Decarbonization of Affordable Multifamily Housing

Application of high-efficiency monoblock heat pumps

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Project Overview

- Developing customer-centric approaches to decarbonization retrofits with Integrated Demand-Side Management
- California Energy Commission (CEC) EPC 15-053
- Project Partners:
  - LINC Housing (Affordable Housing Provider)
  - Pacific Gas and Electric (Utility)
  - Innova (Technology Provider)

Objectives

- Understand the efficacy of packages of envelope, electrification, and on-site renewable measures on decarbonization in affordable multifamily housing
- Develop an understanding of the impact of measures on various stakeholders including community residents, affordable housing developers, electric & gas utilities, and policy makers

Host Site Information

- Pleasant View at Fresno, CA is a 60-unit master-metered affordable housing community with 1, 2, 3, and 4 BR units
- Each unit had individual swamp cooler and gas furnace

Retrofit Challenges

- Distribution infrastructure upgrades required to electrify space conditioning (w/mini-splits) and water-heating
- 120V window heat pumps were used along with centralized CO2 water heaters

120V Inverter Driven Wall Mounted Heat Pumps

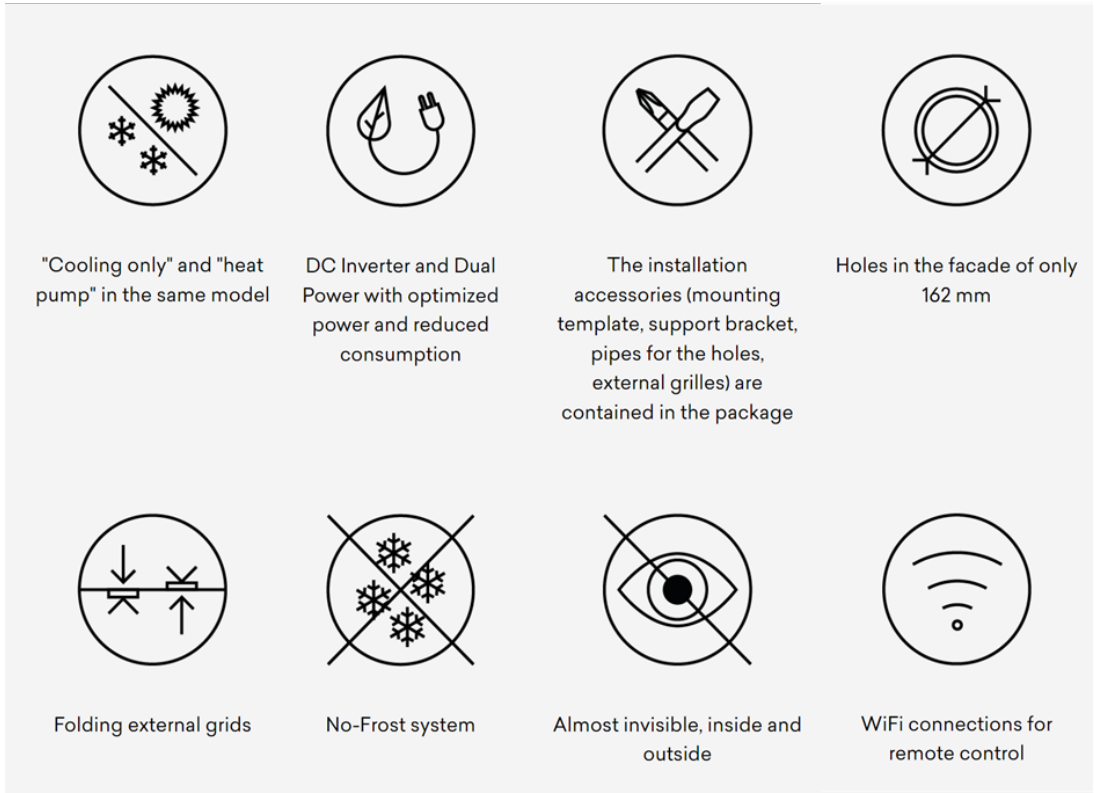
Innova

- Monoblock form factor for easy install
- No outdoor units
- R-32 refrigerant
- Aesthetically appealing design
- Requires 2 small holes in wall (~6 in)

https://www.innovaenergie.com/en/products/air-conditioning-without-outdoor-unit/2.0-verticale/

https://www.gradientcomfort.com/

Technology Specifications



..2.0 10 HP DC Inverter

WiFi connectivity

Nominal heat power A 7 °C / A 20 °C 2,08 kW
Nominal cooling power A 35 °C / A 27 °C 2,09 kW
Efficiency class A+

