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Drake Landing Solar Community

A high solar fraction district heating system

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Task 55: Large Scale SHC Systems Integration
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Solar District Heating with Seasonal Thermal Storage



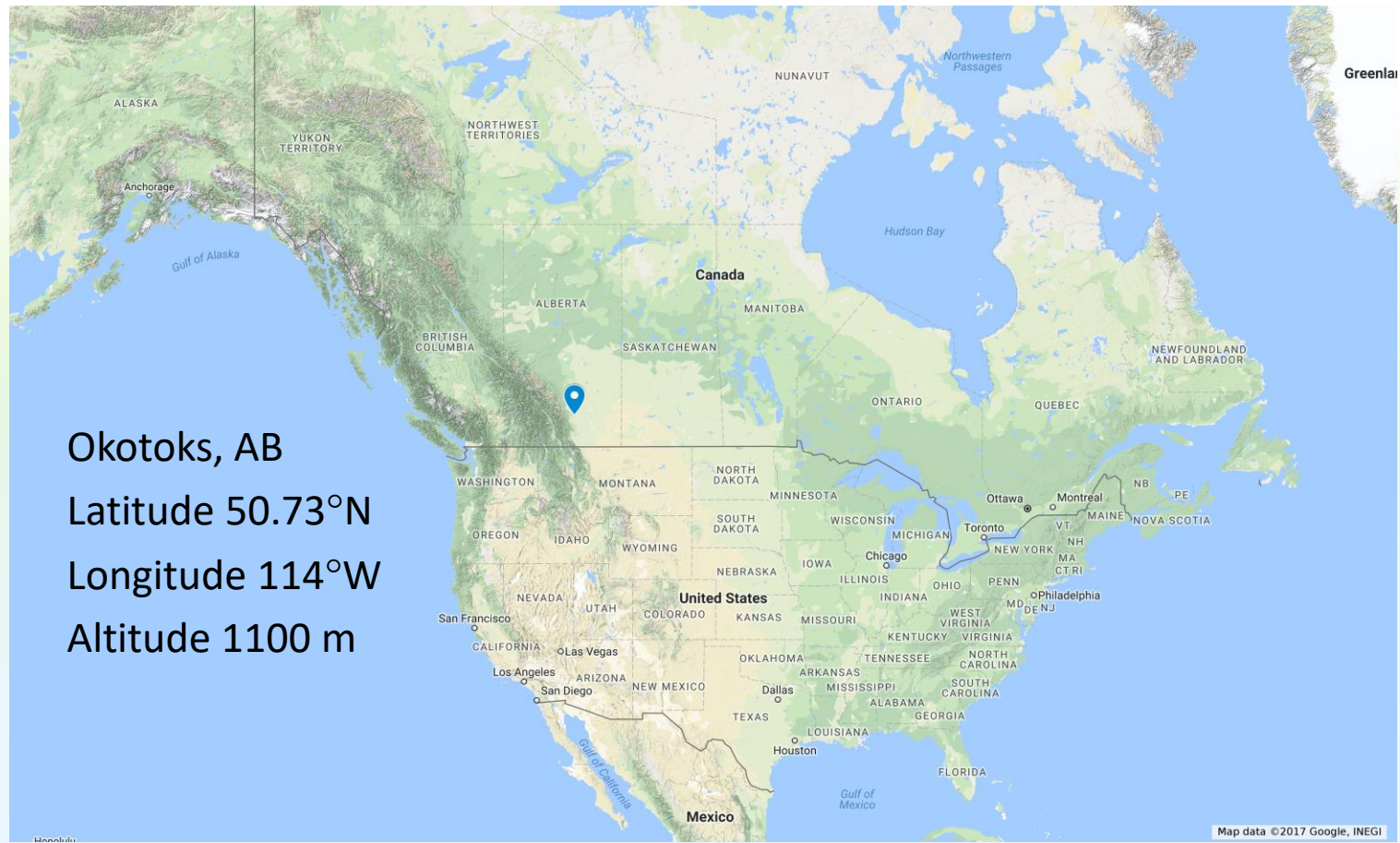
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	Calgary	Amsterdam	Copenhagen	Munich	Stockholm	Vienna
Heating Degree-Days (°C.d)	5199 (1)	3010 (6)	3611 (4)	3733 (3)	4291 (2)	3167 (5)
Incident Irradiation (MJ/m ²)	6426 (1)	3937 (6)	4289 (4)	4750 (2)	4280 (5)	4731 (3)
Latitude (°N)	51.12	52.28	55.62	48.12	59.56	48.12

* Incident solar radiation on tilted is calculated from horizontal data using the Reindl model.

