BENEFICIAL AND EQUITABLE ELECTRIFICATION

ACEP
Alaska Center for Energy and Power
acep.uaf.edu

The ARCTIC program is an initiative supported by the Office of Naval Research (ONR) Award # N00014-18-S-B001.

UAF UNIVERSITY OF ALASKA FAIRBANKS

Harnessing local, sustainable, and cost-effective energy resources to electrify energy loads such as transportation and heating.

Behavioral and Socio-Economic Adoption Factors

Microgrids and Cold Regions

Outreach and Engagement

Costs and Performance

projects and reports at:
https://acep.uaf.edu/projects-(collection)/bee.aspx

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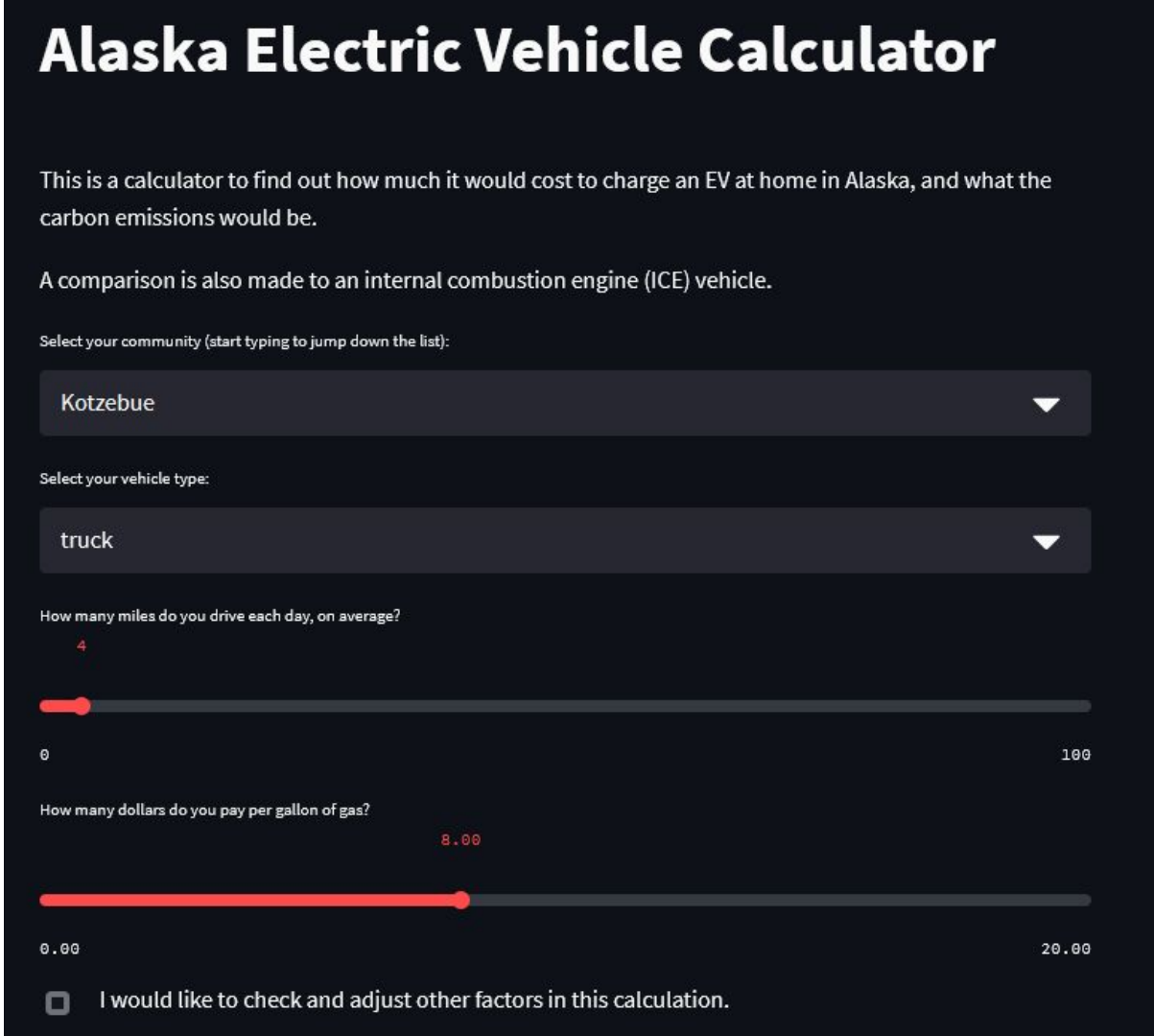
Tinyurl.com/AKEVCalc

User Input

- Community
- Vehicle type
- Daily mileage
- Price of gas

Advanced:

- Utility info (rate/emissions)
- Vehicle efficiency
- Home solar
- Block heater use and idling for gas vehicle
- Garage/temperature
- Weekend mileage



