



Passive House & Affordable Housing

Low Carbon Case Examples

February 13, 2020 | 2:00 - 3:00 PM ET
Bruce (BF) Nagy & George Sweetman



**Clean Air
Partnership**

CLIMATE SOLUTIONS WEBINAR SERIES





Clean Air Partnership

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WEBINAR SERIES - UPCOMING:

- Electric municipal fleet vehicles & buses (NY & Vancouver)
- Geothermal/solar district micro-grids (Richmond & Austin)
- Rainwater, grey water, sewage heat recovery (Seattle & Washington DC)
- Retrofit housing & passive house (Hamilton & Boston)
- Energy, batteries, micro-grids & new kinds of storage (Goderich & beyond)
- And much more...

SOLUTIONS, PRIORITIES, CASE EXAMPLES



BUILDINGS

NEW & RETROFIT TECHNOLOGY & PROGRAMS



TRANSPORTATION

ELECTRIC FLEETS, INFRASTRUCTURE & TRANSIT VEHICLES



POWER GENERATION & STORAGE

TECHNOLOGY, PLANNING & ECONOMICS

BRUCE (BF) NAGY CLIMATE SOLUTIONS

- Columnist & features
- Consultant
- Author 200+ articles on climate solutions
- Author *The Clean Energy Age*, Rowman & Littlefield



Climate solutions
Expert best practices
Case examples
Clear priorities



AGENDA

INTRODUCTION 5 MINUTES

MULTI-FAMILY AFFORDABLE
PASSIVE HOUSE IN NY 20 MINUTES

MULTI-UNIT AFFORDABLE
PASSIVE HOUSE
IN WOODSTOCK 20 MINUTES

DISCUSSION
& WRAP 15 MINUTES



AFFORDABLE HOUSING - PASSIVE HOUSE

PROJECTS ALL OVER NORTH
AMERICA

THESE PROJECTS: 26, 42, 57
AND 65 UNITS RESPECTIVELY

RANGE FROM ZERO TO 5%
UP FRONT CONSTRUCTION
COST PREMIUM

OPERATING COST
25%-45% !



PLEASE DON'T HESITATE TO ASK FOR CONTACT INFORMATION
RE BUSINESS CASES, TECHNICAL DETAILS.

BRUCE.NAGY@ROGERS.COM

PASSIVE HOUSE & GREEN TECHNOLOGY

- SUPER-INSULATION
- DOUBLE OR TRIPE PANE WINDOWS
- ALL ENERGY LEAKS SEALED
- AIR SOURCE HEAT PUMPS
- NEW HYBRID CLEAN HVAC DEVICES
- ENERGY RECOVERY VENTILATORS
- SMART THERMOSTATS
- SOLAR PV
- LOW ENERGY APPLIANCES & LIGHTING
- LOW FLOW PLUMBING
- WATER HEAT RECOVERY
- HEAT PUMP WATER HEATERS
- SOLAR THERMAL FOR WATER INTENSE PROJECTS



