

Data-Logging and Post-Occupancy Energy Performance: Passive House Apartment Building and Single-Family Dwelling

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BSC4300 - BUILDING SCIENCE PROJECT

ALGONQUIN COLLEGE

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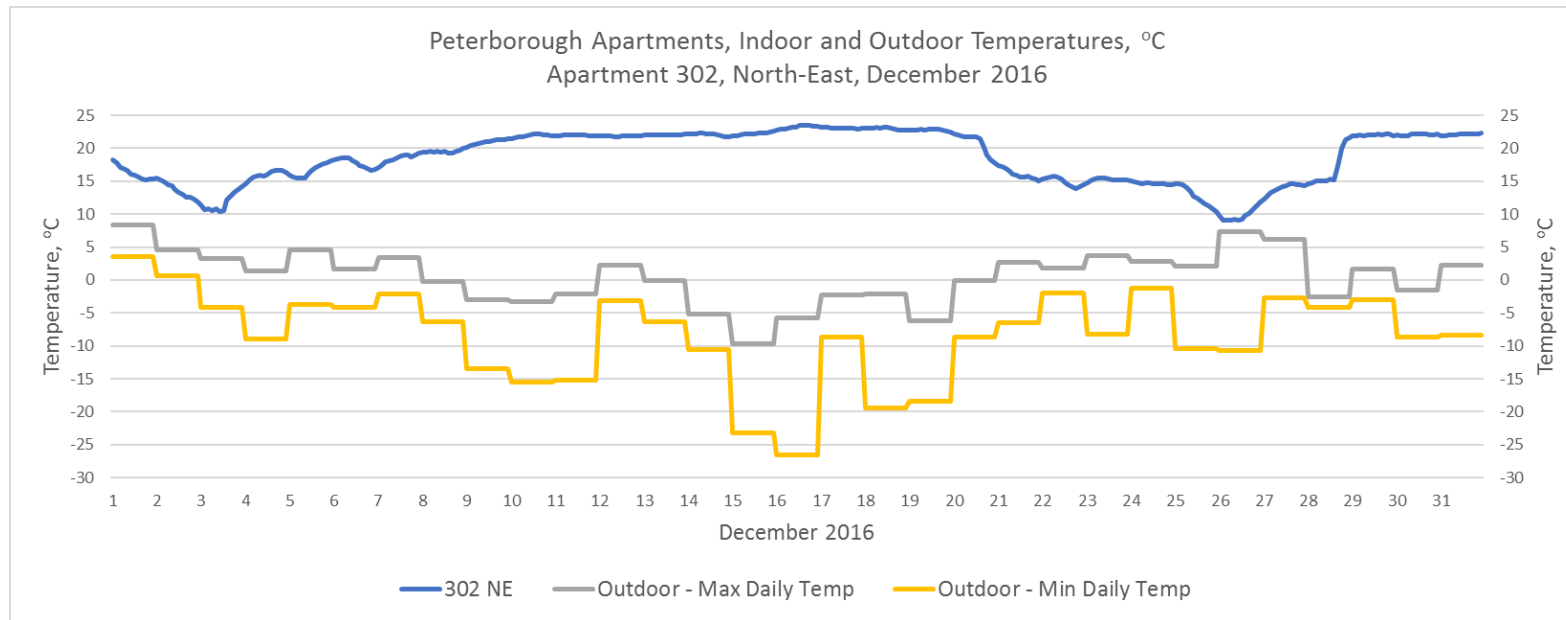
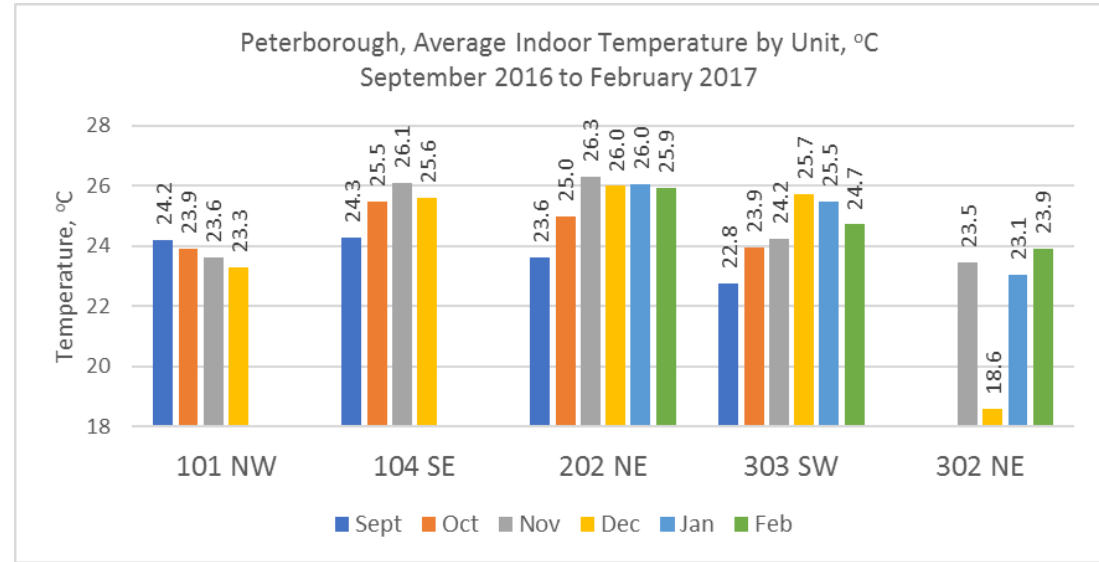
Projects