The surface tilt angle is equal to the latitude.

Data Source: http://apps1.eere.energy.gov/buildings/energyplus/weatherdata_about.cfm

Calgary weather data: CWEC, European weather data: IWEC

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798 collectors (2293 m²) in 4 blocks on the garage roofs

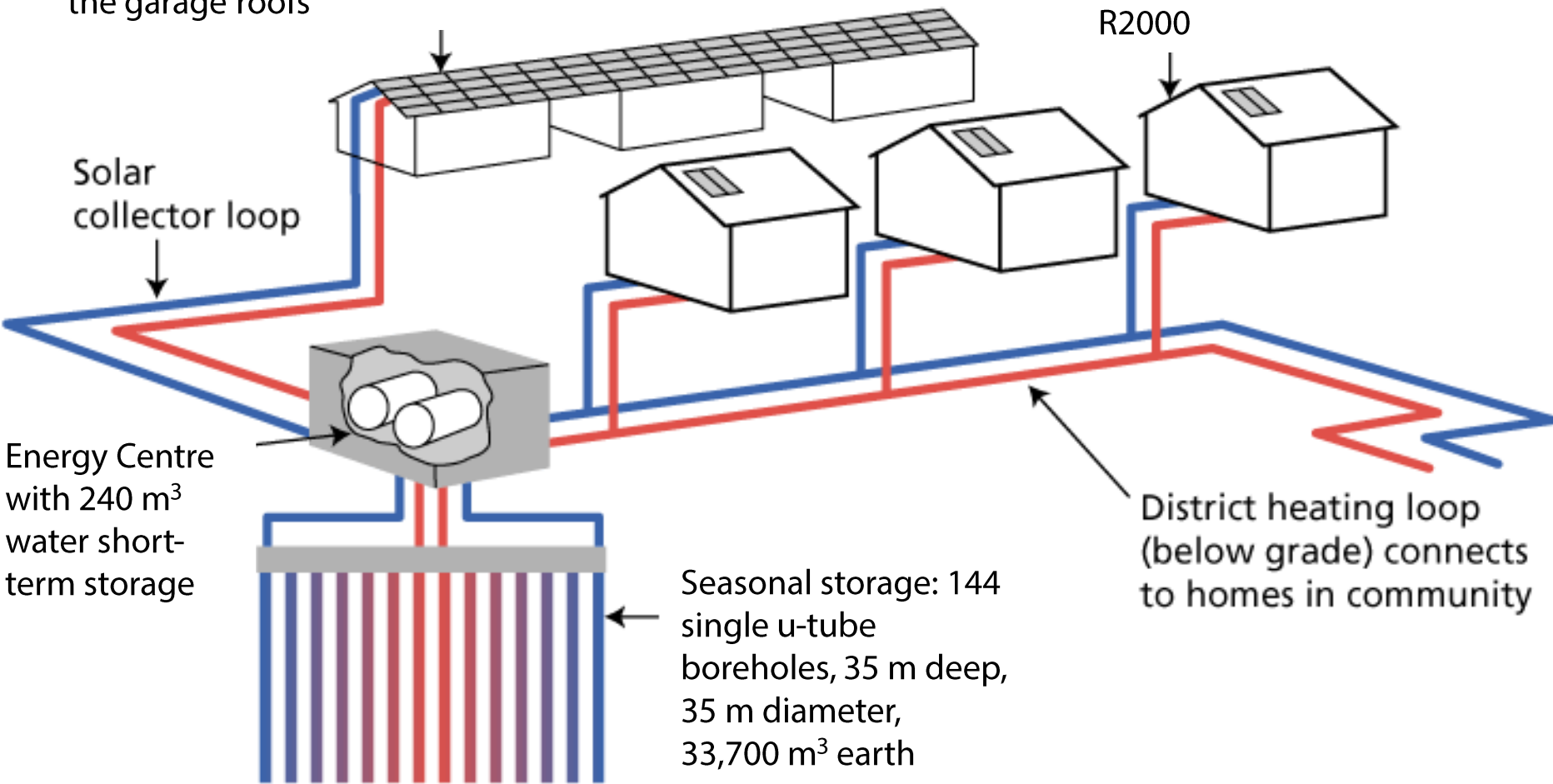
52 two-storey single-family detached homes – 145 m² R2000

