Quebec City’s Eco-District:
Low-Energy, Affordable, Sustainable and Cost-Effective

It’s possible
LEARNING OBJECTIVES

1. Explain best practices for a 13 story cross-laminated timber frame and super-insulated building enclosure;

2. Discuss successful development of an Eco-district: a collaborative approach amongst key players – Origin, Habitus teams and Québec City’s government;

3. Describe how successfully retrofit energy efficient heating/cooling systems in a 17th century building (Augustinian Monastery, Quebec);

4. Identify affordable and sustainable energy efficient building success and lessons learned; comprehensive sustainable practices, Cleantech, resources, water efficiency and waste management.
AGENDA

1. Introduction

2. Québec International Inc/BVI - brief overview

3. Québec Eco-District:
   • Habitus
   • Origine
   • Monastère des Augustines Hôtel

4. Interactive Discussion
SPEAKERS

Martin Gougeon
Director, Green & Smart Building Cluster, Québec International

Alejandro Montero
President, TERGOS Architecture + Construction
Habitus project

André Huot
Quebec Business Development Director, Nordic Structures
Origin project

Dany Blackburn
Senior Partner / Architect, ABCP Architecture
Augustinian Monastery project
It’s possible

Martin Gougeon
Director, Green & Smart Building Cluster, Québec International
AFFORDABLE
ACCESSIBLE
SUSTAINABLE

It’s possible!
400 years of vision?
Creative !
AFFORDABLE
ACCESSIBLE
SUSTAINABLE

It’s possible !
It’s possible

Alejandro Montero
Development Director,
Tergos architecture inc.
LOW COST AFFORDABLE RESILIENT SUSTAINABLE ENERGY EFFICIENT ARCHITECTURE
It’s possible.
<table>
<thead>
<tr>
<th></th>
<th>QUÉBEC CITY</th>
<th>BOSTON</th>
<th>∆</th>
</tr>
</thead>
<tbody>
<tr>
<td>Latitude</td>
<td>46,82°</td>
<td>42,36°</td>
<td></td>
</tr>
<tr>
<td>Heating Degree Days</td>
<td>5320.4</td>
<td>3103.9</td>
<td>2216.5</td>
</tr>
<tr>
<td>Cooling Degree Days</td>
<td>350.4</td>
<td>653.9</td>
<td>-303.5</td>
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statistiques at 18°C (°F) last 12 months, www.degreedays.net
for residential buildings in kWh/m² per year

Source: NRCan Dec. 2005
Breakdown of average electricity use for a home in a plex or multiunit building with air-conditioning

11,441 kWh

-18.28% OFF

Did you know that air-conditioning can account for up to 20% of your summer electricity costs.

only 30$/month…
…1 year off the mortgage
MORTGAGE
MORTGAGE

Death

Pledge
1. Summer passive occultation
2. Winter passive heating
3. Natural cross-ventilation
4. Extensive green roofs
5. Rain water recovery system
6. Three storey prefab low-carbon wood structure
7. High energy-efficiency wall composition
100% **LOW-CARBON** WOOD STRUCTURE

FACTORY **PREFABRICATED**

**R45.3** ROOFS

**R33.5** WALLS

**R31.3** FOUNDATION WALLS

**R11.2** SLABS
Gypsum board 5/8” (R0.55)
2x 1”x3” @ 16” o.c. horizontal (R1.02)
Vapour-barrier
Natural wood fiber panel ½” (R1.15)

