TAF The Atmospheric Fund

ENERGY EFFICIENCY IMPACTS ON INDOOR ENVIRONMENTAL QUALITY

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Multi-Residential Case Studies

Clean Air Council
Metro Hall, Toronto
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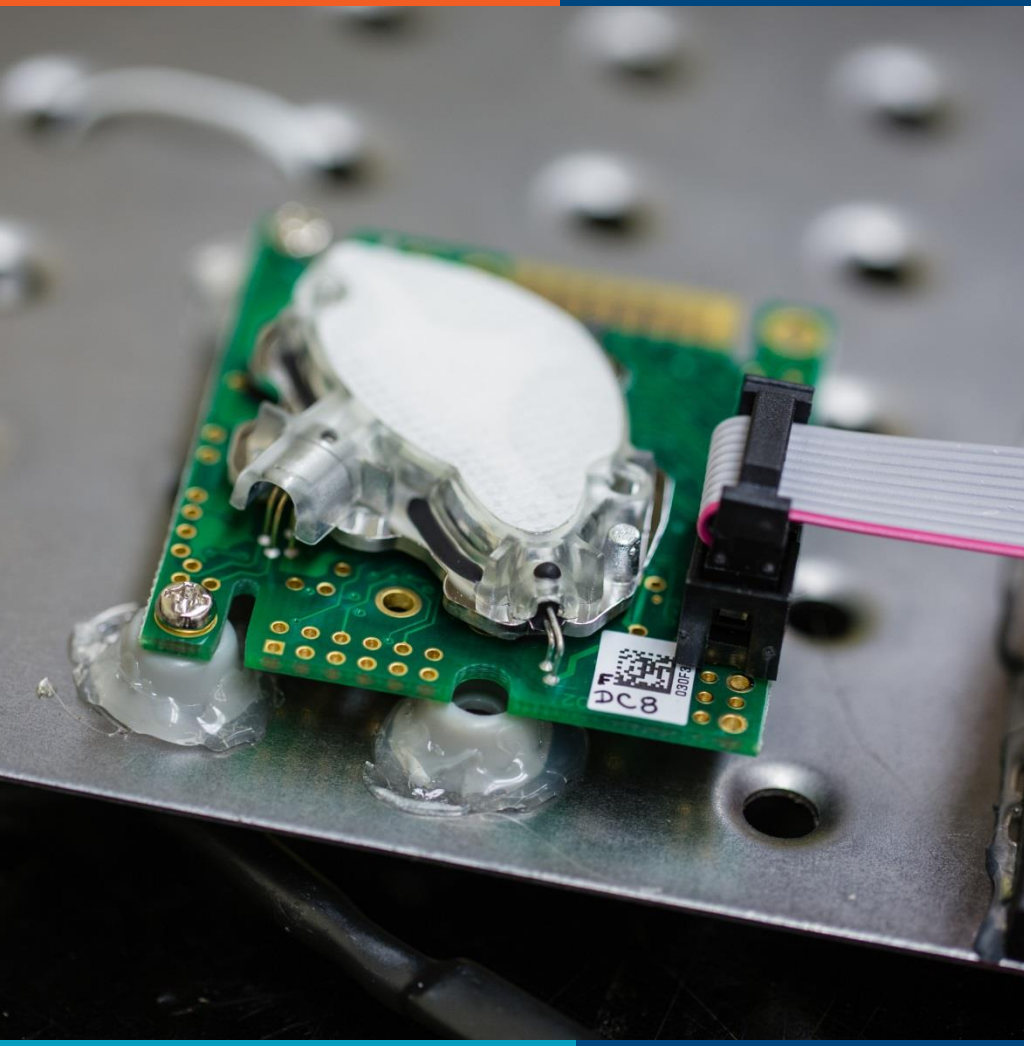
87%

of our time is spent indoors but nearly 100% of research funds focus on outdoor air quality.

