Port Hawkesbury Civic Center

Canadian Green Building Case Study Series
Developed for Natural Resources Canada
By the Sustainable Building Centre

Main Entrance, Reeves Street
Photo credits: Paula Davis

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Overview

Main Entrance, Reeves Street
Picture credits: Paula Davis

- Location: Port Hawkesbury, NS, Canada
- Building Type: Civic Center -Arena
- New Construction
- 9,015 sq. meters
- Project scope: 3-story building
- Rural setting
- Completed in 2004. The official opening was on November 25th.

Becoming the focal point of a small town at the southern tip of Cape Breton Island in Nova-Scotia, Canada, the Port Hawkesbury Civic Centre provides municipal government services as well as art, leisure and sport facilities. Adjacent to the local High School and commercial district, the four-story complex comprises municipal offices, a 500-seat conference facility, a performance centre, dance and art studios, a retail space which showcases local arts and crafts, a fitness center and a walking track. The 1000-seat arena is the first day-lit ice skating rink in North America, a feature that contributes to its remarkable energy efficiency.

Environmental Aspects

Through the use of green protocols and innovative technology, the Town of Port Hawkesbury integrated strategic features into complementary systems which optimize the overall energy efficiency of the building. Notably, the ice-making process for the skating rink which generates heat that is recycled through a thermal exchanger, providing radiant heat inside the arena. This exchanger currently diverts excess heat to the adjacent geo-thermal storage under the adjacent parking lot and could potentially be reused to provide heat for another building. Another multi-faceted strategy is the day lighting system for the arena which not only reduces the lighting costs by 45%, it reduce the heat generated indoors thus lowering the chilling needs for ice-production.

Owner and Occupancy

- Owned and occupied by the Town of Port Hawkesbury.
- There are 22 permanent occupants, composed of management, municipal and YMCA staff. Contract and part-time workers also share this space.
- Due to the service oriented nature of this centre, there is a constant flow of visitors estimated at 2800 weekly with peak flows occurring during conventions and hockey games.

Mayor MacLean at the arena picture credits: Paula Davis

Indoor Spaces

(estimates)

Arena	30%
Circulation	10%
Conference	20%
Electrical systems	5%
Gymnasium	7%
Mechanical system	15%
Offices	3%
Restrooms	2%
Retail food	3%
Retail general	5%

Concourse picture credits: Paula Davis

Municipal offices picture credits: Paula Davis

Bear head Conference Centre p. c: Paula Davis

Art Gallery picture credits: Paula Davis

Retail –Quilt Shop picture credits: Paula Davis

Premier John Hamm and MLA Rodney MacDonald at the YMCA Fitness Centre
picture credits: Paula Davis

Dance Studio picture credits Paula Davis

Outdoor Spaces

Photo credits Paula Davis

Spaces include:

- Drives/roadway
- Garden –decorative
- Parking Pedestrian/ non-motorized vehicle path
- Patio/hardscape

Keywords

Integrated team, Design charrette, Green framework, Simulation, Green specifications, Contracting, Performance measurement and verification, Operations and maintenance, Transportation benefits, Indigenous vegetation, Efficient fixtures and appliances, Massing and orientation, Insulation levels, Glazing, Air tightness, HVAC, Lighting control and daylight harvesting, Efficient lighting, Recycled Materials, C&D waste management, Occupant recycling, Connection to outdoors, Day lighting, Natural ventilation, Ventilation effectiveness, Moisture control, Noise control, Low-emitting materials, Indoor air quality monitoring.

Team and Process

Pre-design

Due to the public nature of the civic centre, the community and major end-user groups were invited to actively participate in the design process through the early establishment of a steering committee. This committee represented local interests within an interdisciplinary team of experts which facilitated a system's approach of the project. To ensure the long term viability of this project, both Environmental and Energy consultants were included in the design team.

Design

The design of the Civic Centre was guided by green protocols based on LEED principles and the Commercial Building Incentive Program. These guidelines provided recommendations for the material selection, energy and water consumption. With the inclusion of a comprehensive wish list compiled by the steering committee, 5 concepts were presented, reviewed and consolidated into a final design.

