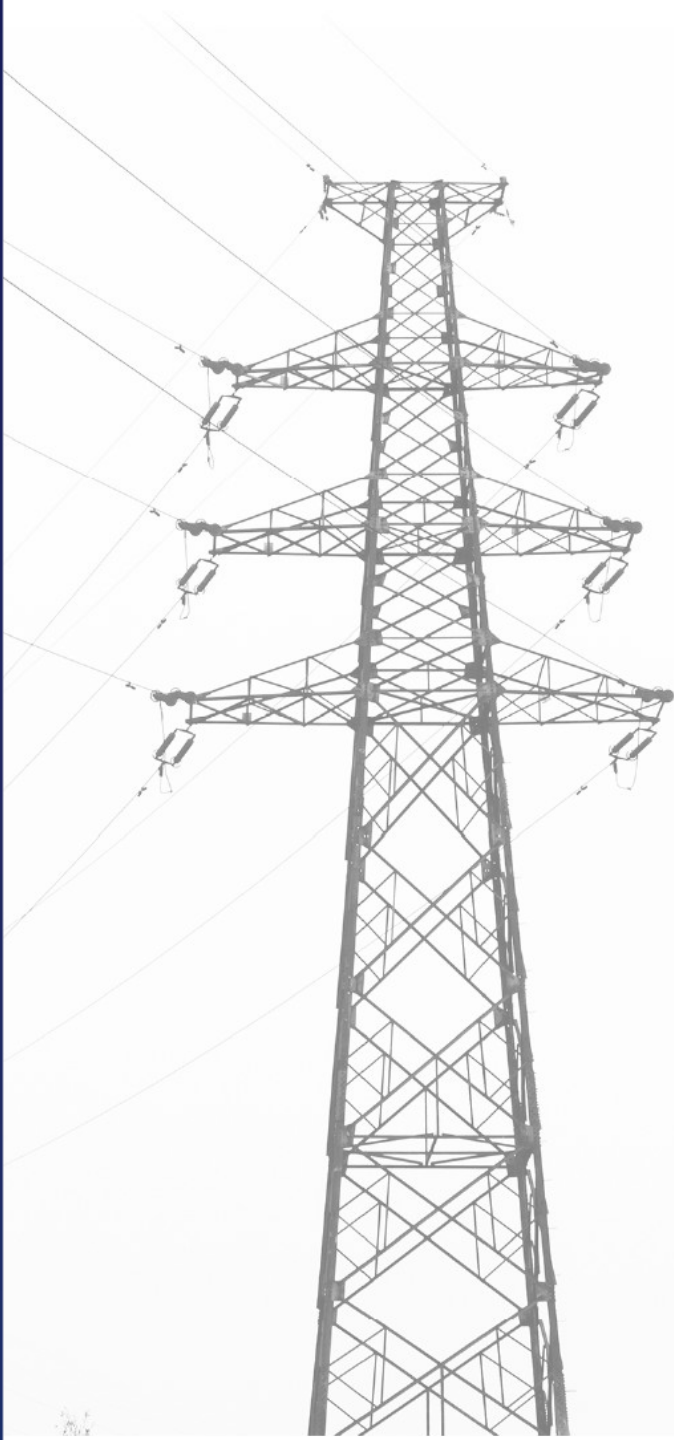


An aerial night photograph of a city, likely San Francisco, with its lights reflecting on the hills and mountains in the background under a dark sky.

Environmental Justice and Energy Equity Considerations in Wholesale Power Markets

A PROJECT OF





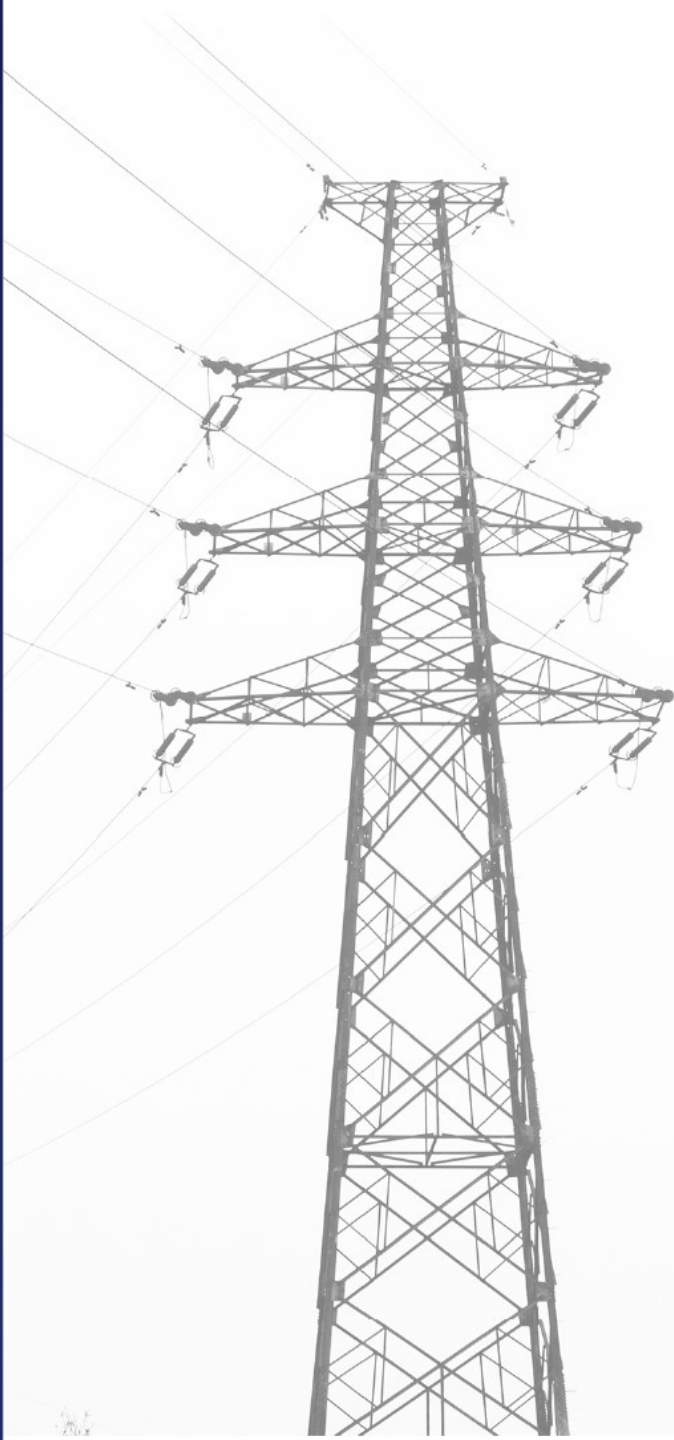
Future Power Markets Forum investigates proposals for market designs that maintain system efficiency and reliability with a high penetration of variable generation.

