

ELECTRIC THERMAL STORAGE PILOT PROJECT

July 28, 2022

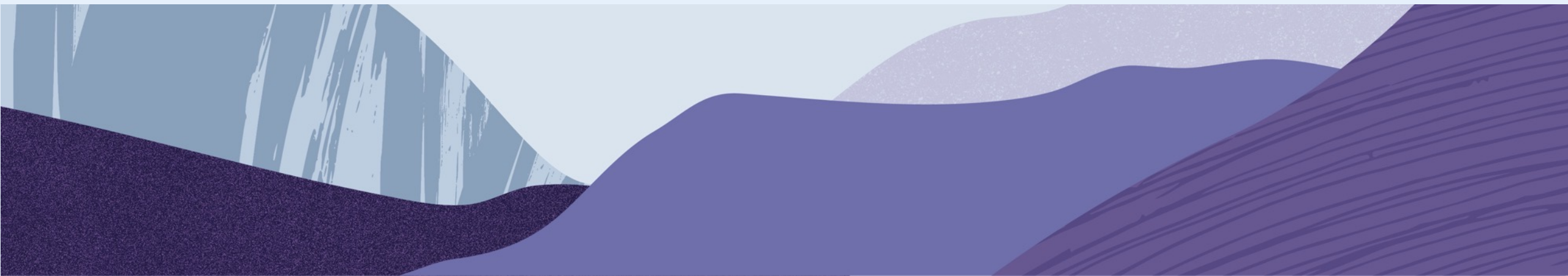
Michael Ross, Patrick Giles
Industrial Research Chair in Northern Energy Innovation





Presentation Overview

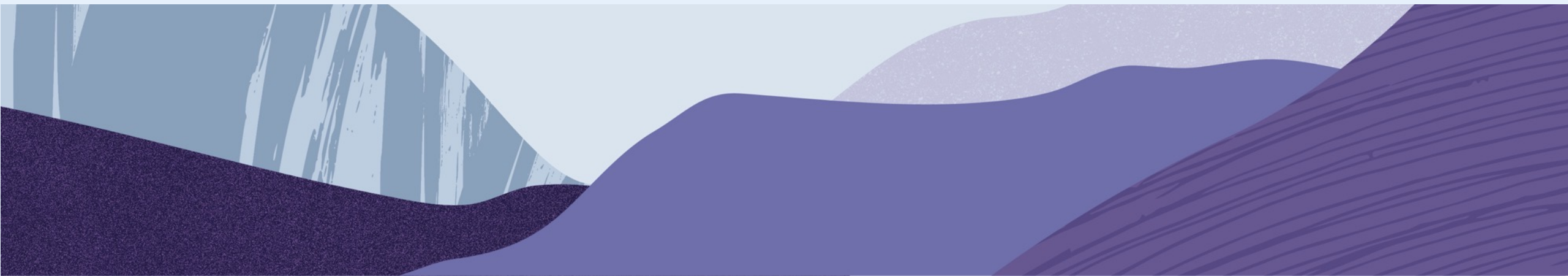
- 1) Project overview
- 2) Preliminary results





Presentation Overview

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Industrial Research Chair mandate and governance



