



Breaking Through the 100% Efficiency Barrier Using GAHP

A Multifamily Case Study

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THE ATMOSPHERIC FUND

The Atmospheric Fund (TAF) invests in urban solutions to reduce carbon emissions.

City of Toronto created TAF in 1991 Non-profit Public Agency

TAF has retrofitted 11 multi-unit residential buildings over last 5 years.



CASE STUDY CHARACTERISTICS

- 2 buildings (176k ft²)
- 4 storeys
- 397 units
- 1972 construction
- Seniors residences

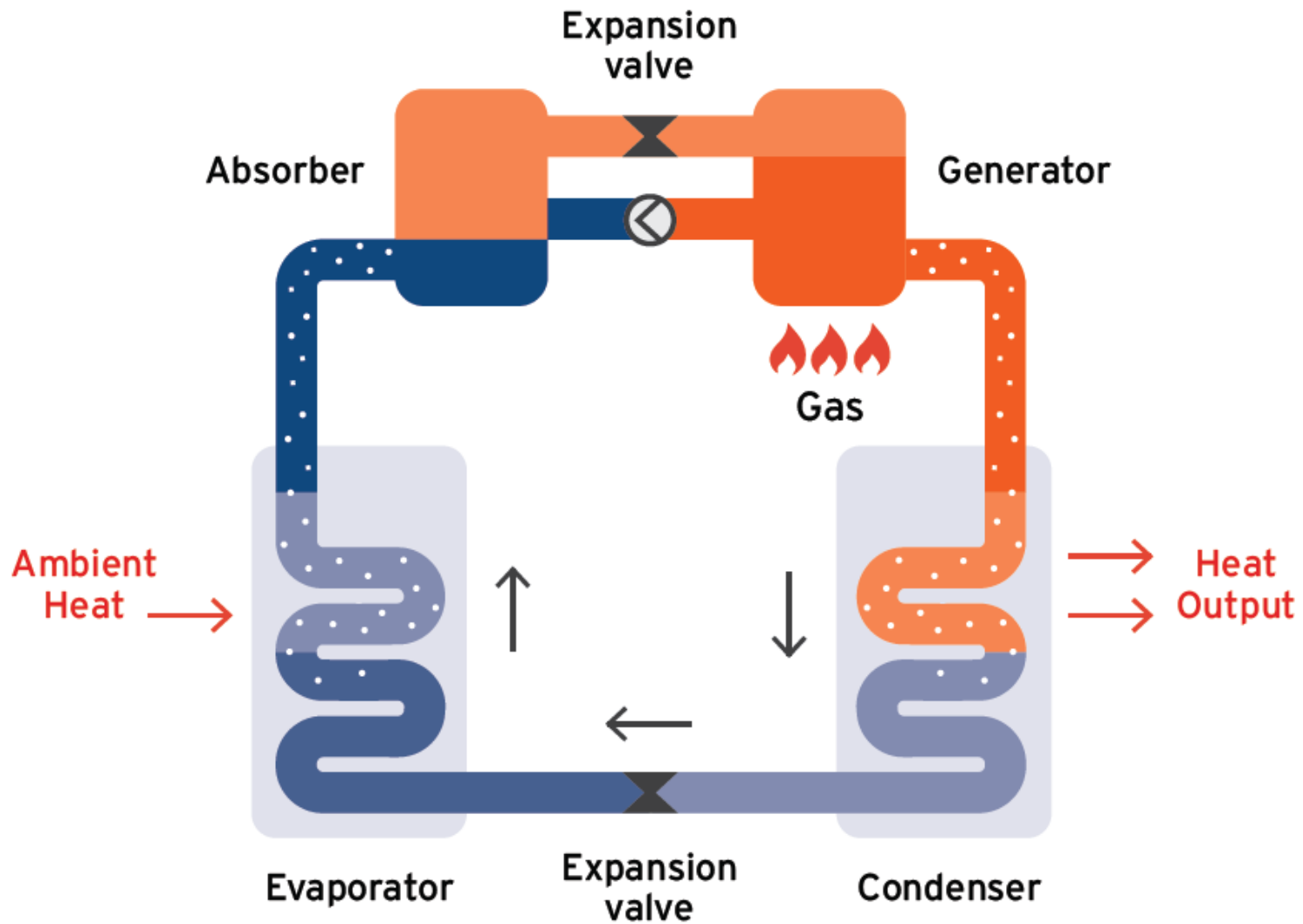