What

- Meetings of practitioners, experts and regulators
- Website and digital resource library to share the the research under discussion and the participant perspectives

How

- To encourage participation, there is no explicit or implied value judgment about whether we SHOULD have a high renewable penetration scenario
- To encourage candid discussions, Chatham House Rule will be followed (no attribution to individual speakers outside the meeting)
- To provide a high-quality resource to stakeholders and policy makers, presentations will be posted publicly if authorized by the speaker
- To ensure balance and quality, a diverse advisory committee will provide input on content and speakers



Thank You

Advanced Energy Economy

Alberta Electric System Operator

Amazon Web Services

American Council on Renewable Energy

BP

California ISO

Calpine

Clean Energy Buyers Association

ClearPath

Constellation

Electric Power Supply Association

Electric Power Research Institute

Electricity Consumers
Resource Council

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Midcontinent Independent
System Operator

National Hydropower Association

Natural Gas Supply Association

New York Independent
System Operator

New York Power Authority

NextEra

Niskanen Center

NRG Energy

National Hydropower Association

Nuclear Energy Institute

PJM Interconnection

Rocky Mountain Institute

Sustainable FERC

Tenaska

Vistra



Moderator and Featured Experts



Michael Dorsey, Ph.D.
Arizona State University



Diana Hernandez, Ph.D.
Columbia University



Rory Christian
New York Public Service
Commission (NYPSC)