- Anthony Mach
 - Bachelor of Building Science
 - CPHD, CEA, Arch. Tech.
- Peterborough PH Apartments
 - 12-unit MURB
 - 2-bedroom units, 800-900 SF
 - Occupied August 2016
 - Natural gas for heating and hot water
- Wolfe Island Passive House
 - Single-family dwelling
 - CLT construction
 - Occupied November 2016
 - 100% electric resistance heating and hot water
- Occupancy data-logging
 - Indoor Temperature
 - Relative Humidity
- Post-Occupancy Energy Performance



Peterborough: Temperature

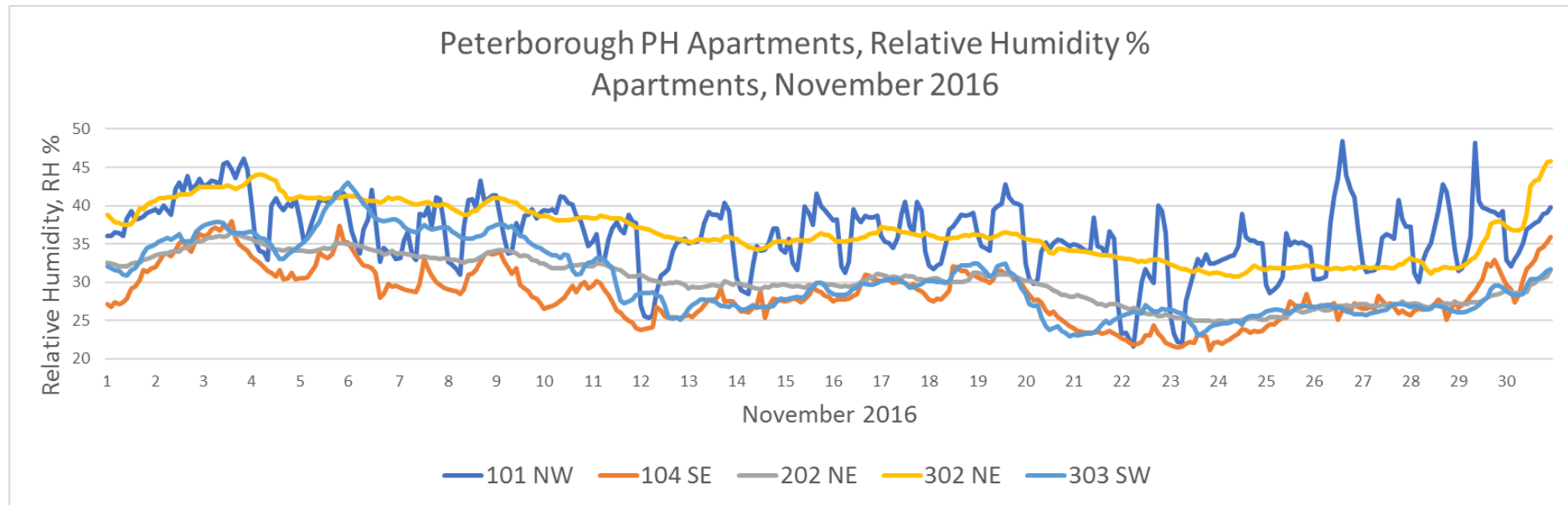
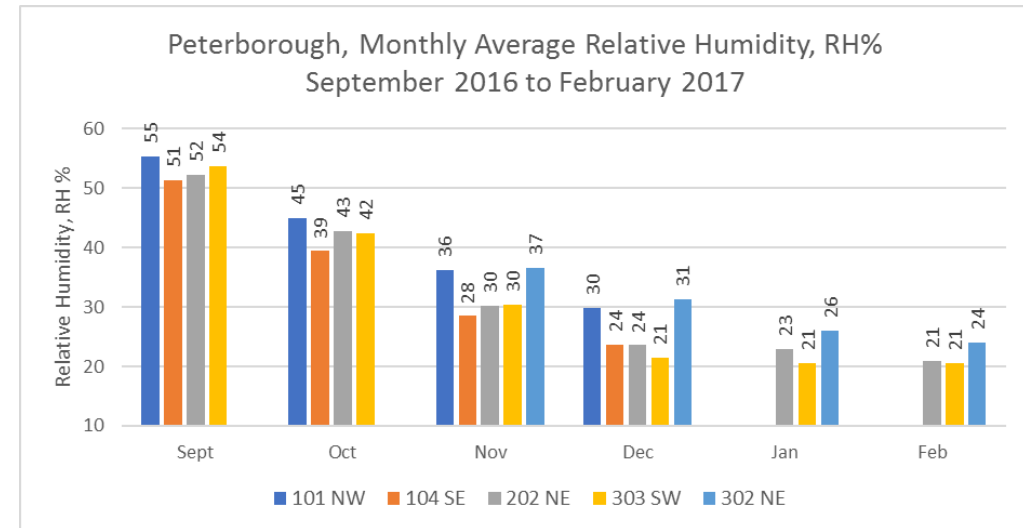
- Data-logged 5 units
- 22.8°C to 26.3°C (73°F to 79°F)
- 4/12 units required heating
- First floor: no heating
- 202 heated Dec-Jan
- Third floor: quickest cooling rate



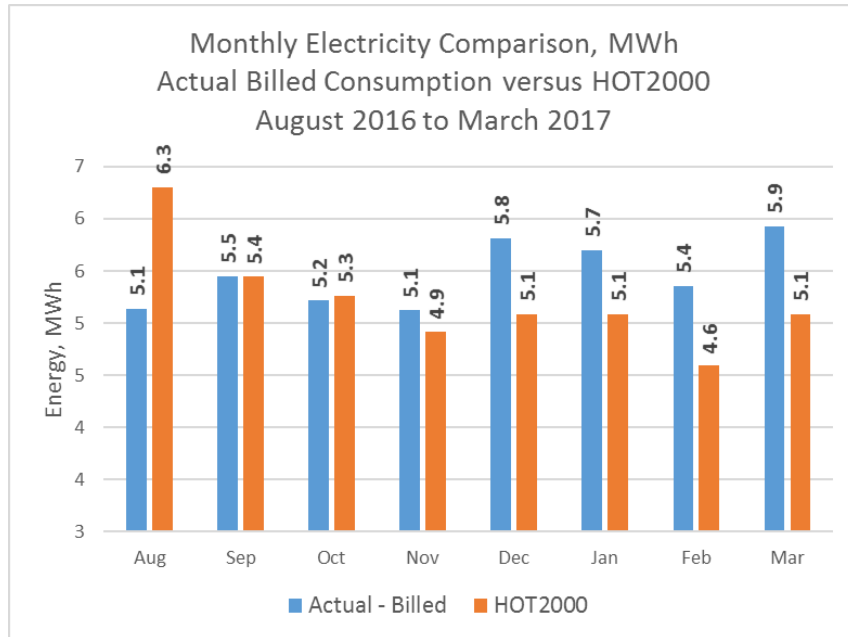
- Vacation Dec. 20-28
- 20-25th: Settles at 14°C
- Dec. 26, 11:00am: 9°C
- Dec. 28th
 - from 3pm to 11pm
 - 15°C to 22°C
 - 59°F to 72°F