PRE-RETROFIT HEATING PERFORMANCE

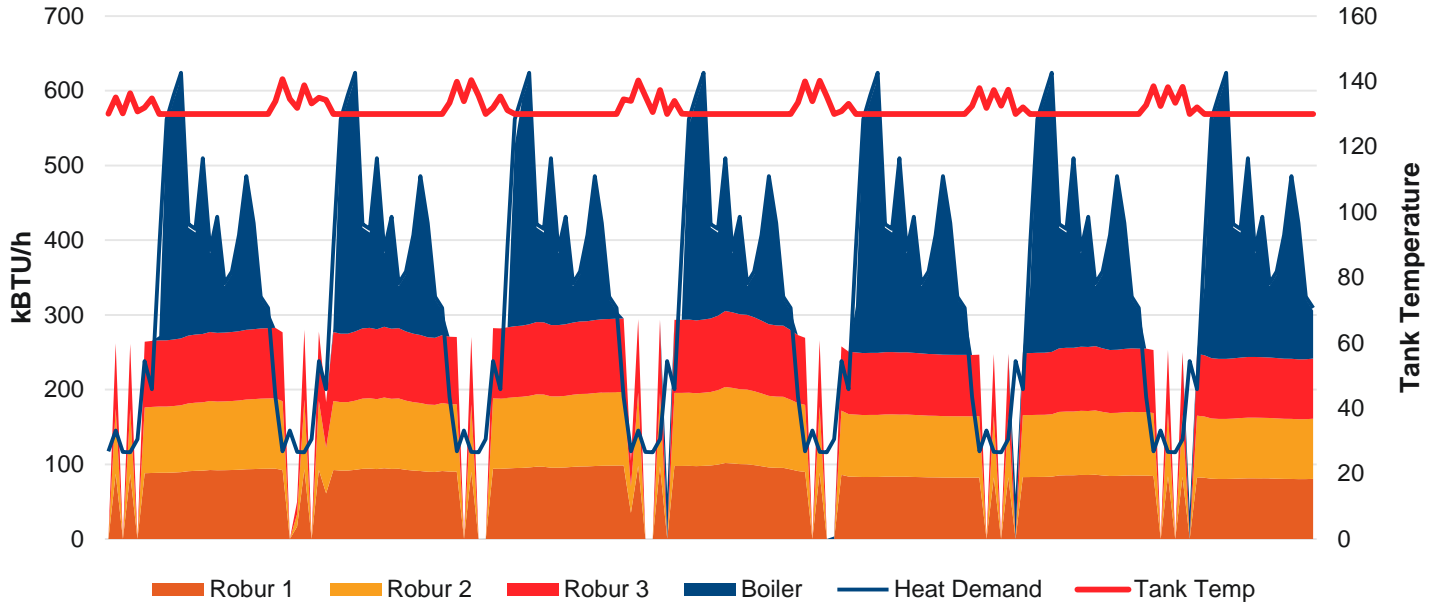


53% Avg. boiler efficiency

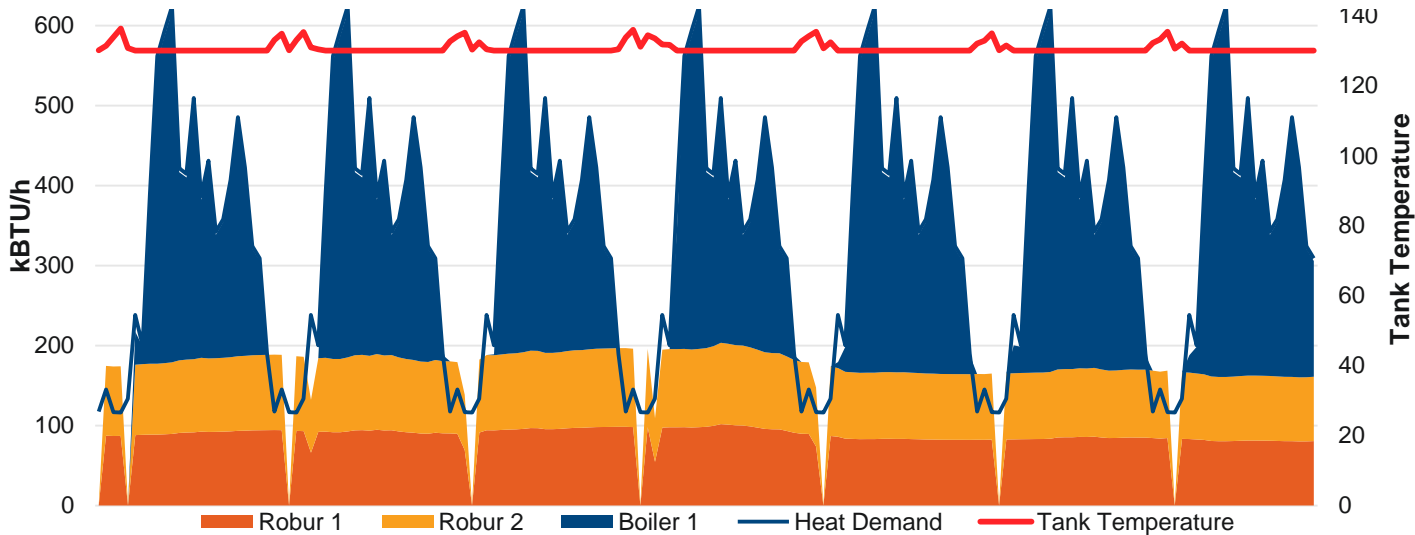
GAS ABSORPTION HEAT PUMPS



SYSTEM DESIGN – ANALYZING THE OPTIONS



3 GAHP
1 Boiler



2 GAHP
1 Boiler

CAPACITY

Specs

- 2 GAHP units