In the north, by the north, for the north

Industrial Partners

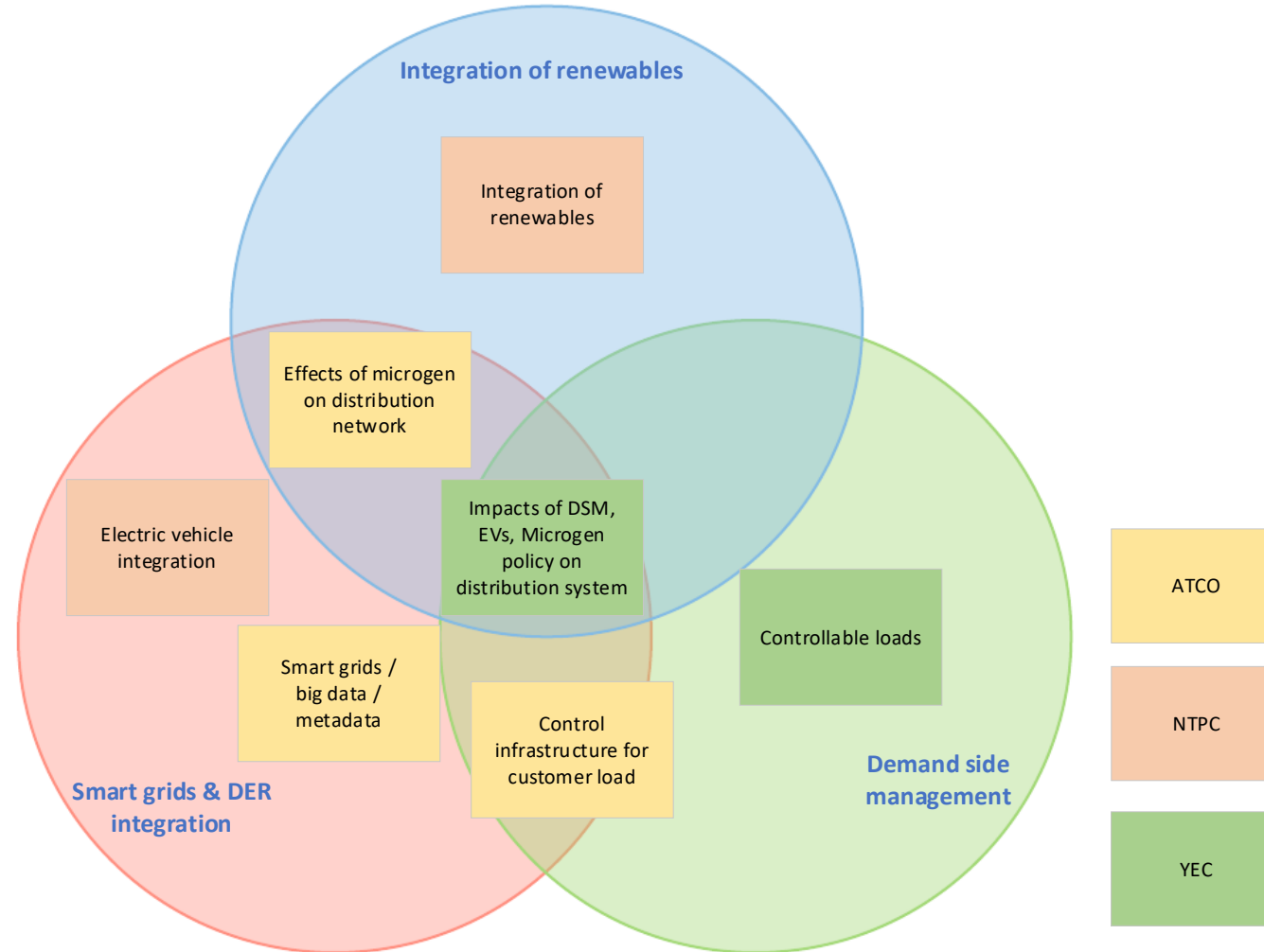


Funding Partners



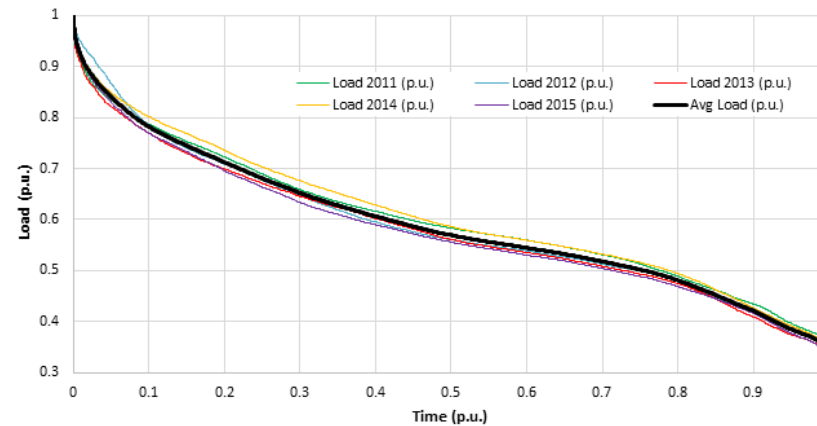
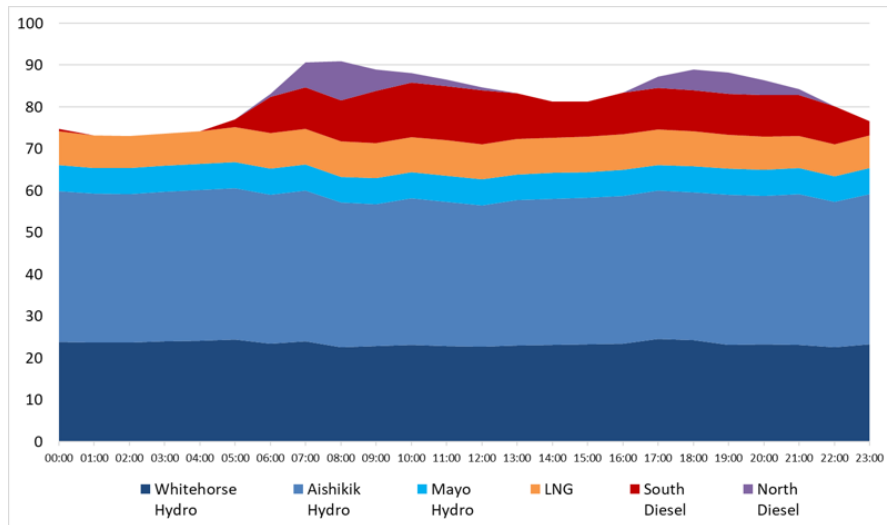
Industry-driven applied research program areas

Northern Energy Innovation research program direction



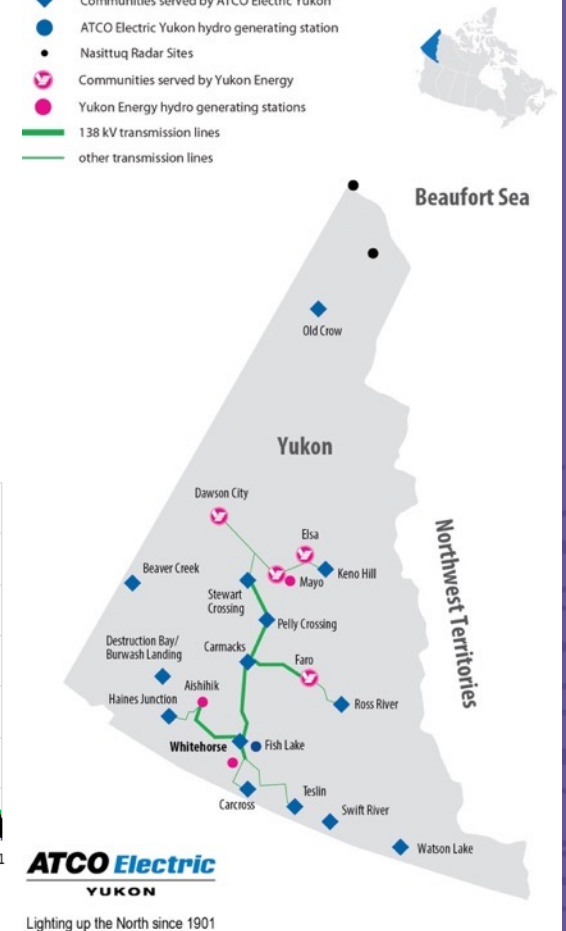
ETS project overview

- Yukon Integrated System (YIS) is disconnected from North American Grid
- Our biggest issue is Capacity during winter peaks, typically met by rented diesel generators
- Yukon Government needs to see 45% GHG emission reduction by 2030



Service areas and facilities

- ◆ Communities served by ATCO Electric Yukon
- ATCO Electric Yukon hydro generating station
- Nasittuq Radar Sites
- ◆ Communities served by Yukon Energy
- ◆ Yukon Energy hydro generating stations
- 138 kV transmission lines
- other transmission lines



Security and GHG issues with peak capacity

CBC MENU Beijing 2022

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North

Yukon Energy eyes more diesel generators to meet winter demand

f t e r in

Utility plans to rent 17 generators this year at a cost of \$4.1M

Chris Windeyer · CBC News · Posted: Oct 09, 2020 2:13 PM CT | Last Updated: October 9, 2020



Ranj Pillai, Yukon's minister of Economic Development and minister of Energy, Mines, and Resources, speaks with reporters in November 2019. The Yukon government is pushing to get more renewable power online, but until then, it will have to rely on diesel generators. (Chris Windeyer/CBC)