Indoor unit dimension ↔ 1010 mm ↕ 549 mm ⤢ 165 mm

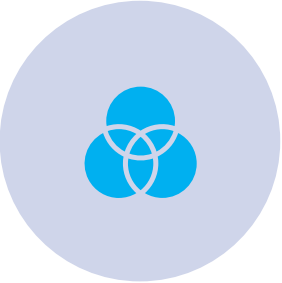
https://www.innovaenergie.com/en/products/air-conditioning-without-outdoor-unit/2.0-verticale/

Fresno Field Demonstration – Research Questions

How do Innova Heat Pumps perform relative to swamp coolers and gas wall furnaces?

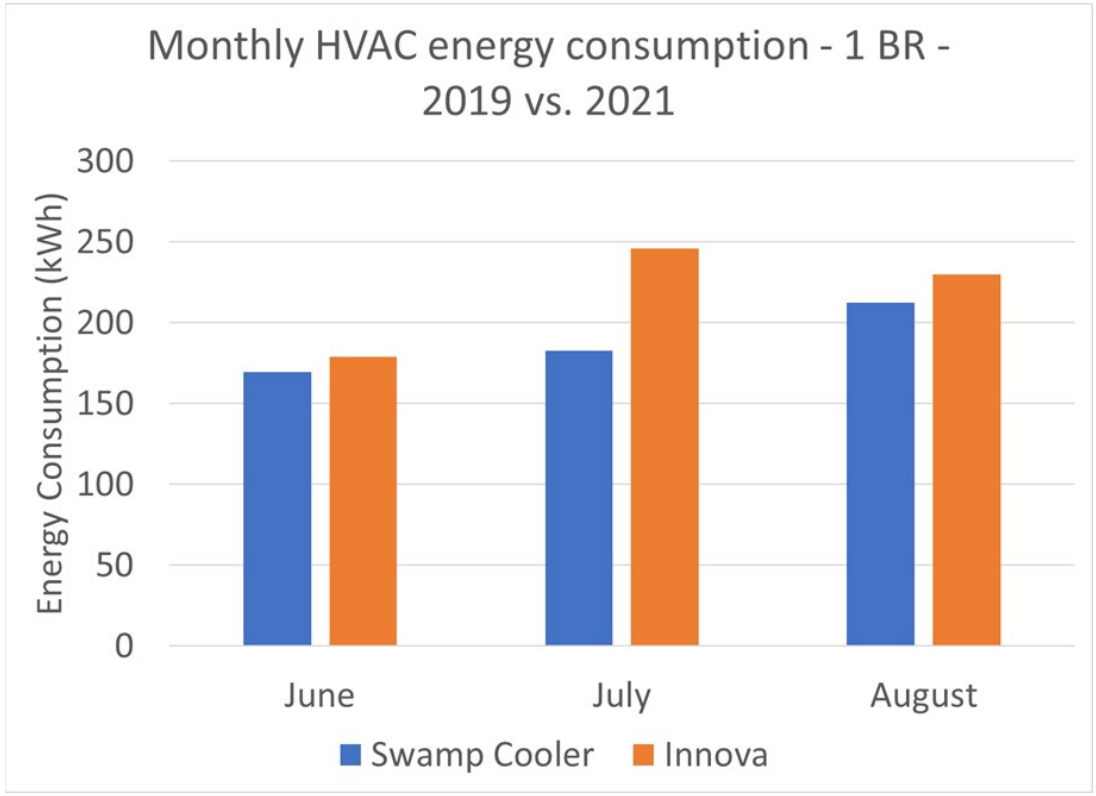
What is the HVAC load shape as a result of Innova Heat Pumps?