- 60% DHW load
- 123,500 BTU/h (ea.)
- 140°F max outlet

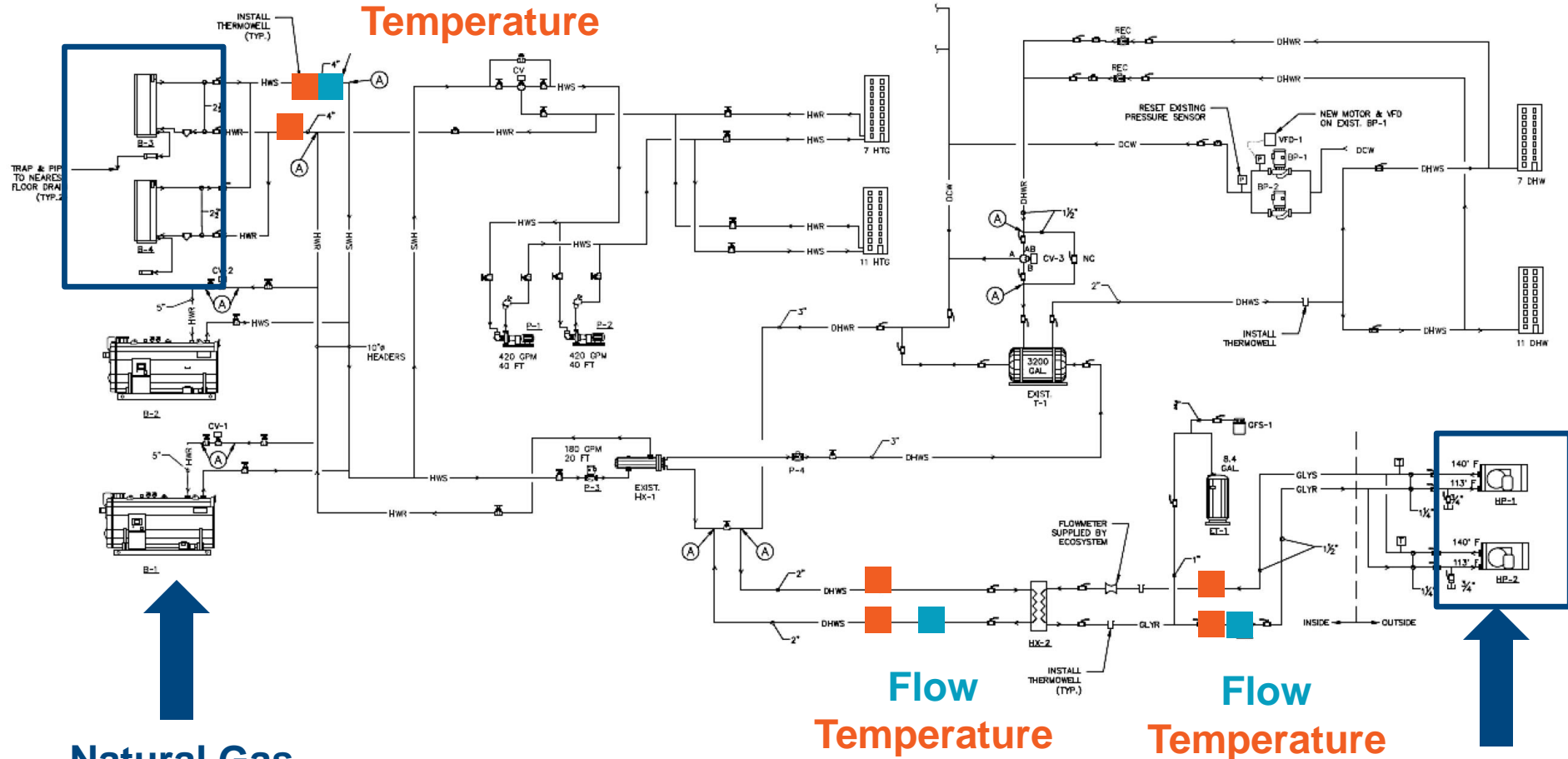
Expected Performance

- 110-120% GAHP
- >100% overall DHW



MONITORING PLAN

Flow Temperature



Natural Gas
Consumption

The Atmospheric Fund

+ GAHP power consumption
+ Pump power consumption