PASSIVE HOUSE BENEFITS - GENERAL

OPERATING COST
SAVINGS MORE THAN

55%

DRAMATIC GHG
EMISSIONS REDUCTION

ELECTRIFIED -
NO COMMODITY
FUEL UNCERTAINTY

RESILIENCE - MINIMAL
ACTIVE HVAC, ENVELOPE
RETAINS ENERGY FOR DAYS



SMALL FOSSIL FUEL BACKUP GENERATOR
AS CONTINGENCY FOR POWER OUTAGES

WITH ENERGY THE BUILDING ENVELOPE IS CRITICAL

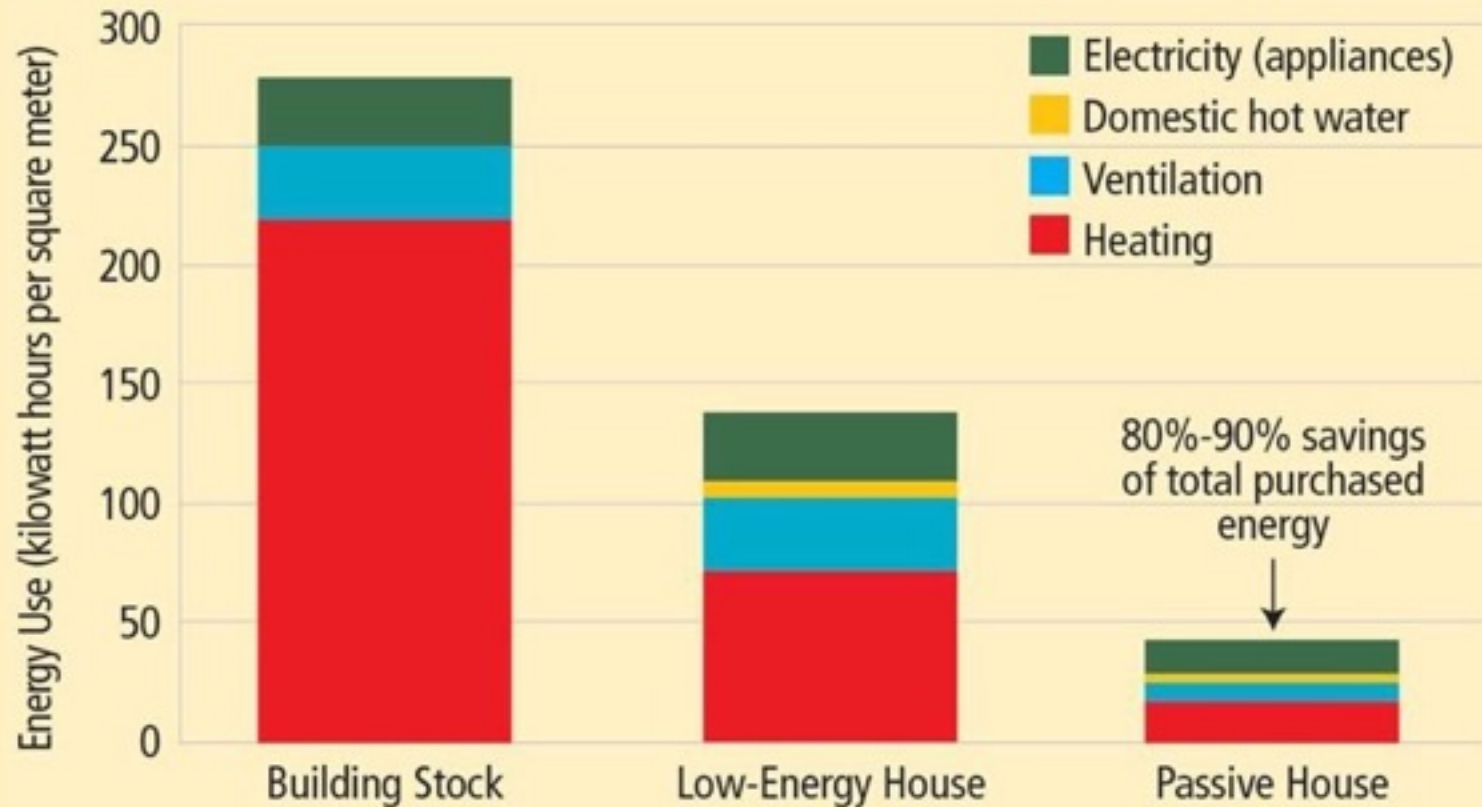


ENERGY DOES NOT GET “USED UP”
ENERGY LEAKS OUT



TIGHT BUILDING ENVELOPES
MAKE EVERYTHING ELSE EASIER.