Total cost of Electric Vehicle fuel per year = $ 397.0

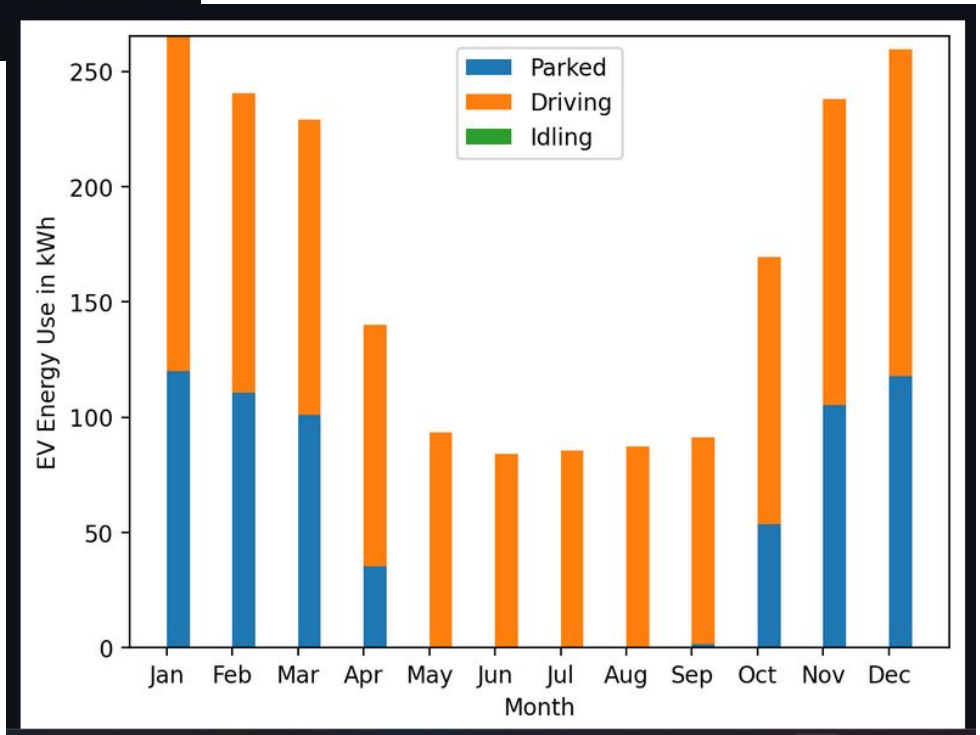
Total cost of Internal Combustion Engine (gas) fuel per year = $ 646.0

Total kg CO2 emissions of Electric Vehicle per year = 683.0

Total kg CO2 emissions of Internal Combustion Engine per year = 1428.0

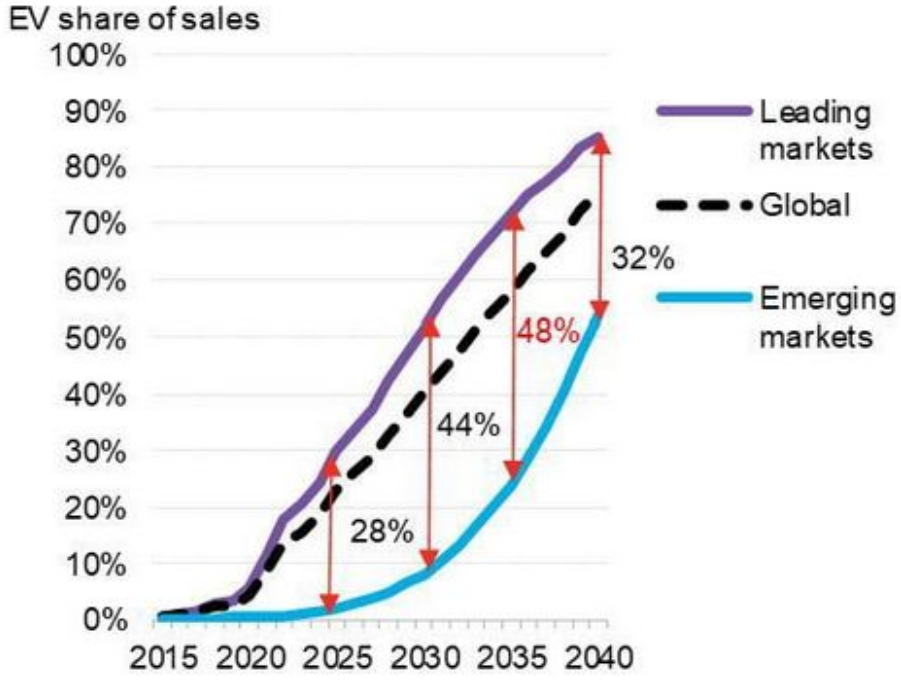
Output

- Cost comparison
- Climate emissions comparison
- Monthly electricity use for EV

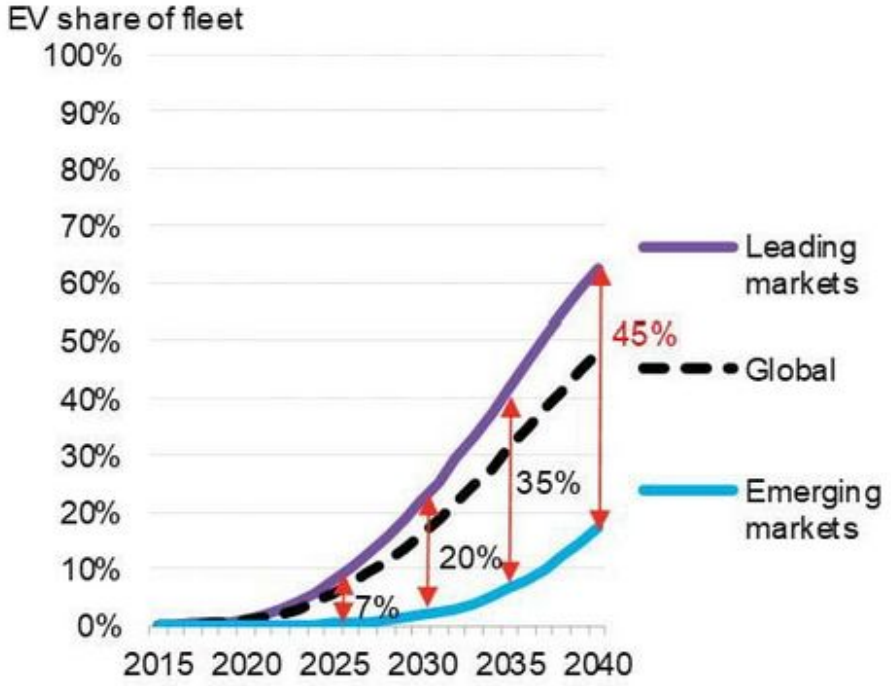


Opportunity?