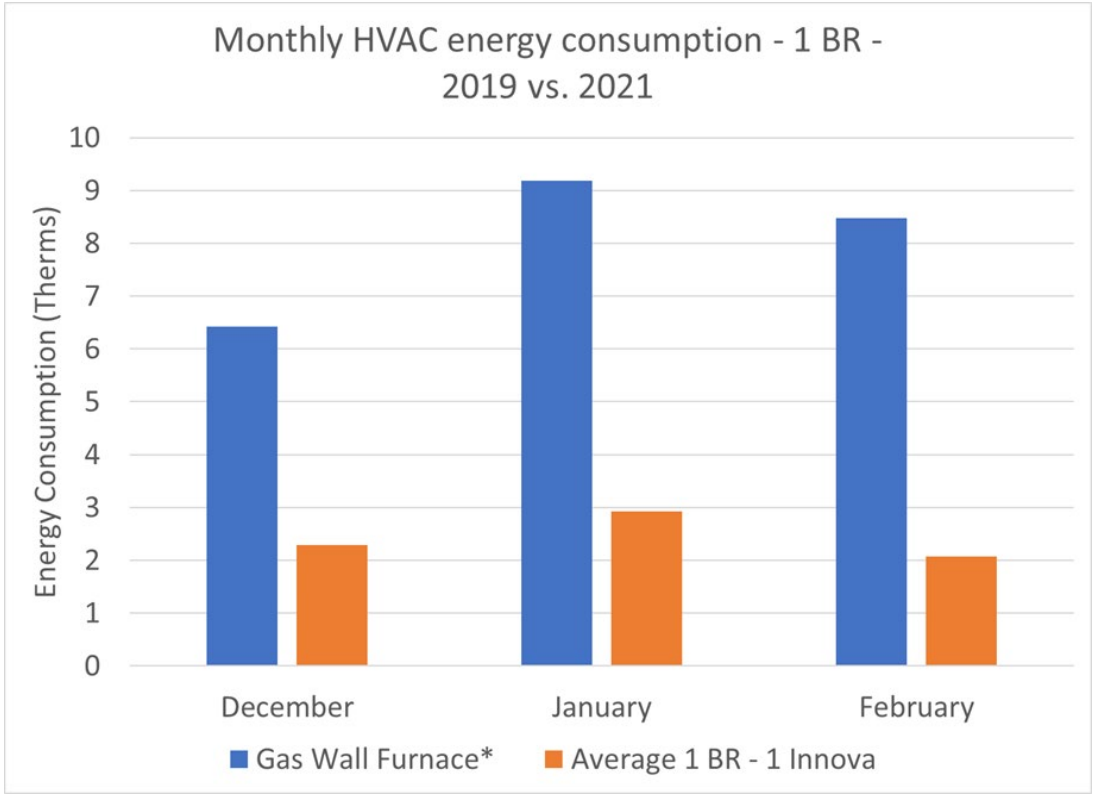
Are multiple Innova heat pumps per living unit a significant concern for the building's electrical capacity?



