DOCKETED	
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Project Title:	Informational Proceeding on Non-Energy Benefits and Social Costs
TN #:	262166
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Docketed Date:	3/12/2025

Scoping Workshop for the Non-Energy Impacts (NEI) Informational Proceeding

California Energy Commission

March 13, 2025

Housekeeping

- Workshop is being conducted in person and remotely via Zoom
  - Workshop is being recorded

- Attendees may participate in the workshop by:
  - Making comments during public comment periods and asking questions during public Q&A periods
    - Questions can be entered in the Q&A section of the Zoom application

  - Submitting written comments due **March 27th, 2025**

Workshop Overview

Introduction & Opening Comments

Presentation: - 10:30 am

- CEC Processes & Decision-Making – NEIs within the CEC

Presentations: - 11:30 am

- NEIs from a Public Perspective: Consideration of Local Risks

Lunch Break – 12:30 pm

Presentation: - 1:30 pm

- NEI Metrics – Challenges & Best Practices

Moderated Panel: - 2:40 pm

- Many Dimensions of NEIs

Public Comments – 4:00 pm

Closing Remarks & Adjourn – 4:30 pm

Opening Comments from the Dais

CEC Processes and Decision-Making: Non-Energy Impacts within the CEC

Lead Commissioner NEI Scoping Workshop

Liz Gill, PhD - Program Manager, Reliability Analysis Branch
March 13, 2025
10:30 - 11:00 am

ACRONYMS

- AB – Assembly Bill
- CALSHAPE- California Schools Healthy Air, Plumbing and Efficiency Program
- CEC - California Energy Commission
- CERRI - Community Energy Reliability and Resilience Investment
- EDD – Employment Development Department
- EBD – Equitable Building Decarbonization Program
- EPIC – Electric Program Investment Charge
- EVID – EV Infrastructure Deployment
- IEPR – Integrated Energy Policy Report
- INDIGO - Industrial Decarbonization and Improvement of Grid Operations
- LI-DAC – Low Income – Disadvantaged Communities
- NEI – Non-Energy Impact
- S4A – Solar For All Program
- SB – Senate Bill
- V2G – Vehicle to Grid
- VPP – Virtual Power Plant

Presentation Overview

- **Purpose** – Describe landscape of CEC's programs
    - What we do
    - How we currently use NEIs
    - Plan for NEIs

- **Objectives**
    - Feedback on the proposed set of non-energy impacts planned for consideration for application in CEC planning and processes

Three Main Functions of the CEC

Policy & Planning

Forecasts of
- Demand
- Supply
- Reliability

Regulatory Functions

- Codes & Standards
- Power Plant Permits

Program Implementation

- Research & Development
- Fueling Innovation & Market Transformation

Examples* of CEC Programs

Policy & Planning

- Demand Forecast
- IEPR
- SB 100
- Reliability Assessments & Reports
- SBX1-2 - Petroleum Industry data collection

Regulatory Functions

- Power Source Disclosure
- CalGreen – Green Building Standards

Program Implementation

- Decarbonization Incentive Programs
  - Zero Emission School Buses
  - Equitable Building Decarbonization
  - Solar for All
- EV Charging Infrastructure Incentives
- EPIC

*not a comprehensive list

Programs Currently using NEIs

Policy & Planning

- Demand Forecasting
  - Resilience
- IEPR
  - Equity
- SB 100
  - Air Quality

Regulatory Functions

- Building Efficiency Standards (Title 20 & 24)
  - Air Quality
  - Environmental
  - Affordability
- Appliance Standards
  - Resilience

Program Implementation

- Decarbonization Incentive Programs
  - Air Quality
- EV Charging Infrastructure Deployment
  - Air Quality
  - Resilience
- EPIC Programs

Current NEI Categories at CEC

Air Quality

Land Use

Affordability & Economics

Workforce & Jobs

Air Quality

Definition: Air quality related health impacts including the monetary and non-monetary evaluation of those impacts.

Air Quality

CEC Context

- Health impacts linked with emissions like $PM_{2.5}$ and ozone
- **Sources**: fuel burn for electricity, transportation, buildings, and industry.
- **Impacts:** total premature mortalities, asthma emergency room visits, and the monetary costs incurred like medical bills and lost work.

CEC Activities

- CalSHAPE & INDIGO programs considers air pollutants in the benefits calculator
- Equitable Building Decarbonization program installs retrofits which benefits indoor air quality
- EV Infrastructure Deployment considers indirect impacts on air quality including a localized health impact report

Land Use

Land Use

- **Definition**: Environmental impacts of siting of energy infrastructure, and implications for lands that have alternative productive uses.

CEC Context

- Impacts that new energy facilities/infrastructure could have on communities
- Risks and benefits for land and the community if it were used for energy purposes or for alternative uses like farmland or housing

CEC Activities

- Land use screens development accounting for land use and environmental information for input into resource and transmission planning.

Affordability and Economics

Affordability & Economics

Definition: Household energy costs, including changes to the home and transportation costs, impacts on local supply chains, lifecycle costs and impacts on economic growth.

CEC Context

- Energy affordability, with an emphasis on households that pay a disproportionately high share of their household income on energy.

CEC Activities

- Solar for All: 20% reduction in energy bills for participants
- EBD Program: no cost retrofits for low-income households; priority invitations to homes most likely to experience beneficial bill impacts.
- EV Infrastructure Deployment considers indirect impacts on transportation costs, affordability of EV adoption

Workforce and Jobs

Workforce & Jobs

Definition: The number, quality, and accessibility of jobs gained through the energy transition.

CEC Context

- Availability and accessibility of jobs that provide family-sustaining wages, health benefits, a pension, worker advancement opportunities, and collective worker input and are stable, predictable, safe and free of discrimination.

CEC Activities

- EV Charging Infrastructure Reports (AB2127) evaluating workforce changes due to charging infrastructure.
- EDD funding under S4A to assess workforce impacts
- Building Standards include estimates of impact on labor due to their measures

NEI Categories Under Consideration

Air Quality

Land Use

Affordability & Economics

Workforce & Jobs

Resilience

Water Supply & Quality

Public Health & Safety

Crosscutting

Additional Categories

Resilience

Definition: "...the capacity of any entity— an individual, a community, an organization, or a natural system—to prepare for disruptions, to recover from shocks and stresses, and adapt and grow from a disruptive experience." (OPR, 2018)

Resilience

CEC Context	CEC Activities Planned or Under Consideration
• Resilience to disruptions to the energy systems and the services they provide through minimizing grid outages and minimizing impacts of outages that can't be avoided	• CERRI Program invests in projects to increase community reliability & resilience • EPIC grant awarded to study valuation of investments in electricity sector resilience • EVID researching potential benefits of vehicle to grid (V2G) technology and building resilience in infrastructure planning • EBD and building standards support retrofits for resilience to extreme high/low temperatures

Water Supply and Quality

Water Supply & Quality

Definition: Developing estimates of changes in water supply by quantifying the amount of water consumed for energy production and use

CEC Context	CEC Activities Planned or Under Consideration
• The energy-water nexus includes energy production's dependence on water for cooling thermal plants, construction of facilities, cooling of buildings, production of hydroelectric power, production of biofuels, and future production of hydrogen.	• SB100 2021 report notes "Non-energy benefits and social costs should therefore encompass energy resource impacts on water quality or quantity and impacts of water supply on the energy system.

Public Health and Safety

Public Health & Safety

- **Definition:** Understanding health impacts that are not fully captured in other categories including: total lifecycle costs, and protection from injury.

