VIRGINIA ENERGY EFFICIENCY COUNCIL

# 2023 ENERGY EFFICIENCY FORUM

October 4th & 5th

VAEEC

KEYNOTE
# ADDRESS

**Dr. Karma Sawyer**

Director of Electricity Infrastructure & Buildings Division *Pacific Northwest National Laboratory*

VAEEC

# Equitable Building Decarbonization through Electrification

**Karma Sawyer**
Director, Electricity Infrastructure & Buildings Division
Pacific Northwest National Laboratory

**October 2023**

U.S. DEPARTMENT OF ENERGY BATTELLE
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PNNL-SA-181814

# **Grand Challenge:** developing a decarbonized energy system that is resilient and equitable

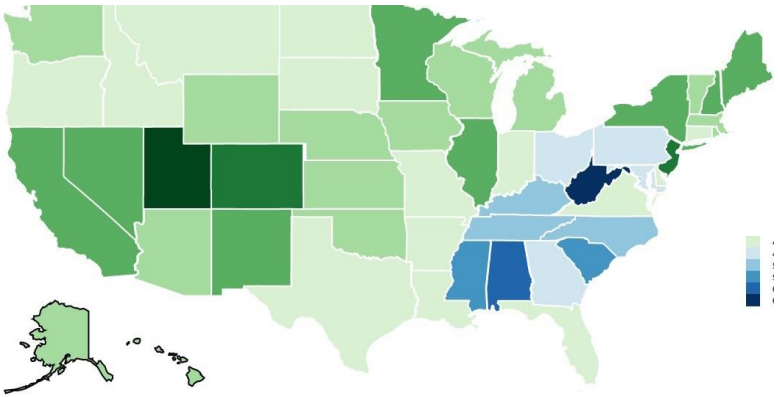
Mitigating **climate change** will require massive shifts in energy production, storage, and use


**Energy systems** are vulnerable to both extreme events and long-term changes

Climate change and energy transitions have a disproportionate impact on **disadvantaged groups**

# How will people experience this change?

## Average Residential Electricity Cost Burden
## Jan 2016



% Household Income Spent on Electricity

- 0 to 2.5
- 2.5 to 3.1
- 3.1 to 3.6
- 3.6 to 4.1
- 4.1 to 4.7
- 4.7 to 5.2
- 5.2 to 5.8
- 5.8 to 6.3
- 6.3 to 6.8
- 6.8 to 7.4

https://www.pnnl.gov/news-media/mapping-electricity-affordability

# How will different people experience this change?

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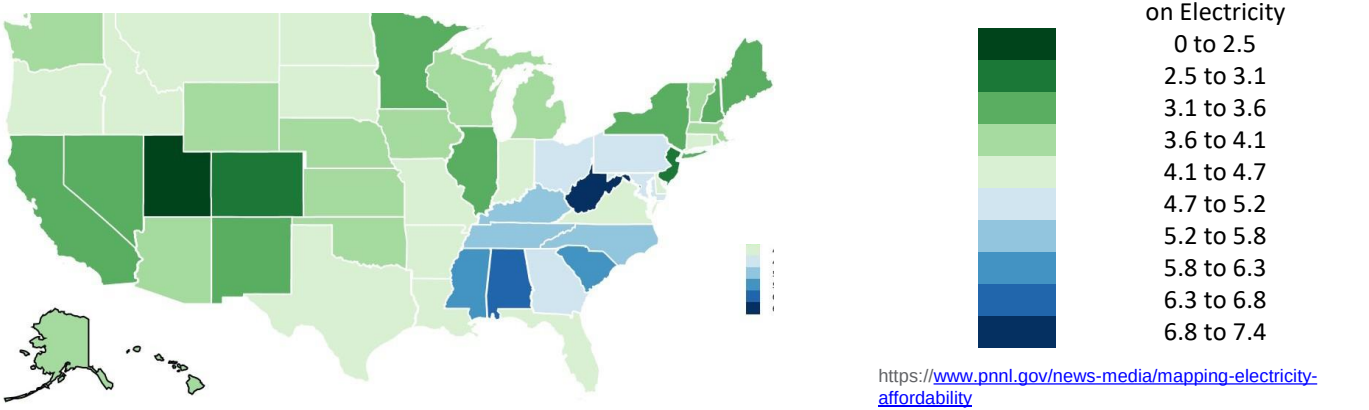


https://www.pnnl.gov/news-media/mapping-electricity-affordability

**Black-majority census tracts installed 69% less rooftop PV** than no-majority tracts of the same household income.

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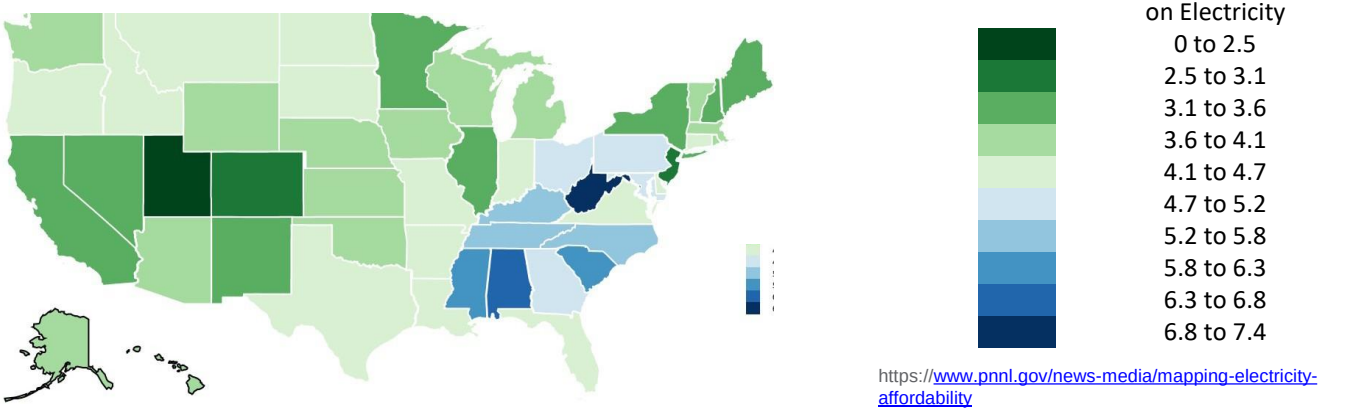