12 comments

Yukon Energy will rely on nearly twice as many diesel generators compared to last year to meet

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North

Yukon Energy's fuel supply reached 'critical' point last winter, says energy minister

f t e r in

Avalanche cut off fuel supply road from Skagway, Alaska, in January

CBC News · Posted: Oct 15, 2020 7:00 AM CT | Last Updated: October 15, 2020



A diesel generator at Yukon Energy's Whitehorse facility. Yukon had a scarce supply of fuel after an avalanche last January, confirmed the energy minister on Wednesday. (Mike Rudyk/CBC)

2 comments

Yukon's power supplier faced a possible fuel shortage for its backup diesel generators last winter after an avalanche cut off the supply road from Skagway, Alaska, in January, according to



Our Clean Future

A Yukon strategy for climate change, energy and a green economy

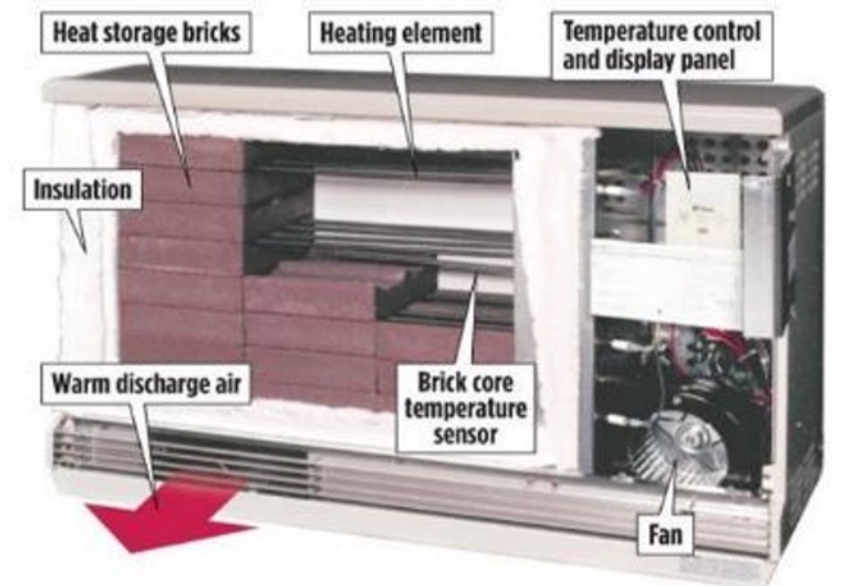
Draft for public review
November 2019



Potential to use electric thermal storage

- Electric heat that doesn't add to the winter peak
 - Replaces fossil-fuel based heating and/or electric baseboard heating
- Utility controlled, "smart charging" based on previous day, or timer based

ETS Systems	Heating Type
Steffes room unit, ECOMBI space heater	Ambient baseboard/space heating
Steffes central furnace	Heat distributed through ductwork/vents
Steffes hydronic unit	Hydronic heating



Source: Steffes Heating Systems

STAFF GRAPHIC | JEFF WOODBURY

Research questions and partners

10 High priority research questions

How effective are ETS units at reducing the Yukon's winter peak?

What regulatory or infrastructure changes would need to be made for adoption and wide implementation in the Yukon?

How effective are ETS units as controllable, predictable, dispatchable resources?

What is the best ETS control approach for peak reduction without producing a secondary peak?

Will occupants experience a disruption in their comfort levels?

What would the GHG emission reduction be from ETS implementation, and what would the heating fuel usage reduction be?

How would wide-spread ETS implementation affect residential load power factor/quality?

Can ETS help mitigate the black start load of the system by delaying when it charges after a power outage?

What is the added value of controlling the ETS units in aggregate?

What are the value streams for integrating ETS units in diesel-powered communities?

~45 participants

High priority questions

Mandatory question for NRCan funding

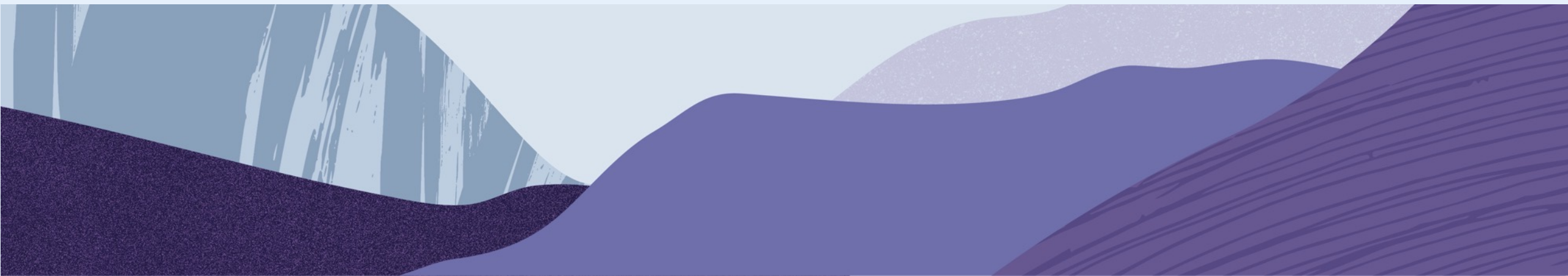
Parallel/sub questions of the high priority set