Construction

A fast-track method facilitated by computerized modeling and pre-fabrication reduced the timeline in half which as allowed for the building to be ready for occupancy within a short time frame. During this phase, the Facility Manager was consulted to inquire about suitable fixtures and appliances.

Operation/ Maintenance

After a year of operation, the center's performance is continuously being monitored, evaluated and adjusted to optimize its efficiency. Maintenance regimes and product selections are under constant reviewing and the control systems fined tuned to increase energy efficiency.

Commissioning

The commissioning and design process for this project began in November 2002. Construction started in July 2003 and the building was completed in November 2004. The official opening of the Port Hawkesbury Civic Centre was on November 25th.

Measurement & verification/ Post-occupancy evaluation

Based on real-life post-occupation data, the Civic Center's performance is currently being measured against a reference building in order to evaluate a payback period for the green infrastructures.

Useful Information Resources and Software

- Based on LEED guidelines
- Commercial Building Incentive Program (CBIP)

Primary Design Team Members

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Finance & Cost

The total cost for the Port Hawkesbury Civic Centre is of $ 17, 3 -million. The project received over $9 million from government agencies at the federal, provincial and municipal level. Additionally, the Federation of Canadian Municipalities Green Municipal Funds approved an estimated grant of $1,092,000 can, plus low interest loan of $900 000 can. Furthermore, the community, local businesses and surrounding municipalities contributed $4.5 million to the project through fund-raising.

Incremental Cost analysis: $1 919 516

- Roof insulation: $345 000
- Wall Insulation: $176 000
- Glazing: $240 000
- Ice Making System $321 400
- Earth Loop $197 400
- Piping for expansion $20 000
- Heating System $384 716
- LEED Energy Studies $235 000

Financing Mechanisms

- Credit Enhancement: Loan guarantees-public
- Grant: Public agency, Private
- Loans: Public institution

Cost Data

Total project cost (land excluded): $17, 300,000 CAD.

Soft Costs

- Professional fee: $90 per sq. meters
- Management fee: $41 per sq. meters
- Total: $131 per sq. meters

Hard Costs

- Site work: $ 772 per sq. meters
- Construction: $ 1,845 per sq. meters
- Total hard cost: $ 2,031 per sq. meters

Cost and Payback Description

At the time of this writing in March 2006, there is currently a study being performed by High Performance Energy Systems Inc. on the payback period for the green initiatives. The study showed that the prediced energy consumption from the energy model was within 10 % of the actual consumption of the building.

Land Use and Community

The Civic Center's clustered amenities provide a convenient focal point to this rural community and its adjoining municipalities. It is conveniently located at walking distance of the town's commercial centre and is adjacent to the local High School which makes it easily accessible for local foot traffic. Additionally, it is fully accessible by wheel chair users, including preferred seating in the arena.

Wheel chair access, Picture credits: Paula Davis

Green Strategies

- Property Evaluation
    - Assess property for integration with local community and regional transportation corridors
- Responsible Planning
    - Ensure that development fits within a responsible local and regional planning framework
    - Carry out mixed-use development
- Support for Appropriate Transportation
    - Design development to have pedestrian emphasis rather than automobile emphasis
- Property Selection Opportunities
    - Select already-developed sites for new development

Site Description

Site plan with permission of Paula Davis

Previously an abandoned elementary school, the site selection for this project has rejuvenated a strategic area of this town which was already connected to the municipal infrastructures. With its mixed-used development and convivial landscape design which provide outdoors sitting areas, the Civic Centre invites social gathering. Additionally, the limited parking area and proximity to the downtown core promotes foot traffic.

- Lot size: 22, 663 m2
- Building footprint: 7,105 m2
- Previously developed land

Water Conservation and Use

For the purpose of water conservancy, the Centre is equipped with low flow fixtures and faucets and automatic controls for lavatories.