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Since 2006, **90% of electric vehicle income credits were received by the top income** quintile.

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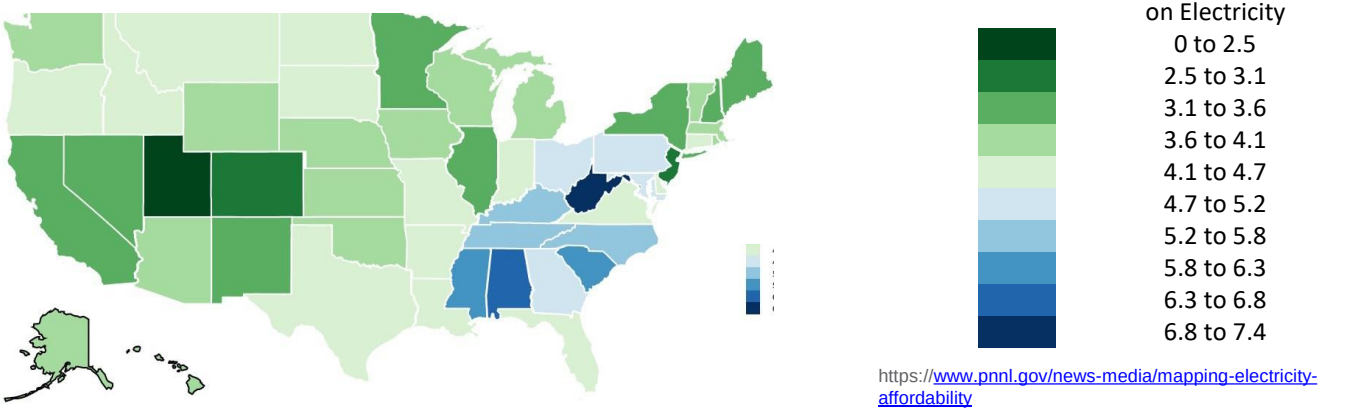


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**~10% of people with multiple disabilities have no access to paratransit** because they live in paratransit deserts.

Energy equity recognizes that disadvantaged communities have been ***historically marginalized and overburdened by pollution, underinvestment in clean energy infrastructure***, and lack of access to energy-efficient housing and transportation.

https://www.pnnl.gov/projects/energy-equity

Achieving energy equity requires ***intentionally designing systems, technology, procedures, and policies*** that lead to the fair and just distribution of benefits in the energy system.

https://www.pnnl.gov/projects/energy-equity

# AMERICA IS ALL IN

PRINCIPLE 1

## ACCELERATE TOWARD 100% CLEAN ELECTRICITY

Decarbonize electricity and other energy supplies

PRINCIPLE 2

## DECARBONIZE END-USES

Decarbonize energy end-uses in our transportation, buildings, and industry, primarily through electrification and efficiency