Peterborough: Relative Humidity

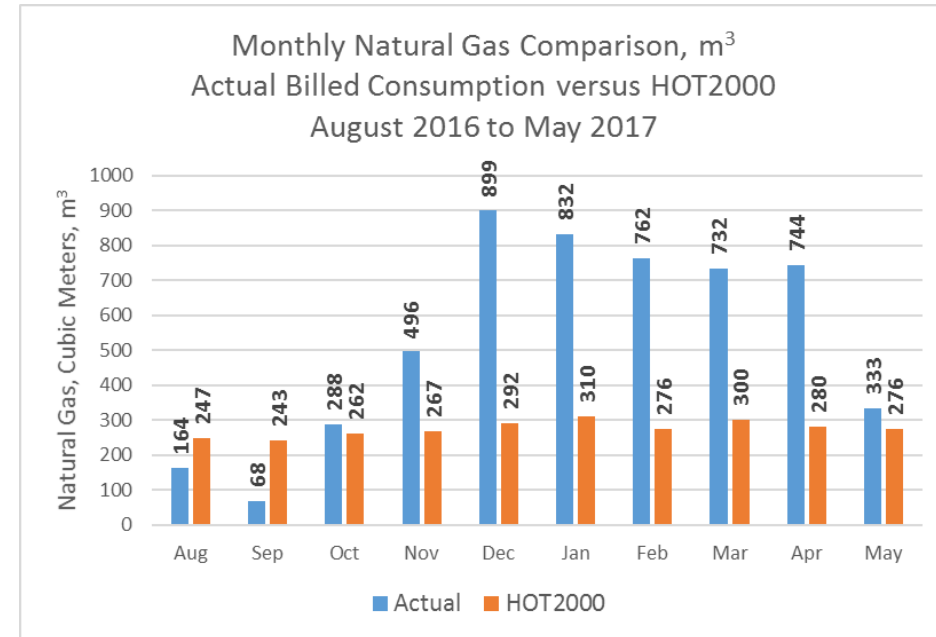
- All apartments have independent HRV
 - Tenants only control booster switch
 - Peak early September: 70%
 - Low mid January: 15%
- September: Units running AC = steady RH
- November 2016
 - Unit 101: retired couple
 - Mid-November: Outdoor temperatures cooling down



Peterborough: Energy Performance



- Electricity
- August:
 - Building not fully occupied
 - HOT2000 includes cooling
- September: temporary electric HWT
- Dec-March: Actual 10-17% more than simulation



- Natural Gas H+HW
- September: re-commissioning boiler
- HOT2000:
 - Simulation heats Dec. to Feb.
 - Designed for existing and Code buildings