TINY ENERGY LOADS INCREASE TECH OPTIONS



PASSIVE HOUSE ENVELOPES MAKE ELECTRIFICATION MORE AFFORDABLE

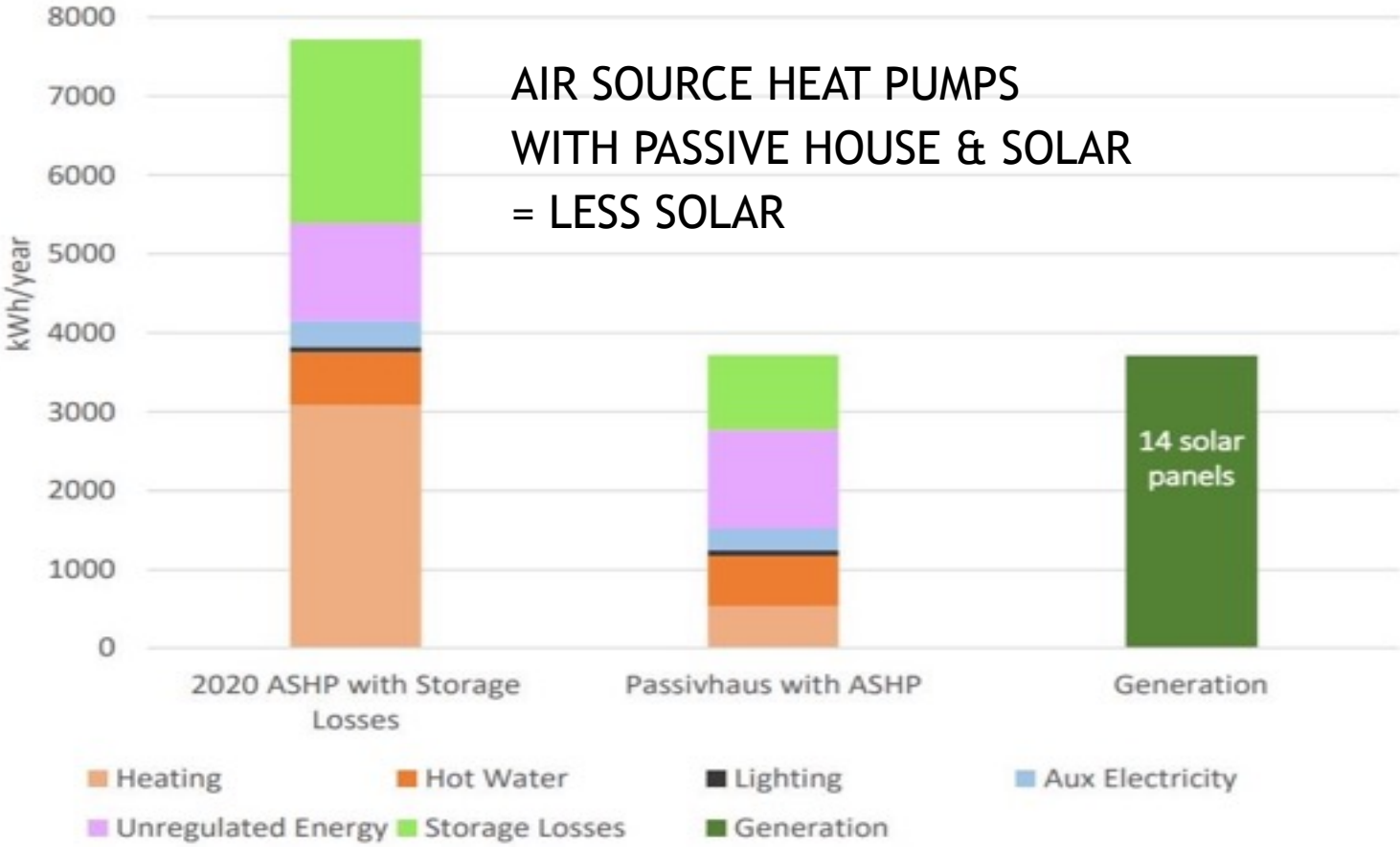


Figure 4 - Average new build energy demand vs Passivhaus

COMFORT IN COLD PLACES



GODERICH



CALGARY



SASKATOON

FEATURE PROJECT: SENDERO VERDE



HARLEM, NEW YORK

674 UNITS AFFORDABLE HOUSING

COMMUNITY FACILITIES

COMMERCIAL SPACE

812,250 SQUARE FEET

MAIN HEATING & COOLING:

ZERO EMISSIONS VRF

(LARGE AIR SOURCE HEAT PUMPS)

FRESH AIR WITHOUT ENERGY LOSS:

ENERGY RECOVERY VENTILATORS

LOIS ARENA & DEBORAH MOELIS



LOIS ARENA

STEPHEN WINTER & ASSOCIATES

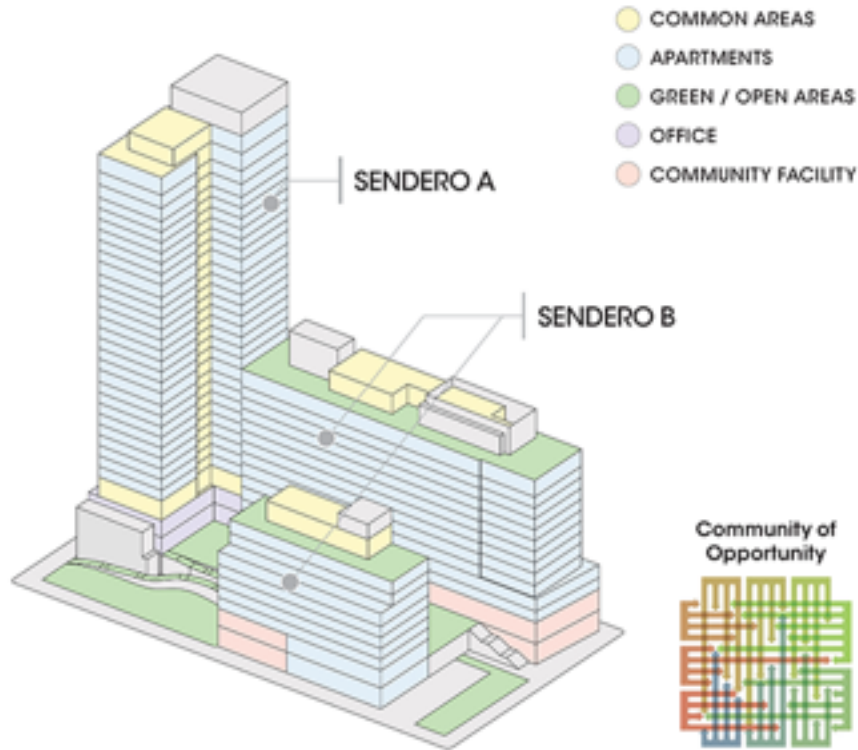
DEBORAH MOELIS

HANDEL ARCHITECTS



PROJECT DETAILS

Sendero Verde: Project Summary



10.17.2019 | Passive House Canada | © copyright Hinkel Architects and Steven Winter Associates

PROJECT SUMMARY

Overall: 812,250 GSF / 75,460 GSM
Residential: 627,646 GSF / 58,310 GSM
Community Facilities: 150,110 GSF / 13,394 GSM
Commercial: 34,494 GSF / 3,204 GSM
674 Affordable Units

USERS



High School Students



Residents



Seniors



Health Clinic Users

BUSINESS CASE



SENDERO VERDE

AFFORDABLE HOUSING

PASSIVE HOUSE UP FRONT

BUILDING COST PREMIUM IS

LESS THAN 5%

OPERATING SAVINGS

WILL BE

50% - 60%

BUSINESS CASE COMMONALITIES ARE DRIVING ADOPTION



**“It’s not rocket science,
we’ve just finally decided
to put up better buildings.”**

ONION FLATS IN PHILADELPHIA,
DISTILLERY NORTH IN BOSTON,
ORENCO STATION IN PORTLAND OREGON,
DOZENS OF OTHERS

ALL PASSIVE HOUSE AFFORDABLE PROJECTS
BUILT FOR ABOUT THE SAME COST AS
CONVENTIONAL AFFORDABLE HOUSING.

RETROFIT BUSINESS CASES ARE LESS WELL ESTABLISHED. WE HAVE SOME CASE
EXAMPLES, AND HAVE A WEBINAR UPCOMING ON THE KEN SOBLE PROJECT IN HAMILTON.

CARBON EMISSIONS

Passive House

Overall Source Energy Allowed 120 kWh/m² per year
38.1 kBtu/ft²/yr

Heating Energy Allowed 15 kWh/m² per year
Max 4.75 kBtu/ft²/yr

Cooling Energy Allowed (NY) 17 kWh/m² per year
Max 5.39 kBtu/ft²/yr
(region specific)

**Air Changes per Hour (ACH)
through the facade
@ 50 pascals of pressure** 0.6 ACH
5-10 times tighter
than typical

**Exhaust and Supply
Ventilation** Balanced, with
energy recovery

kWh/m²/yr

120

kBTU/ft²/yr

38.1

SENDERO VERDE ENVELOPE R VALUES



“WE’VE BEEN PAYING A LOT OF ATTENTION TO THERMAL BRIDGES.”

SENDERO VERDE WALLS WILL BE INSULATED CONTINUOUSLY AND CAREFULLY SEALED FOR AN R-VALUE OF 30, THE ROOF FOR R-40, AND THE DOUBLE PANE WINDOWS WILL PROVIDE U VALUES OF 0.149 (OPERABLE) AND 0.134 (FIXED).

ENVELOPE RIGOUR

WHAT IS PASSIVE HOUSE?