Passenger EV share of sales – Economic Transition Scenario



Passenger EV share of fleet – Economic Transition Scenario

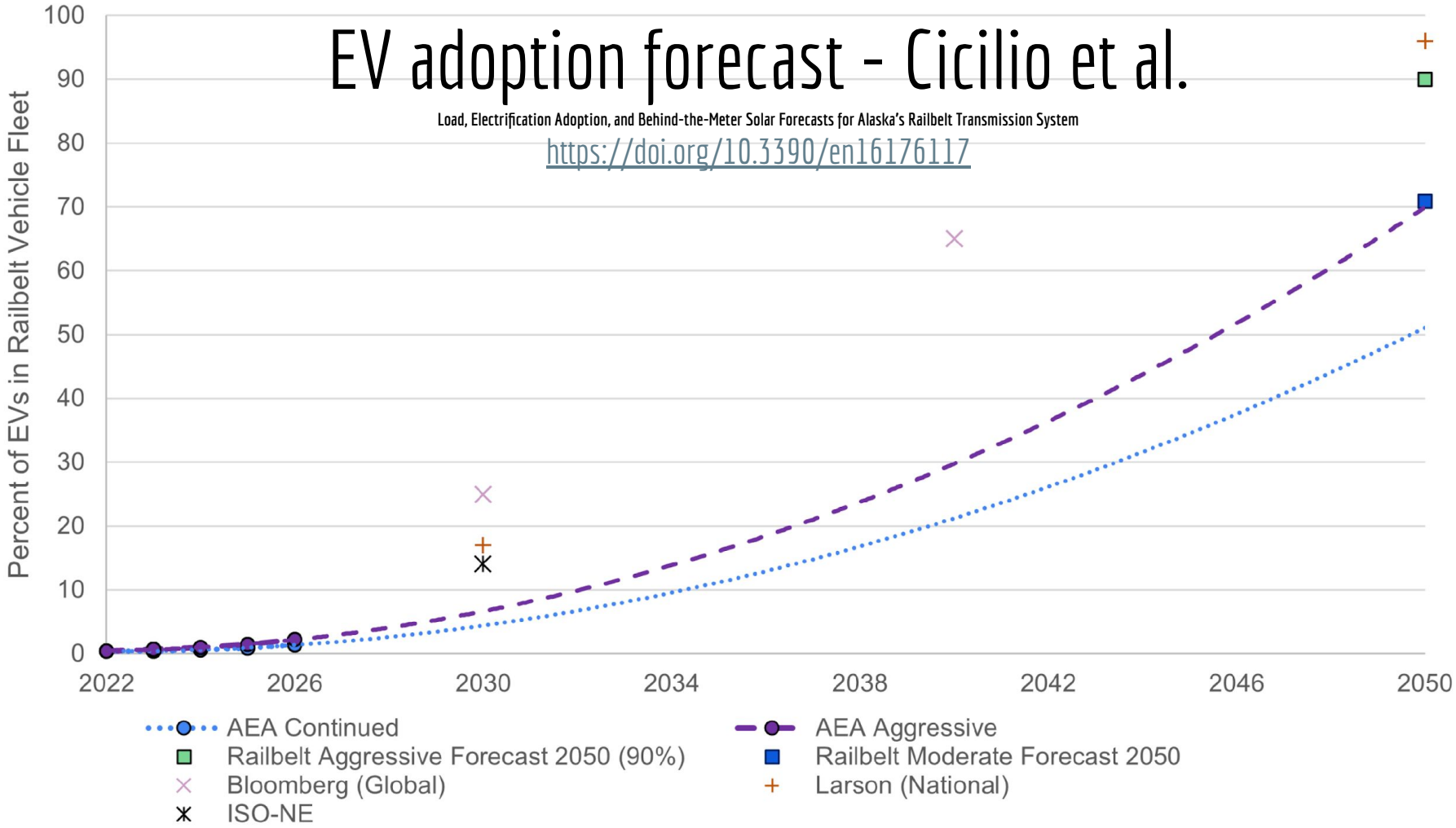


Source: BNEF. Note: EV includes battery electric, plug-in hybrid and fuel cell vehicles.

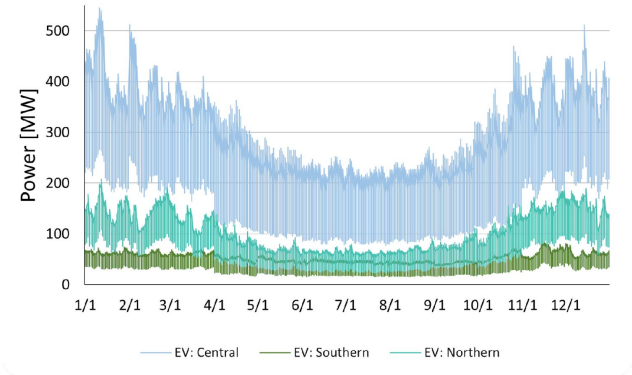
EV adoption forecast - Cicilio et al.

Load, Electrification Adoption, and Behind-the-Meter Solar Forecasts for Alaska's Railbelt Transmission System

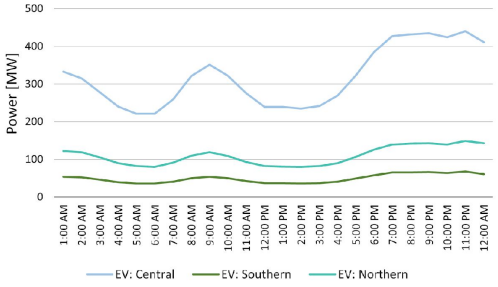
https://doi.org/10.3390/en16176117



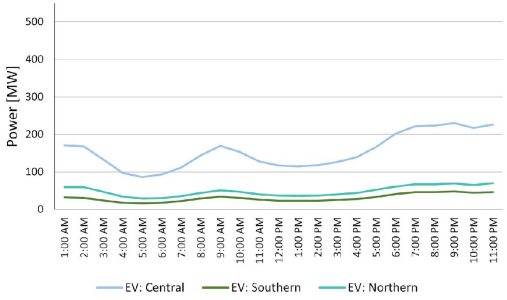
2050 EV load forecast - Cicilio et al.