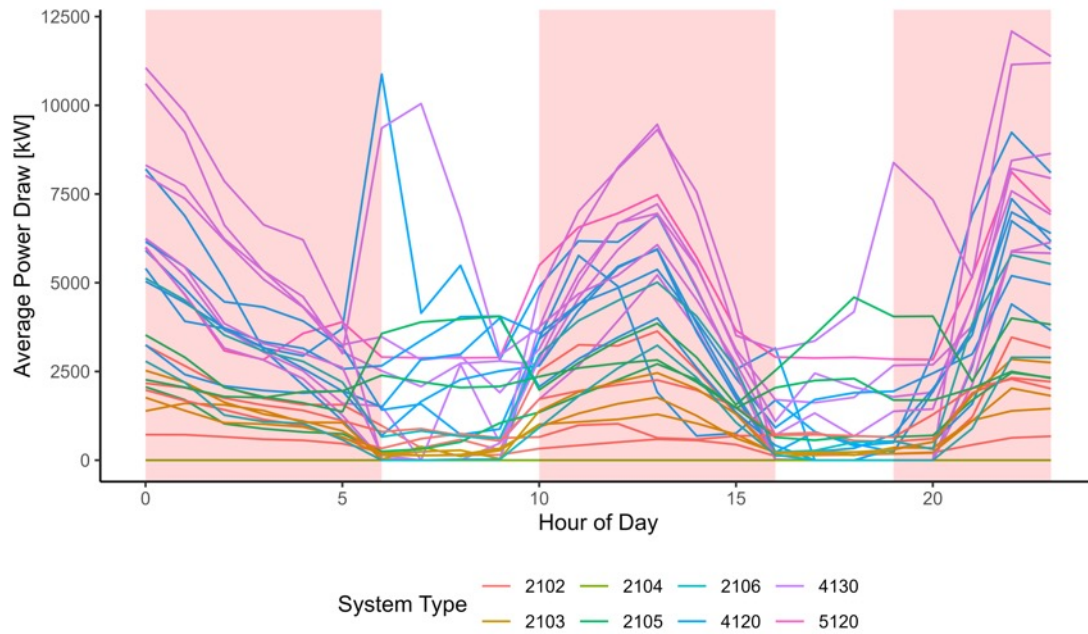
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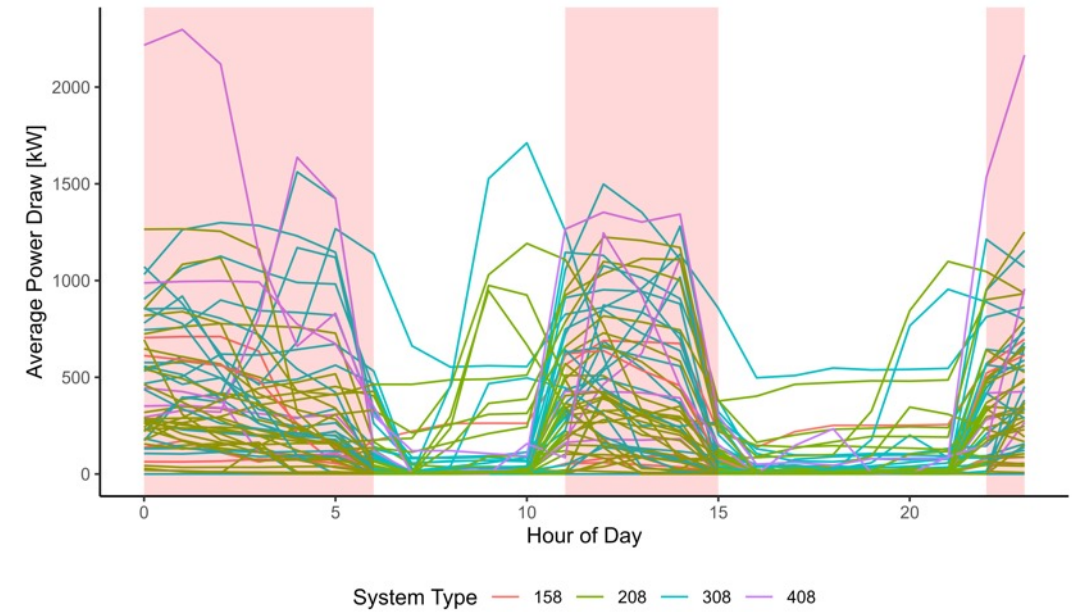