Solar collector loop

Energy Centre with 240 m³ water short-term storage

Seasonal storage: 144 single u-tube boreholes, 35 m deep, 35 m diameter, 33,700 m³ earth

District heating loop (below grade) connects to homes in community





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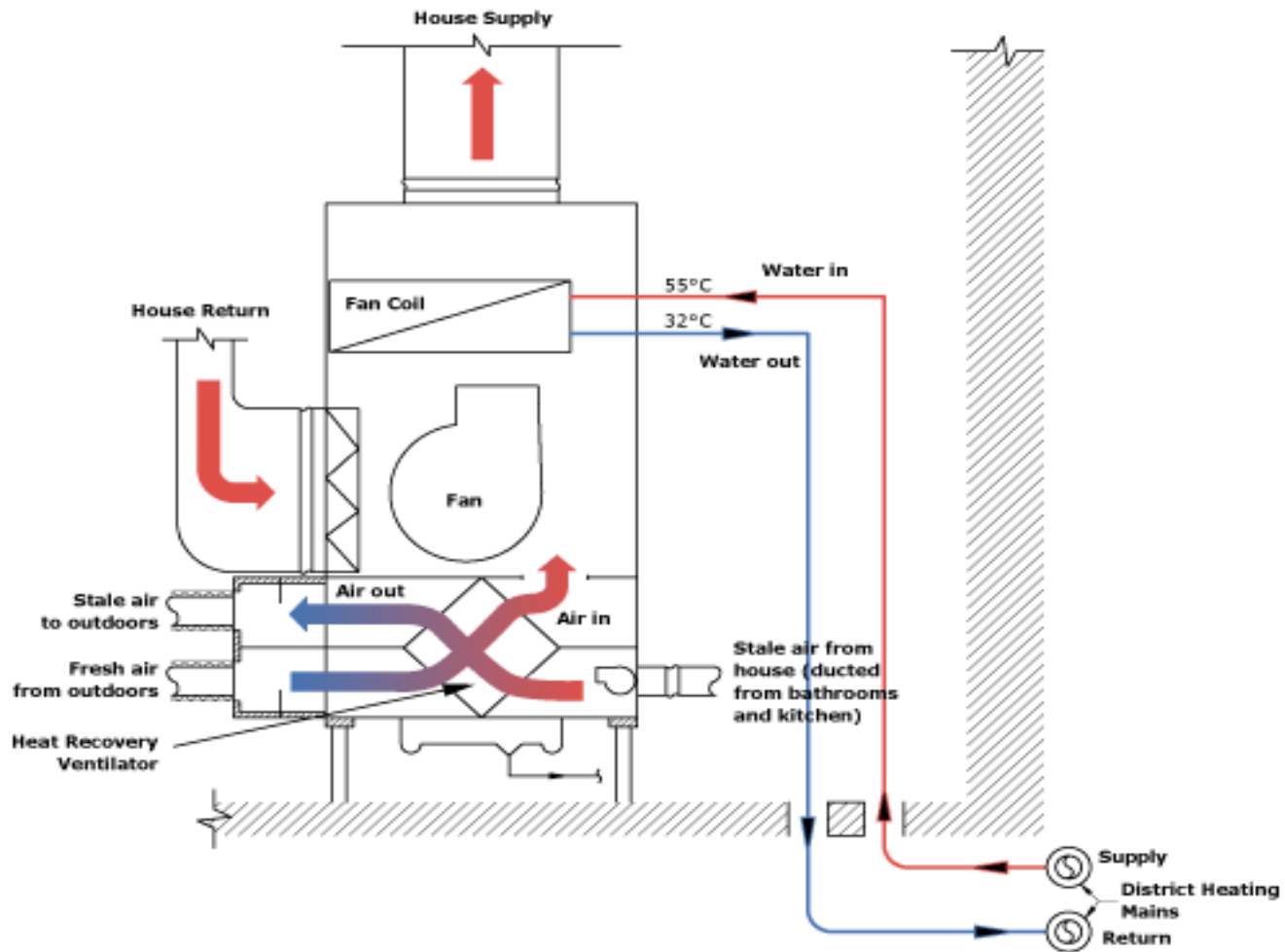
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ESP-r