(**a**) Year 2050.

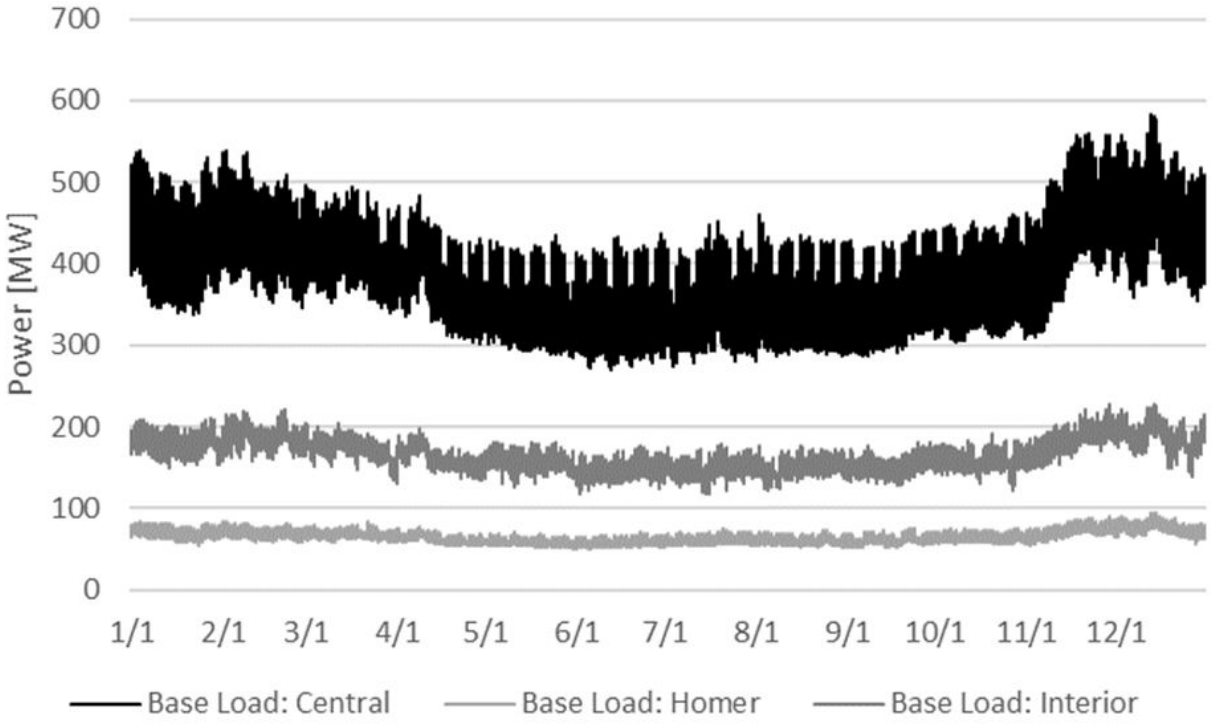


(**b**) 1 January 2050.



(**c**) 1 June 2050.

2050 Baseline Load Forecast - Cicilio et al.

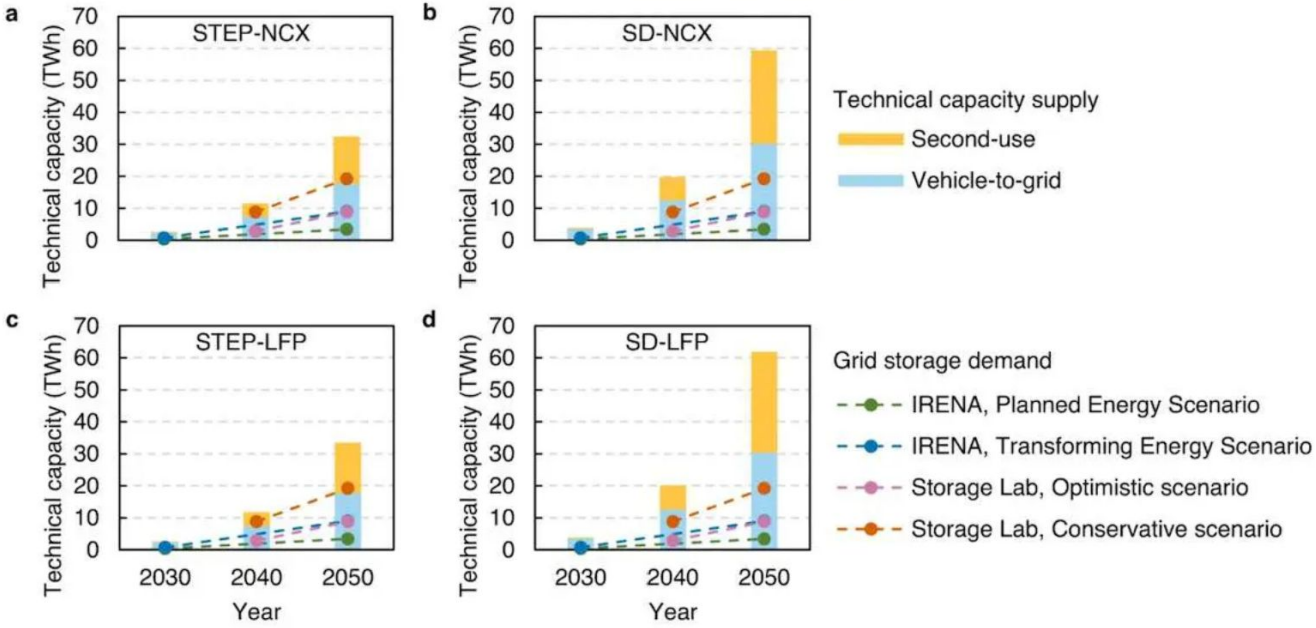


EVs could satisfy global short-term grid storage by 2030

Xu et al – Nature Communications 1/17/23

Fig. 2: Total technical capacity for EV batteries and comparison to grid storage demand.