Natural Gas
Consumption

INSTALLATION & START UP COMMISSIONING

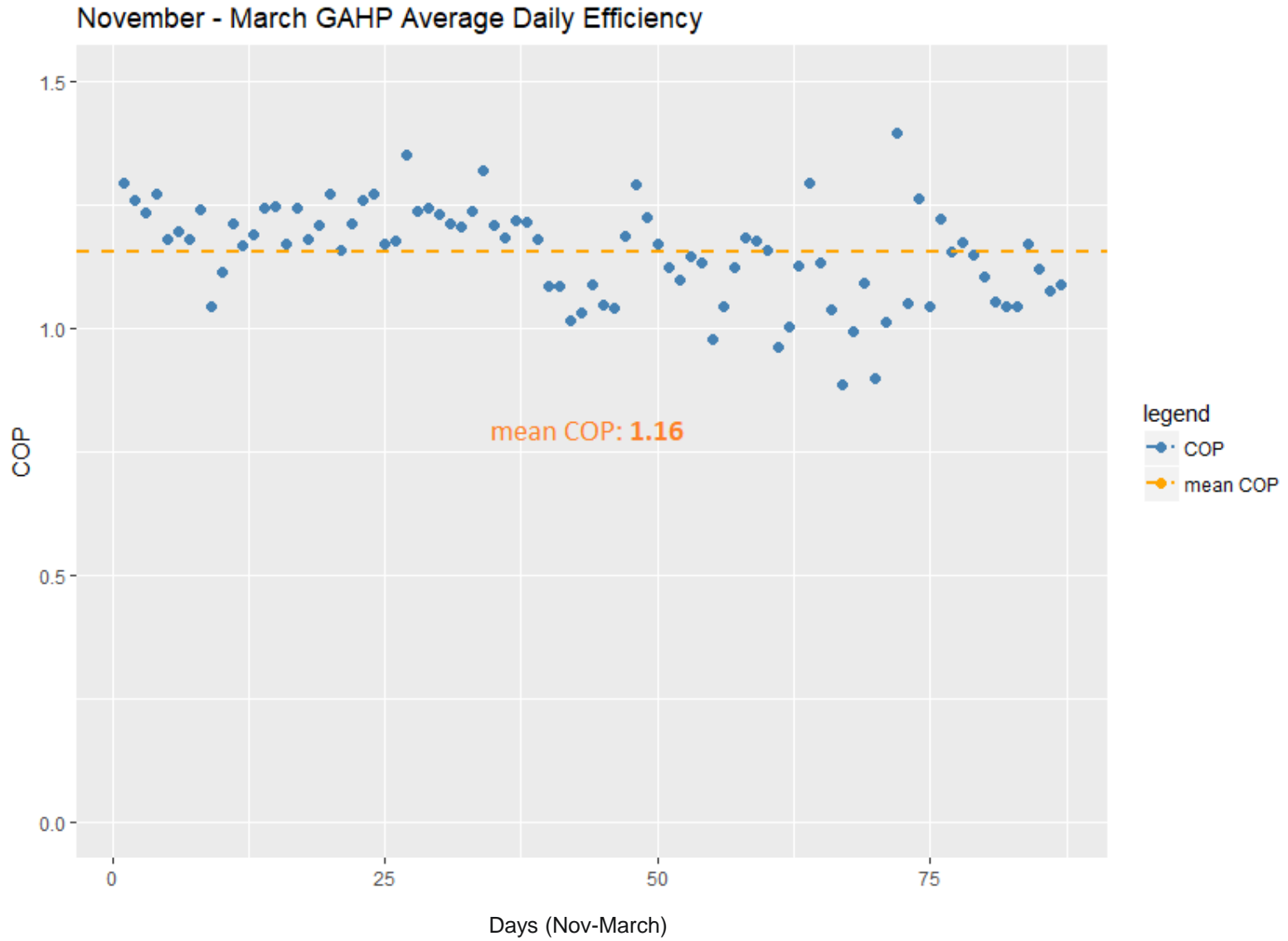
- Venting & clearance
- Location can have large impact on cost
- Sound
- Pipe length & insulation
- Flow, leak, temperature differential checks
- Maintenance