PRINCIPLE 3

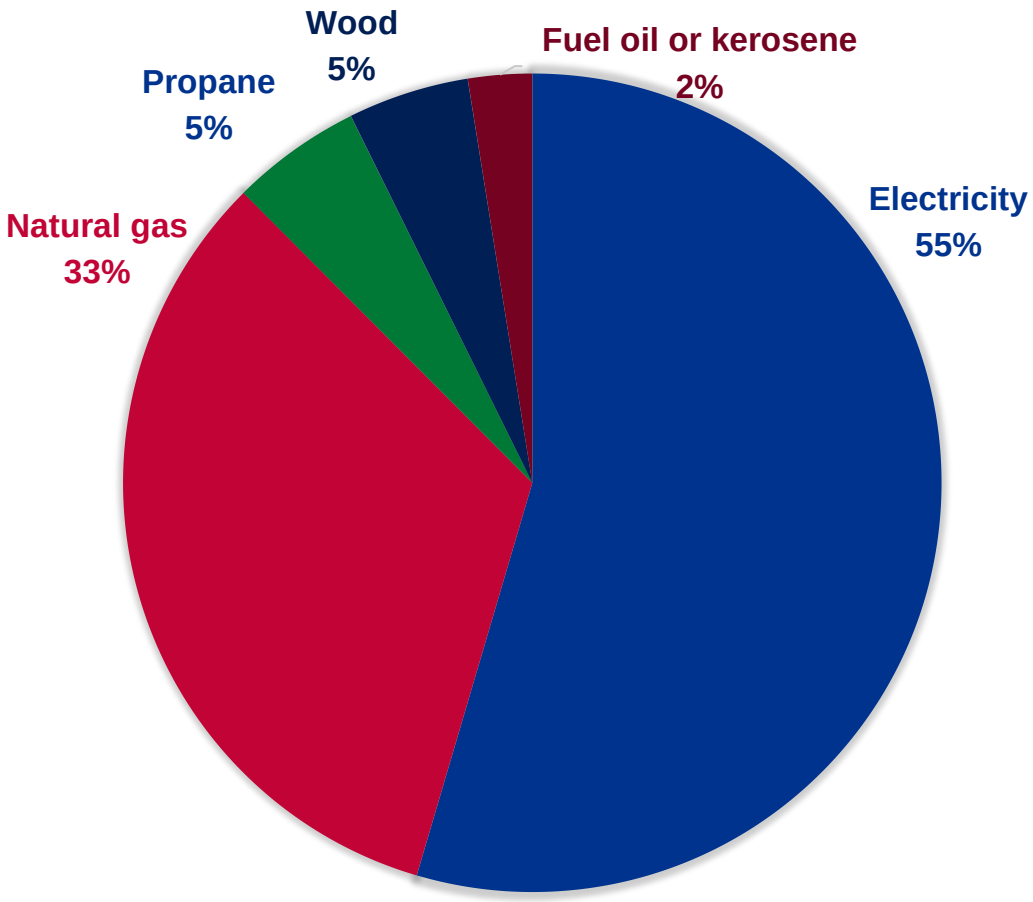
## ENHANCE ECOSYSTEMS

Enhance the carbon storage potential of our forests, farms, and coastal wetlands

PRINCIPLE 2

## DECARBONIZE END-USES

Decarbonize energy end-uses in our transportation, buildings, and industry, primarily through electrification and efficiency




https://www.eia.gov/consumption/
https://www.eia.gov/environment/

PRINCIPLE 2

## DECARBONIZE END-USES

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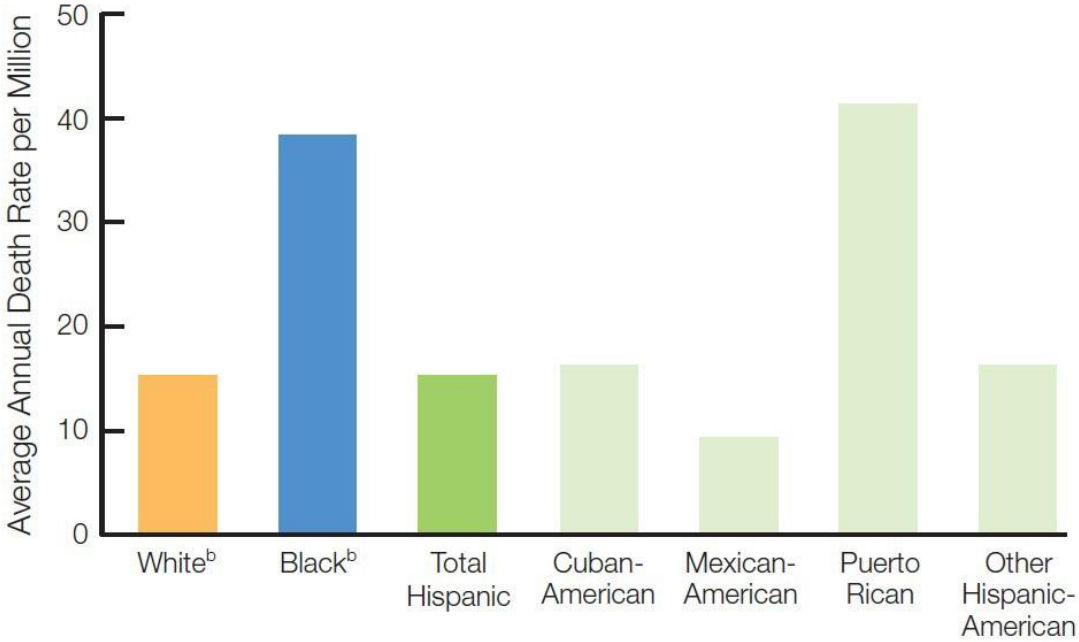
PRINCIPLE 2

## DECARBONIZE END-USES

Decarbonize energy end-uses in our transportation, buildings, and industry, primarily through electrification and efficiency