From: Electric vehicle batteries alone could satisfy short-term grid storage demand by as early as 2030



a STEP-NCX scenario. **b** SD-NCX scenario. **c** STEP-LFP scenario. **d** SD-LFP scenario (see details in Supplementary Table 1). IRENA = International Renewable Energy Agency.

CEC EV Use Case Grid BESS vs. EVs

- CEC BESS COST: $2,000,000
- 1MW, 1 MWh Storage
- Equivalent 52 ‘20 Nissan Leaf Cost
- 52 Nissan Leafs = 3.2 MWh Storage
- Can Balance CEC Grid with 16 Leafs
- Can Balance localized microgrids
- Substantial Customer Benefits:
  - Free Car
  - Free Electricity
  - Energy Security
  - Reduces other’s electric bills
  - Portability (take your microgrid anywhere)

The path to get there:

Enroll in the Vehicle to Everything pilot.

GET S

Keep your lights on using your EV

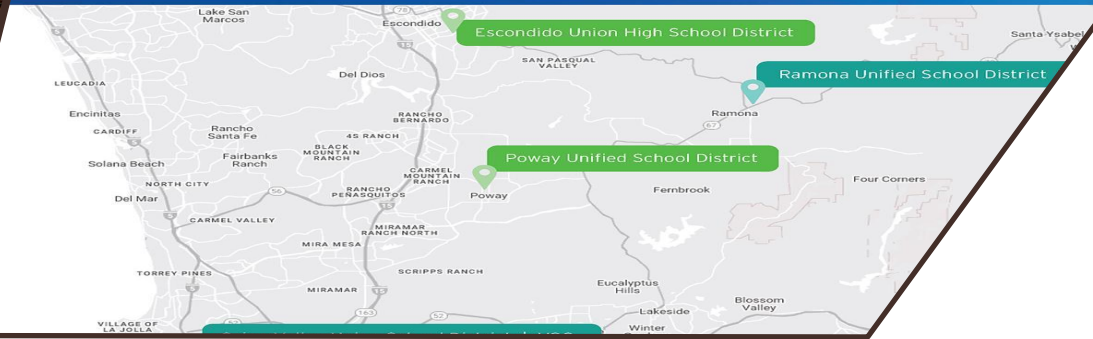
New bidirectional charger technology allows you to use the power in your electric vehicle's battery. PG&E's Vehicle to Everything (V2X) pilots offer incentives to help customers access this technology.

- Power your property temporarily when there is an electrical outage
- Charge your vehicle when electricity is less expensive and use vehicle power when it's more expensive (4 p.m. – 9 p.m.)

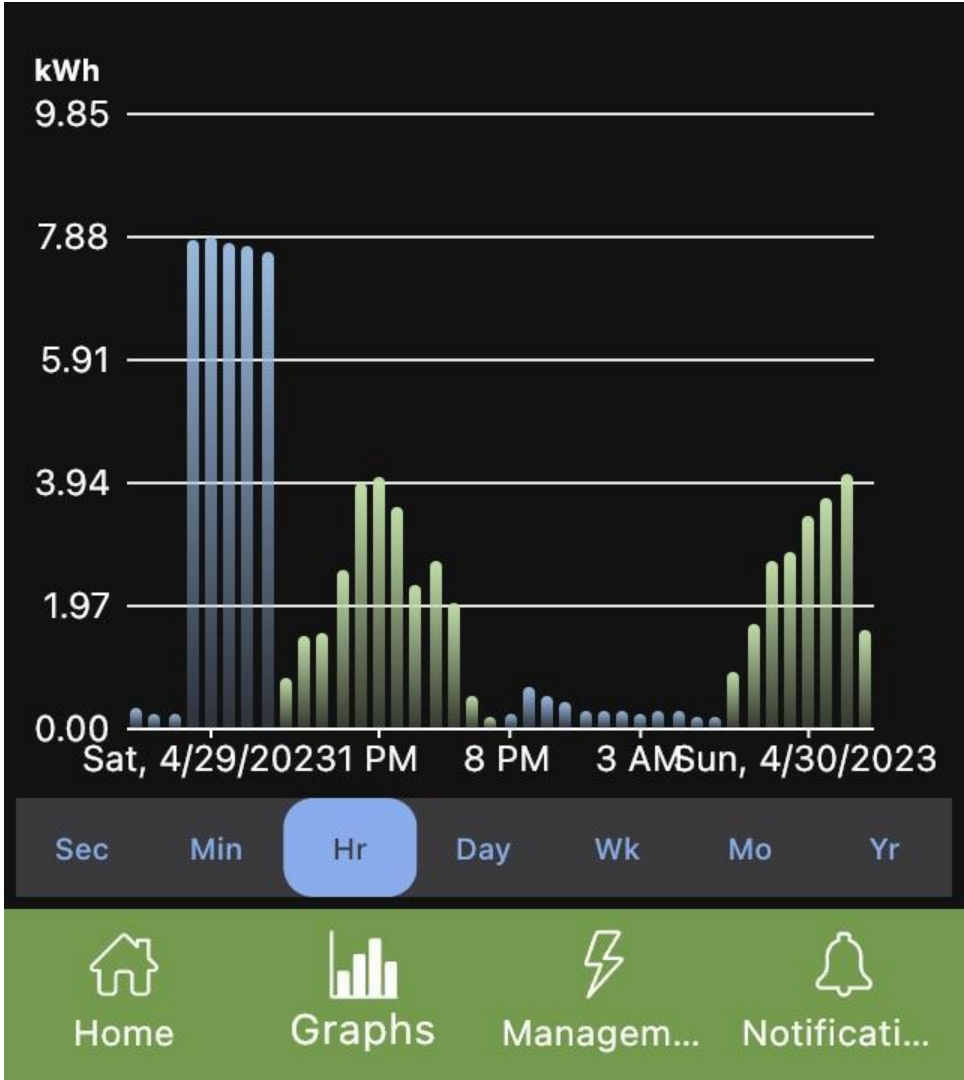
BUILDING A NET ZERO FUTURE

Local Electric School Bus and Vehicle-to-Grid (V2G) Projects

SDGE



even managed charging could produce a lot of the benefits of storage...