CEC Context

- Impacts on air quality due to outdoor gas leaks (e.g. H2 and natural gas)
- Impacts on wildfire risks (e.g., if woody biomass harvested for biofuel production)

CEC Activities Planned or Under Consideration

- S4A program is designed for LI-DAC for improved air quality

Cross Cutting

Crosscutting

- **Definition:** Impacts that are not fully captured in specific factors including equity

CEC Context	CEC Activities Planned or Under Consideration
• Identification of disadvantaged communities with compound impacts such as health or affordability using screening tools like CalEnviroScreen and Energy Equity Indicators	• EV Infrastructure Deployment exploring vehicle-to-home arbitrage and VPP • SB 1000 requires assessment of equitable distribution of charging infrastructure; AB 626 requirement to directly impact DACs. • EBD program goal: bring low-income household adoption to parity with non-low-income household adoption rates

Implement structure & consistency in assessing NEIs

Current Typical Methods

- Outdoor GHG Reductions
- Social Cost of Carbon
- Environmental Analysis
- Affordability (Bill impacts)
- Equity

Potential New Structure/Methods

- Align metrics across CEC divisions
- Assign monetary value where possible
  - Energy affordability gap
  - Resilient energy affordability gap
- Develop methods to "tell the whole story"
  - Outdoor & Indoor Air Quality
  - Increase regional granularity of data reporting

OIIP NEI Categories

Air Quality

Land Use

Affordability & Economics

Workforce & Jobs

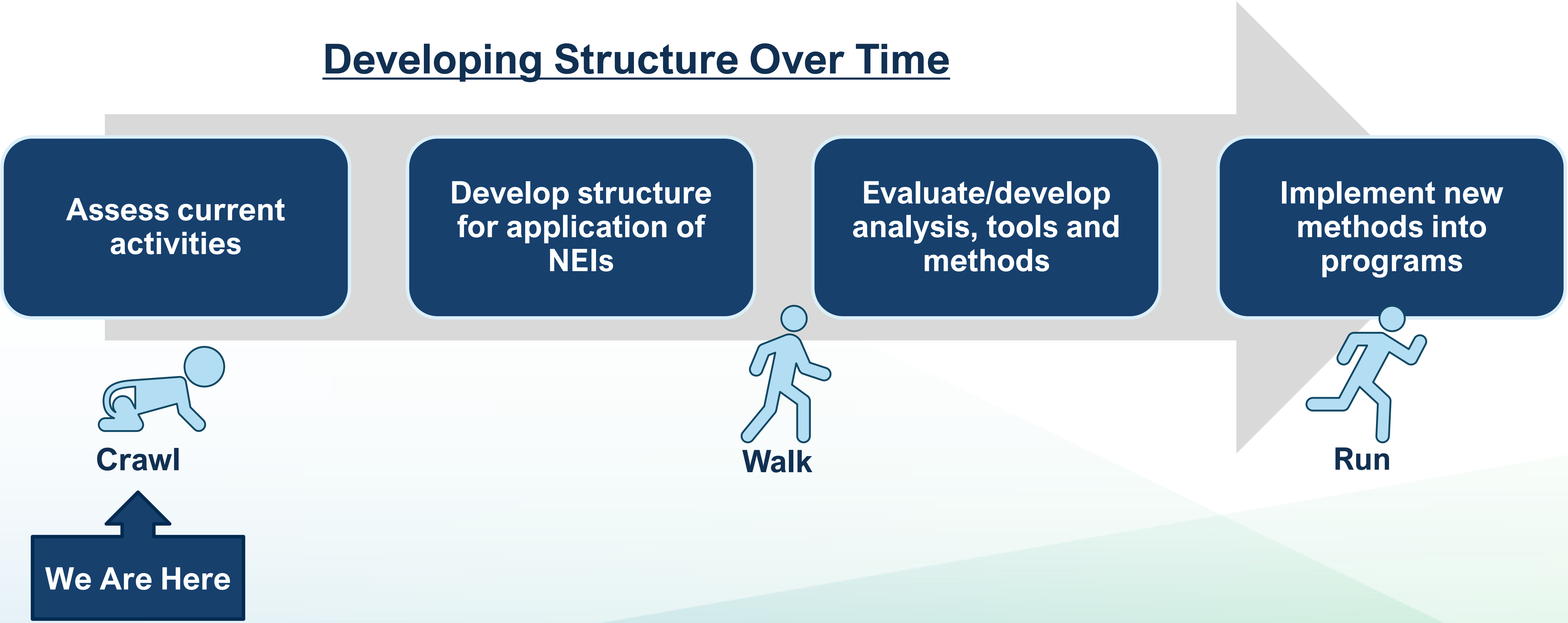
Resilience

Water Supply & Quality

Public Health & Safety

Crosscutting

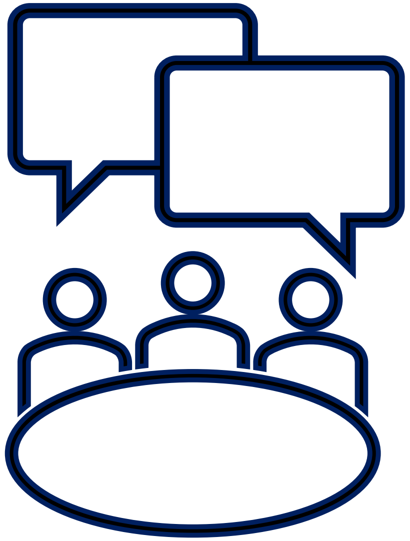
To reach the OIIP goal, we will move forward in phases



We look forward to your feedback

There are two ways to provide feedback:

- Oral Comments – there is a public comment period at the end of today's workshop for participants in the auditorium or through zoom
- Written Comments – written comments can be submitted to the docket by 5 pm on March 27th, 2025



Thank You!

Liz.Gill@energy.ca.gov

Questions from the Dais (1/4)

Questions from the Public (1/4)

Electrifying, Grid Resiliency, and Decarbonizing Schools

Matthew Belasco

Director of Maintenance,
Operations, and Transportation

PITTSBURG UNIFIED
SCHOOL DISTRICT

PITTSBURG UNIFIED SCHOOL DISTRICT

- Located in Contra Costa County, CA (1 hour from San Francisco)
- **13 K-12 Schools**
  - 8 Elementary Schools (K-5)
  - 3 Junior High School (6-8)
  - 1 Comprehensive High School (9-12)
  - 1 Continuation High School (9-12)
- **10,700 students**
- **80% of students** are eligible for free & reduced lunch

PITTSBURG UNIFIED
SCHOOL DISTRICT

Foundation for Success: School Board Policy

PUSD Superintendent
Dr. Janet Schulze

“My advice to other districts is to codify your sustainability practices and commitments as school board policy,” says Dr. Schulze. “Doing this gives staff the directive and encouragement to press forward and ensures these practices continue, regardless of changes in district leadership.”

District Leadership Paves the Way to Electrification

Pittsburg Unified School District
PITTSBURG, CALIFORNIA

School District
11,000 students at 14 schools

Solar Installation
3.49 MW capacity, 55 shade structures at 14 schools

Battery Storage Installations
1.6 MW (3.0 MWh) at 10 schools

Energy Offset
- 63% of district's total energy consumption
- 90% of district's electricity consumption

Cost Savings
- Solar: $11 million over the life of the project
- Battery Storage: $2.8 million over seven years

Financing
- Solar: Power purchase agreement and certificate of participation
- Battery Storage: $715,000 from MCE Energy, $1 million in infrastructure grants from utility PG&E

Local Funding

Pittsburg Unified School District

District-wide solar project funded by General Obligation (GO) Bond

- 55 shade structures at 14 schools (13,000 PV panels)
- 10 Year O&M Contract
- 90% of district electricity use

  in design phase
- $11 million in cost savings over 30 years to General Fund
- Sell SRECs into open market for revenue

District investments in EVs

PITTSBURG UNIFIED SCHOOL DISTRICT

White Fleet Electrification

- **27 EVs in fleet** (including School buses, light and medium duty trucks and cars, twelve-passenger vans, box trucks, & riding lawn mower)
- **$100,000 per year in fuel savings** from entire EV fleet, due to renewable being on site
- Increased demand on grid - How do we offset this?