Peterborough: Builder/Owner POE

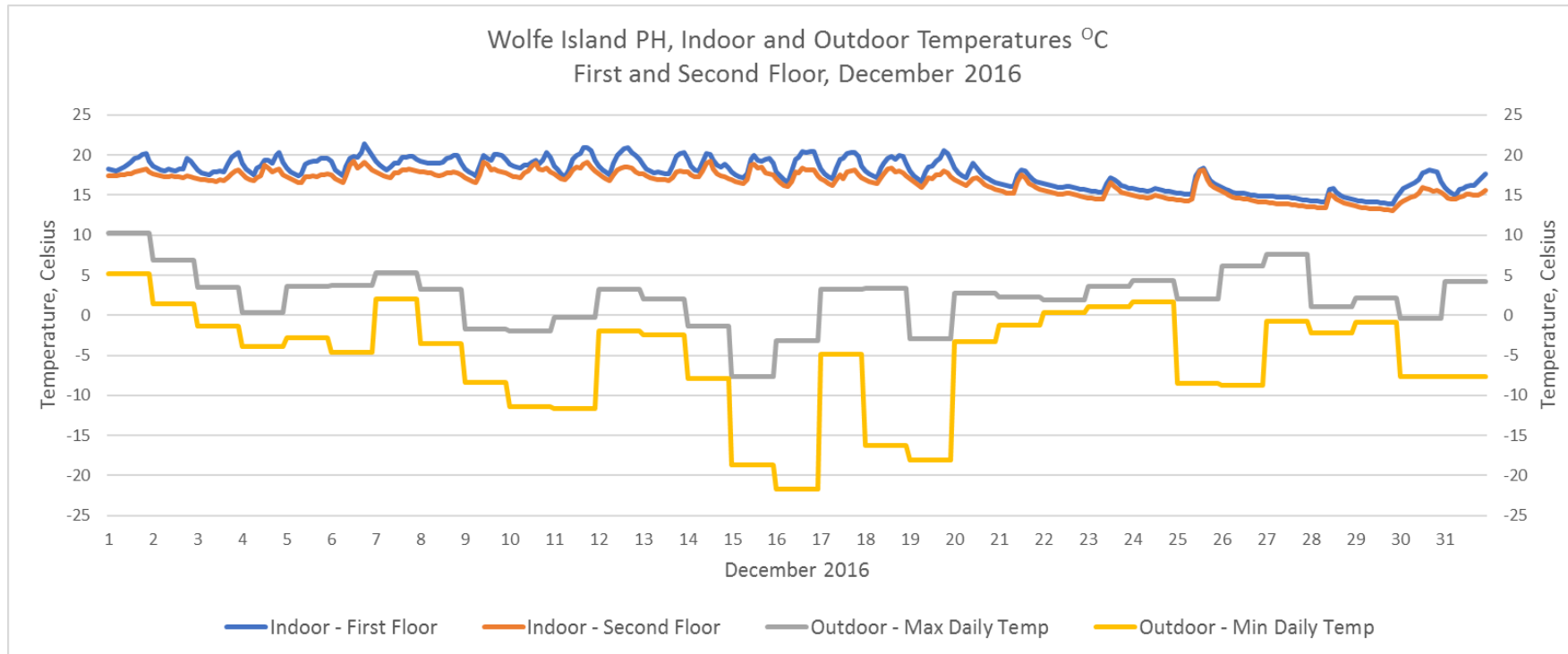
- Builder/Owner very satisfied with the performance
- 8000 BTU/h Portable A/C units installed due to overheating
 - Will install wall units
- Lessons learned:
 - Install A/C during construction phase
 - Alternatively: mini-split heat pumps for heating and cooling
 - External shading louvers on south side windows
 - Glycol preheat/defrost loop for ventilation system