### Asthma mortality by ethnicity in the United States, 1990-1995[a]



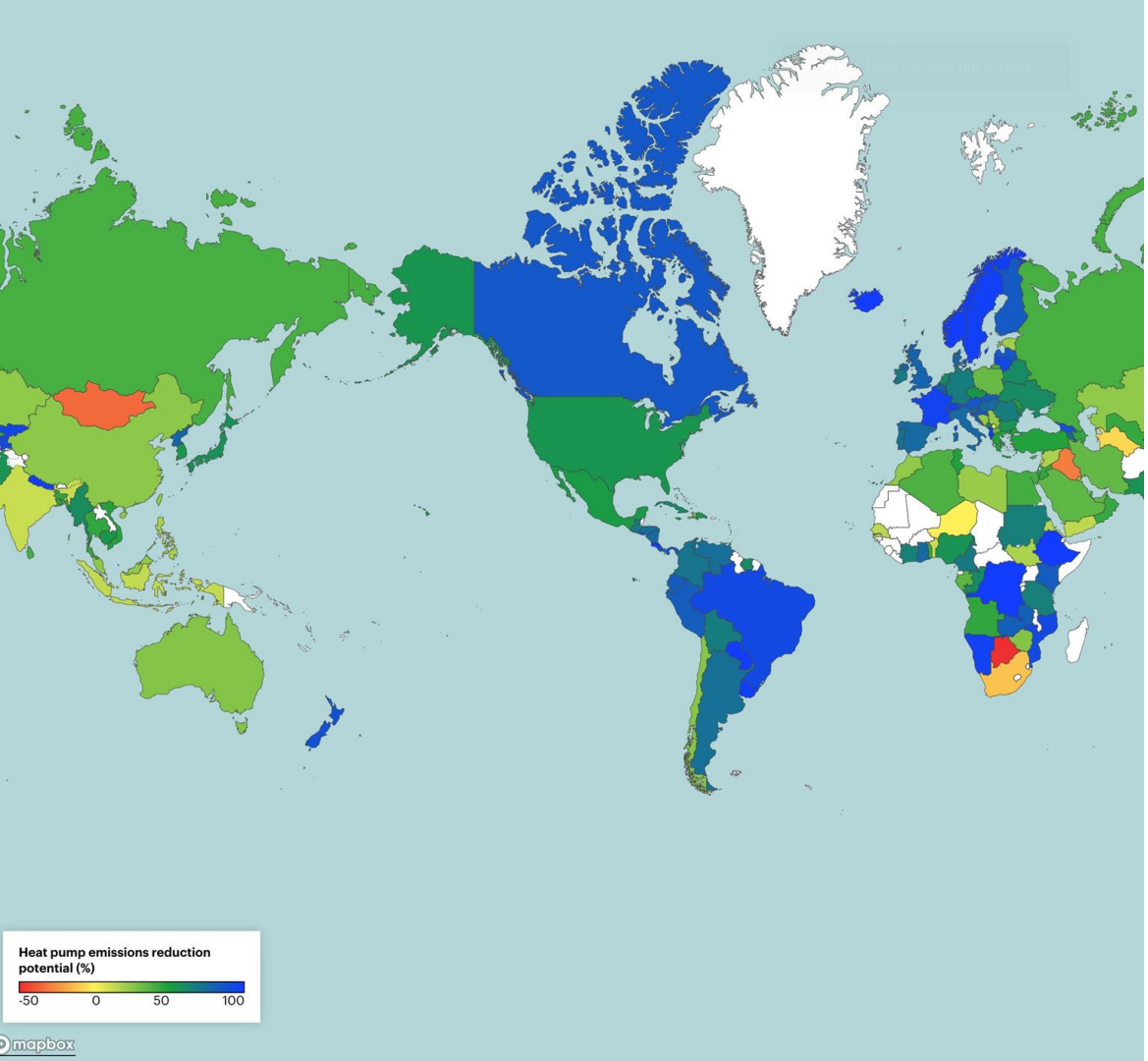

[a]Mortality rates are age-adjusted rates standardized to the 1970 U.S. population.
[b]Non-Hispanic.

It cools.
It heats.
It saves money.
What is it?
It's Heat Pump!


Heat Pump visits the White House.

REWIRING AMERICA

**Residential heat pumps deployed in the US reduce 20-year global warming potential by 53-67% compared to gas furnaces.**



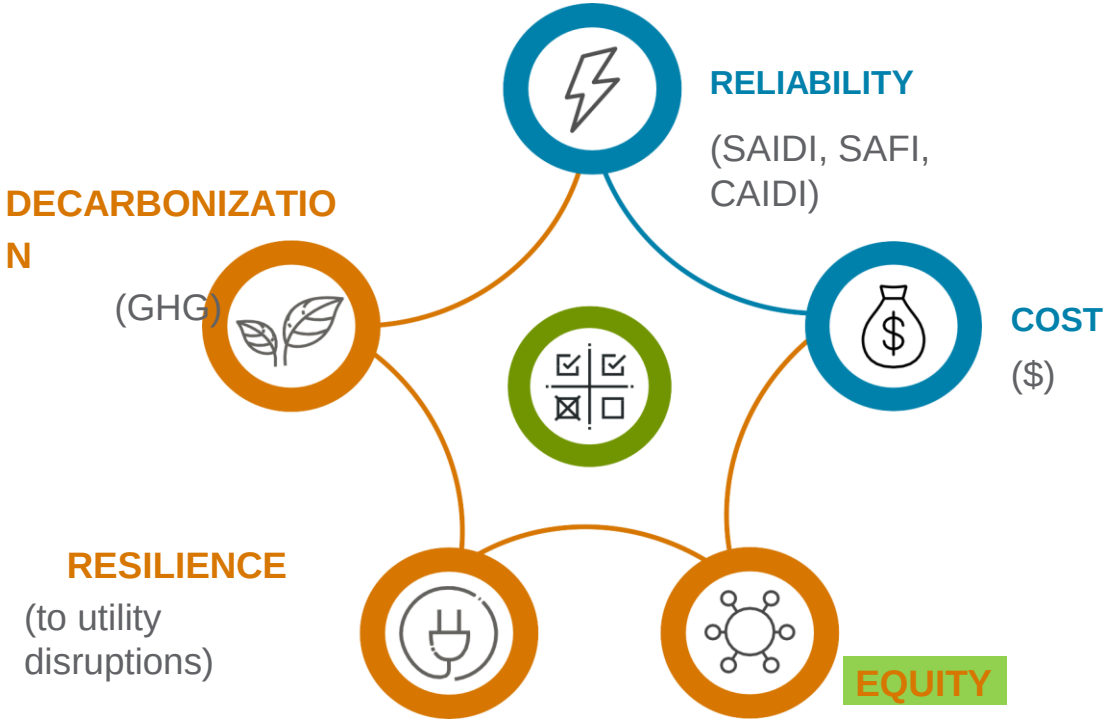

**Today air-source heat pumps can supply more than 90% of global space and water heating with lower $CO_2$ emissions than gas boilers.**

# Can flexible, residential heat pumps decarbonize home heating AND provide a grid resource in Alaska?

Sam Rosenberg


Reduce Carbon Emission
Increase Affordability and Enhance Equity
Buildings and Communities of the Future
Enhance Grid Reliability and Resilience
Improve Health and Comfort for Occupants