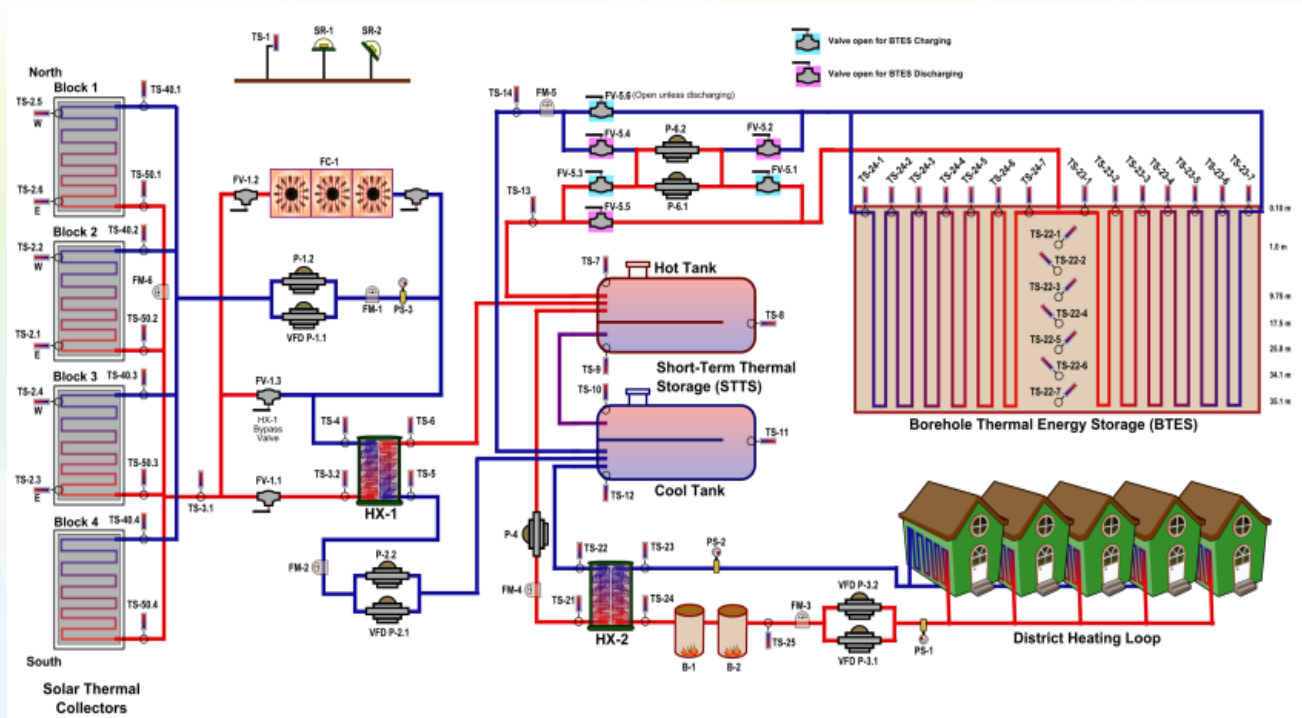


TRNSYS

- ESP-r simulations for heating load calculations
- TRNSYS simulations for energy performance and design optimization