Rate 72

GMP partners with you and manages the charging for you during peaks. We alert you to energy peaks (about 5-7 per month, they last a few hours and usually start around 5pm or 6pm). By not charging during peaks, you will save money. You can opt out, and still charge during a peak, and you will pay more. Off peak charging is $0.14274/kWh, which on average is like paying $1.03 per gallon. If you charge during a peak, it is $0.73388/kWh.

Twitter: The US Census musing on the load-balancing benefits of timed EV charging - in 1912.

station circuits. It is only natural, therefore, that throughout the country an effort has been made to develop this new class of business and build up the vehicle "load." The opportunity thus offered is enormous. At the meeting of the Illinois Electrical Association in 1912 it was stated by Mr. George Jones that if half the horses in use in Chicago were replaced by electric vehicles, the central station load created would amount to 94,000,000 kilowatt hours per annum As such vehicles are usually charged late at night, when the ordinary demand for current is small, no additional investment in central station apparatus would be necessary, and this "off peak" business would improve the general load factor about 13 per cent.

National Museum of American History


https://dssg2023heatpump.shinyapps.io/VisApp/
Heat Pumps in
Motivation
Statewide Adoption
Borough Potential
Frequently Asked Questions
UNIVERSITY of WASHINGTON
eScience Institute
DATA SCIENCE FOR SOCIAL GOOD
GitHub
An Interactive Visualization Tool to Explore Heat Pump Adoption in Alaska
Why Study Heat Pumps?
Navigating the Dashboard

Projected Heat Pump Adoption Rates

Toggle between current heat pump estimates, moderate projections (5% of households), and aggressive projections (15% of households)

Current | 5% | 15%

Show absolute or relative numbers?