Meredith Fowlie, Ph.D.
University of California Berkeley

Energy Insecurity: Obstacles and Opportunities

Dr. Diana Hernández

Associate Professor of Sociomedical Sciences, Mailman

Co-Director of Energy Opportunity Lab, CGEP-SIPA

Columbia University



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Energy Opportunity Lab

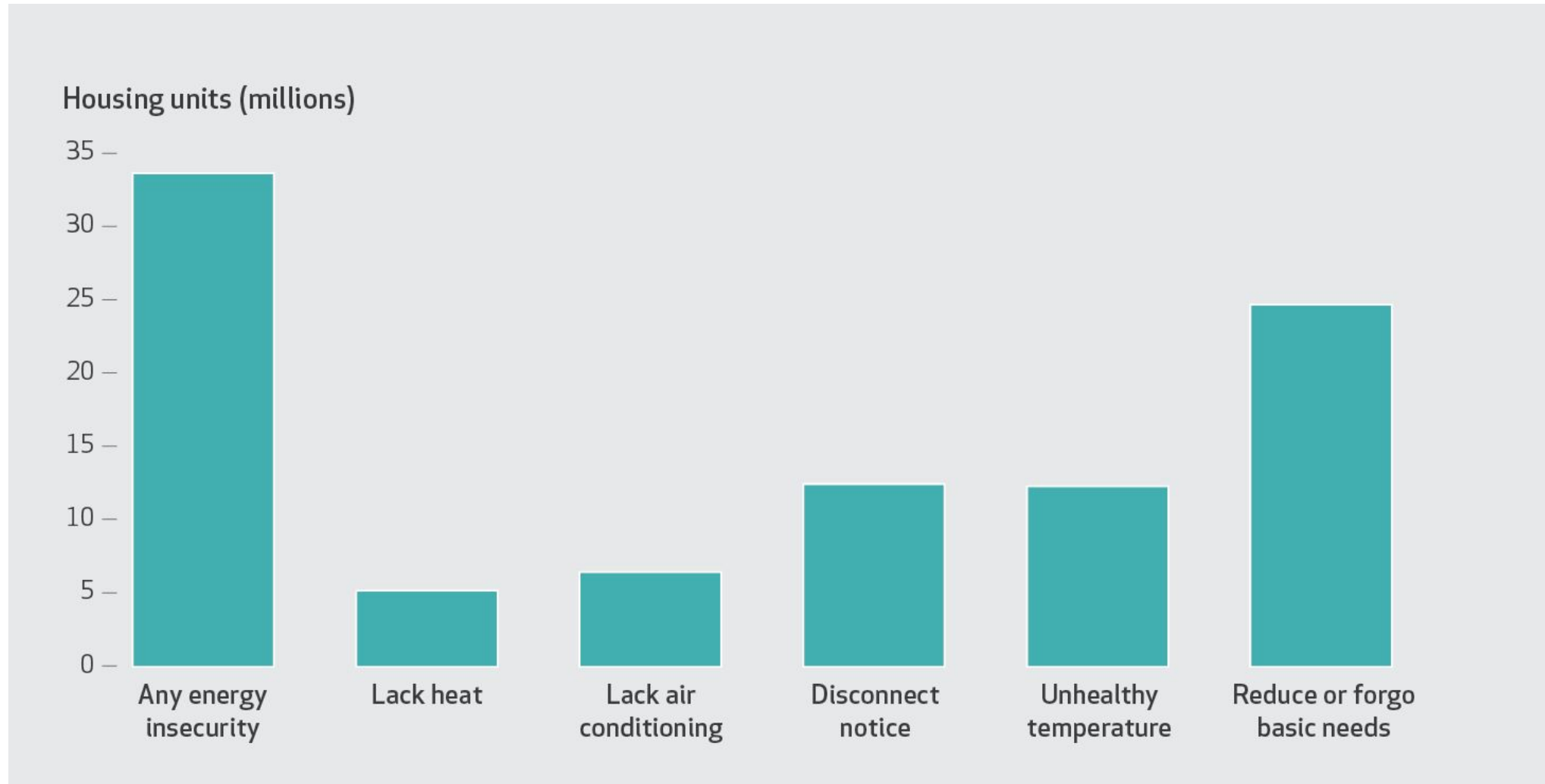
COLUMBIA | SIPA | CGEP

Introduction

- Energy insecurity is defined as the inability to adequately meet household energy needs
- Comprise of Three Dimensions: Economic, Physical and Coping
- Can be a chronic or acute problem
- Known links to adverse health outcomes



Energy Insecurity in the US



Data Source: Residential Energy Consumption Survey, 2020

Hernández, *Health Affairs*, 2023

Key obstacles/challenges to overcome

- Utility Rate Structures
- LIHEAP
 - Limited cooling assistance
 - Restricted to household that pay for heat
 - Seasonally-focused
- Disconnection Protections
 - Under-enrollment of elderly and medically vulnerable in shutoff protection plans
 - Expansion of protections to households with children, pregnant persons
- Building Performance and Energy Efficiency

Benefits/Consequences of Addressing EI

Comfort



Health



Dignity



Who Will Pay for the Clean Energy Transition?

Future Power Markets Forum
September 28, 2023

Meredith Fowlie
UC Berkeley



Electricity markets and the clean energy transition

Two-step plan for deep decarbonization:

1. Generate clean electricity
2. Electrify everything

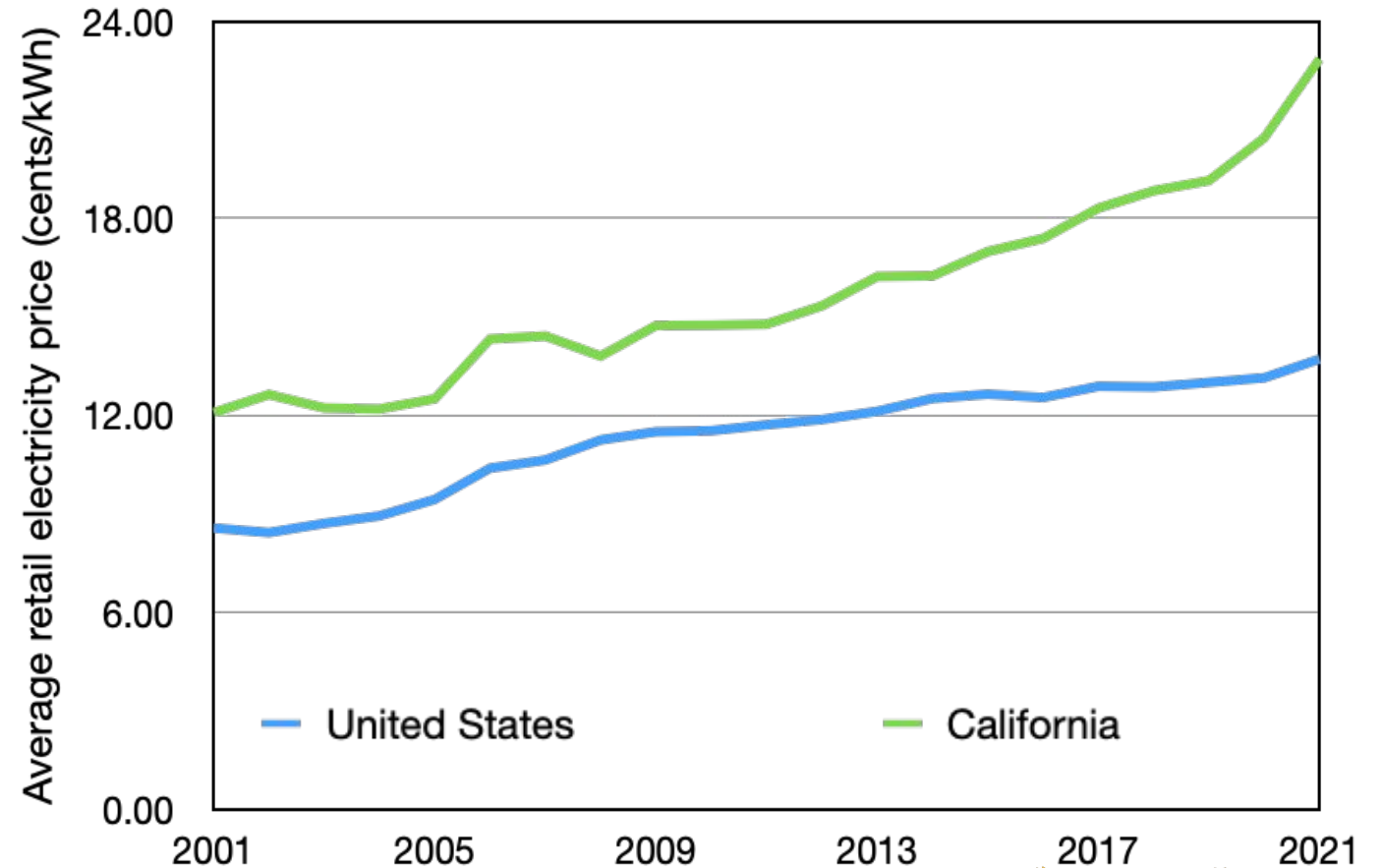
This will require large investments in a cleaner, larger, more resilient power system.