Charging profiles

Steffes centralized forced air units



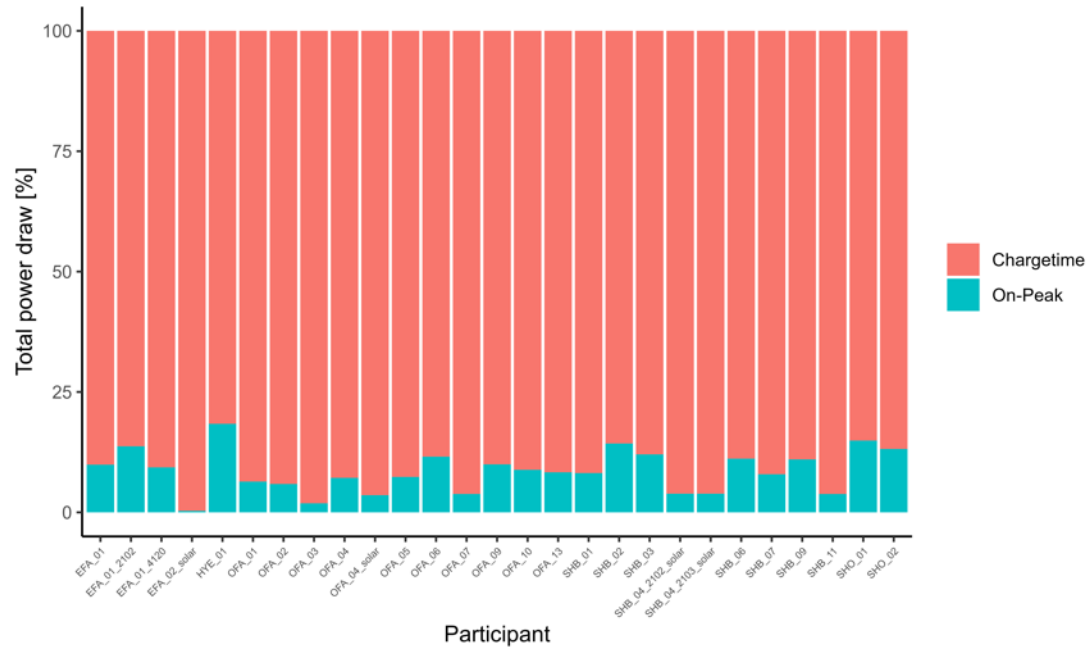
ECOMBI room-based units



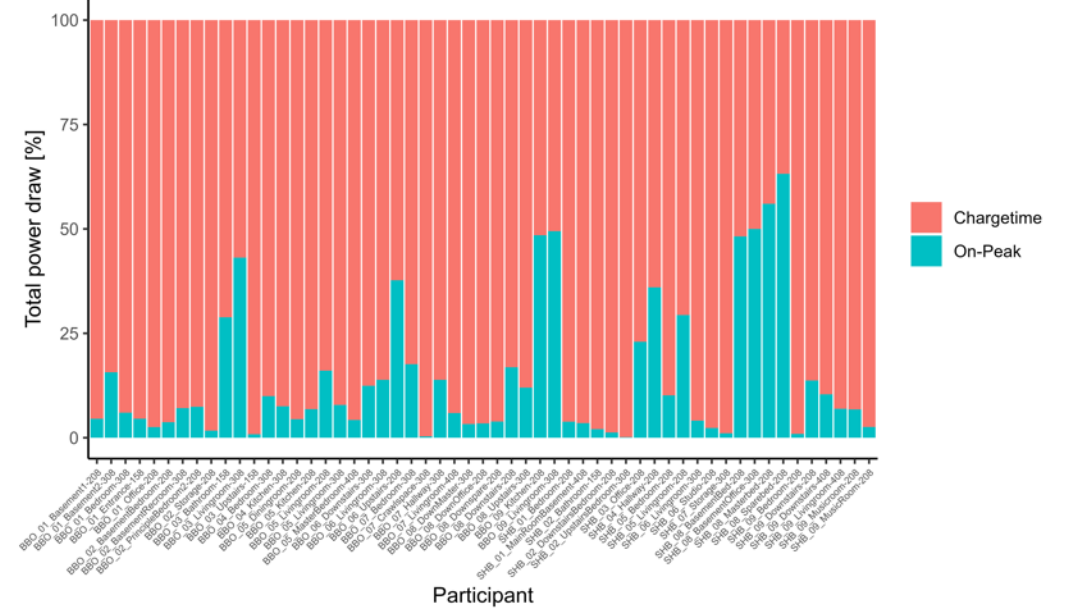
- Pink = off-peak, white = on peak

Charging profiles

Steffes centralized forced air units



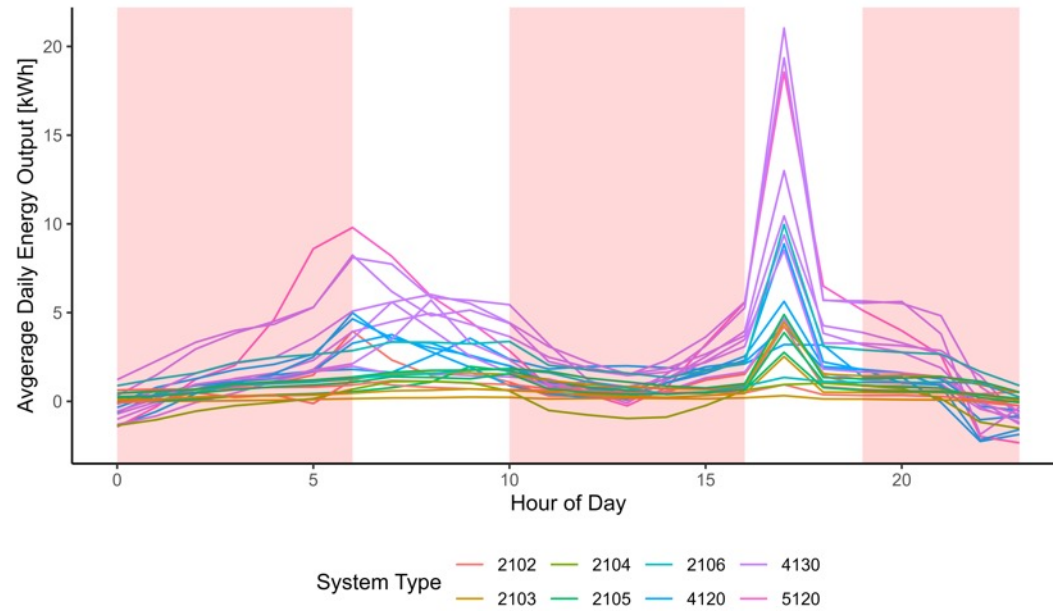
ECOMBI room-based units



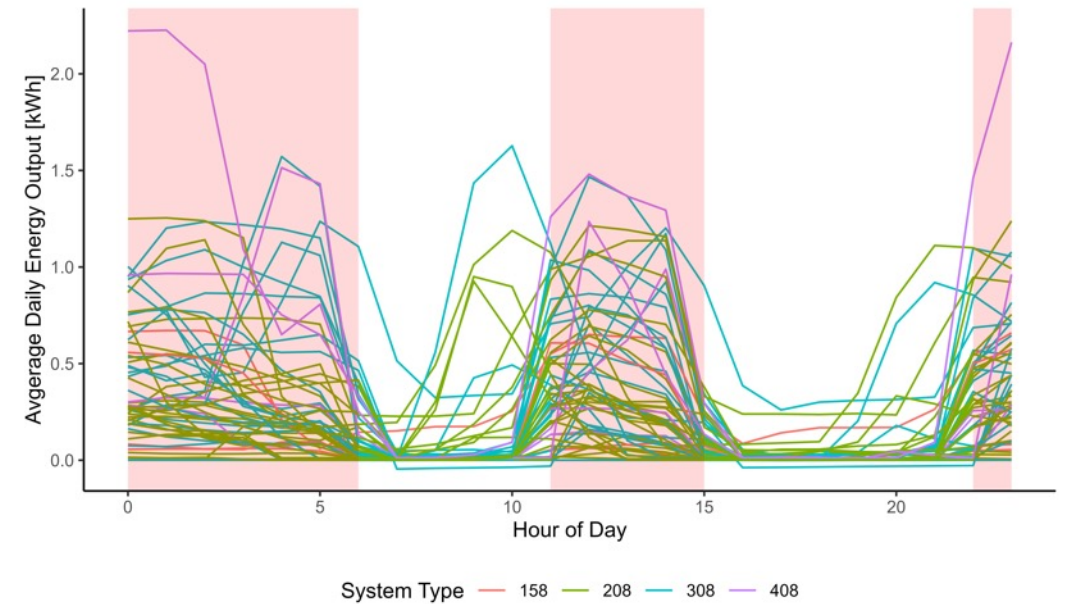
- Bar plot of total distribution of power draw across set charging times