Grant Funding from State of California

PITTSBURG UNIFIED SCHOOL DISTRICT

Vehicle-to-Grid (V2G)
Bi-directional Charging Pilot

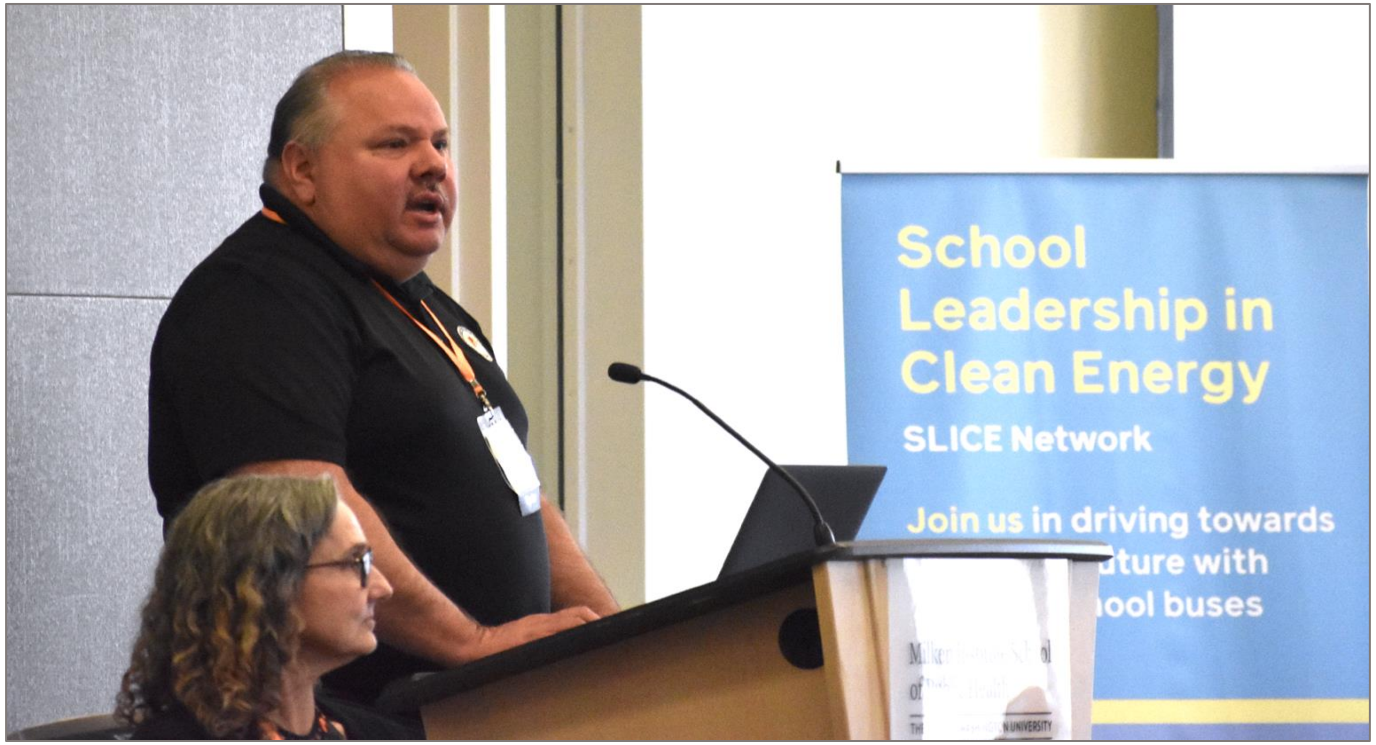
- **$1.7 million grant** from state for **7 bi-directional, level 3 EV chargers**
- Chargers send power from bus to the grid during peak hours in summer. **District earns $2 per kWh.**
- Chargers will be part of a community resilience hub.

California Energy Commission Awards $2.9 Million Grant for Electric School Bus Bidirectional Charging Infrastructure

Led by The Mobility House, the project will provide a replicable solution for school districts across the state

School buses charging at the Pittsburg Unified School District bus depot. Photo provided by Pittsburg USD.

Questions???


School
Leadership in
Clean Energy
SLICE Network
Join us in driving towards

Questions from the Dais (2/4)

Questions from the Public (2/4)

Lunch Break – Return @ 1:15 PM

Metrics for Measuring Non-Energy Impacts: Challenges and Best Practices

Lead Commissioner NEI Scoping Workshop

Boris Lukanov, PhD, Senior Scientist, PSE Healthy Energy
Yannai Kashtan, PhD, Air Quality Scientist, PSE Healthy Energy
March 13, 2025

PSE Bringing science to energy policy

Agenda

Introduction

Non-Energy Impacts (NEIs): Challenges and Strategies

Example Impacts for NEIs Related to Buildings:

- Affordability Metrics
- Air Quality and Health Metrics

Questions and Discussion

About PSE

PSE Healthy Energy (PSE) is a nonprofit research institute that studies the way energy production and use impact public health, the environment, and the climate.

Boris Lukanov, PhD, joined PSE in 2017 to develop analyses on energy transition pathways that maximize health, equity, and environmental co-benefits. His work focuses on clean energy technologies, energy equity, air quality, and integrated resource modeling and optimization.

Yannai Kashtan, PhD, joined PSE in 2024. His work focuses on the health impacts of fossil fuel use, particularly in the home. Dr. Kashtan received his PhD from Stanford University where he researched indoor pollution from gas stoves through direct measurement field studies and modeling.

NEIs: Challenges and Strategies

Challenges of Integrating NEIs

Difficulty in Quantification — Non-Energy Impacts Are Local

Mismatched Methodologies Across Programs and Sectors

Mismatched Data Scales; Supply and Demand Side Divide

Technologies Have Multiple and Interacting Impacts

Examples: Current Implementation

- Statewide resource planning and rulemaking
- CPUC Societal Cost Test
- Utility IRPs and rate cases
- CEQA
- Federal (LEAD tool, IRA provisions, air permitting processes)
- Implementation at the local community level

Strategies for NEI Integration

GHGs as the first NEI — we've done this before.

Standardization across programs, sectors, and stakeholders and metrics that work across geographic scales

Options include monetized impacts integrated in modeling, NEIs as targets/constraints, qualitative approaches

Explore various scenarios and sensitivities

Metrics need to be identified / developed with input from community stakeholders.