Monitoring Results



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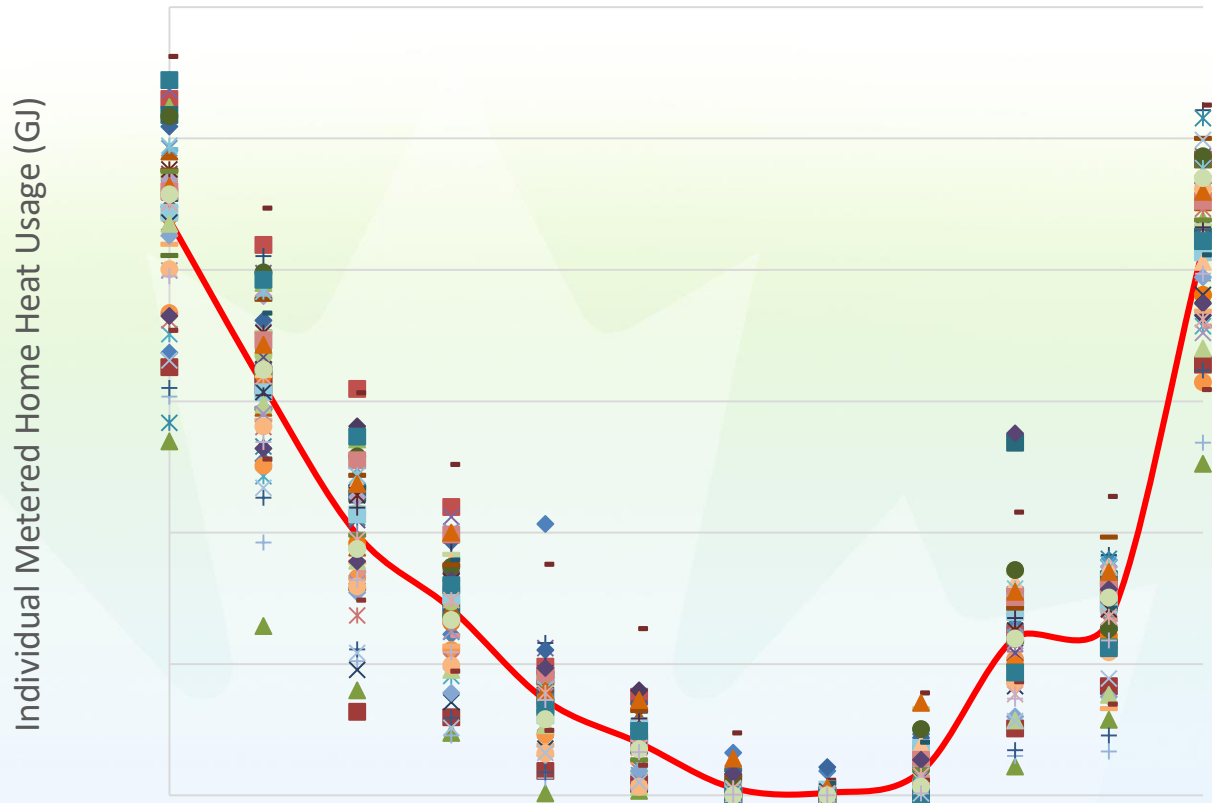


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- Estimated 44.8 GJ/yr
- Measured* 43.2 GJ/yr