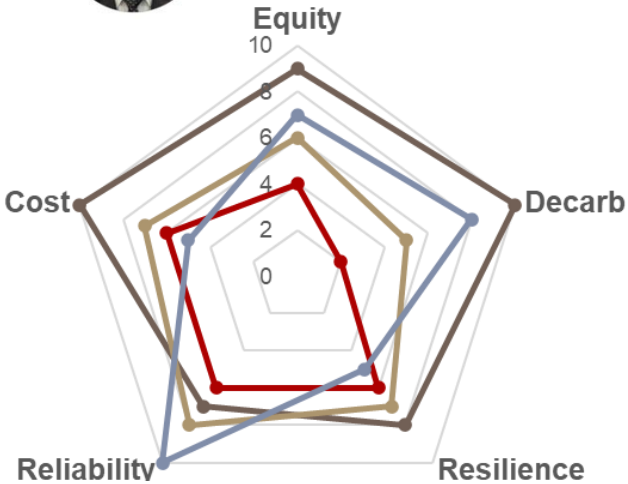
# Emerging Objectives in Grid Planning




Bethel Tarekegne

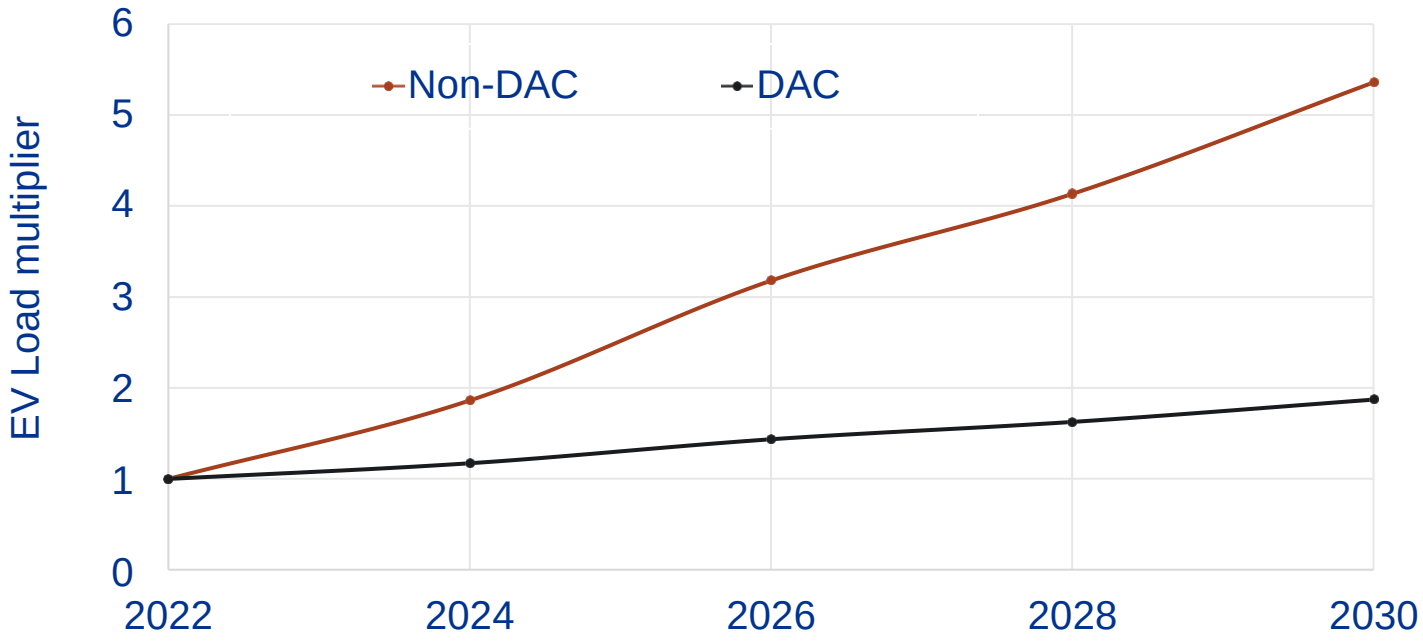
Alok Bharati

Rohit Jinsiwale



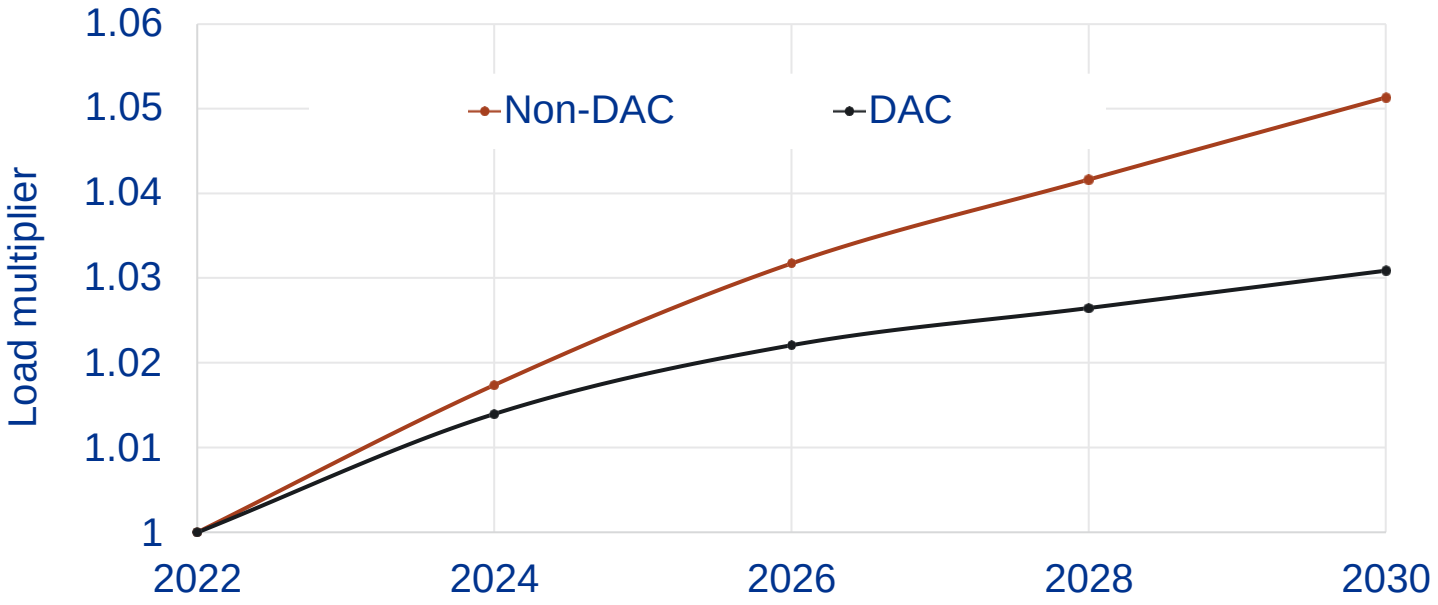

A.K. Bharati, A. Singhal, R. Jinsiwale, K. Kazimierczuk, J. Yoshimura, and B.W. Tarekegne. 2022. "*Advancing Energy Equity Considerations in Distribution Systems Planning*" Accepted in IEEE ISGT North America 2023, Washington DC, January, 2023