Example Approaches: Energy Affordability

40 million

U.S. households struggle to pay their energy bills

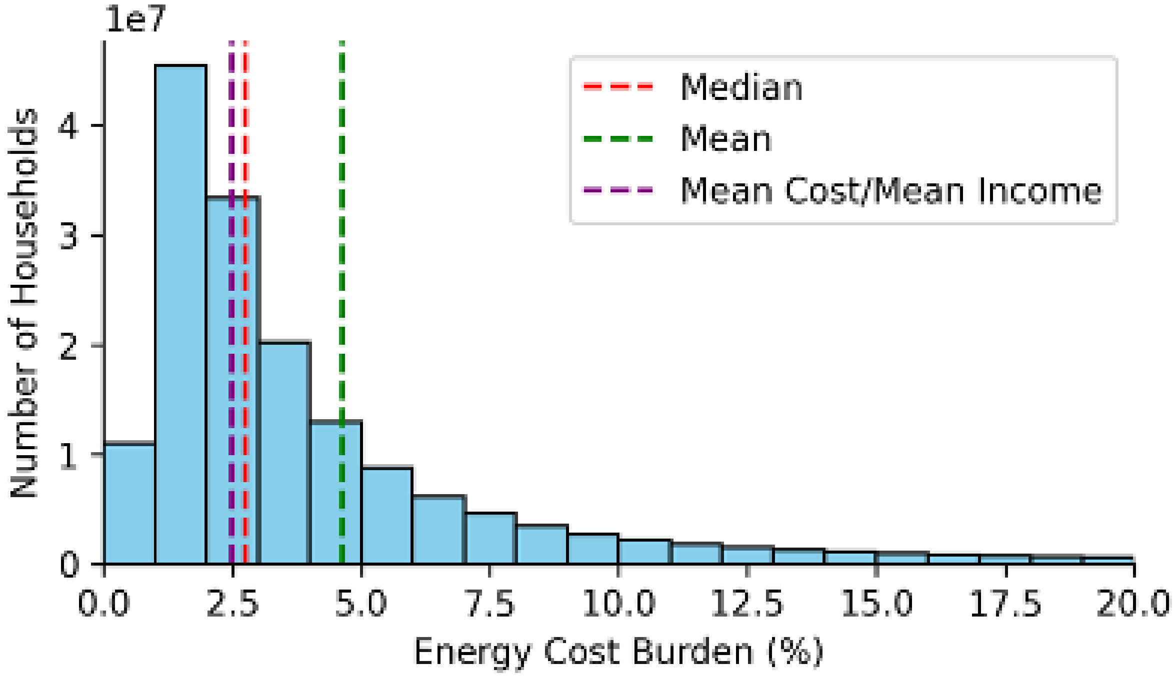
U.S. Energy Information Administration. 2018. “One in Three U.S. Households Faces a Challenge in Meeting Energy Needs.” Today in Energy, September 19, 2018. www.eia.gov/todayinenergy/detail.php?id=37072

Energy Affordability Metrics

Metrics	Definition	Data Dimensions Needed: Fuel Use	Energy Bills	Other Costs	Income	Utility Shutoffs	House Size
Energy cost burden	Percent of household income spent on energy bills		X		X		
Mean individual burden	Average of the percent of income spent on energy by each household		X		X		
Mean group burden	Overall energy expenditures as a percent of total income in the group		X		X		
Affordability ratio	Fraction of household income spent on energy bills after housing and other utility costs		X	X	X		
Energy affordability gap	The total amount spent on energy bills in excess of an affordability threshold	X	X	X	X		X
Energy Use Intensity	Energy use per square foot, used as a proxy for energy efficiency	X					X
Energy insecurity	Vulnerability to utility disconnections					X	
Gini coefficients and disparity ratios	E.g., energy use intensity (EUI) reported in the lowest income vs. highest income quintiles	X			X		X

Two Metrics, Two Stories

Energy Cost Burden



Advantages

Simple, easy to use.

Limitations

Aggregate values can be misleading

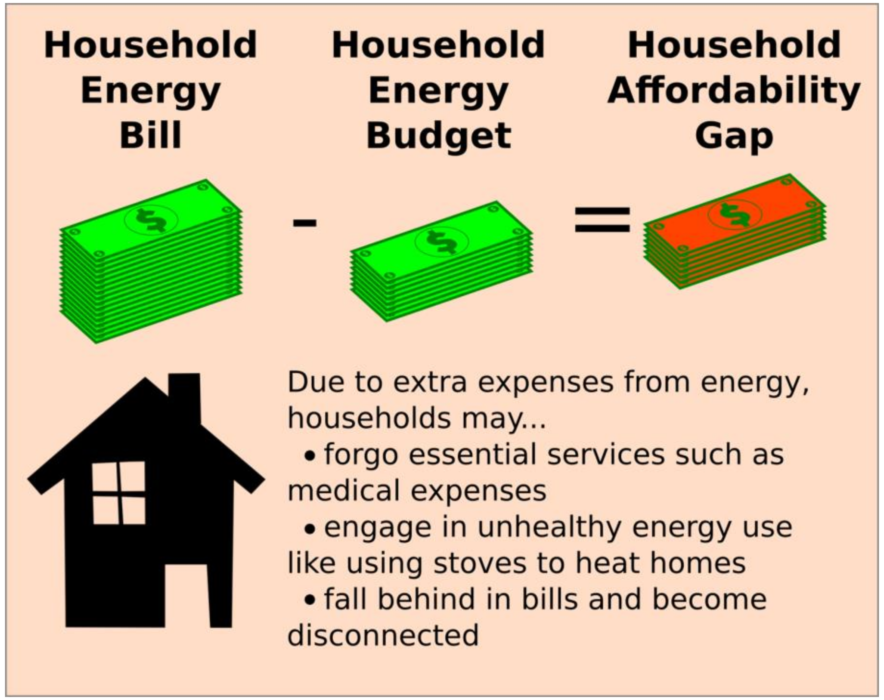
6% threshold is somewhat arbitrary.

Does not consider other household expenses (CPUC's Affordability Ratio does).

Not monetizable

Two Metrics, Two Stories

Energy Affordability Gap



Advantages

Assigns a dollar value to unaffordable energy bills; represents the total societal cost for bill assistance needed.

Summation variable (does not resort to statistical averages).

Allows for quantifying the impacts of bill-reducing home interventions.

Requires household-level energy consumption data (helps quantify related GHG emissions too).

Limitations

Requires household-level energy consumption data

Develop Novel Methods

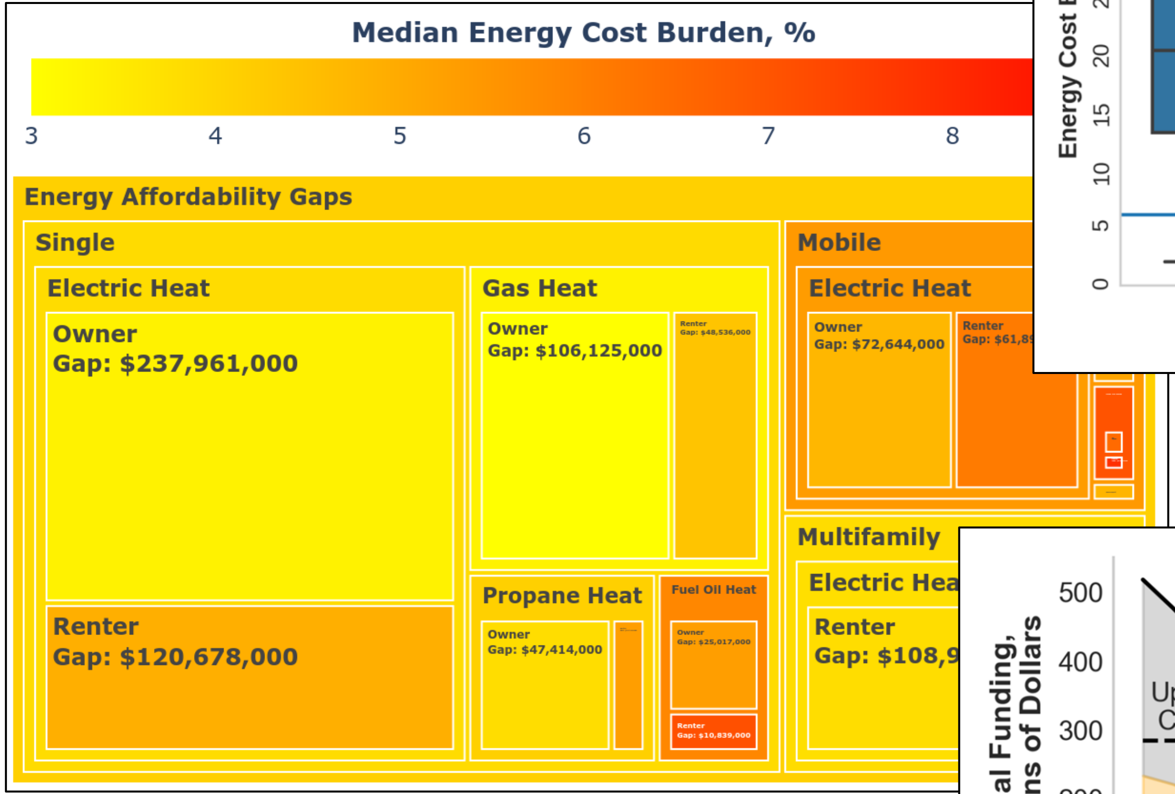
Household-Level Energy Use Data

Energy use data not typically available at the household level → **Requires Modeling (Downscaling)**