Absolute | Relative

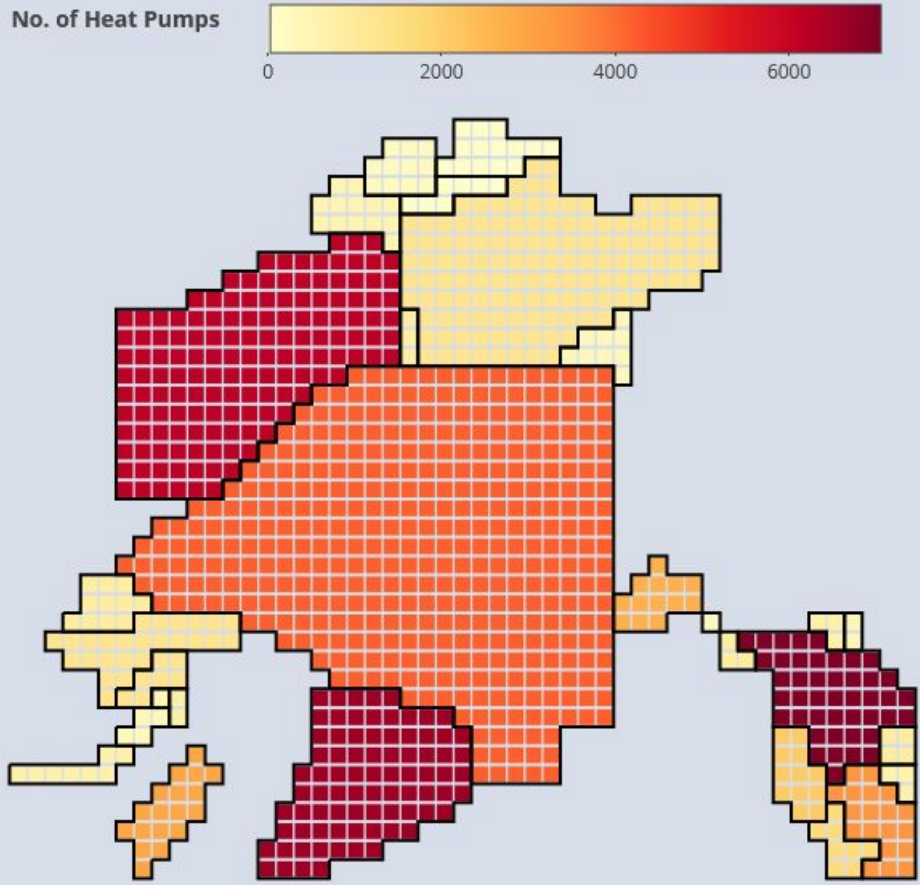
97.1 %

of Heat Days Covered

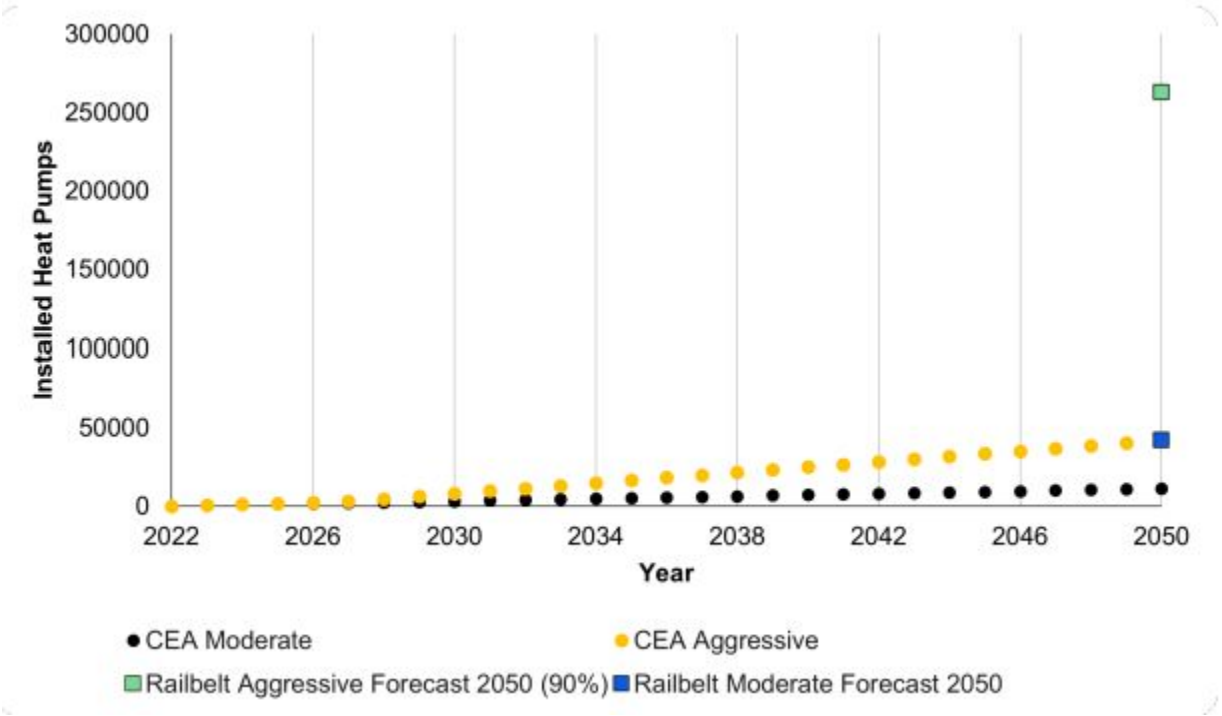
169.8

Millions of $ Saved

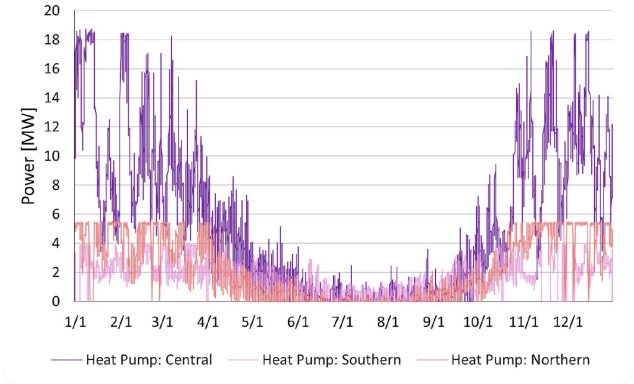
Number of Heat Pumps Installed by Borough



Heat pump adoption forecast - Cicilio et al.



2050 Heat pump load forecast - Cicilio et al.



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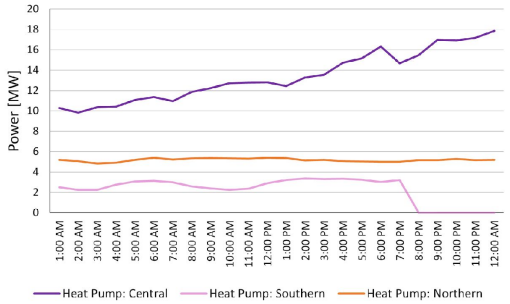
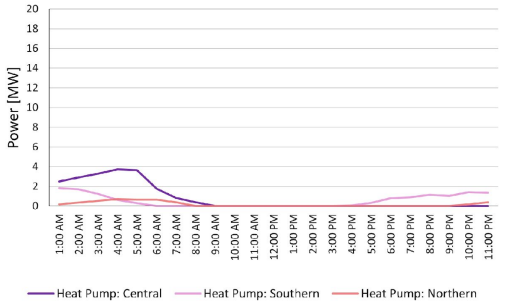
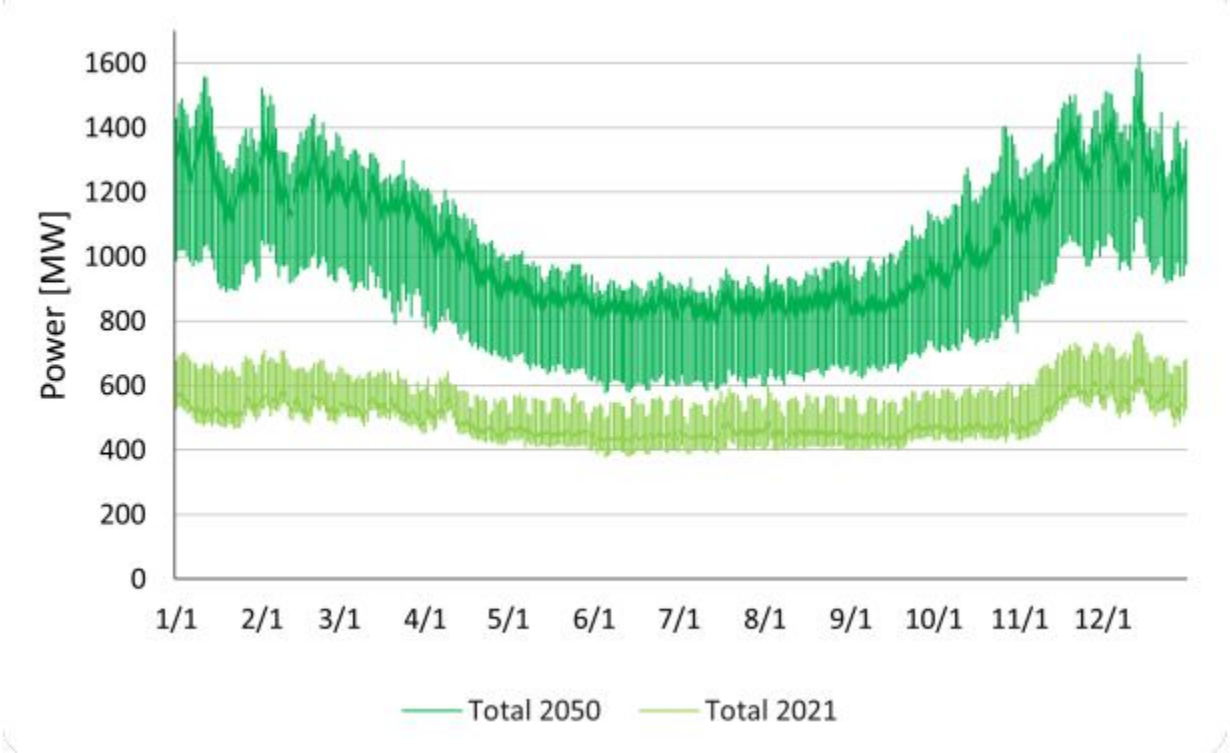