As power sector costs rise, so do retail prices

- High volumetric rates disproportionately impact disadvantaged households.
- Affordability concerns loom large in areas with high prices.
- California could foreshadow trends in other jurisdictions with rising fixed electricity costs and increasing climate ambition.

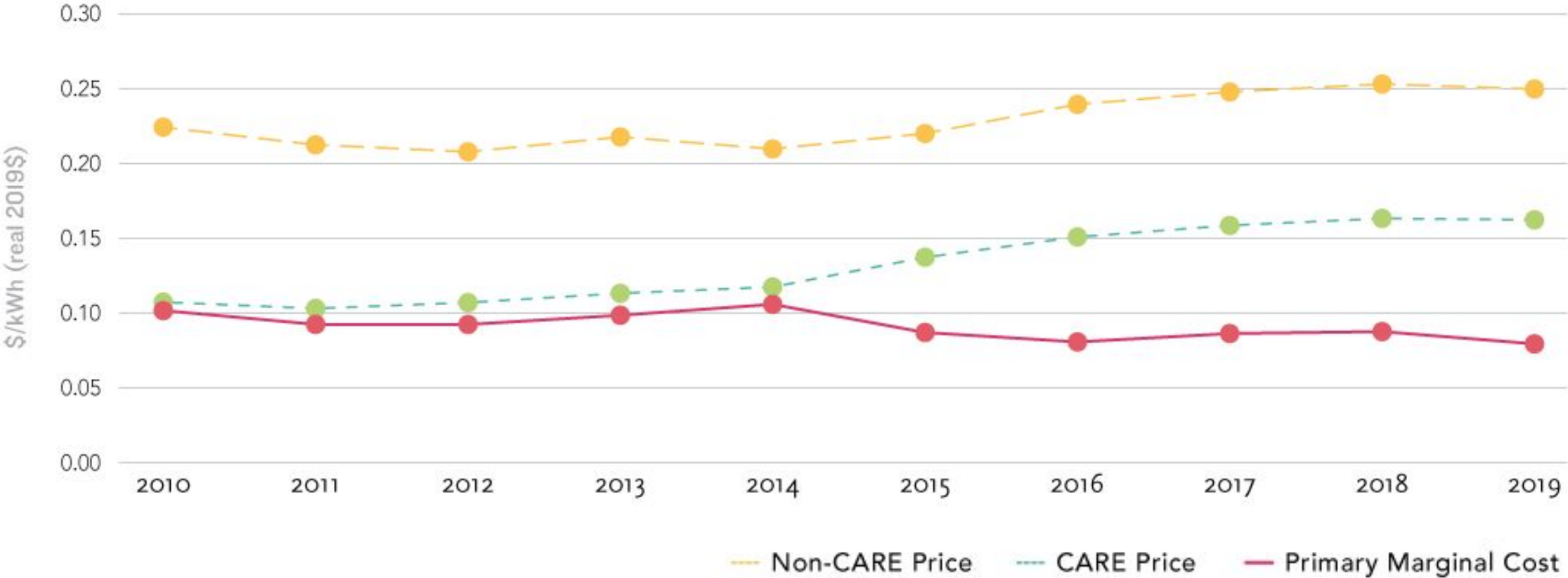
Average Residential Electricity Prices



Source: US Energy Information Administration

Residential prices versus social marginal cost (\$/kWh)