**Structure:** 2” x 6” @ 16” o.c.
Rockwool 5 ½” (R22.00)
Wood chip bracing panel ½” (R0.71)
Air-barrier
Rigid rockwool panels 1 ½” (R6.00)
Vertical wood furrings 1”x3” (R1.02)
Exterior sheathing
<table>
<thead>
<tr>
<th></th>
<th>QUÉBEC CITY</th>
<th>BOSTON</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>AVERAGE GROSS FAMILY INCOME</strong></td>
<td>56 674$ USD</td>
<td>85 691$ USD</td>
</tr>
<tr>
<td><strong>30% Monthly Gross Income</strong></td>
<td>1 417$/month</td>
<td>1 977$/month</td>
</tr>
<tr>
<td><strong>Utilities and Condo Fees</strong></td>
<td>58$/utilities 68$/condo fees (50%)</td>
<td>58$/utilities 68$/condo fees (50%)</td>
</tr>
<tr>
<td><strong>Property and School Taxes</strong></td>
<td>187$</td>
<td>187$</td>
</tr>
<tr>
<td><strong>Maximum Monthly Mortgage</strong></td>
<td>1 104$</td>
<td>1 664$</td>
</tr>
<tr>
<td><strong>Maximum Purchase Price</strong></td>
<td>210 000$ MAX LOAN 262 500$ MAX PRICE</td>
<td>316 000$ MAX LOAN 395 000$ MAX PRICE</td>
</tr>
</tbody>
</table>

*20% Cash-Down, 4% interest rate, 25 year amortisation*
C-34 Rue du Cardinal-Maurice-Roy, La Cité-Limoilou (Québec), QC, G1K 0H1
MLS® # 27905789

Home > Quebec > La Cité-Limoilou (Québec)

CONDÒ FOR SALE IN LA CITÉ-LIMOILOU

$322,525 USD

= 215.16 USD/sq.ft.

3 Bedrooms

2 Baths

136 USD Maintenance Fees

Ask about this listing

First and Last Name

Email

Phone (Optional)

I would like to find out more about this property.

Optional: (Please add any questions or comments you have.)

Contact This Agent
D-32 Rue du Cardinal-Maurice-Roy, La Cité-Limoilou (Québec), QC, G1K 0H1

MLS® # 15818374

Home > Quebec > La Cité-Limoilou (Québec)

Condo for sale in La Cité-Limoilou

240,831$ USD
= 178.79$/sq.ft.

1+2
Bedrooms

2
Baths

104$ USD
Maintenance Fees

Ask about this listing

First and Last Name

Email

Phone (Optional)

I would like to find out more about this property.
Optional: (Please add any questions or comments you have.)

Contact This Agent

Stéphane Tremblay
Courtier immobilier et commercial
Royal LePage Blanc-Rose
Real Estate Agency
MOBILE: 418.952.2697
EMAIL: stremblay@royallepage.ca

Guylaine Joannette
Courtier immobilier
Royal LePage Blanc-Rose
Real Estate Agency
Pure construction costs: no land costs, promoter hard and financing costs, no overhead, just the building cost

7.53M$ USD
85$/sq. ft.
AFFORDABLE & SUSTAINABLE IS ELEGANT
It’s possible

André Huot
Quebec Business Development Director, Nordic Structures
Origin project
Built Smarter
Our responsibility

A 13-storey building located in the Pointe-aux-Lièvres eco-district, Quebec City (Quebec)
NOVEMBER 2013

Régie du bâtiment du Québec (Quebec building commission, or RBQ)

• Initial meeting for project presentation (November 2013)
• Evaluation of the request and creation of a working group
• Tentative agreement (December 2014) and final agreement (May 2016)

OCTOBER 2016
- Regulatory precedent
- Public support
- Reproducibility
- 100% mass timber
- Fire
I feel like I’m in a cocoon!
Total volume of wood: 3,000 m³

Greenhouse gas emission savings:

Absorption / sequestration by wood: 2,295 CO₂ (equiv.)