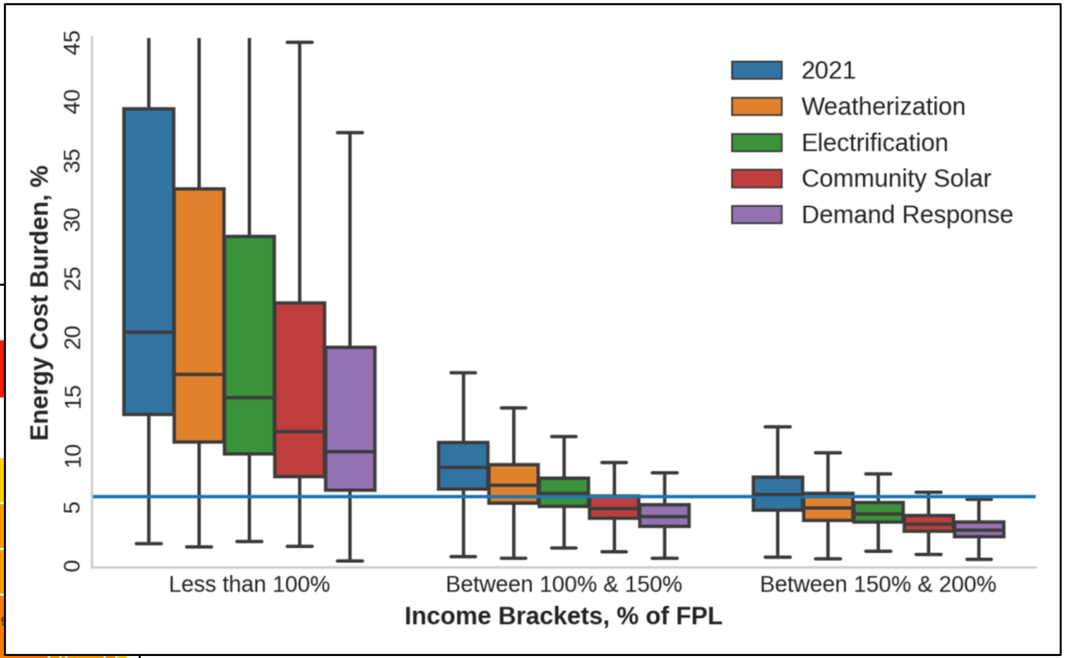
Constrained Dataset	Random Forest Regression	Household-Level Energy Prediction	Validation and Analysis
Used an integer programming method for each census tract to sample households from the RECS survey constrained to match population count breakdowns from the American Community Survey data.	Used 2015 RECS microdata to identify predictors of energy consumption Predictors include geographic, demographic, energy, and housing characteristics (e.g., climate zone, household income, fuel price, rooms in housing unit)	Applied regression estimates to the portfolio of simulated households within Colorado. Climate predictors derived from NOAA data in ArcGIS Fuel prices from CEO and EIA	Validated estimates against state-wide, aggregate values Analyzed demographic and spatial trends in energy consumption, bill burden