Green Strategies

- Development Impacts
    - Cluster buildings to preserve open space and protect habitat
    - Limit parking area
- Low-Water-Use Fixtures
    - Use automatic faucet controls for lavatories
- Siting Analysis
    - Hire a landscape architect to help with siting of buildings and infrastructure
- Low-Impact Siting
    - Select an already-developed portion of a site for new development

Energy

The Port Hawkesbury Civic Center design team has implemented several key innovations to optimize the energy efficiency of the building. With an overall R-value of RSI 4.5, the centre has achieved a performance of 42% superior to MNECB (Model National Energy Code for Buildings) standards (this is a Canadian national standard).

The overall R-value are RSI 4.5, the average roof R-value is RSI 6.6, the aluminum windows have thermal resistant gas in insulating units, USI 2.7, and the Solera Windows of the arena are at 2.0.

Daylighting the arena picture credits: Paula Davis

In order to provide natural day lighting for this project, a band of glass coated with a transparent glaze was integrated at the intersection of the roof and the walls. This material, Solera, by Advanced Glazings evenly distributes direct sunlight which eliminates glare and reduces lighting cost by 45% (estimate).

Mechanical System

The arena is equipped with the Ice Kube System which is an energy efficient geothermal chiller which has cold storage in the rink slab. The heat generated during the ice-making process is recovered and use throughout the facility as radiant heating.

A site-specific pipe layout design optimizes the efficiency of mechanical pumping reducing the needs from 20-30 hp to 3 hp. The modular design of distributed heat pump network system allows adaptation to variable energy needs thereby reducing part-load inefficiencies. The modular design allows adaptation to variable energy needs thereby reducing part-load inefficiencies.

Electrical System

Energy efficiency being a focus point of this project, a multitude of initiatives were implemented throughout the facility that reduce electricity use. In addition to the passive solar energy gains obtained through large windows, energy efficient lighting was installed notably with high-efficiency electronic fluorescent lamp ballasts. The interior and exterior signs are lit by 3W/sign Light Emitting Diodes (LED), and the exterior lighting is controlled by an energy management system.

Data Source & Reliability: NRCan GHG C06-613

- MNECB standard: 7,829 GJ
- Proposed building: 4,516 GJ
- Energy Saving 3,311 GJ
- 42.3% over MNECB

Green Strategies

- Wall Insulation
    - Achieve a whole-wall R-value greater than 25
- Ground-coupled Systems
    - Use earth tubes to preheat or pre-cool ventilation air
    - Use ground-source heat pumps as a source for heating and cooling
- Daylighting for Energy Efficiency
    - Use building elements to redirect daylight and control glare
    - Use large interior windows to increase daylighting penetration
    - Use skylights for daylighting
- Water Heaters
    - Use waste heat from mechanical systems to heat water
- Cooling Systems
    - Use high-efficiency electric air-to-air heat pumps
- Standby Heat Loss
    - Minimize the length of hot water piping
- Light Sources
    - Use LED or other super-efficient exit signs
- Foundation Insulation
    - Use sub-slab insulation with a minimum insulating value of R-10
- Lamp Ballasts
    - Use high-efficiency electronic fluorescent lamp ballasts
- High-performance Windows and Doors
    - Optimize energy performance of glazing systems
    - Use windows with a whole-unit U-factor less than 0.56 (greater than R-1.8)
- Luminaires
    - With outdoor lighting, specify luminaires that direct light downward
- Air Infiltration
    - Minimize pressure difference between the building and the outside
- Ventilation Systems
    - Use heat-recovery ventilation
- HVAC Distribution Systems
    - Use high-efficiency pumps and motors
- Refrigerators and Freezers
    - Obtain independent refrigeration engineering services during initial design phase
- Roof Insulation
    - Achieve a whole-roof R-value greater than R-35

Materials and Resources

The Port Hawkesbury Civic Centre is the first in North America to use an engineered daylighting system for its arena. Additionally, this strategy provides multiple benefits as the natural light generates only two thirds of the heat associated with conventional lighting systems which further reduces the energy expenditure associated with the ice-making process.