(**b**) 1 January 2050.

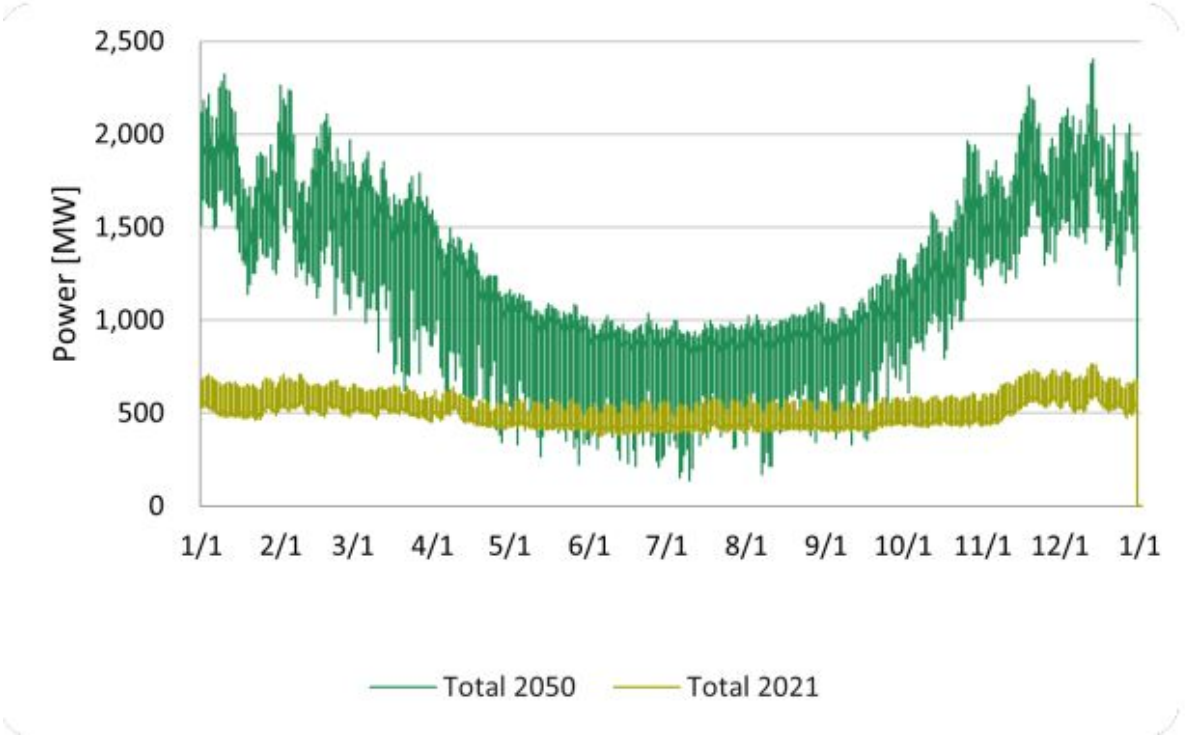


(**c**) 1 June 2050.

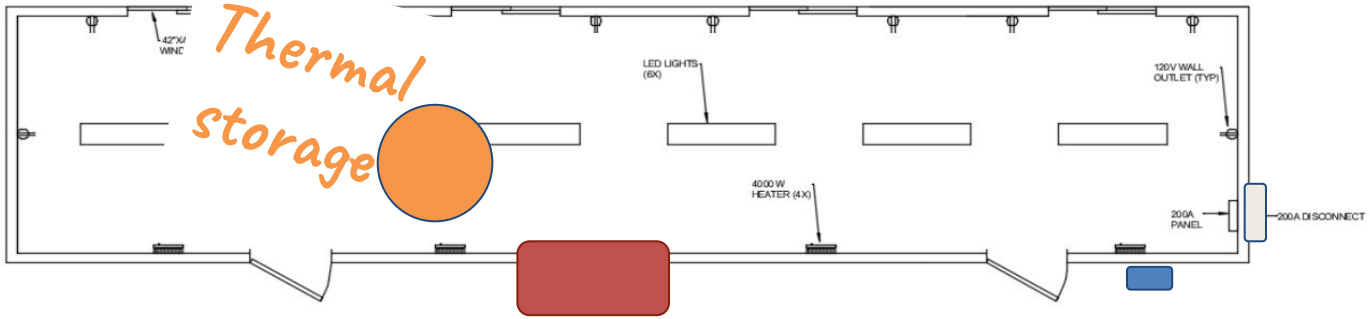
2050 load forecast (moderate) - Cicilio et al.



2050 load forecast (High adoption) - Cicilio et al.



Beneficial and Equitable Electrification Home InnoVation Experiment (BEEHIVE)



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Questions?

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