Example Uses

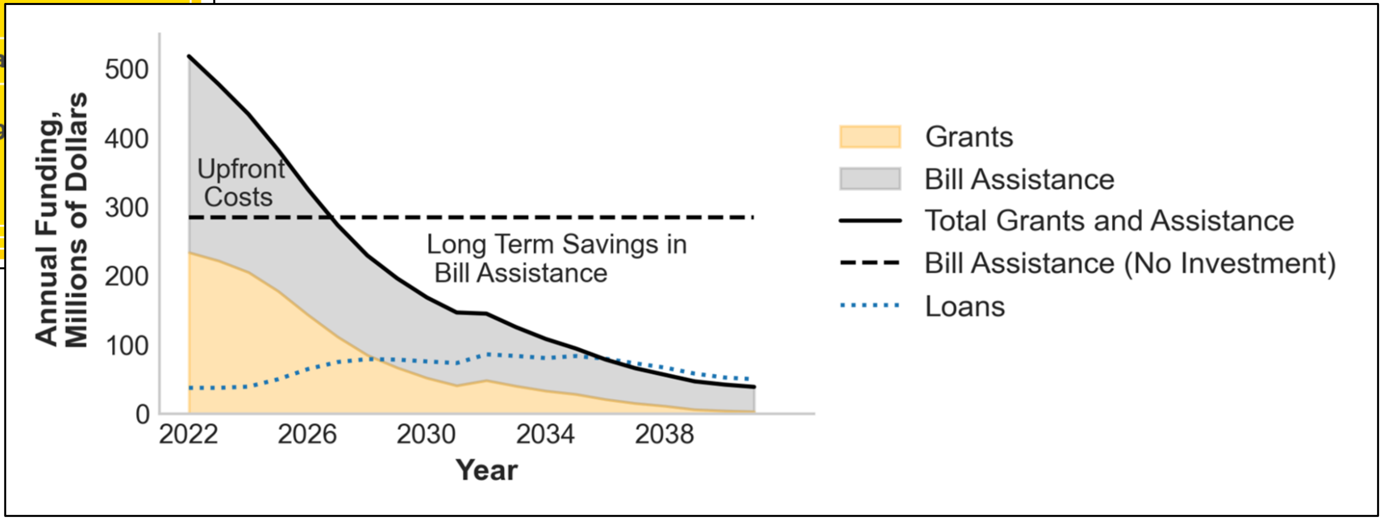
Data Reaggregation



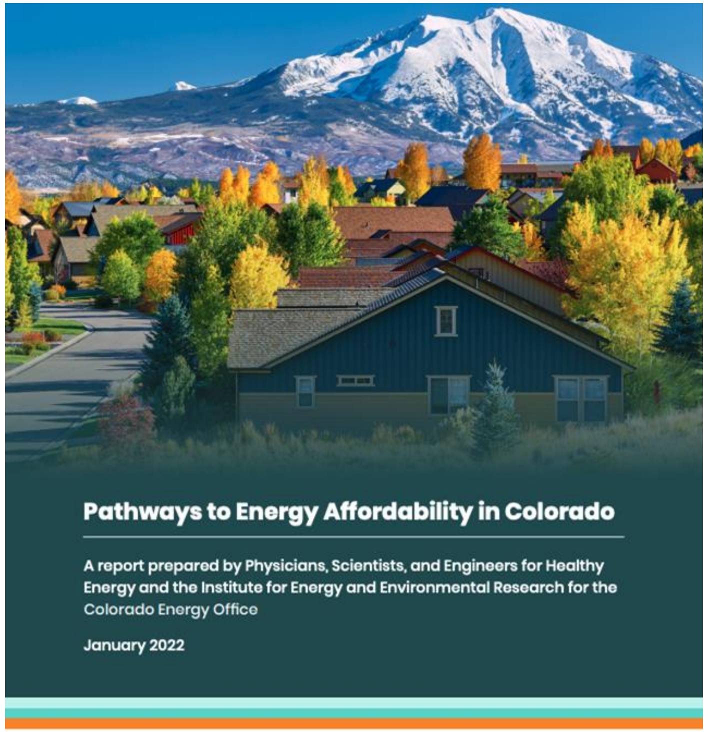
Effects of Sequential Interventions

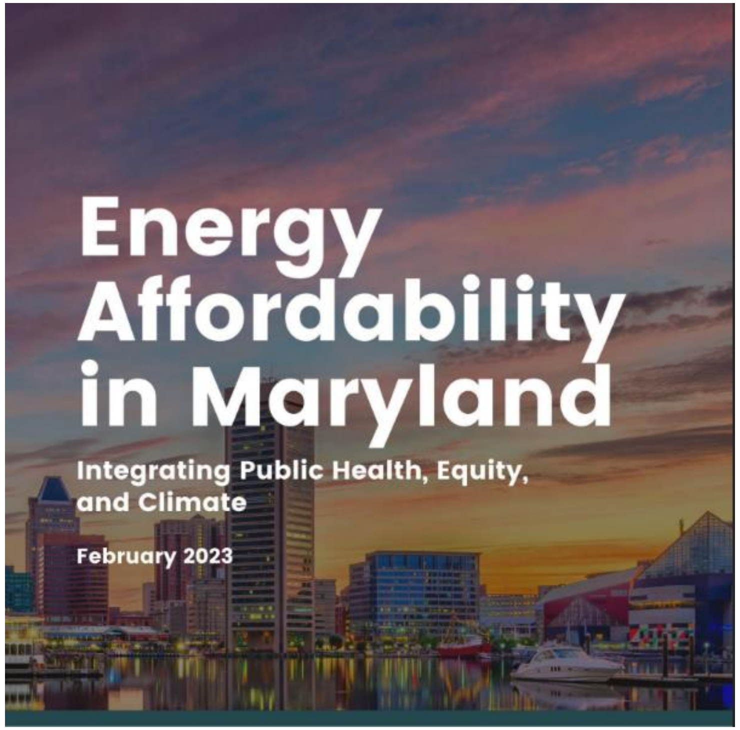


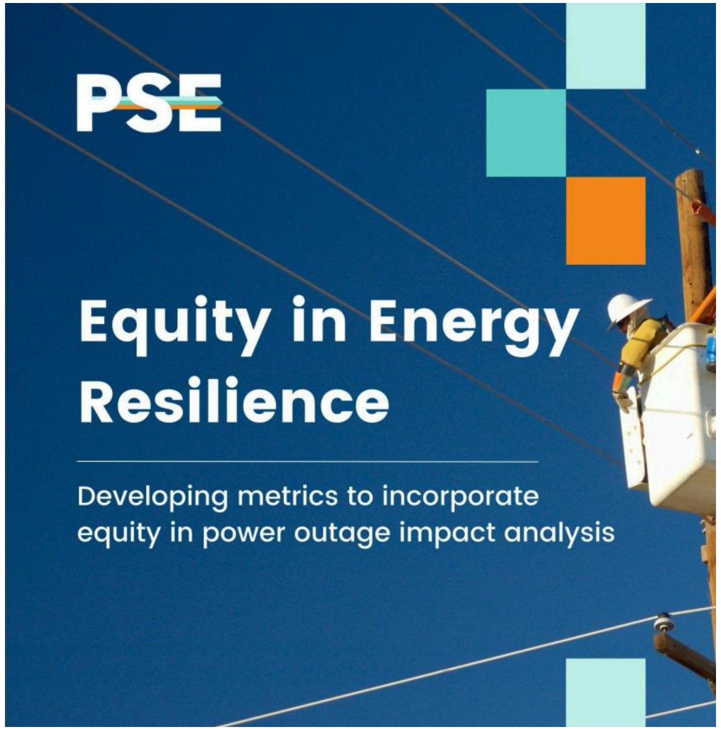
Societal Cost Implications



Additional Resources







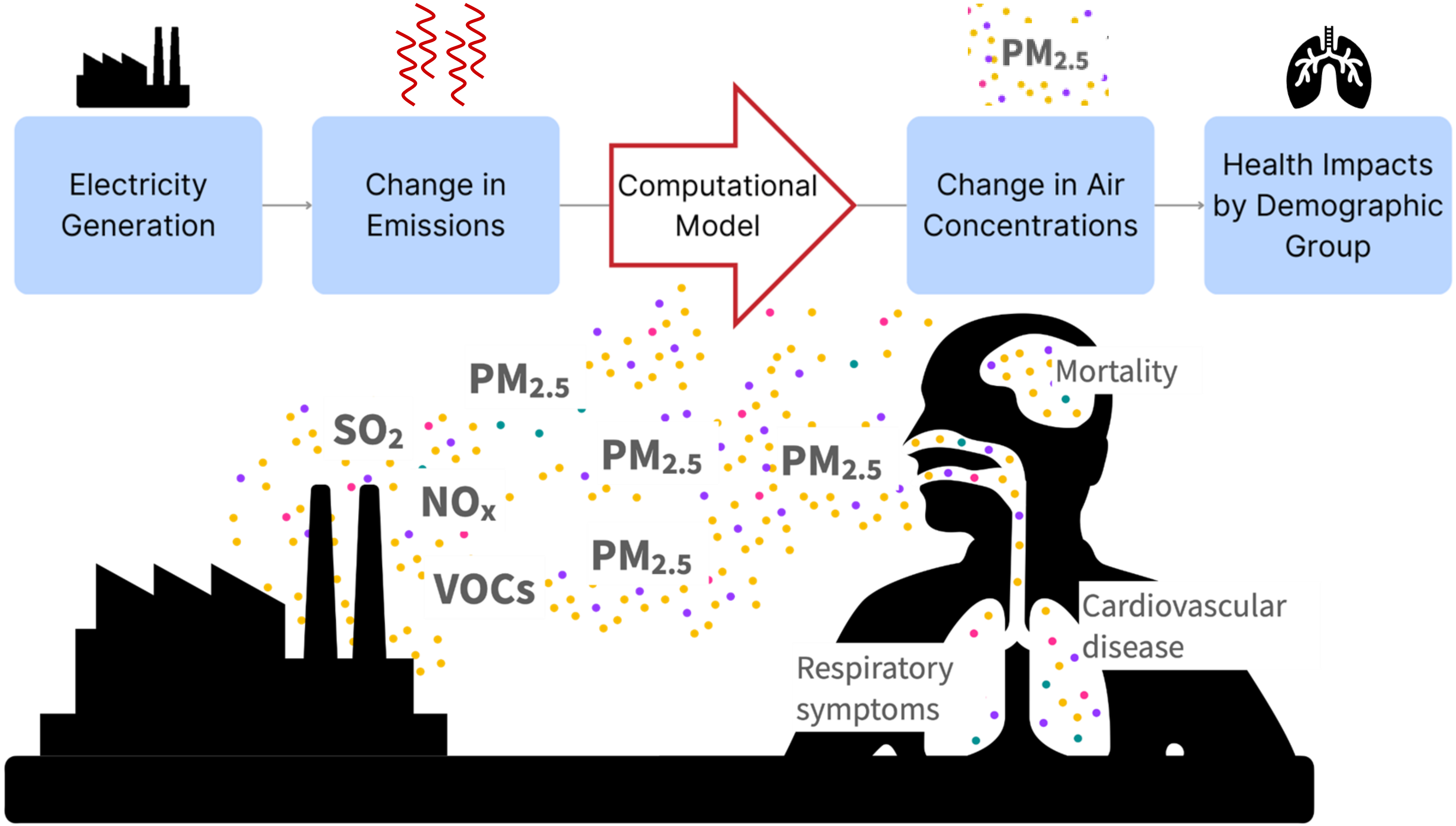
Aligning climate and affordability goals can save states billions. **Opinion, Utility Dive.**

Planning for affordability. **Blog Article, PSE Healthy Energy.**

Example Approaches: Air Quality

Air Quality and Health

We can use computer models to estimate the air quality and monetary impacts of energy choices.



Approach for Determining Health Impacts

Goal: To understand the full picture of energy choices on air quality and human health, we need to consider impacts on both indoor and outdoor air quality.