Substitution of more polluting materials: 1,000 CO₂ (equiv.)
<table>
<thead>
<tr>
<th>Impact Category</th>
<th>kg of CO₂ eq.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forest carbon uptake</td>
<td>-741.36</td>
</tr>
<tr>
<td>Life cycle GHG emissions</td>
<td>121.89</td>
</tr>
<tr>
<td>Unaccounted biogenic carbon emissions in GWP reporting</td>
<td>28.50</td>
</tr>
<tr>
<td>Net GWP</td>
<td>-590.97</td>
</tr>
</tbody>
</table>
## Percentage of reduction between the reference building and the proposed one

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Reference building (CONCRETE)</th>
<th>Proposed building (WOOD)</th>
<th>Units</th>
<th>Percentage (%) of reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>GWP Global warming potential</td>
<td>8119870.00</td>
<td>4095870.00</td>
<td>Kg CO2 eq.</td>
<td>-49.29</td>
</tr>
<tr>
<td>ODP Ozone depletion potential</td>
<td>2.39</td>
<td>2.29</td>
<td>Kg CFC-11 eq.</td>
<td>-3.82</td>
</tr>
<tr>
<td>AP Acidification potential</td>
<td>54473.90</td>
<td>49501.30</td>
<td>Kg SO2 eq.</td>
<td>-9.06</td>
</tr>
<tr>
<td>EP Eutrophication potential</td>
<td>23373.30</td>
<td>20581.60</td>
<td>Kg N eq.</td>
<td>-11.90</td>
</tr>
<tr>
<td>POCP Photochemical ozone creation potential (smog)</td>
<td>561995.00</td>
<td>501497.00</td>
<td>Kg O3 eq.</td>
<td>-10.59</td>
</tr>
<tr>
<td>Resource depletion – fossil</td>
<td>35904200.00</td>
<td>35071500.00</td>
<td>MJ</td>
<td>-2.31</td>
</tr>
<tr>
<td>Number of indicators with at least 10% of reduction</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>
WELL BUILDING STANDARD
Origine

Energy cost for heating and hot water

35$ per month

- Radiant heating floor
- Central boiler powered by natural gas
  - Heating
  - Hot water
- Solucycle organic matter collection system
- A safe, high-performance living space
- Improved isolation
- Superb acoustics for ultimate privacy
MUR EXTÉRIEUR DE TÔLE (D.R.F. = 2 HEURES):

- REVÊTEMENT EXTÉRIEUR VICWEST POSÉ VERTIC
- LATTAGE MÉTAL. HORIZONTALE 22 mm À 600 mm C/C
- ISOLANT "CONFORTBO DE ROXUL 90 mm"
- MEMBRANE PARE-AIR AUTOCOLLANTE DE TYPO "SOPRASEAL STICK VP"
- SOPREMA (JOINTS SCELÉS)
- CLT 175 mm (VOIR STRUC)
- LATTAGE U-14 @ 400 mm
- GYPSÉE 16 mm TYPE X
- GYPSÉE 16 mm TYPE X

MUR EXTÉRIEUR DE TÔLE VERTIC.

14B PANNEAUX CLT 175 mm
ÉCHELLE 1:10
CONSTRUCTION
- Full-scale three storey stair shaft and adjacent apartment
- 175 mm 5-ply CLT
- Structural floor load of 4.75 kPa
- Fire load density of 790 MJ/m², equivalent to the 95th percentile value for residential rooms
PERFORMANCE

- No temperature increases and no change in smoke optical density; no smoke leaked into the stair shaft

- No impact on safety conditions in the stair shaft
Results

• Origine project approved by the Régie du bâtiment du Québec
• Increased trust in mass timber: ARBORA
• Advancements that can be applied to other mass timber projects
• Expertise that can be applied to code changes
• New provincial regulation
NO PROJECT

Soil characteristics
• Seismic activity
• Poor quality backfill from the diversion of the river
• Soil liquefaction
• Rock at 32 meters deep
• Need 320 piles - 1 meter diameter

5 millions $$$
54% of the weight of a similar concrete building

**SOLUTION**

- 900 mm rigid concrete raft
  - Distribute evenly the load on the soil
  - Place the building at a strategic place on the raft
  - The weight of existing/remove backfill would compensate for most of the added weight

1.5 million $$
900 mm concrete rigid raft

Parking

Parking and R-d.C