*last 5 years

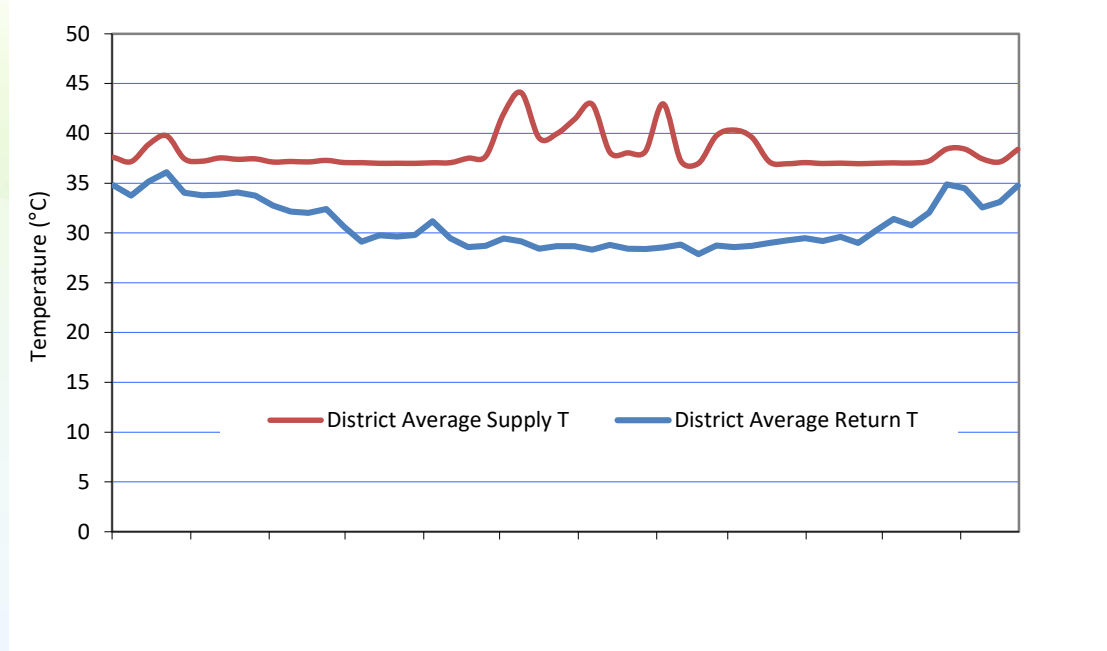
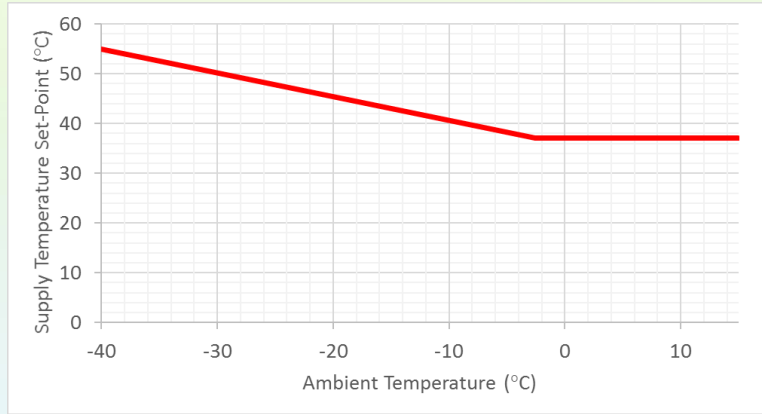
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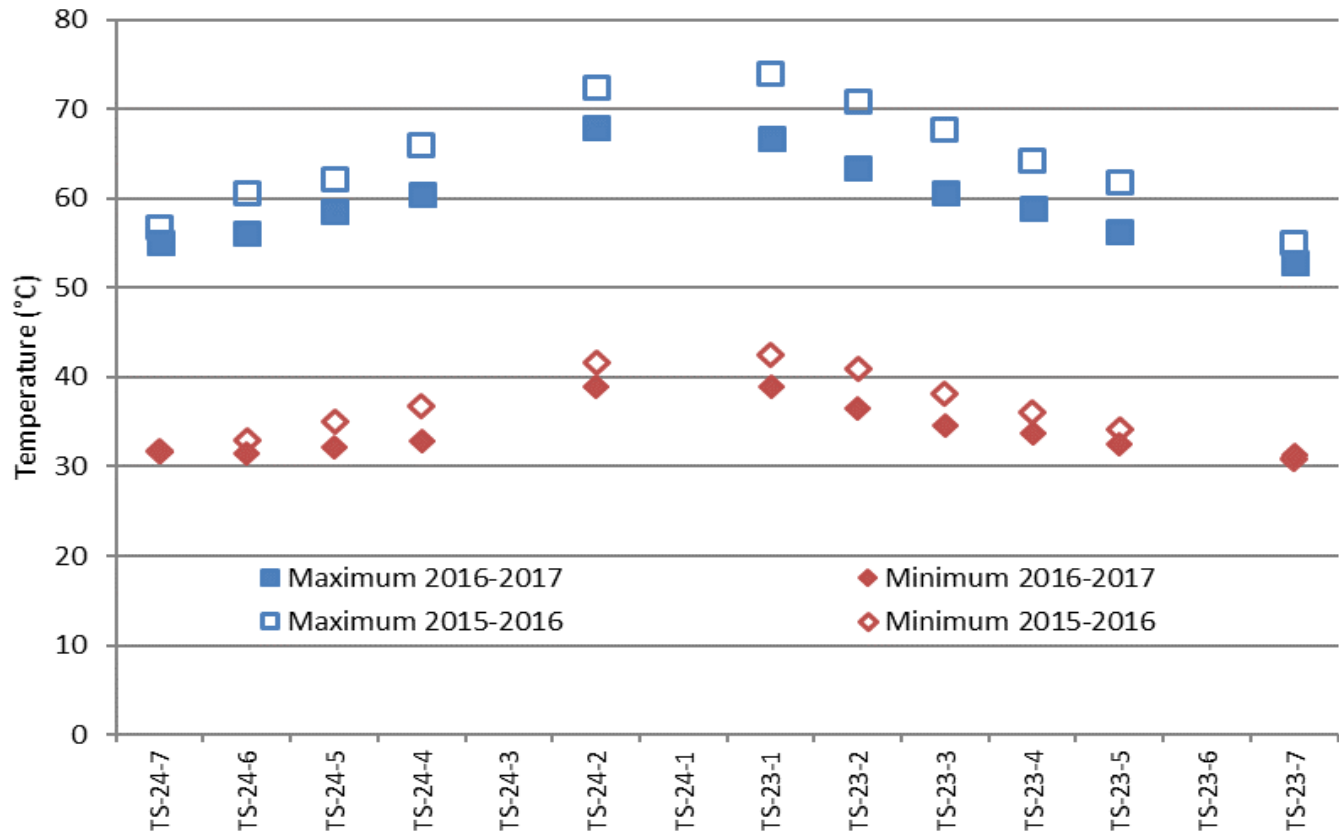
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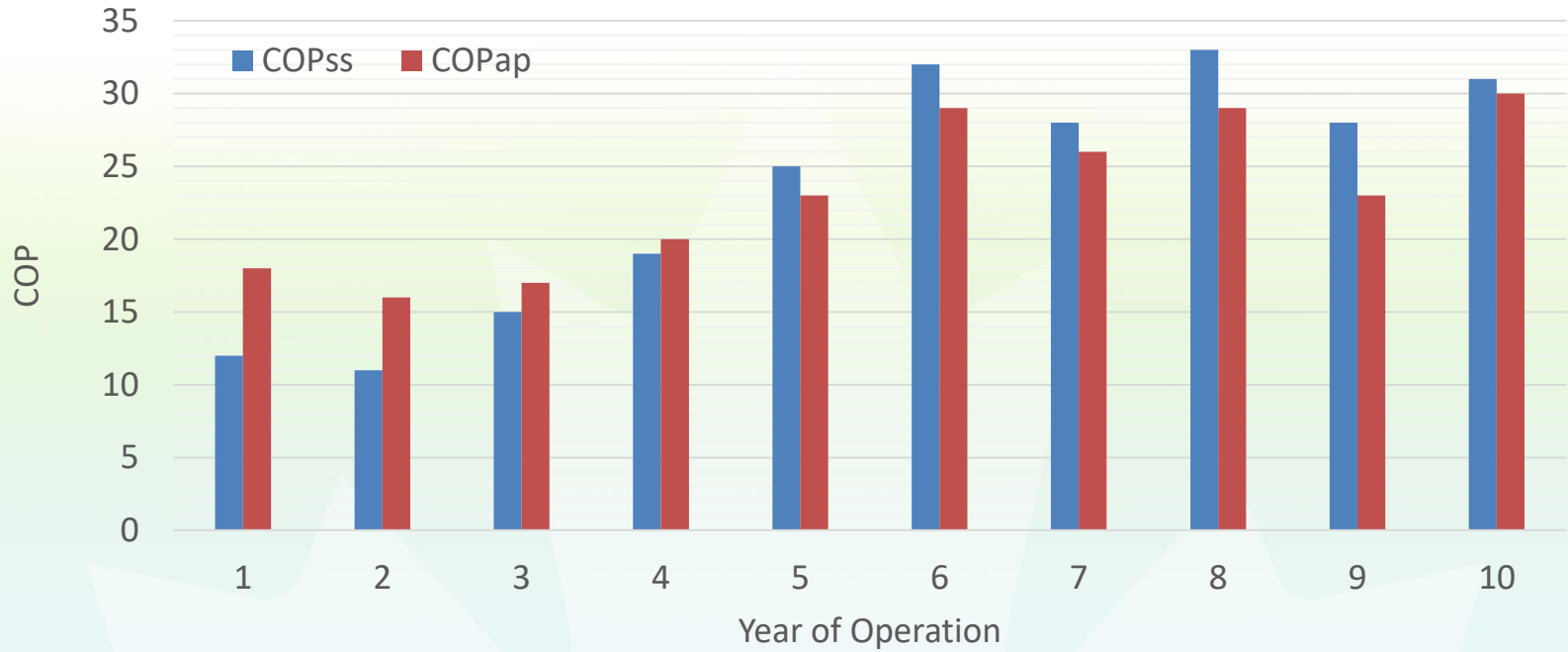
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- $COP_{ss} = (\text{Heat consumed} \times \text{solar fraction}) / (\text{electricity for solar} + \text{storage pumps})$
- $COP_{ap} = (\text{Heat consumed}) / (\text{electricity for all pumps})$
- Pumps offset by PV