- ✓ **The most rigorous** of the energy focused building standards/certifications
- ✓ **An overall holistic** approach to the designing of a building that is guided by both curtailing energy usage and increasing user comfort
- ✓ **A strict quality control** program during construction that assures the building is assembled as designed



ENVELOPE QUALITY CONTROL

The House at Cornell Tech

Quality Control During Construction



Control of Scope of work

- Bid/Buy documents need to be sure to cover passive house requirements
- Not enough to say "follow spec"
- Work with contractor and trades to make sure full scope is included in buy to meet passive house requirements
- Contracts / Change orders

Trades Affected by PH Requirements

- **Exterior Sealing**
 - Exterior Panel Fabricator
 - Window Supplier
 - Carpenter
 - Mason
 - Caulker
- **Interior Sealing**
 - Mechanical
 - Electrical
 - Plumbing
- **Heating / Ventilation / Airside Contractor**
- **MEP Equipment and Lighting Supplier**

COMMUNICATE RE INSPECTIONS

The House at Cornell Tech

Site Inspection Checklist

Unique Conditions

Item #	Inspection	Detail Date
U3	Below Grade Wall - Insulation	100% CD - 08-25-17

Description
See Wall Type 9: 6" (approved by ZHA) or 5" of Owens Foamular 400; insulation continuous at benched area; must be inspected before Proppro is installed.

Images

Checklist developed during construction documents

Instructions provided to inspector for items to inspect

Details provided to assist on-site inspection

Photos annotated to help guide visual inspection

CORNELL U PREFAB PASSIVE HOUSE PANELS



PREFAB CONTINUES TO PROGRESS AS A VIABLE CONSTRUCTION ALTERNATIVE

NUMEROUS PASSIVE HOUSE PRODUCTS BEING INTRODUCED

ALTHOUGH THEY CAN HELP CONTROL QUALITY IT'S NOT A PERFECT WORLD

AT CORNELL SOME UNEXPECTED CHALLENGES CAME UP RE MAINTAINING CONTINUOUS SEAL

PASSIVE HOUSE IS OUTCOME-BASED

The House at Cornell Tech

Quality Control Pays Off

Final Blower Door Test

- Final Blower Door Test results for The House were .15 Air Change/ Hour (ACH).
- Passive House requirements allow a maximum .6 ACH.