Outdoor Air Quality

Approach: Off-the-shelf air quality/health models to calculate impacts (e.g., CMAQ, COBRA, InMAP)

Indoor Air Quality

Approach: Scientific decisions need to be made to specify approach

Limitations: Depend more on individual activities leading to larger uncertainties in baseline concentrations and exposures

Challenge: Mapping air quality and health cost or benefits of indoor and outdoor emissions scenarios into a unifying NEI framework.

Use Case: Estimating Societal Cost of NO_2 Exposure from Gas and Propane Stoves

Behavioral & Building Datasets

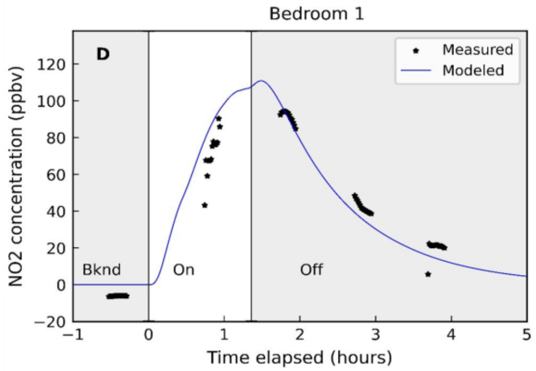
Outdoor Pollutant Concentrations

Combined Model

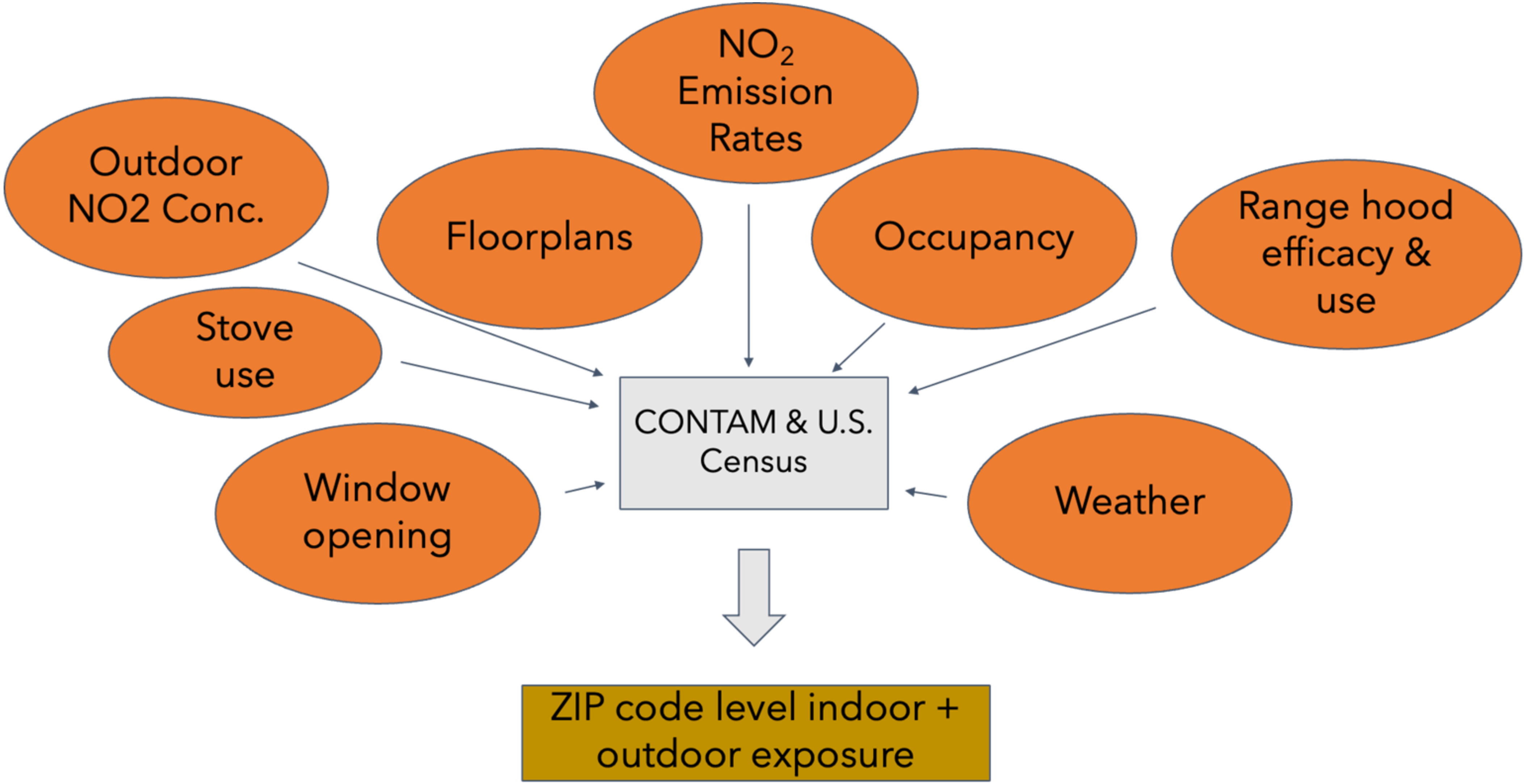
Indoor Pollution Sources

Validation

Population-Level Exposure Estimate

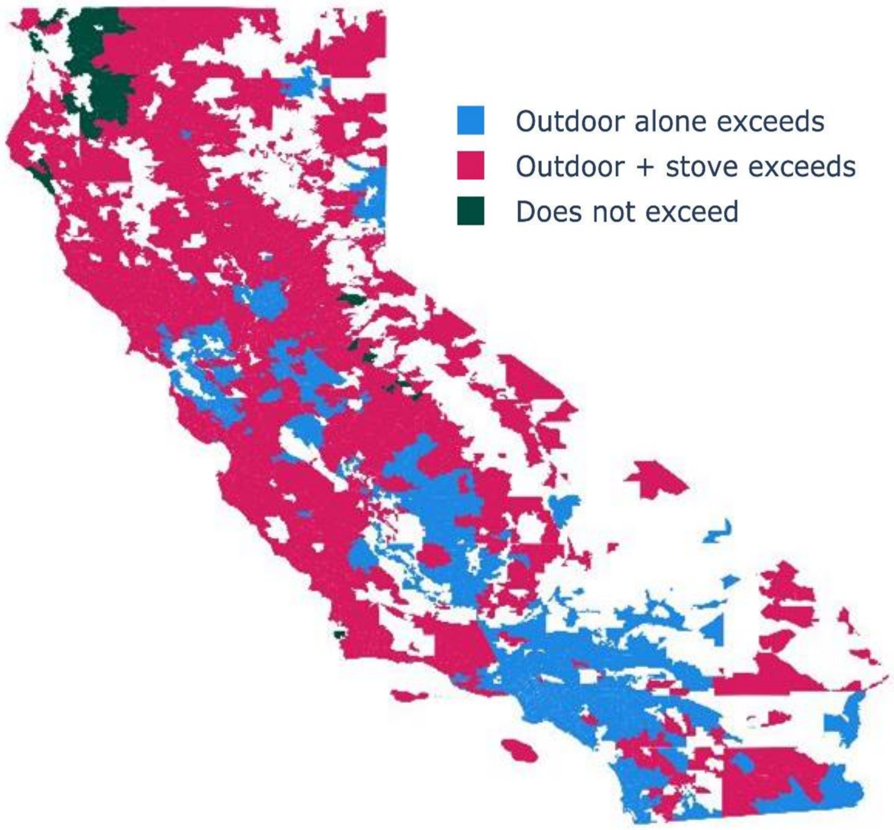


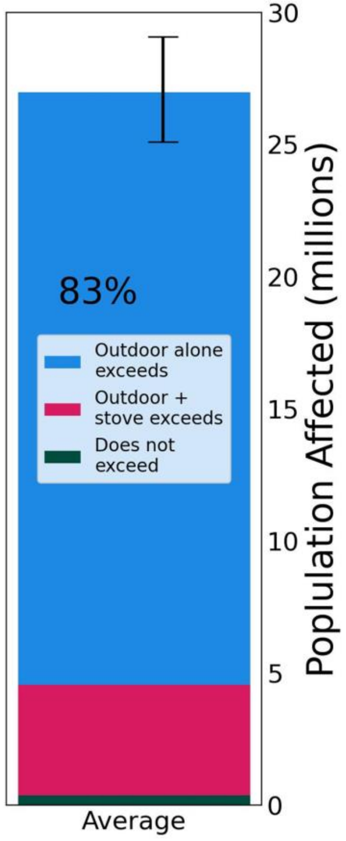
Input Parameters for Exposure Model



Mapping NEIs of Cooking Electrification in California

There are approx. 5 million Californians for whom long-term NO_2 exposure would fall below the WHO's guideline ($10 \mu g/m^3$) if they electrified their cooking.