Discharging profiles

Steffes centralized forced air units



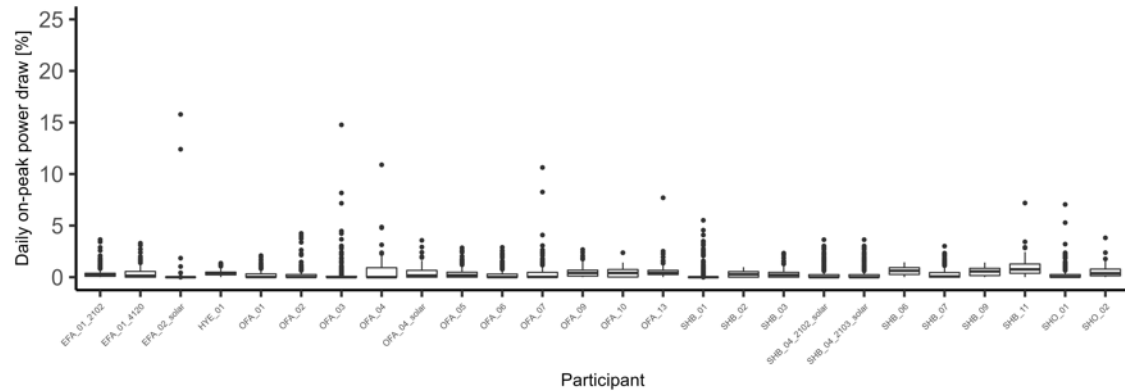
ECOMBI room-based units



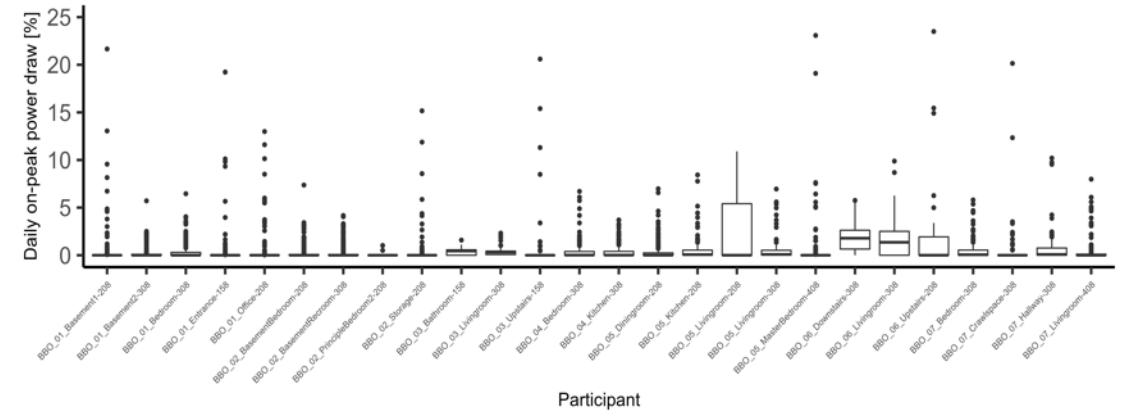
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Boxplots of on-peak charging percentage profiles

Steffes centralized forced air units

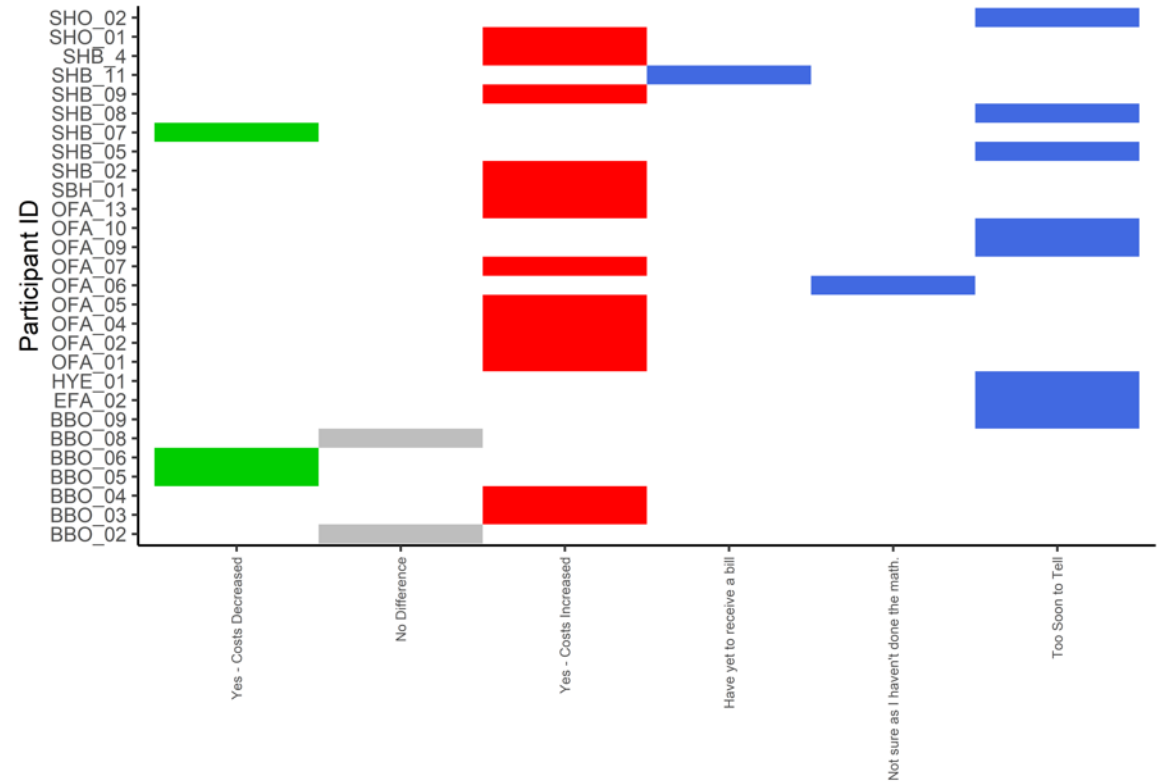
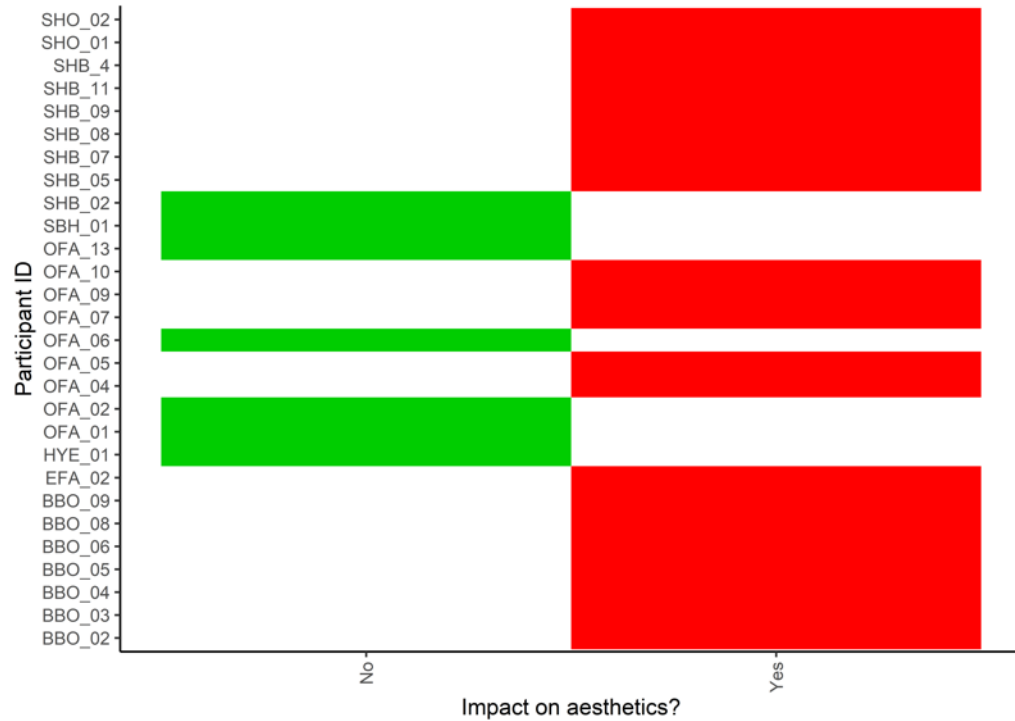