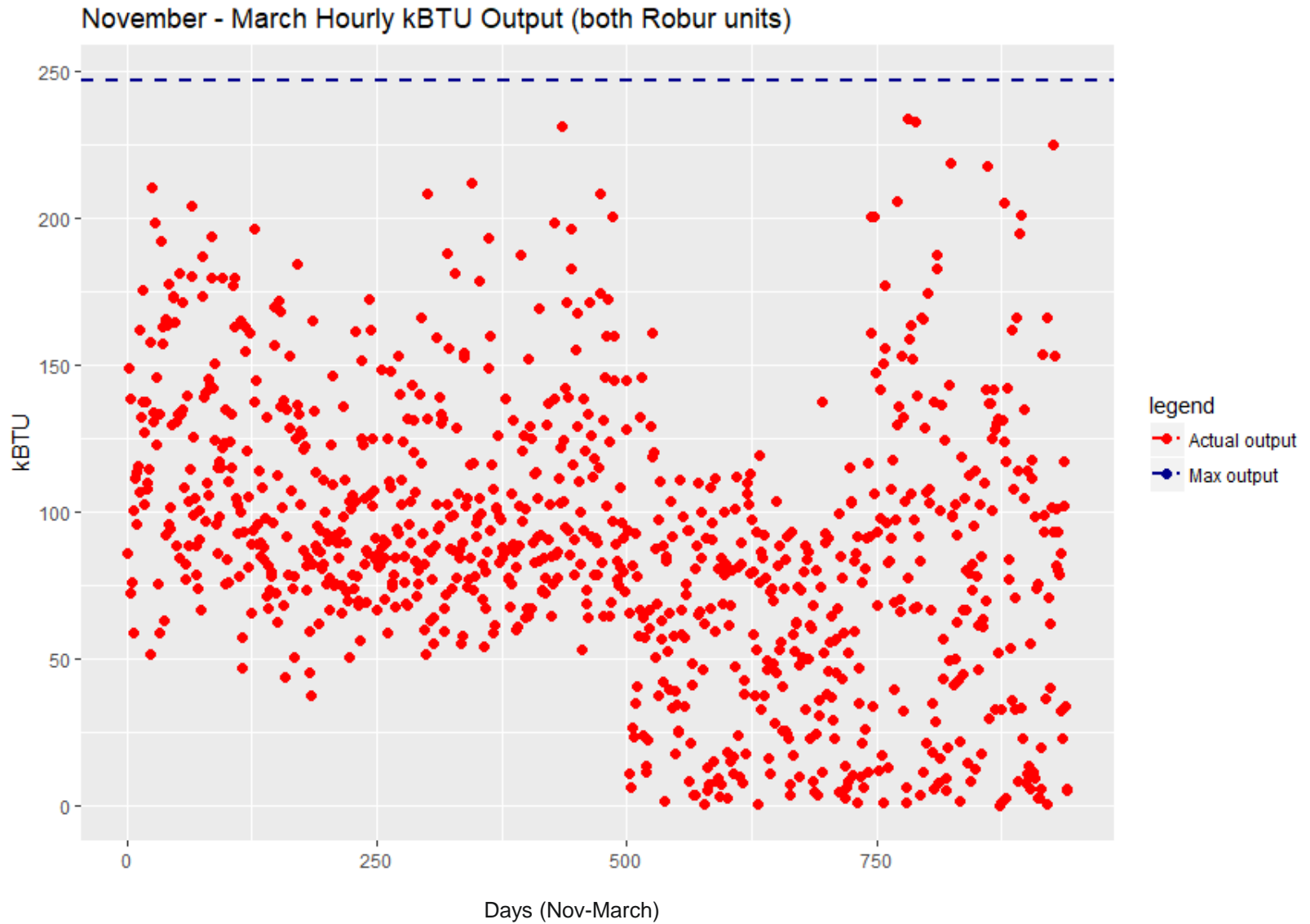
SITE STAFF TRAINING



WINTER PERFORMANCE



WINTER PERFORMANCE



WINTER PERFORMANCE SUMMARY (November - March 16th)

1.16

COP under normal operating conditions

1.09

COP based on all data

0.89

COP during low-utilization and high return temperatures

WINTER PERFORMANCE SUMMARY (normal operation)

Quartile	Average Outdoor Temp °F (°C)	Average COP
1	17.5 (-8.06)	1.05
2	28.7 (-1.85)	1.15
3	35.1 (1.73)	1.17
4	43.3 (6.30)	1.25

LESSONS LEARNED

- Proper sizing of heat exchanger
- Pumps running only when needed
- Optimal sequencing of tank temperature



LESSONS LEARNED

- Whole building approach
 - Correct sizing balancing performance and financials
- Iterative design
 - Incorporate information along the way
- Proper startup commissioning
 - Don't forget about ongoing optimization!
- GAHP performance is performing as expected



STAY CONNECTED!

TAF.ca

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