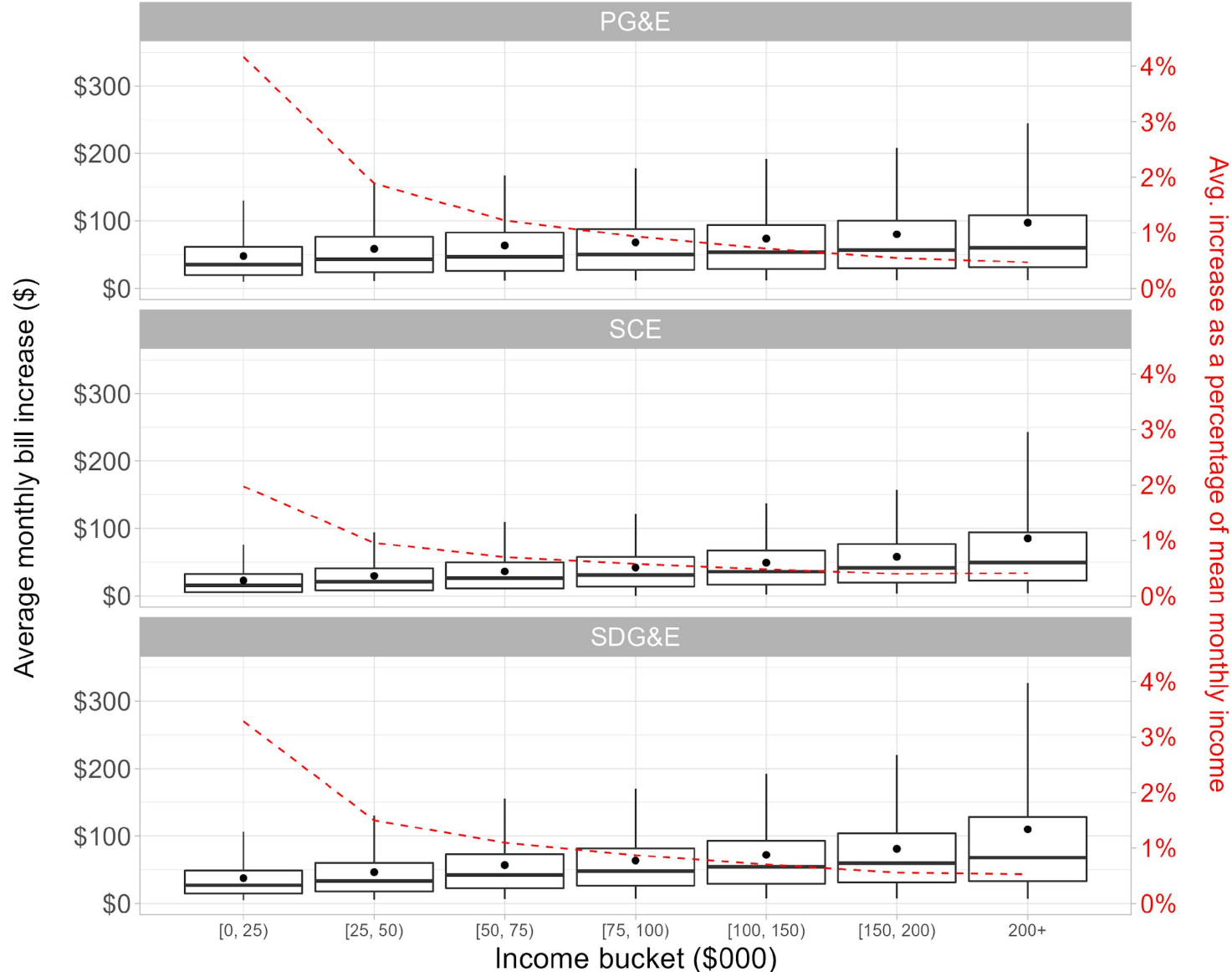
a. PG&E



What is driving the gap between price and SMC?

- Legacy infrastructure costs
- Legacy energy contracts that are now above market
- Vegetation management
- Distribution system maintenance and upgrades
- Grid hardening/wildfire risk mitigation
- Wildfire victim compensation (due to “inverse condemnation”)
- Subsidies for new technology R&D
- Energy efficiency programs, EV charging stations
- Subsidies for low-income customers
- Net energy metering for rooftop solar (due to $P \gg SMC$)
- ...and prices are set to rise further relative to SMC

Monthly Residual Cost Burden by Income Category (2019)