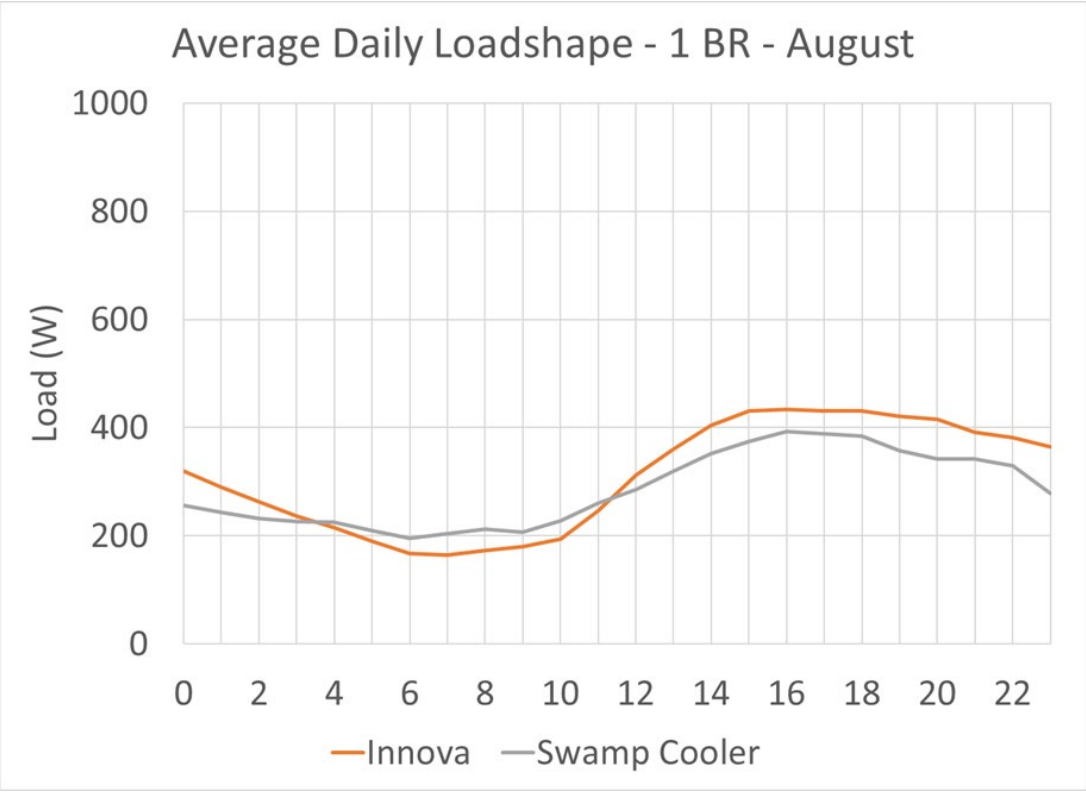
How are Innova units in different rooms used differently?