Furthermore, this project has integrated a variety of local materials such as structural steel, masonry units, translucent glazing, hardwood floor, GWB and marble.

Diversion of Construction & Demolition Waste

Existing onsite landscaping features were salvaged and adapted to the remodeled site which also includes semi-permeable pavers to allow infiltration. Cardboard, paper and plastic products were recycled onsite during the construction process.

Green Products Used

- Solera by Advanced Glazings
- Ice Kube system

Design for adaptability to future uses

Situated under the Civic Centre's parking area, a geo-thermal heat sink is currently storing the excessive heat from the building. This storage will potentially be by-passed and overflow to provide heating for a swimming pool which is in the planning stage.

Green Strategies

- Design for Materials Use Reduction
    - Cluster buildings to minimize infrastructure requirements
- Job Site Recycling
    - Set up labeled bins to keep recyclable materials separate
- Recycling by Occupants
    - Specify recycling receptacles that are accessible to the occupants
- Resource-Efficient and Biobased Materials
    - Use structural premanufactured panels for walls and floors

Indoor Environment

The indoor environment and its maintenance has been carefully planned to ensure that healthy and resource efficient surroundings are promoted.

- The air quality in monitored by CO2 and CO sensors and low VOC paints and carpets were selected.
- The operable windows allow a direct connection to the outdoors and provide the user with direct control over its environment.
- Non-toxic and biodegradable cleaning products are selected for the facility.
- To further reduce energy consumption, laptops are preferred over desktop computers.
- In an effort to save paper, communications via e-mail are favored over paper memos and there is a linen reuse program for the catering services.

On a social note, the centre is actively promoting equal access to all members of its community notably by employing its mentally challenged citizens to operate a bottle recycling depot.

Green strategies

- Thermal Comfort
    - Maintain relative humidity levels between 30% and 60%
- Visual Comfort and Light Sources
    - Use electronic ballasts with fluorescent lighting
- Acoustics and Outdoor Noise
    - Install acoustical glazing to reduce sound transmission
- Acoustics and Occupant Noise
    - Minimize sound transmission between rooms with appropriate detailing and material densities
- Ventilation and Filtration Systems
    - Provide heat-recovery ventilation
- Above Grade Humidity and Condensation
    - Design building envelope to avoid thermal bridging
- Reduction of Indoor Pollutants
    - Use only very low or no-VOC paints

Lessons Learned

Several challenges such as the sun light creating softer areas in the ice and glare issues often prevent arenas from the benefits of natural day lighting. This project successfully fulfilled this goal by associating technological advancement with an innovative design.

Awards

The Center is currently pursuing LEED certification. Additionally, it could potentially receive five out of five Green Globes from GG Canada.

Visiting

Directions with permission of Paula Davis

The Port Hawkesbury Civic Centre is located at the southern point of Cape Breton Island, near the Canso Causeway.
606 Reeves Street
Port Hawkesbury
Nova Scotia
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The centre is open to the public daily from 6 am until 10 pm. For tour bookings, please contact Ms. Paula Davis, Marketing and Events Manager at 902-625-7891

Information resources

- "Arena systems run hot and cold: Port Hawkesbury facility will capture heat from ice-making" by MacDonald, Christine (The Halifax Herald, business section) December 23rd, 2003.

- "Bright Idea illuminates new arena" by MacDonald, Christine (The Halifax Herald) January 14th, 2004.

- "Civic Centre to house innovative system" by Britten, Cindy (The Reporter) January 13th, 2004.

- "Experience reigns on site: Civic centre construction manager builds on lengthy career history" by MacDonald, Christine (The Halifax Herald, Business section) January 2nd, 2004.

- "Strait civic centre fundraising underway: $14,5-million facility to open in Port Hawkesbury" by MacDonald, Christine (The Mail-Star The Chronicle-Herald) November 2nd, 2003.

- "The port Hawkesbury Civic Centre" http://www.phcivic.com/

- World Class Sports Stadium: Wonders of the World" (BusinessWeek Online) http://images.businessweek.com/ss/06/02/sports_stadiums/source/7.htm

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