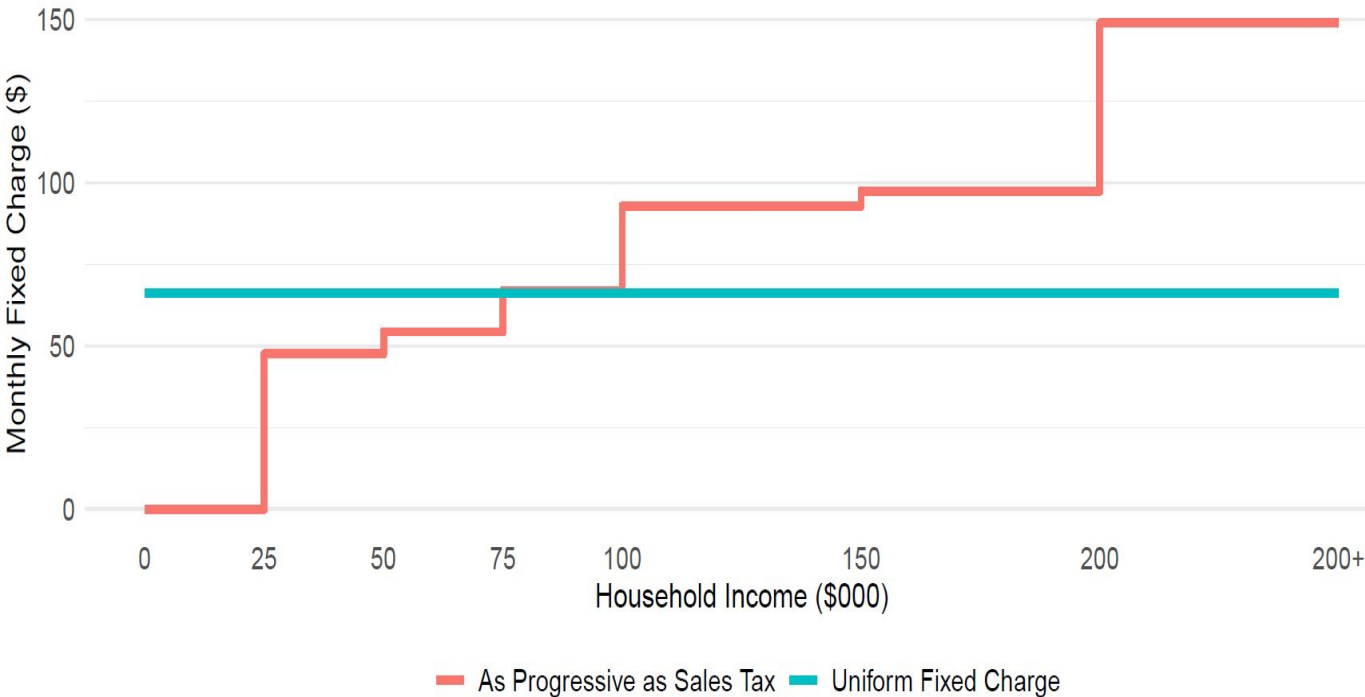


- Richer households pay more per year towards residual cost recovery.
- But lower income households pay a much higher share of income.
- This “electricity tax” is quite regressive.

Solutions?

- The current rate structure (high volumetric prices above SMC to recover non-incremental costs) is slowing progress on electrification and amounts to a relatively regressive tax.
- There are feasible rate reforms that are both good for the climate and good for affordability/equity.
- We consider how an alternative rate shifts the burden of fixed cost recovery in the power sector.

Example of Income-graduated Fixed Charge (PG&E)