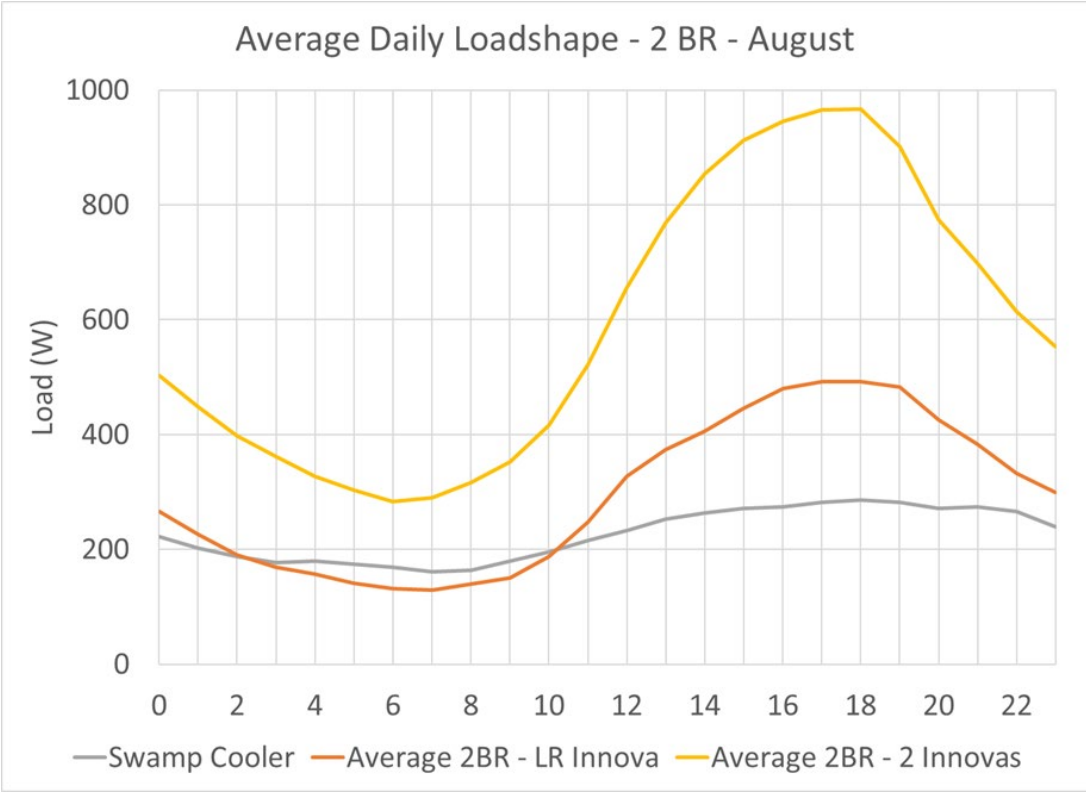
Energy Performance Comparison to Swamp Cooler – 1 BR



