>
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<tr>
<td>LANDSCAPE DESIGN</td>
<td>Hilderman Thomas Frank Cram / Phillips Farevaag Smallenberg</td>
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<tr>
<td>OFFICE INTERIOR DESIGN</td>
<td>Marshall Cummings/IBI Group / Number Ten / LM Architectural Group</td>
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<tr>
<td>GEOTECHNICAL</td>
<td>UMA Engineering / Dyregrov Consultants</td>
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<tr>
<td>LIFE SAFETY</td>
<td>Leber Rubes</td>
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<tr>
<td>ENVELOPE</td>
<td>Brook Van Dalen / Crosier Kilgour</td>
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<tr>
<td>ELEVATOR</td>
<td>Soberman Engineering</td>
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<tr>
<td>ACOUSTICS</td>
<td>Aercoustics</td>
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<tr>
<td>SPECIALTY LIGHTING</td>
<td>Pivotal Lighting</td>
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<tr>
<td>QUANTITY SURVEYOR</td>
<td>Hanscomb</td>
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<tr>
<td>CIVIL / TRANSPORTATION</td>
<td>Wardrop / N D Lea</td>
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<tr>
<td>ENERGY ADVISOR</td>
<td>Natural Resources Canada</td>
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</tbody>
</table>
Quality of Workspace
Thermal comfort

Mean radiation temperature $t_r$ in °C

Room air temperature $t_A$ in °C

too cold

too warm
Supportive Workplace Productivity Drivers

Case Studies Introducing Improved Indoor Air Quality

Supportive Workplace Productivity Drivers

Case Studies Introducing Improved Performance with Lighting Control Strategies

* Performance improvement for specific tasks multiplied by estimated time at tasks.

Studies support that an individual has a higher level of comfort when:

- individual ventilation control
- air quality
- indirect/high quality artificial light
- daylight
Winnipeg Climate Conditions
Climatic Responsive Design
Weather Analysis

Source: Transsolar Klimaengineering
Climatic Responsive Design
Weather Analysis

outdoor temperature statistics

cwec_mb_winnipeg

frequency in temperature range [h]

outdoor air temperature [°C]

k-value is upper limit
Climatic Responsive Design
Weather Analysis

Source: Transsolar Klimaengineering
Humidity levels
Climatic Responsive Design
Weather Analysis

wind rose: cwec_mb_winnipeg

- Red: wind-total
- Purple: wind < 12.0 m/s
- Yellow: wind < 9.0 m/s
- Mint: wind < 6.0 m/s
- Dark Purple: wind < 3.0 m/s

Height: 10 m; wind velocity profile exponent: 0.22

Source: Transsolar Klimaengineering
How to utilize these climatic factors to achieve comfort and energy efficiency (the goal of a 60% energy reduction (MNECB))?
Different approaches for a low energy building design: closed box vs. breathing buildings
CLIMATIC RESPONSIVE DESIGN
Indigenous Architecture
Thermal Active Slabs

Conventional System

Thermal Active Slab System
Displacement Ventilation

Displacement Ventilation Air Pattern
Green Roof
Climatic Responsive Design

Daylight Factor

- Floor to Floor = 4.0m
- Outside Insolation = 10,000 Lux
- 1% = 100 Lux

Source: Transsolar Klimaengineering
Climatic Responsive Design
Buffer Zones

Atria

Double Facade
Buffer Zones

Solar chimney provides natural exhaust

North atrium (3 story) used as a cafeteria (18 - 28 °C)

Double facade used as a buffer zone provides natural ventilation (0 - 40 °C)

South atrium (6 story) used as a semi-conditioned cafeteria / meeting space (10 - 35 °C)
Atrium
Climate and energy concept: summer
Six story tower module

- Naturally-driven exhaust via north atria
- Solar shade and high openings remove solar gains
- Chilled water fall for cooling and dehumidification
- Supply air 17 - 21°C
- Slab cooling
- Per floor air handling units for fresh air distribution
- Fresh air supply through facade
- Per module fresh air supply unit deactivated
- 16°C - 40°C
- 20°C - 30°C
Climate and energy concept: winter
six story tower module

- Highly efficient heat recovery from exhaust to fresh air
- Central exhaust fan & heat recovery coil
- Exhaust air for parking heat and ventilation
- 10°C - 20°C per floor air handling units for fresh air distribution
- Supply air 18 - 22°C
- Slab heating
- Solar preheating of supply air
- Water dispersion and water fall for humidification
- Facade closed in winter
- Auxillary heating for extreme winter conditions
- 4°C
- 18°C - 23°C
- 18°C - 23°C
Climate and energy concept: shoulder seasons

- Fresh air supply via operable window
- Facade cavity (12 - 25 °C)
- Exhaust air to north atrium/solar chimney
- Office space: 21 - 24 °C

Source: Transsolar Klimaengineering
### Energy Usage

<table>
<thead>
<tr>
<th>Category</th>
<th>Energy Usage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Canadian Buildings</td>
<td>572 kWh/meter squared</td>
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<tr>
<td>New Buildings in Canada</td>
<td>479 kWh/meter squared</td>
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<tr>
<td>MNECB</td>
<td>258 kWh/meter squared</td>
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<tr>
<td>CBIP</td>
<td>194 kWh/meter squared</td>
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<tr>
<td>Downtown Office Project</td>
<td>91 kWh/meter squared</td>
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</tbody>
</table>
Climatic Responsive Design
Portage Avenue
Graham Avenue
Thank you

Any questions?