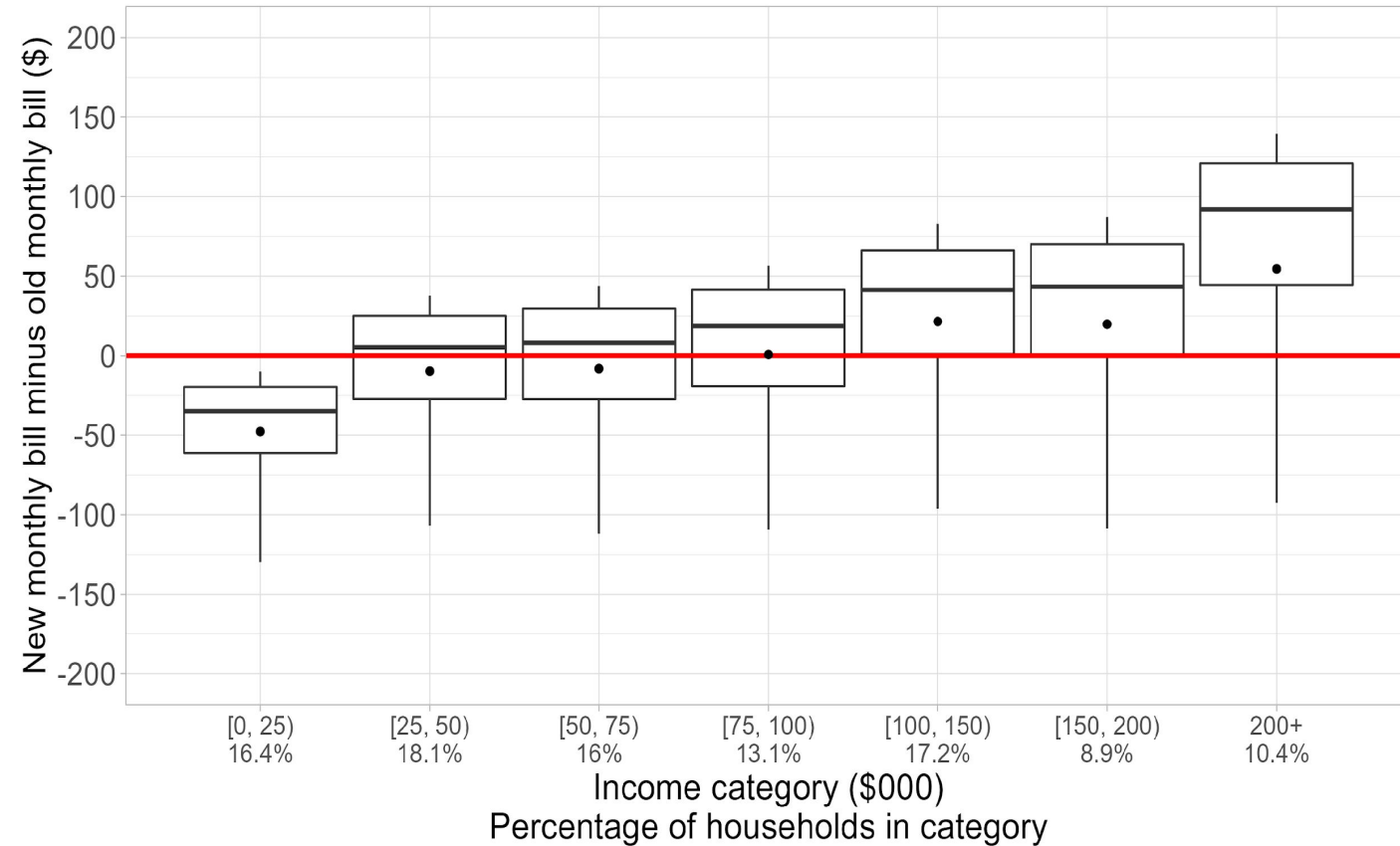


Example of Income-Based Fixed Charge

- In PG&E, a uniform monthly fixed charge would be \$67 in 2019 to recover same revenue with P=SMC (green line).
- Red line shows an income-graduated fixed charge (IGFC) that matches progressivity of sales tax.

Effect on Monthly Bills (PG&E)

- Volumetric prices are much lower, so net impact on bill depends on both consumption and the IGFC.
- A negative number in figure indicates bill reduction under IGFC approach.
- Wealthiest households would see bill increase of about \$51 on average.
- Bill impacts will vary substantially depending on consumption.



Effect on Monthly Bills by Income Bracket

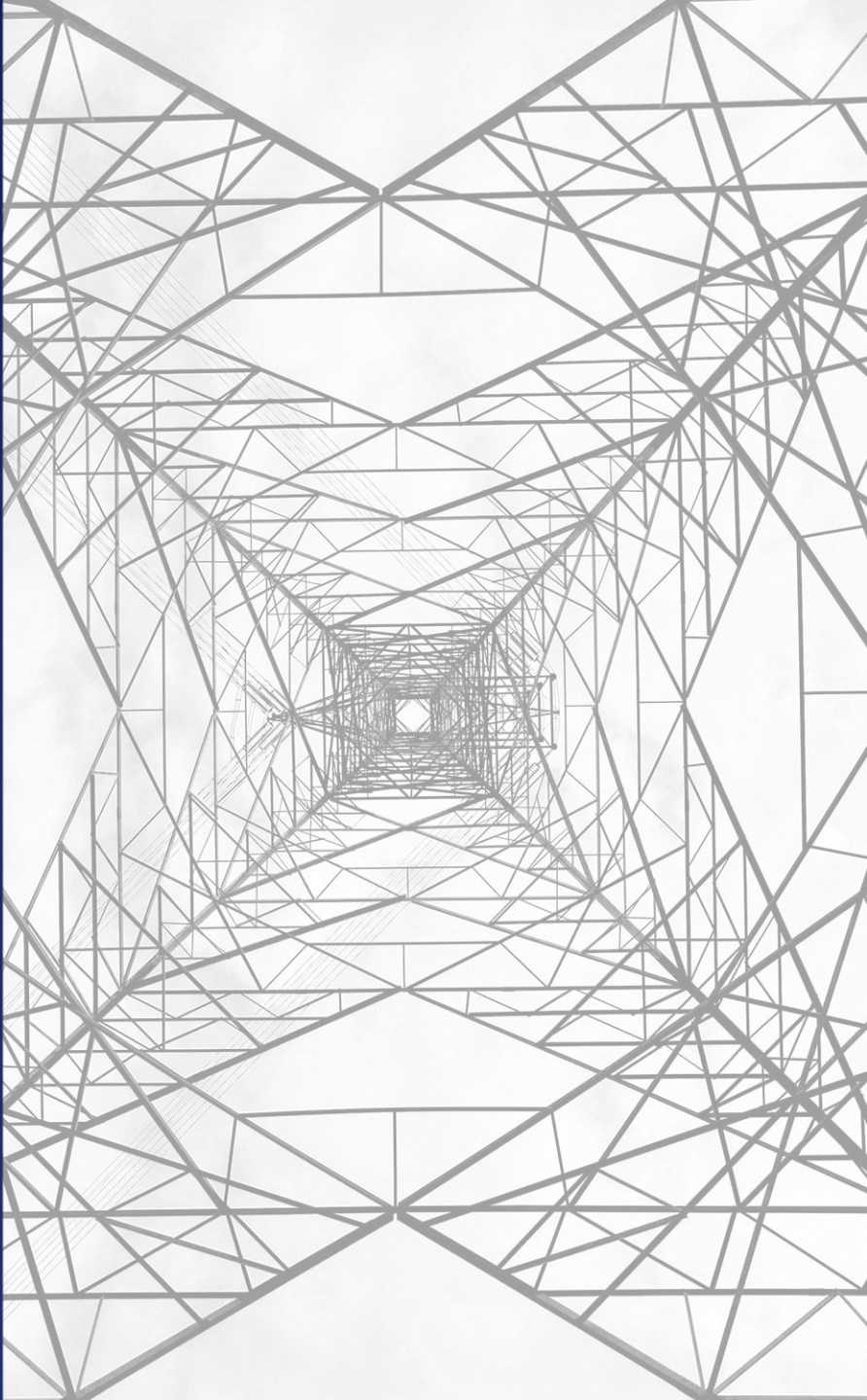
Box and whisker plot shows the mean impact in a group (dot), the median impact (bar), the 25th to 75th percentile impact (box) and the 5th and 95th percentile (lines).