South Elevation

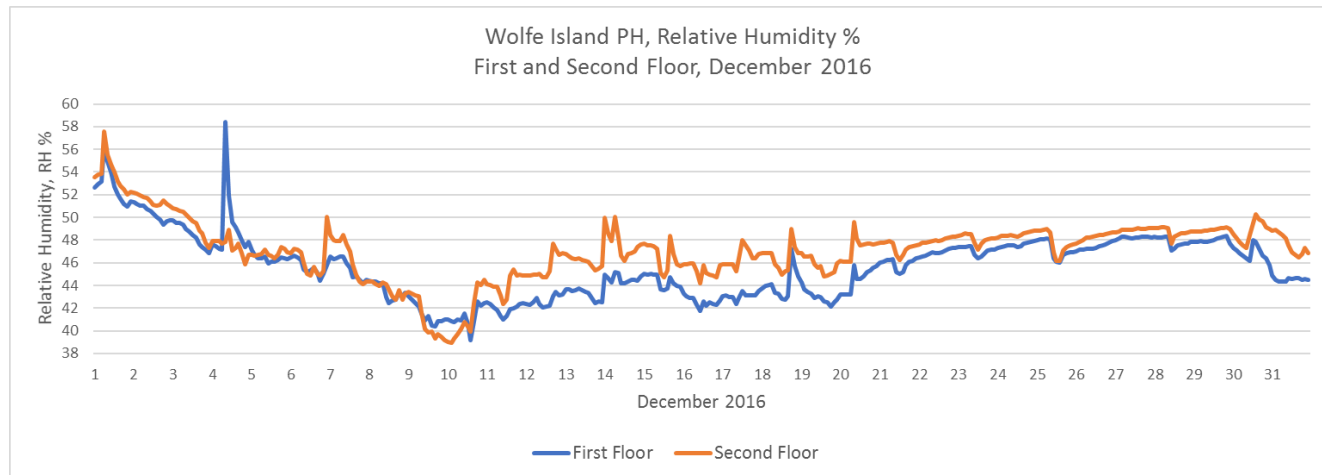
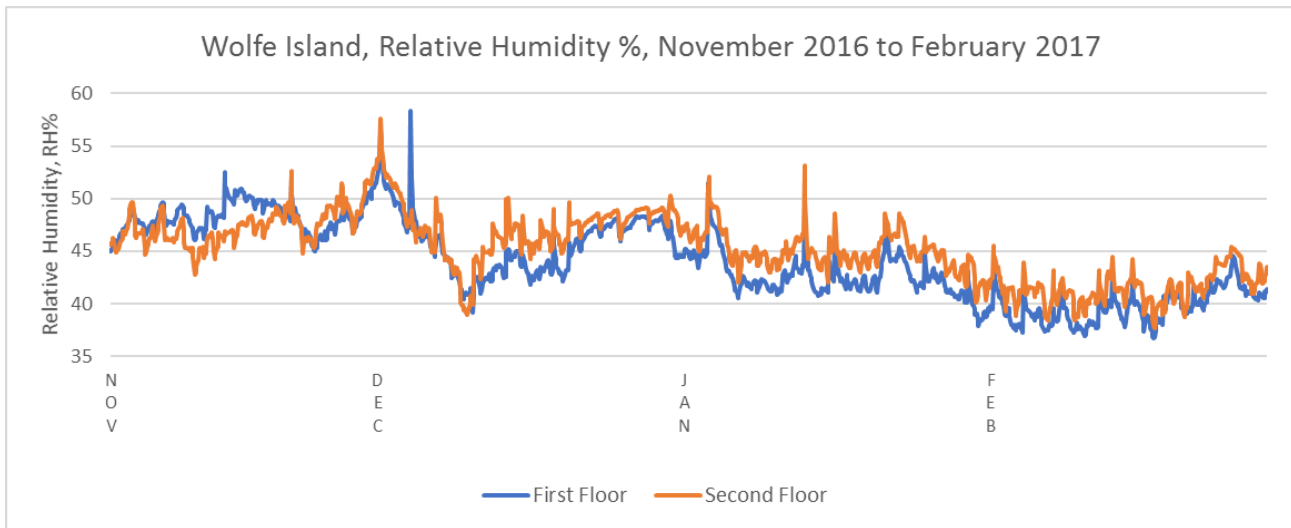
Wolfe Island: Temperature

- Until Dec. 14th: 1kW portable electric heater
- Dec. 14th: installed 2kW Thermolec heating element
- Vacation Dec. 20 to 30
 - Dec. 25th, 3:00pm: 18.4°C (65.1°F)
 - Dec. 28th, 9:00am: 14.1°C (57.4°F)
- Solar heat gain
 - Warm-up periods from 9:00am to 3:00pm
 - Homeowner experience
- Lowest temperature Dec. 29th: 13.0°C (55.4°F)
- Homeowners kept house at 18 to 20°C