# In 2022, electric vehicle adoption in the US is 25% in non-disadvantaged communities and 5% in disadvantaged communities.



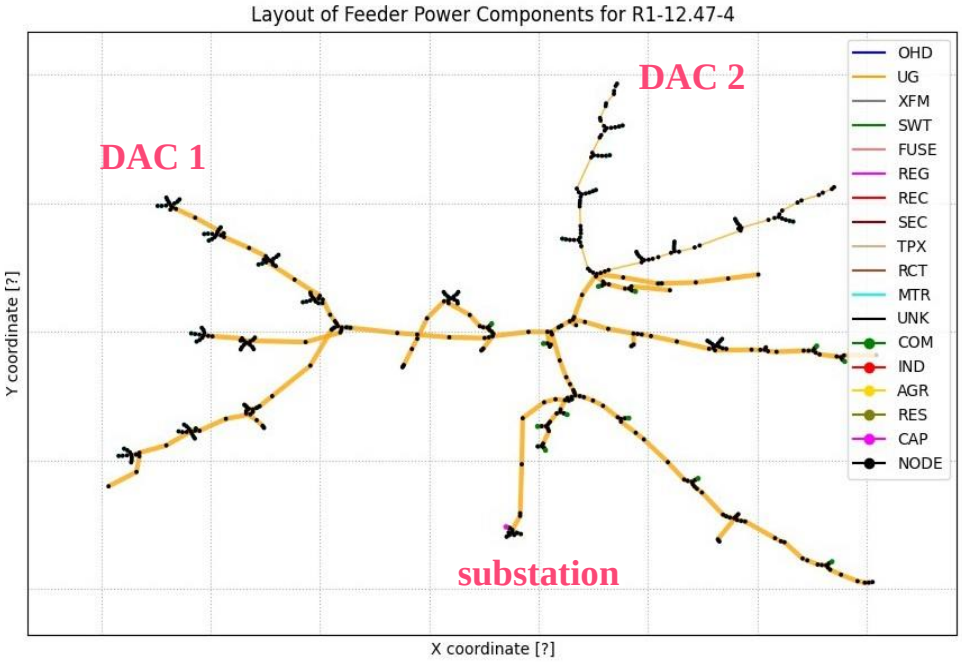

Source: Historical sales data, Evadoption.com

# Disadvantaged communities have lower electricity base loads and growth rates.




Source: https://www.eia.gov/outlooks/aeo/electricity/sub-topic-01.php

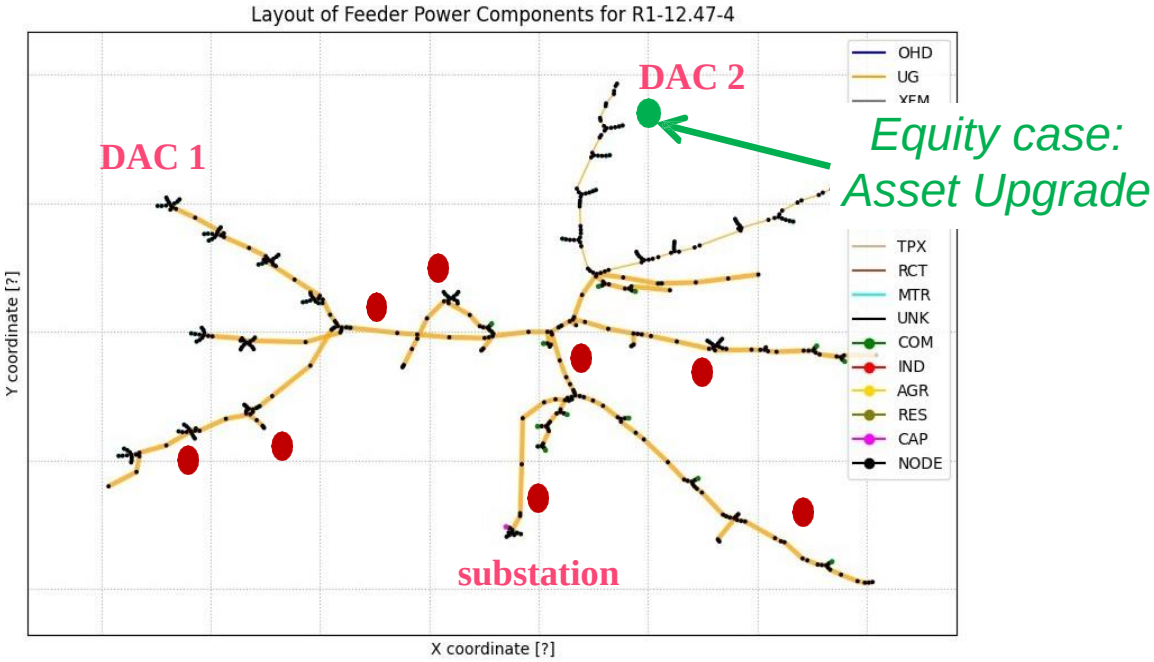
# How would distribution planning change with equitable load growth and electric vehicle adoption?