Who will pay for the clean energy transition?

- Recovering escalating capital costs in the power sector with higher volumetric retail prices will slow decarbonization and exacerbate income inequality.
- **Good news!** We can improve rates by:
 - Moving costs onto the state budget.
 - Creating an income-based fixed charge.
- **A California experiment:**
 - New law directs CPUC to develop an IGFC.
 - Other proposals would move select costs onto state budget, but less momentum for that.

Related Work:

- Borenstein, Fowlie and Sallee. [Designing Electricity Rates for An Equitable Energy Transition](#), Energy Institute at Haas Working Paper #314, February 2021
- Borenstein, Fowlie and Sallee. [Paying for Electricity in California: How Residential Rate Design Impacts Equity and Electrification](#), Energy Institute at Haas Working Paper #330, September 2022

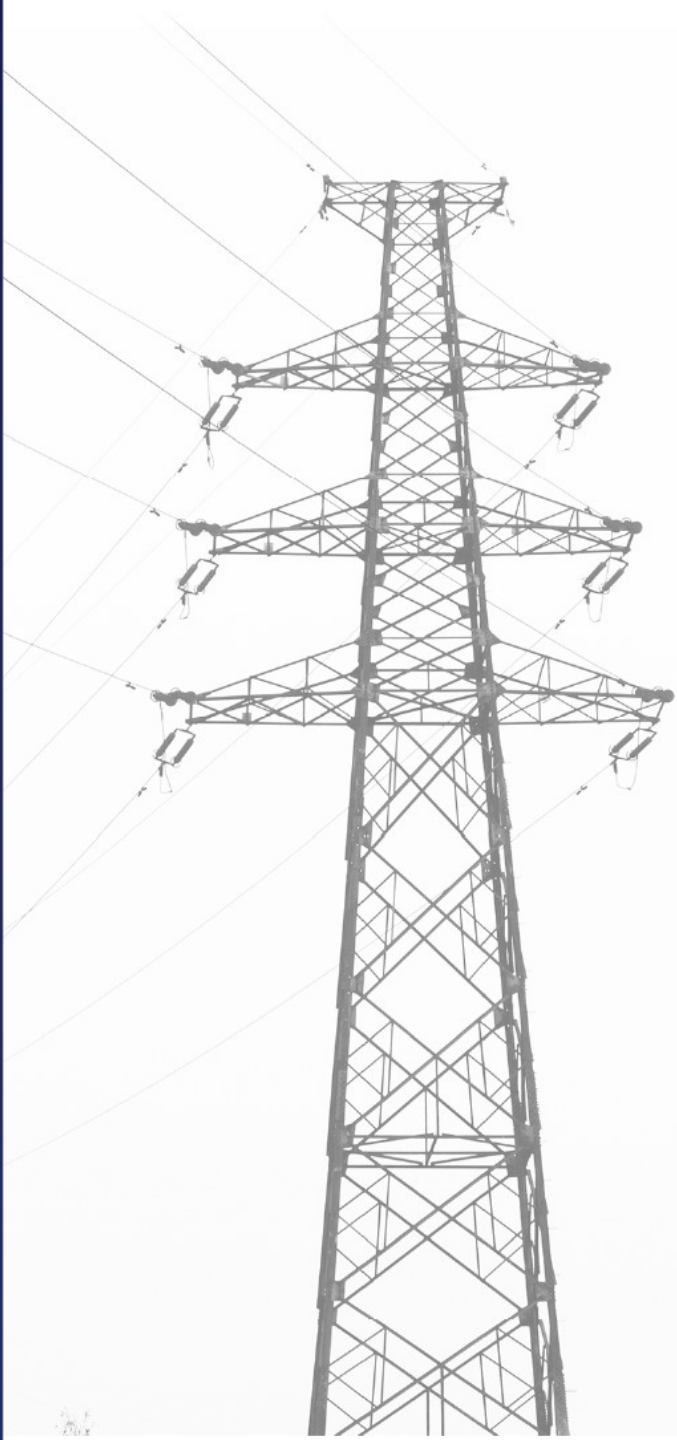


Coming up:

Load Growth Forecasts

- Is significant load growth back, driven by data centers, AI, and electrification? How will that affect power markets?
- Load forecasting methodologies – how much error is there in forecasts and what are the implications of that?

We welcome suggestions on speakers!



Thank You

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Contact team@powermarkets.org