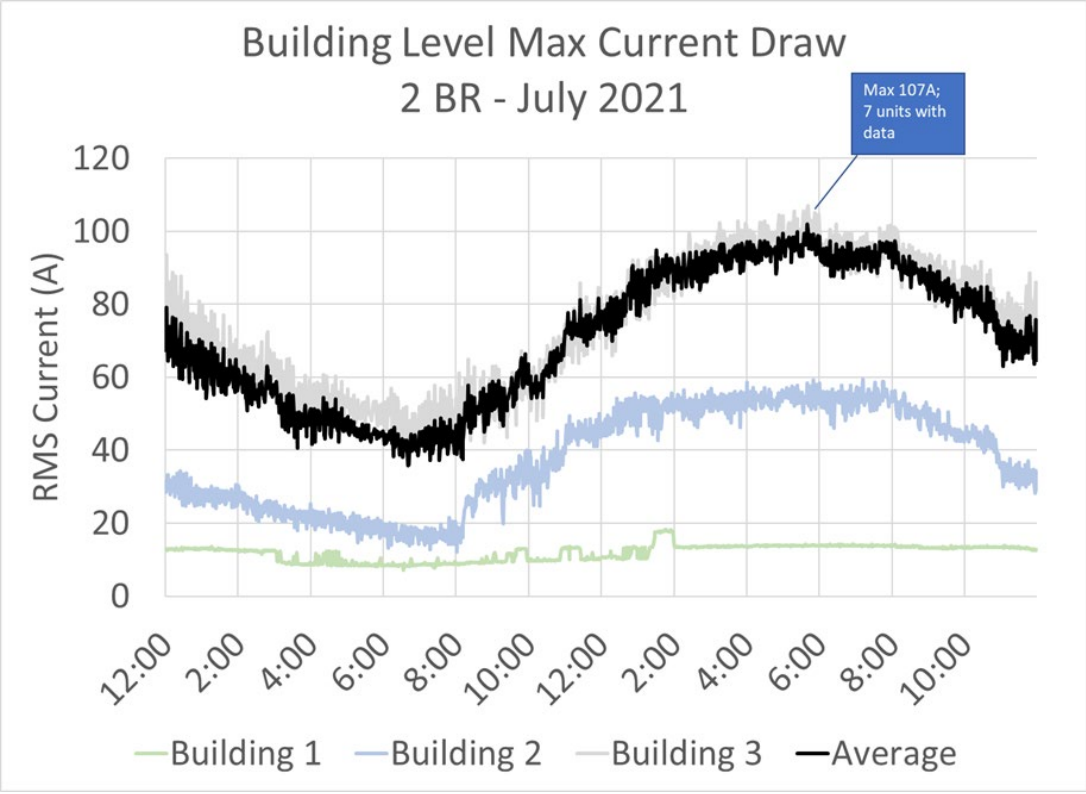


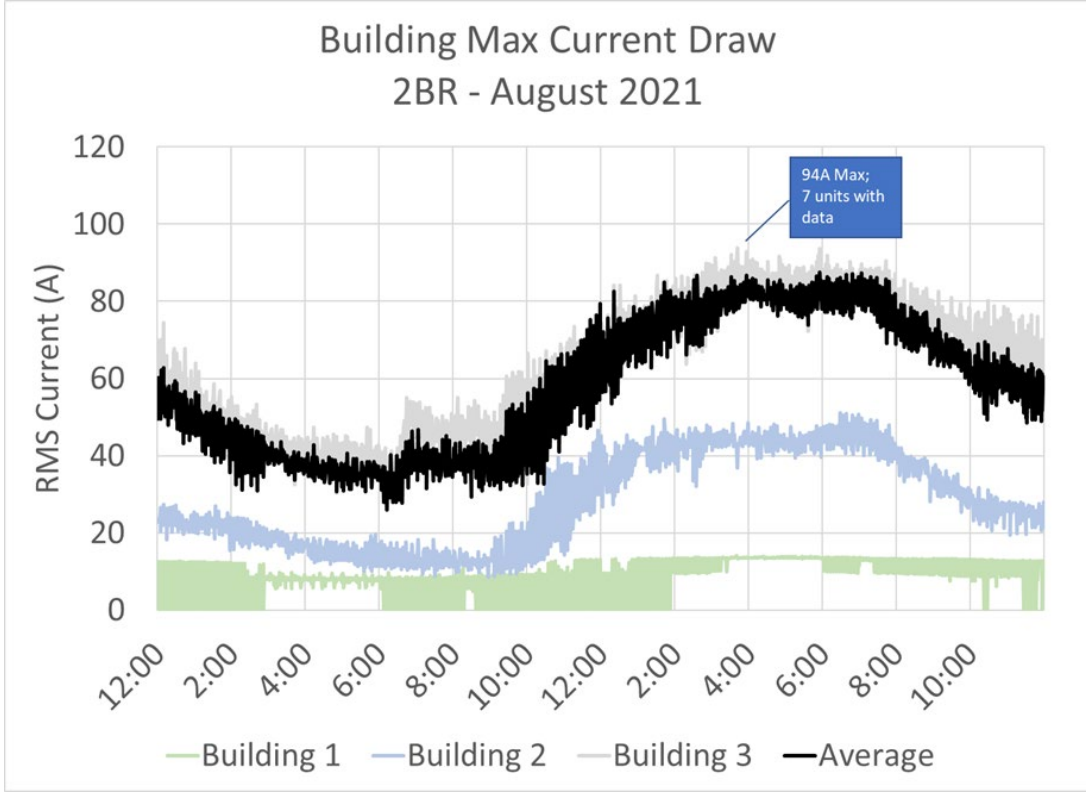
Load Shape Comparison to Swamp Cooler – 1 BR & 2 BR