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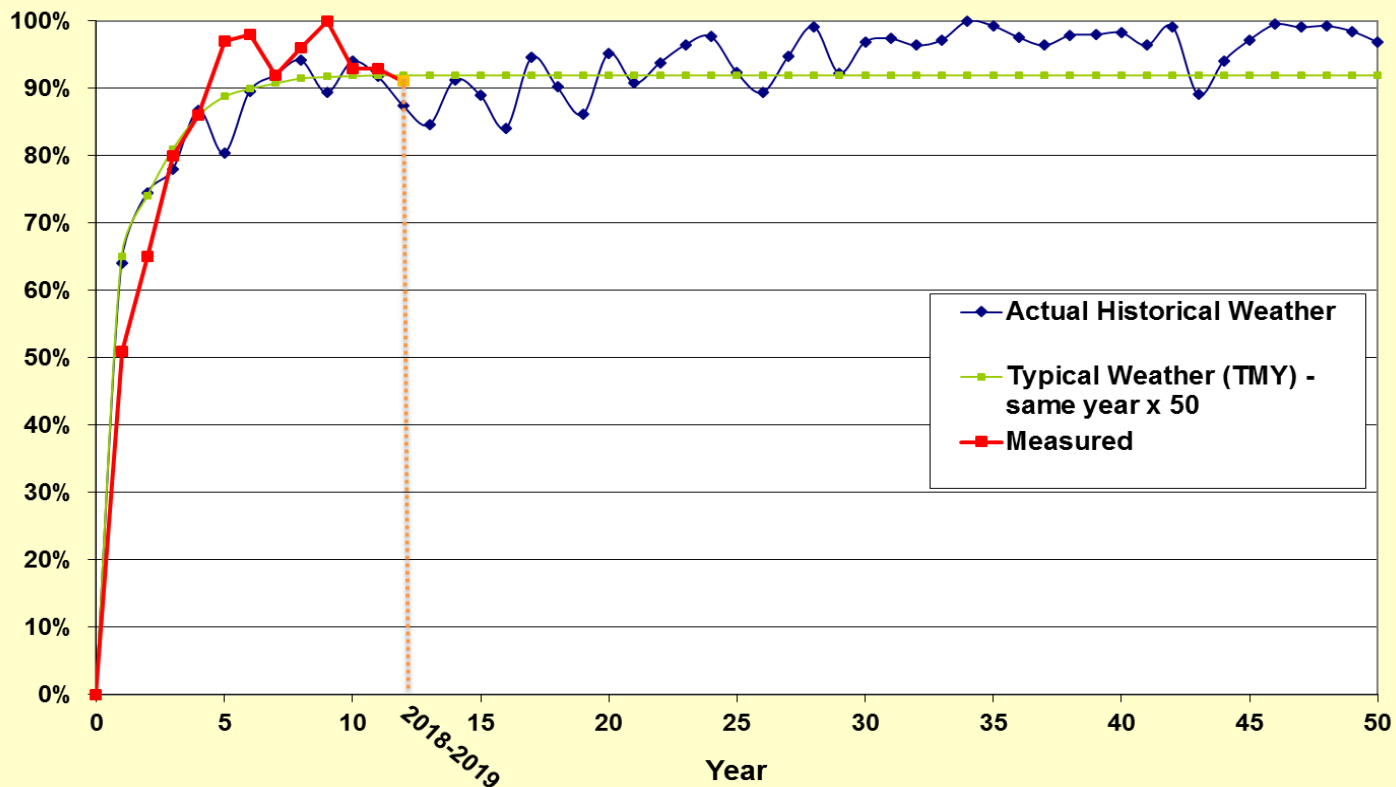
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Solar Fraction - Measured vs Actual and TMY Weather

- Average SF for the last 5 years is 95%
- 100% in 2015/2016 Heating Season



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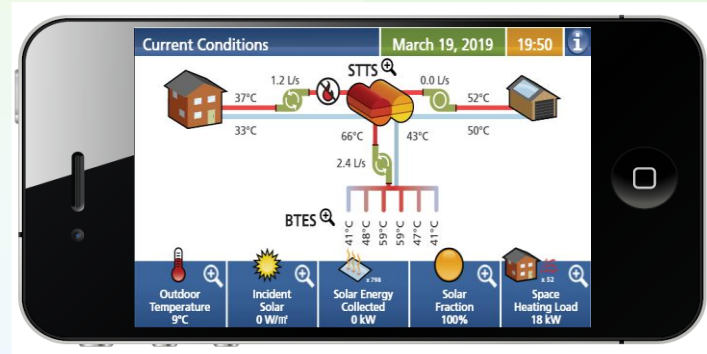
Conclusions and Future Work

- System has operated reliably and has performed as expected and simulated
- Current work: controls fine tuning and predictive controls, model calibration, continuous operation
- Future: larger system (1000+ units), DLSC 2.0



Thank you!

Drake Landing Mobile App (DLSC Dashboard) Visit dlsc.ca or app stores for free download



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