Wolfe Island: Relative Humidity

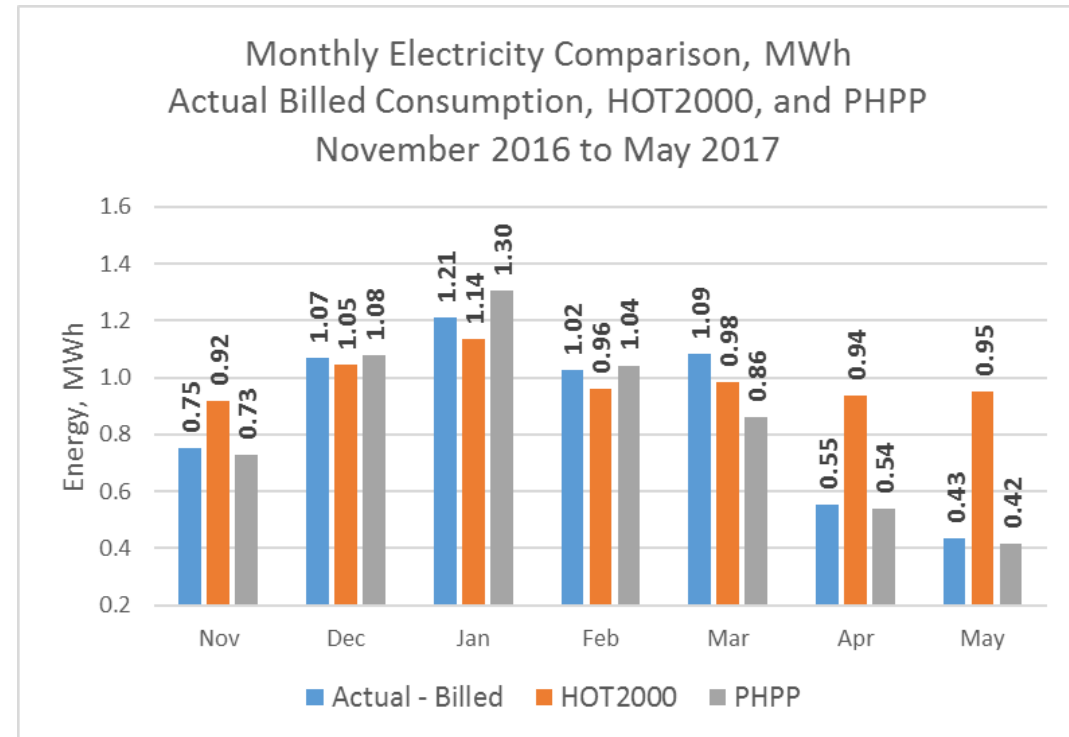
- Zehnder ComfoAir-200 ERV
- Occupancy
 - Until November 21: moving-in
 - Dec. 4: ERV balanced
 - Dec. 20 to 30: away on vacation
- Four-month period RH
 - Average: 44%
 - Peak: 58% (2-4 hours)
 - Low: 37%



- December 2016
 - Vacation
 - No occupants
 - ERV functioning
 - Average RH 48%
- Comparison with Peterborough
 - ERV
 - CLT

Wolfe Island: Energy Performance

- HOT2000
 - Heating Dec. to Feb.
- PHPP
 - Heating Nov. to March
- Results
 - HOT2000 overestimates baseload consumption April and May
 - HOT2000 underestimates heating consumption



Wolfe Island: Homeowner POE

- Homeowner is very satisfied with the energy and passive house aspects of the house
- Constructability:
 - Importing CLT from Germany limits home design by length of shipping container
 - Cover CLT quickly during construction to protect from rain
 - Larger crew for assembly
- Future renewable energy projects
 - PV array with battery storage
 - Solar thermal hot water system
 - Homeowner blog
 - wolfeislandpassivehouse.wordpress.com



Thank You

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