ECOMBI room-based units

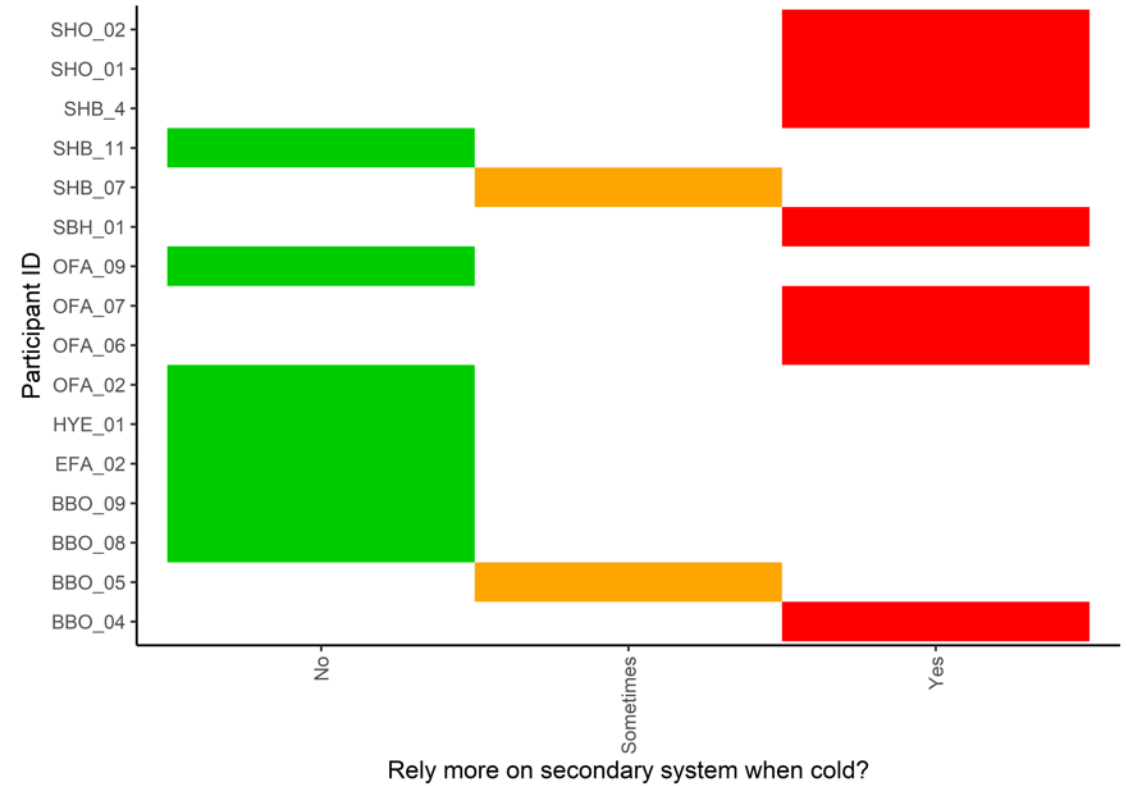
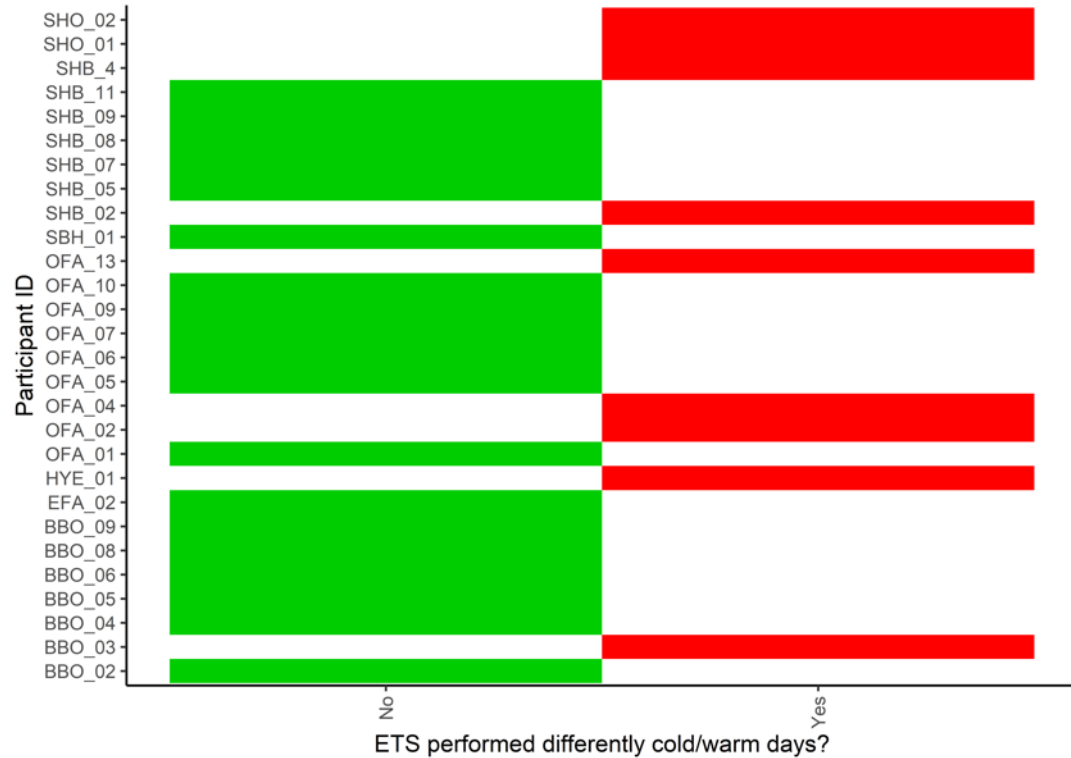