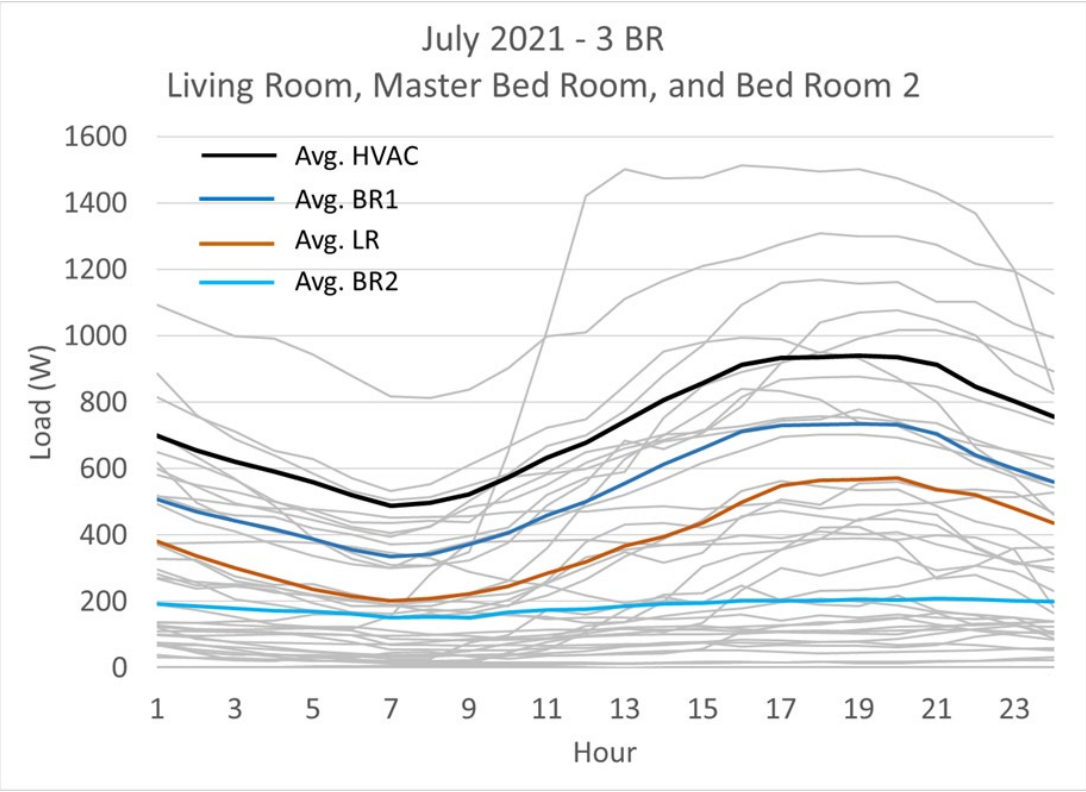


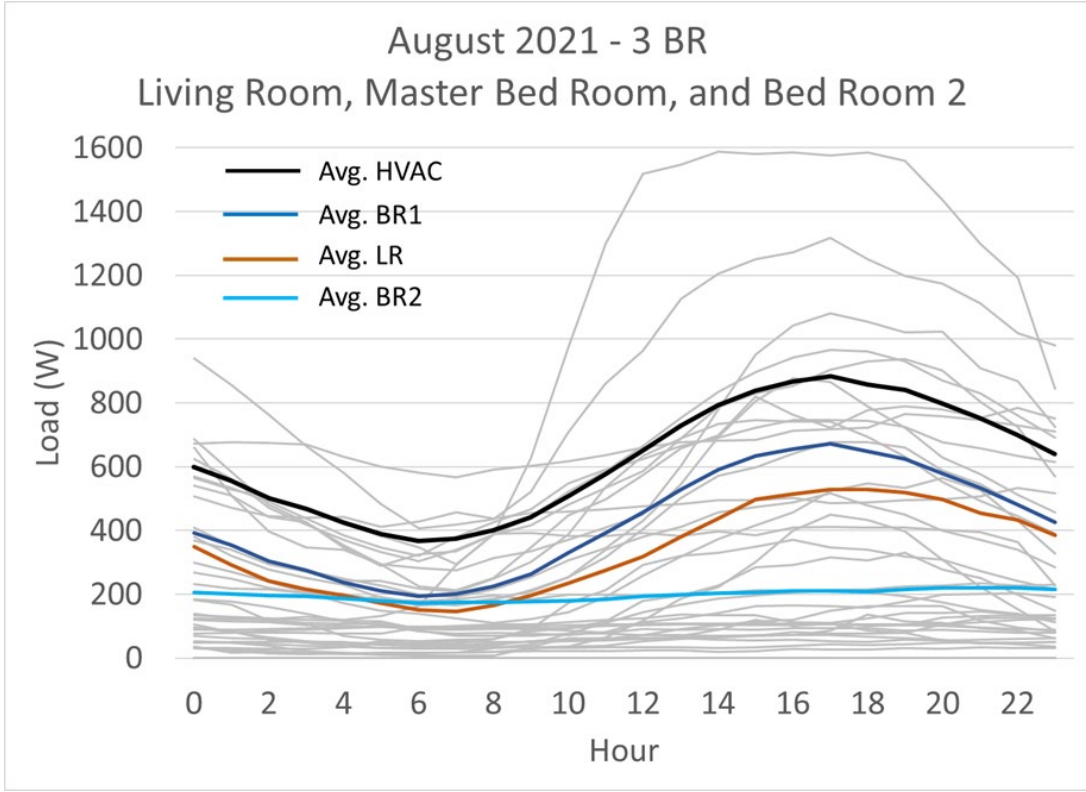
Is coincident use of multiple Innova units a cause for concern?