CASE STUDY

- 7 MURBs
- 5-15% suites monitored
- 3 years



IEQ MONITORING EQUIPMENT

- Onset HOBO U12-013
  - Temperature, relative humidity
- Onset TMCx-HD
  - Mean radiant temperature
- SenseAir K30
  - CO_2

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THERMAL COMFORT

- Indoor air temperatures uncomfortably hot
  - Summer average: 27°C - 29°C
  - Winter average: 24°C - 27°C
- Sustained high temperatures – even at night
- Boilers were very inefficient, overheating especially in shoulder months

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VENTILATION

- Fresh air supply provided was 46% below ASHRAE 62.1 on average
- CO_2 levels were above 950 ppm between 2% - 19% of the time
- Relative humidity peaks when cooking or bathing, due to poor ventilation
- Conditions were overly dry in winter and spring (<30% RH)

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RETROFIT MEASURES

- Condensing boiler retrofits or recommissioning
- Gas absorption heat pumps (GAHPs)
- Duct cleaning
- AHU replacement
- New make-up air units (MAUs)
- Individual smart thermostats

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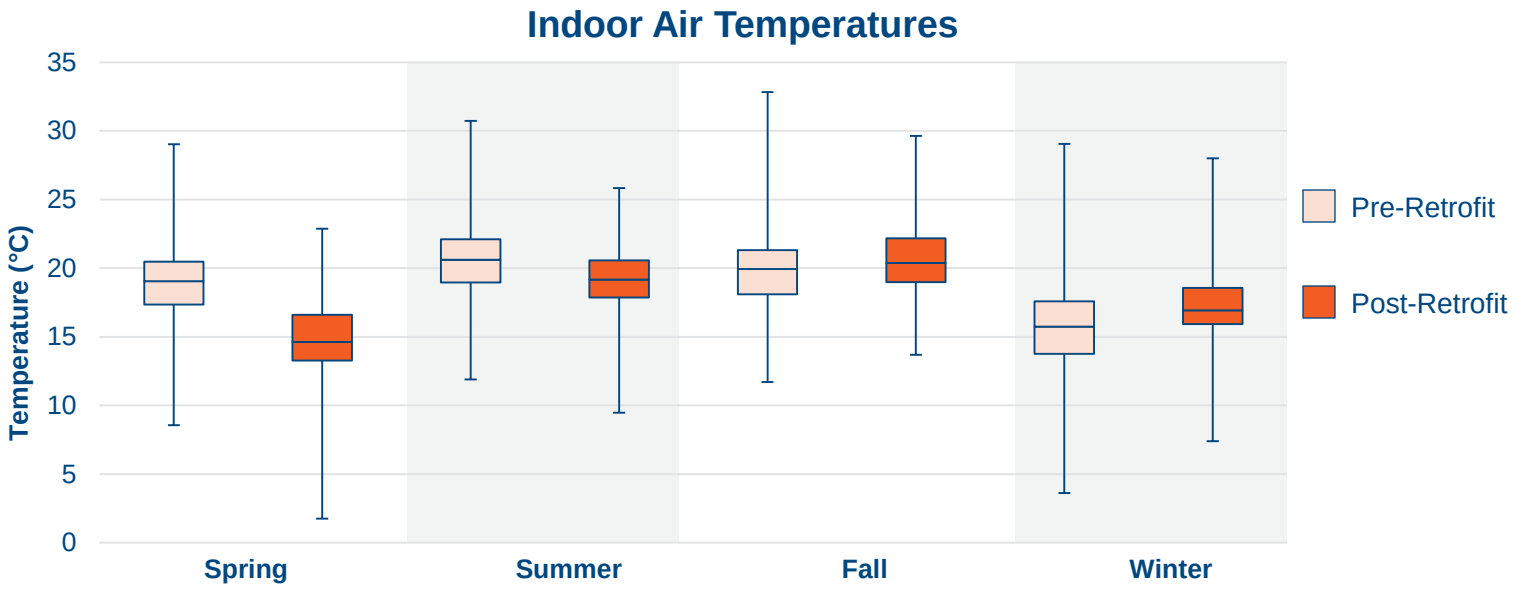
THERMAL COMFORT OUTCOMES

- Interior temperatures 2°C - 3°C ↓
- Peak temperatures (>28°C) 22% - 30% ↓
- 54% decrease in reported overheating in winter



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VENTILATION OUTCOMES

- Residents' experienced 21% less drafts post-retrofit
- Average CO_2 levels did not decrease significantly post-retrofit
- Majority of sites saw decreases in time spent above 950 ppm CO_2 threshold in spring and summer
- Survey responses indicated 39% less open windows in winter