- Lower = better
- More variability and higher charging with room-based units

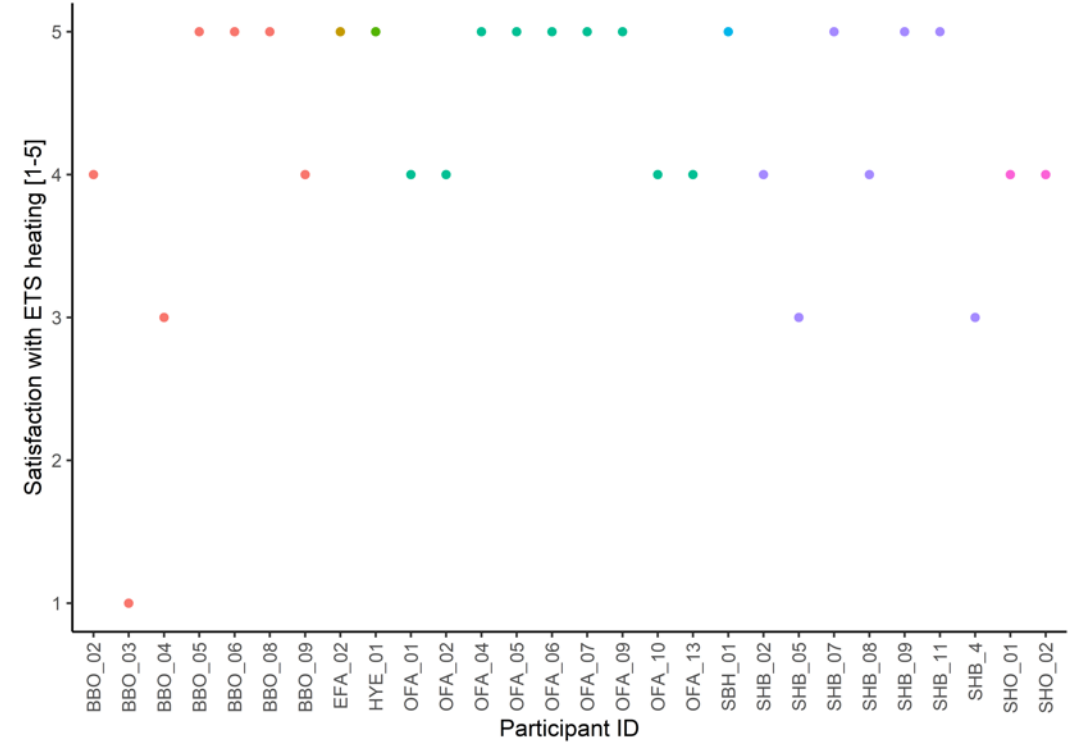
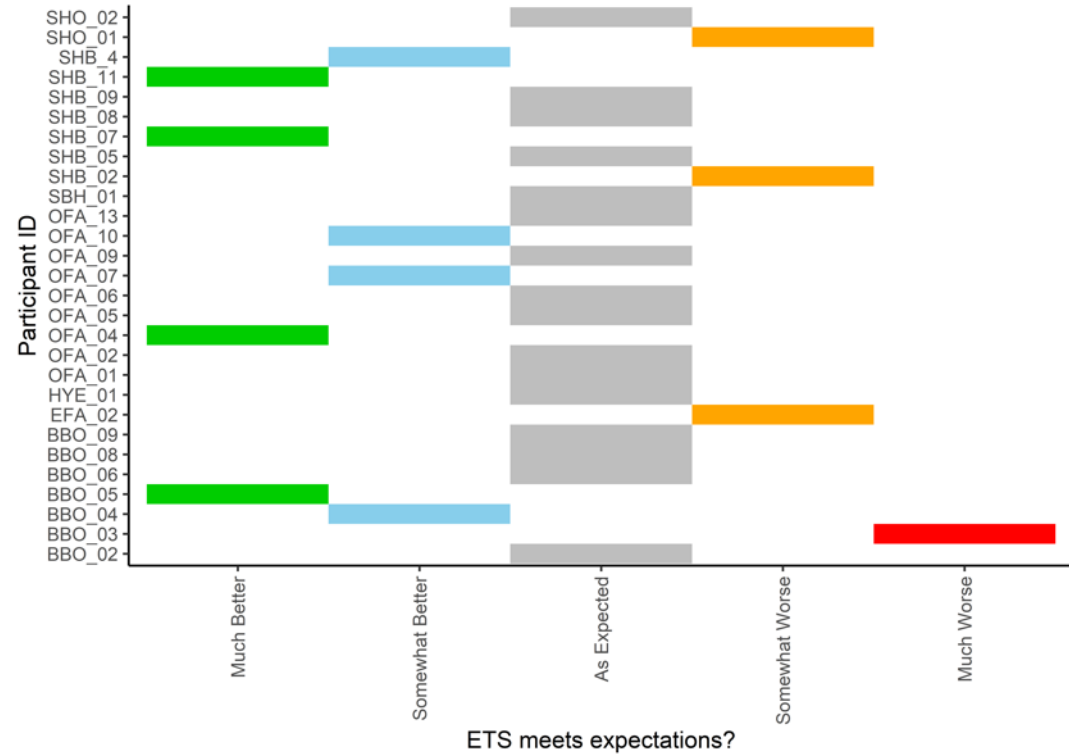
Qualitative results - living



Qualitative results - performance



Qualitative results - satisfaction





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