**4 TIMES
TIGHTER
THAN
REQUIRED!**



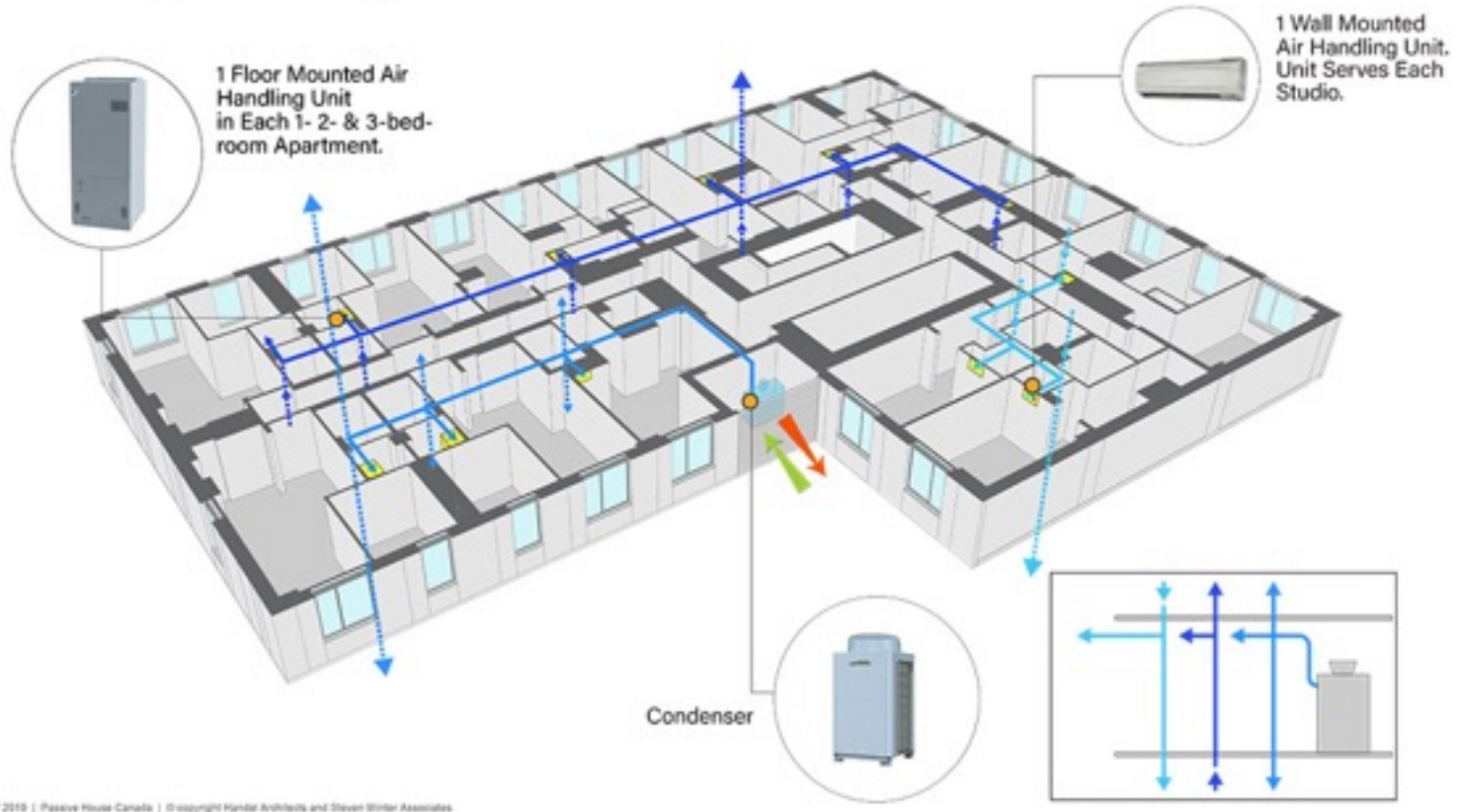
CORNELL U
RESIDENCE



HEATING & COOLING AT SENDERO VERDE

Sendero Verde

Heating & Cooling



HOLISTIC INTEGRATED DESIGN FOR EFFICIENCY

EXAMPLE: MECHANICAL DESIGNERS
CONSIDERED SOLAR GAIN, WHICH VARIES
IN DIFFERENT SECTIONS OF THE COMPLEX,
DEPENDING ON A GIVEN SECTION'S
EXPOSURE TO THE SUN.

ALTHOUGH EACH FLOOR'S VRF UNITS
ARE SERVED BY THE EQUIVALENT
OF ONE CONDENSER,
IN EXECUTION EACH CONDENSER
SERVES PART OF THREE FLOORS,
THUS ALLOWING SETTINGS TO
MORE CLOSELY MATCH
THE SOLAR CONDITIONS IN THAT ZONE.



VENTILATION



VENTILATION IS PROVIDED BY ROOFTOP ENERGY RECOVERY VENTILATORS, WITH THE GOAL BEING TO BALANCE EXHAUST AND SUPPLY VENTILATION WITHIN 10% OF ONE ANOTHER, AND OF COURSE, RETAIN AS MUCH HEATING OR COOLING ENERGY AS POSSIBLE.

COOLING IN THE NEW YORK AREA CAN BE 17 KILOWATTS PER SQUARE METRE PER YEAR, 5390 BTUS PER SQUARE FOOT PER YEAR.