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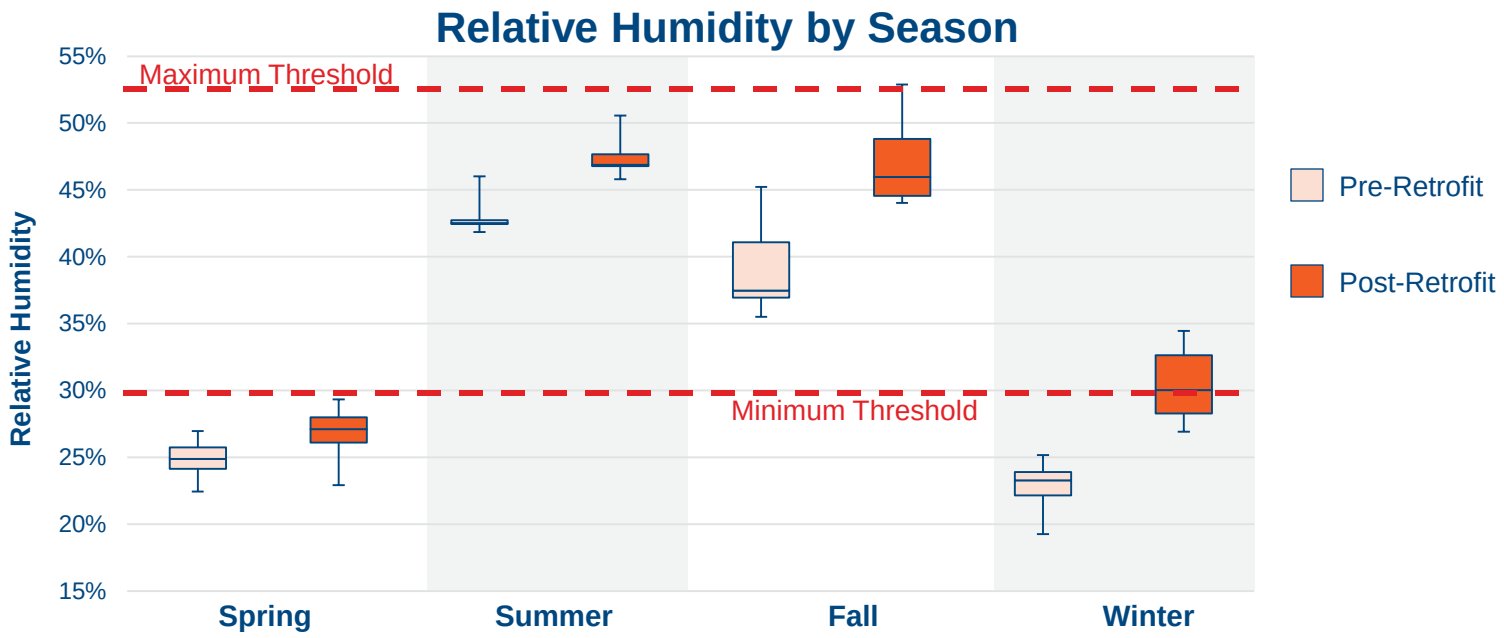
VENTILATION OUTCOMES (CONT'D)

- Average relative humidity increased post-retrofit, alleviating some dryness



IEQ-RELATED SYMPTOMS

- Fatigue, tiredness, exhaustion
- Headache
- Itching, burning, irritation of eyes
- Irritated, stuffy or runny nose
- Hoarseness, dry throat
- Cough
- Dry or flushed skin on the face

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SELF-REPORTED HEALTH OUTCOMES

58% **less absenteeism** from work or school.

38% **decrease** in reported symptoms, on average.

37% **decrease** in hospital visit at 2 of 3 sites.

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RECOMMENDATIONS

- Reducing wintertime overheating especially during shoulder season and ensure mechanical equipment is properly sized
- Address summertime overheating using active and passive strategies
- Cleaning supply and return ducts regularly to improve ventilation
- MAU tempering for both comfort and energy efficiency

Integrated Design Process

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THANK YOU

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