#### Quebec City's Eco-District:

#### Low-Energy, Affordable, Sustainable and Cost-Effective





## **LEARNING OBJECTIVES**

- 1. Explain best practices for a 13 story cross-laminated timber frame and superinsulated 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* 







NORDIC STRUCTURES

ABCP



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 !



Alejandro Montero Development Director, *Tergos architecture inc.* 





## LOW COST AFFORDABLE R E S I L I E N T S U S T A I N A B L E ENERGY EFFICIENT A R C H I T E C T U R E

## It's possible.









# Latitude46,82°42,36°QUÉBEC CITYBOSTON $\Delta$ Heating Degree Days5320.43103.92216.571%Cooling Degree Days350.4653.9-303.5-46%

statistiques at 18°C (°F) last 12 months, www.degreedays.net



#### for residential buildings in kWh/m<sup>2</sup> per year



Breakdown of average electricity use for a home in a plex or multiunit building with air-conditioning 3



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

#### MORTGAGE



- 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

## **7**SIMPLE STRATEGIES



## SIMPLE & EFFICIENT A R C H I T E C T U R E



## 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 <sup>1</sup>/<sub>2</sub>" (R1.15) Structure:2" x 6" @ 16" o.c. Rockwool 5 <sup>1</sup>/<sub>2</sub>" (R22.00) Wood chip bracing panel <sup>1</sup>/<sub>2</sub>" (R0.71) Air-barrier Rigid rockwool panels 1 <sup>1</sup>/<sub>2</sub>" (R6.00) Vertical wood furrings 1"x3" (R1.02) **Exterior sheathing** 



	QUÉBEC CITY	BOSTON
AVERAGE GROSS FAMILY INCOME	56 674\$ USD	85 691\$ USD
30% Monthly Gross Income	1 417\$/month	1 977\$/month
Utilities and Condo Fees	58\$/utilities 68\$/condo fees (50%)	58\$/utilities 68\$/condo fees (50%)
Property and School Taxes	187\$	187\$
Maximum Monthly Mortgage	1 104\$	1 664\$
Maximum Purchase Price	210 000\$ MAX LOAN 262 500\$ MAX PRICE	316 000\$ MAX LOAN 395 000\$ MAX PRICE

\*20% Cash-Down, 4% interest rate, 25 year amortisation



CONDO FOR SALE IN LA CITÉ-LIMOILOU

322,525\$ USD

= 215.16\$/sq.ft.

2

Baths

C-34 Rue du Cardinal-Maurice-Roy, La Cité-Limoilou (Québec), QC, G1K 0H1 MLS® # 27905789

Home > Quebec > La Cité-Limoilou (Québec)





< Back





View All

Email

First and Last Name

Ask about this listing

3

Bedrooms

Phone (Optional)

I would like to find out more about this property.

136\$ USD

Maintenance Fees

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

#### Stéphane T Courtier immobili et commercial

**Royal LePage Blan Real Estate Agence** 

SHARE

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MOBILE: 418,952,2697

EMAIL: stremblay@royalle

Participa Broker

**Contact This Agent** 



**Guylaine Jo** Courtier immobili





D-32 Rue du Cardinal-Maurice-Roy, La Cité-Limoilou (Québec), QC, G1K 0H1 MLS® # 15818374

Home > Quebec > La Cité-Limoilou (Québec)





< Back





ر View All CONDO FOR SALE IN LA CITÉ-LIMOILOU

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

1+2 2 Bedrooms 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.)



Stéphane T Courtier immobil et commercial

SHAR

<

Royal LePage Bla Real Estate Agen

> MOBILE: 418.952.2697

EMAIL: stremblay@royall

ROYALE Participa Broker

Contact This Agent



Guylaine Jo Courtier immobili

**Royal LePage Bla** 

## 7.53M\$ USD 85\$/sq. ft.

Pure construction costs: no land costs, promoter hard and financing costs, no overhead, just the building cost

## **AFFORDABLE & SUSTAINABLE**





André Huot Quebec Business Development Director, Nordic Structures *Origin project* 



## Built Smarter Our responsability

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 m<sup>3</sup>

Greenhouse gas emission savings:

Absorption / sequestration by wood:

Substitution of more polluting materials:

2,295 CO<sub>2 (equiv.)</sub> 1,000 CO2<sub>(equiv.)</sub>

Impact Category	kg of CO <sub>2</sub> eq.
Forest carbon uptake	-741.36
Life cycle GHG emissions	121.89
Unaccounted biogenic carbon emissions in GWP reporting	28.50
Net GWP	-590.97

h

#### Percentage of reduction between the reference building and the proposed one

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





#### WELL BUILDING STANDARD





The mark of responsible forestry FSC\* C002803







## 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









#### 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/m<sup>2</sup>, equivalent to the 95<sup>th</sup> 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





## 5 millions \$\$\$

## **NO PROJECT**

- **Soil caracteristics**
- Seismic activity
- Poor quality backfill from the diversion of the river
- Soil liquifaction
- Rock at 32 meters deep
- Need 320 piles 1 meter diameter

## NORDIC STRUCTURES

# 54% of the weight of a similar concrete building SOLUTION

# 1.5 million \$\$

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

#### 900 mm concrete rigid raft

Parking and R-d.C

Parking