CONDENSER CUBICLE ON EACH FLOOR

Sendero Verde

Lessons Learned



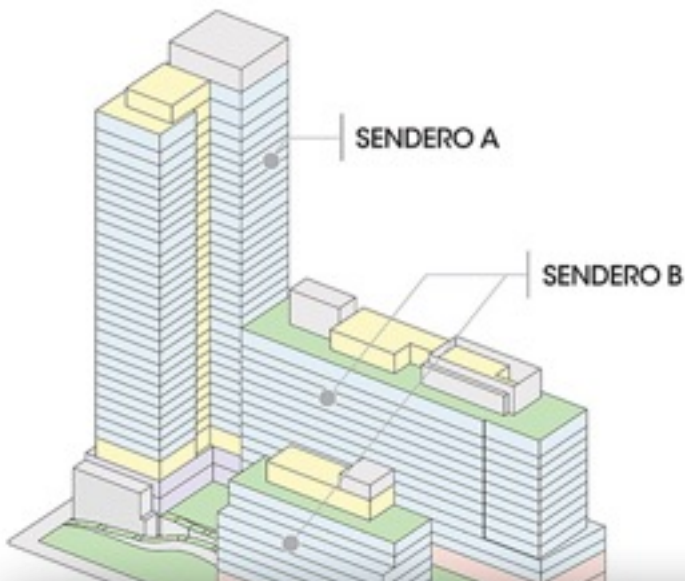
The House



Sendero Verde

LESSONS LEARNED

Sendero Verde: Project Challenges



PROJECT CHALLENGES

- Supply chain - small enough equipment
- Steel stud back up wall - thermal bridge mitigation at window heads and sills
- Sequencing of façade vs. window install & air barrier continuity
- Duct run conflicts between ERV's & VRF in unit
- Height impacts on ERV fan power
- Very dense building - Source EUI target needs adjusting

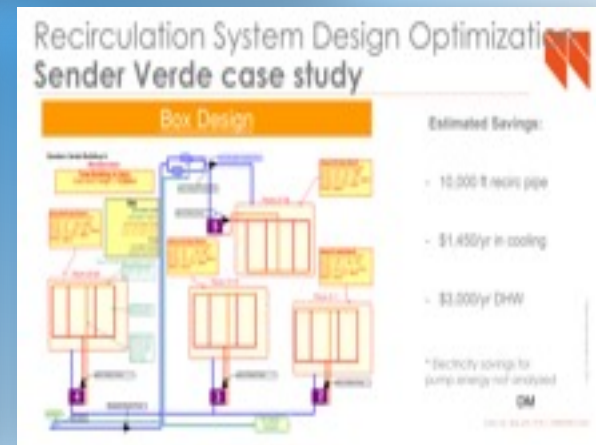
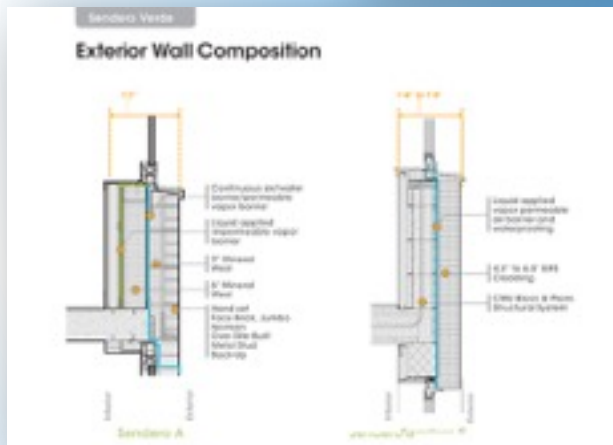


1 Ton Evaporator



1/4 Ton Evaporator

WALL DETAIL, CORRIDORS, PLUMBING



I HAVE ADDITIONAL ENGINEERING & ARCHITECTURAL DETAILS.
I HAVE CONTACTS WHO ARE BETTER QUALIFIED TO DISCUSS THESE.

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2000+ PASSIVE HOUSE PROJECTS IN NORTH AMERICA & GROWING FAST



VANCOUVER



SASKATOON



CALGARY



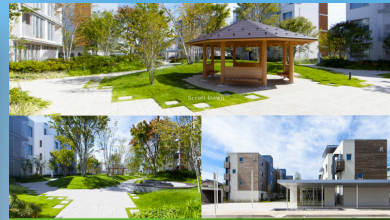
VICTORIA, BC



SASKATOON



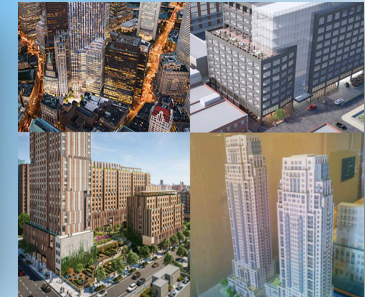
CHINA



JAPAN



USA



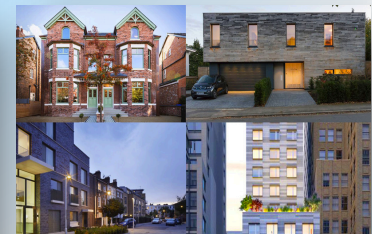
SPAIN & FRANCE



GERMANY



PACIFIC



UK

BLOSSOM PARK WITH GEORGE SWEETMAN



WOODSTOCK

SWITCH TO GEORGE

**THEN AFTER BACK TO
BRUCE**



QUESTIONS? DISCUSSION?

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THANK YOU

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CLIMATE SOLUTIONS WEBINAR SERIES