**2024**

** Note that the results are only for a specific feeder with assumed definitions of DAC*

# How would distribution planning change with equitable load growth and electric vehicle adoption?




**2026**

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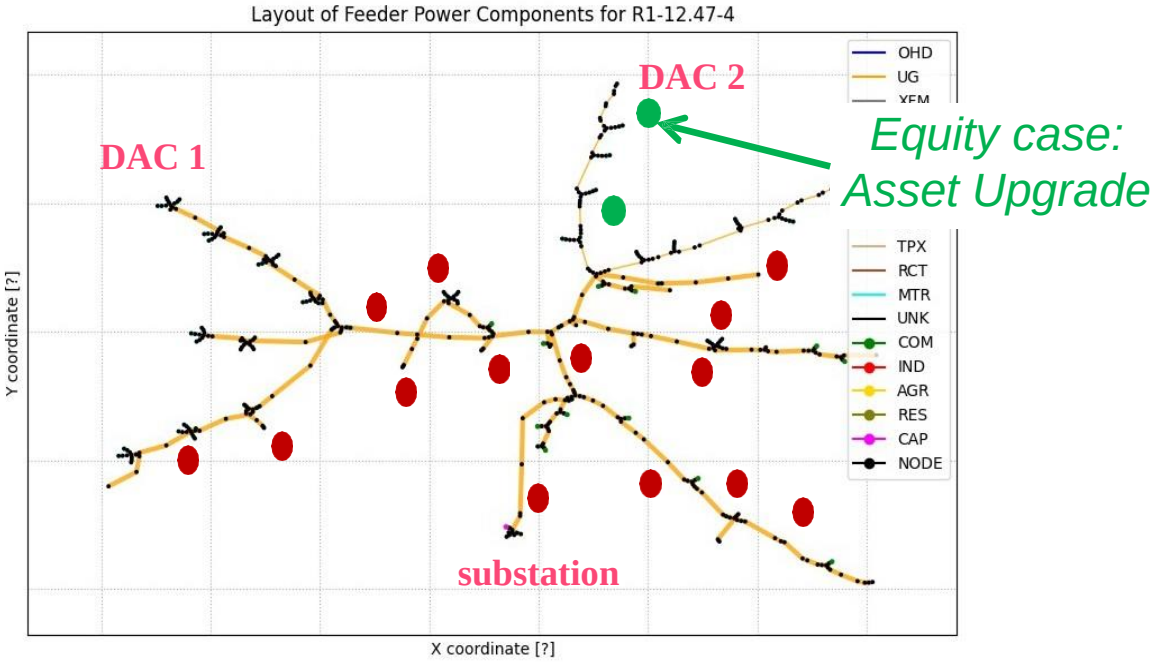
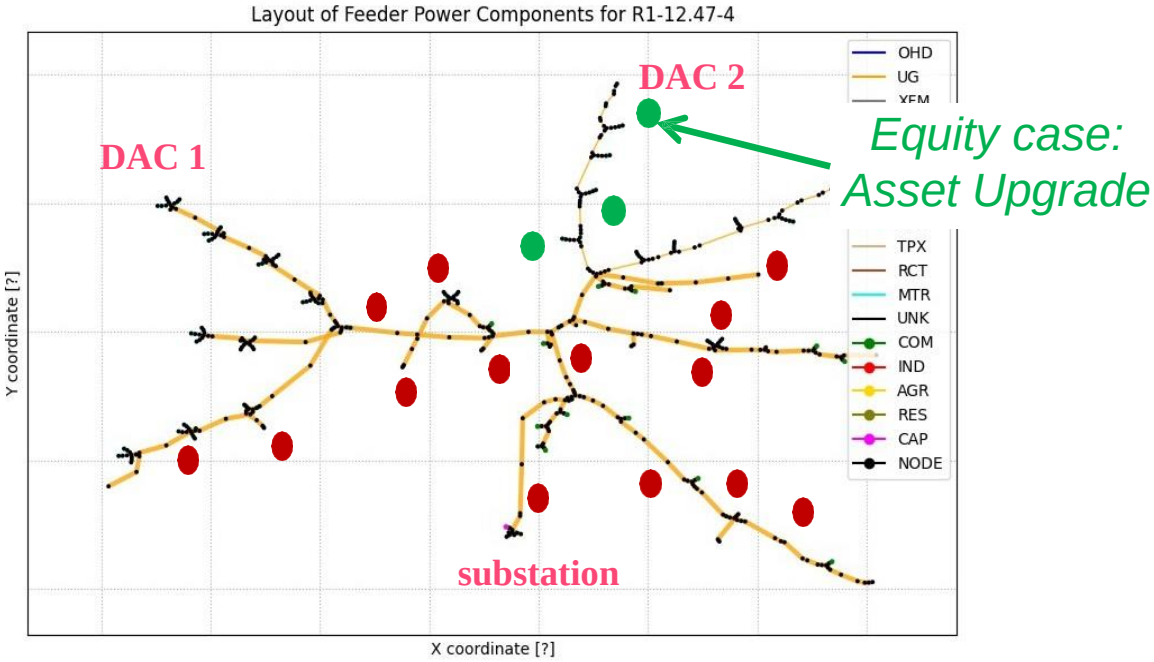
# How would distribution planning change with equitable load growth and electric vehicle adoption?