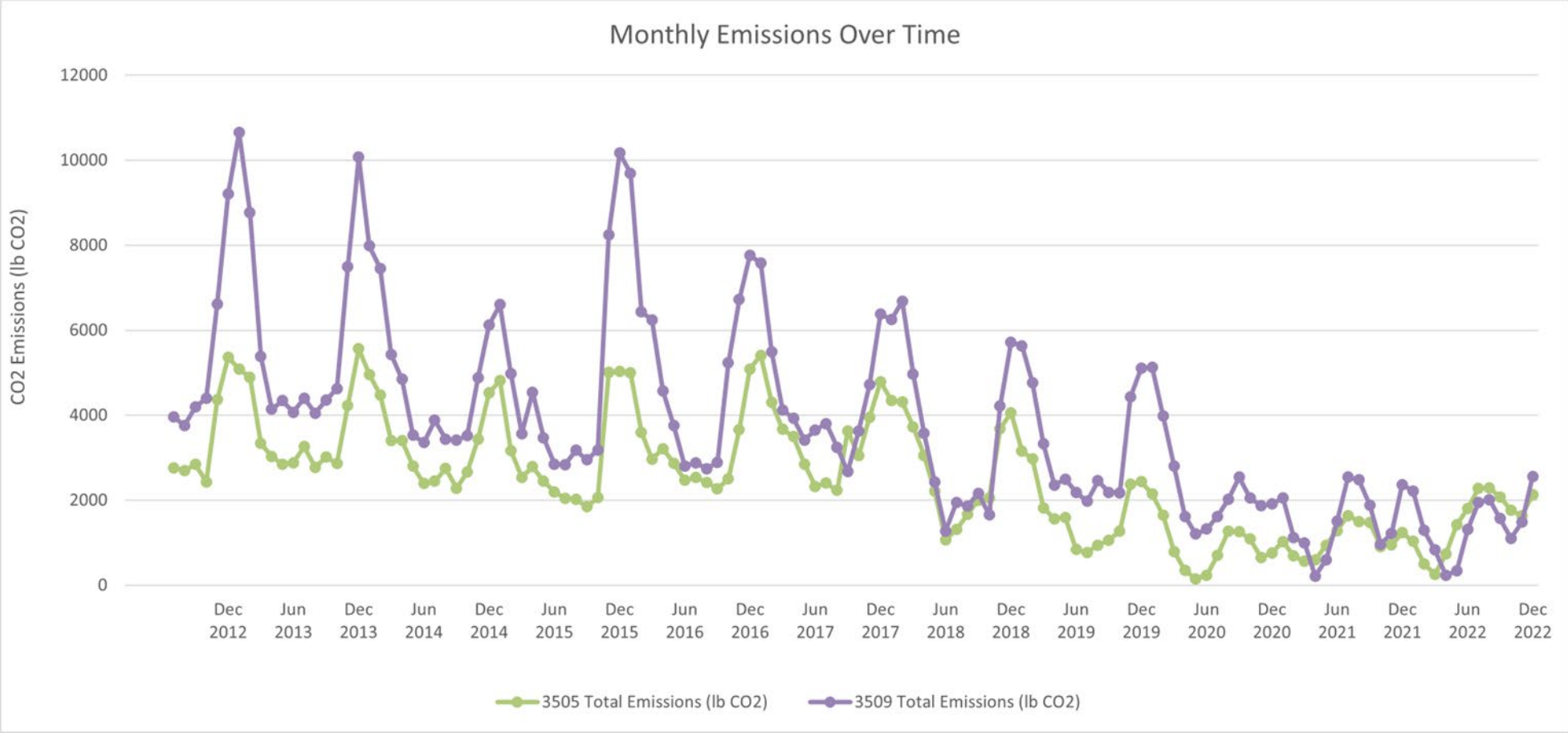


How does use of Innova vary between different rooms?





Overall GHG Emissions Reductions



Observations and Recommendations

The results indicate the potential for Innova to be a viable solution for retrofits in affordable housing given the significant reduction in winter energy consumption compared to moderate increases in summer.

There were a few cases where high overall usage (arising from low thermostat set points) caused maintenance issues. The product supports a “hoteling” mode that can help prevent extreme set points from causing maintenance issues especially in master-metered facilities

With a peak usage around 700W and an average around 400W, there is about 300W in flexibility potential per unit provided a suitable controls platform is available to aggregate and implement demand side flexibility measures for TOU management and/or demand response.