**2028**

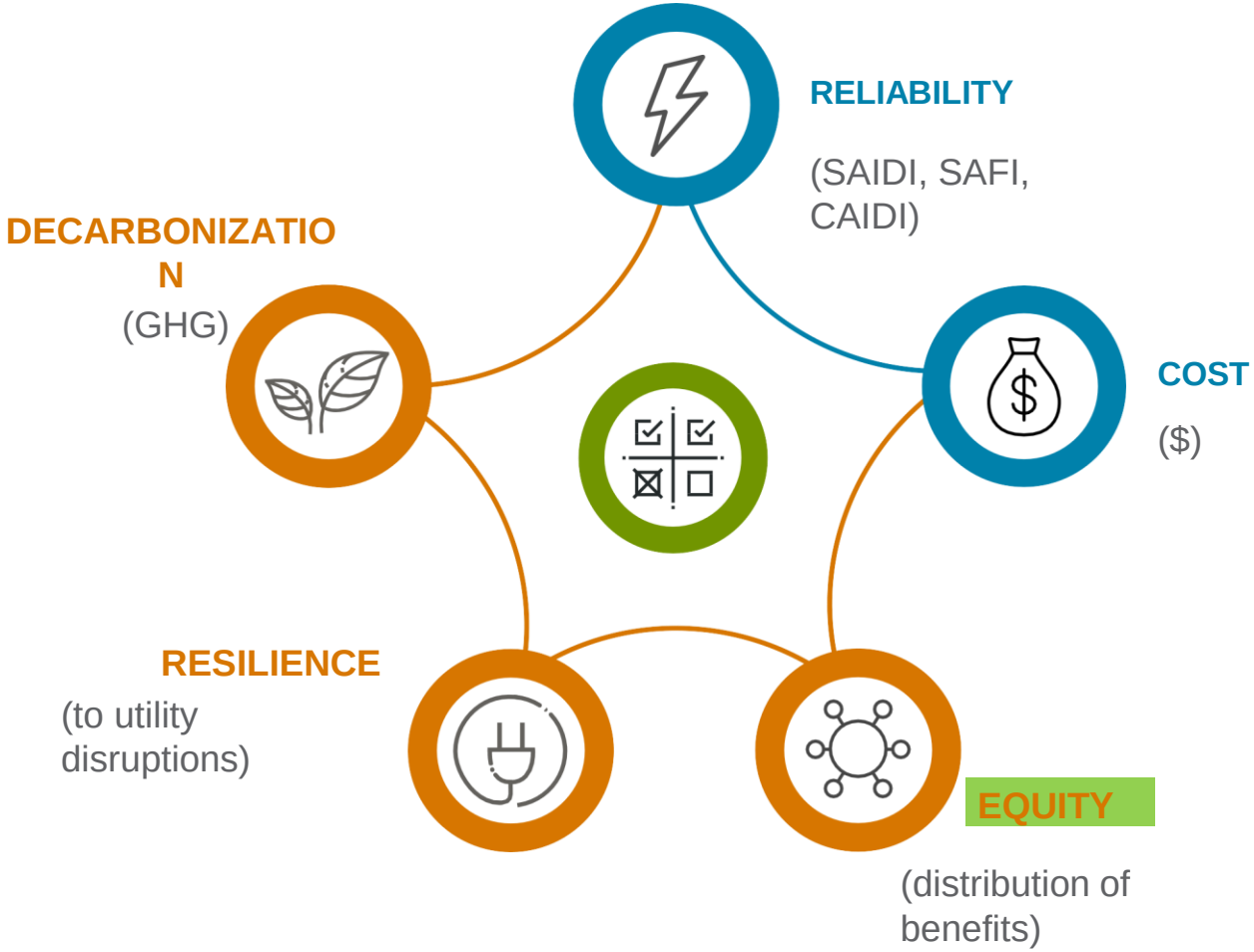
** Note that the results are only for a specific feeder with assumed definitions of DAC*

# How would distribution planning change with equitable load growth and electric vehicle adoption?




**2030**

** Note that the results are only for a specific feeder with assumed definitions of DAC*


RELIABILITY
(SAIDI, SAFI, CAIDI)
DECARBONIZATION
(GHG)
COST
($)
RESILIENCE
(to utility disruptions)
EQUITY
(distribution of benefits)

# Building electrification provides an opportunity to mitigate climate change while improving energy access and health outcomes for many different communities.

# Positive impacts from electrification will only reach underserved communities if we work in partnership with them and perform equity-aware analyses in grid planning and operations.

# Engineers must develop and deploy technologies and policies that address the unique community goals across the energy system.

# Thank you

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