Connecting Exposures to a Decision-Making Framework

Societal cost approach:

- Easy comparison
- Fits into existing decision-making frameworks

✓

- Relies on opaque and contestable assumptions
- The impact of one dollar is different in different places and contexts
- Can silo calculation that can obscure cumulative benefits

✗

Another option:

Explore the pathways that would involve reduced air quality impacts and explore how those would simultaneously affect other key parameters (e.g. power reliability, affordability, and safety)

Natural Gas Leaks – Hidden Costs to Fire Departments

B

Rarely do we think about how emergency public services interact with our energy systems -
Fire Departments are first responders to mitigate explosive hazards such as natural gas leaks

1

From 2003 to 2018, a total of 2.4 million gas leaks required U.S. fire department responses, costing an estimated $564 million in response costs alone.

2

Gas leak emergencies are an underappreciated cost to emergency services that can be a form of cost savings as cities reduce gas use in buildings.

3

However, in a scenario where the energy transition away from natural gas is not managed equitably, outcomes could worsen both for first responders and for ratepayers.

Energy Policy
Volume 192, September 2024, 114214

The burden of natural gas leaks on public sector emergency response in the United States

Casey N. Brodsky [a], Matthew D. Bucala [b], Sebastian T. Rowland [c], Drew R. Michanowicz [c]

PSE

Next Steps for NEIs Integration

Step 1

Identify the biggest non-energy impacts

Step 2

Synchronize quantification methods

Step 3

Explore different scenarios' impacts

Step 4

Make informed decisions

(Q&A or Thank You!)

Questions from the Dais (3/4)

Questions from the Public (3/4)

Energy Equity and Energy Justice

Gabriel Chan
University of Minnesota

California Energy Commission
March 13, 2025

What is Energy Justice?

The goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those historically harmed by the energy system (Institute for Energy Justice)

<u>Four core tenets of energy justice:</u>

Recognitional Justice (who?)

- Identifying and advocating for communities that are ignored or misrepresented in energy decisions

Procedural Justice (how?)

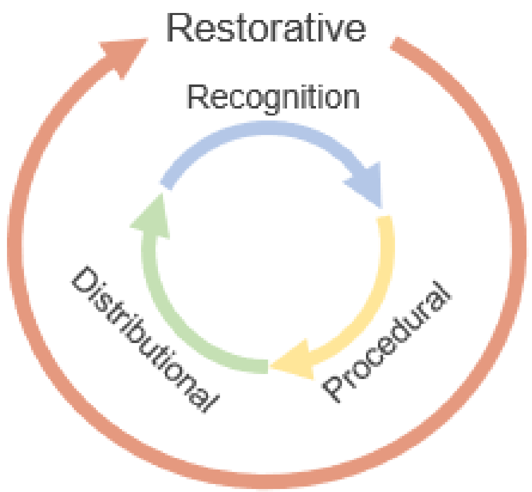
- Ensuring equitable decision-making processes across the energy system

Distributional Justice (what?)

- Ensuring that the benefits and burdens of the energy system are equitably distributed

Restorative Justice (why?)

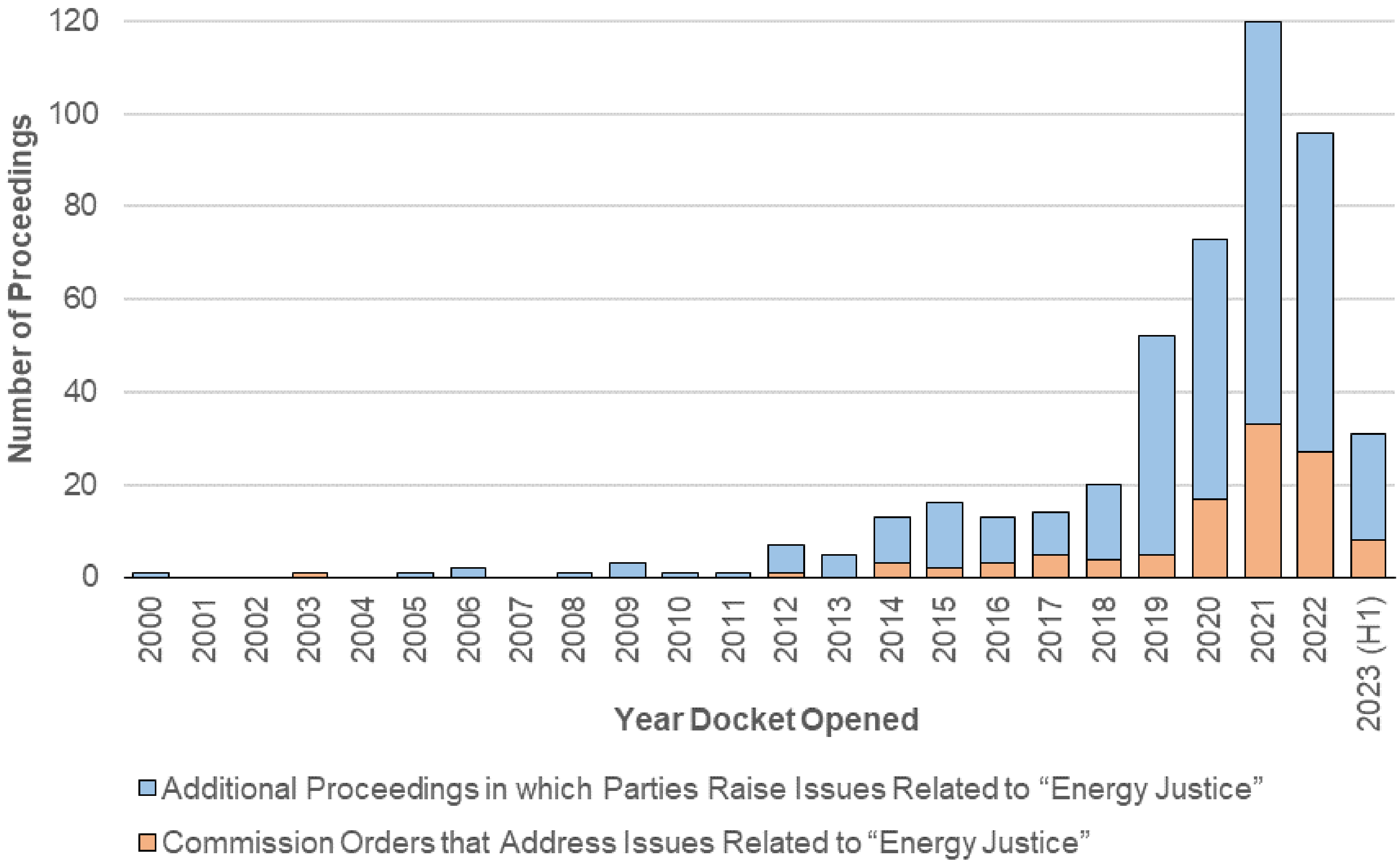
- How to respond to harm caused by the energy system and identifying systemic changes to prevent future harms



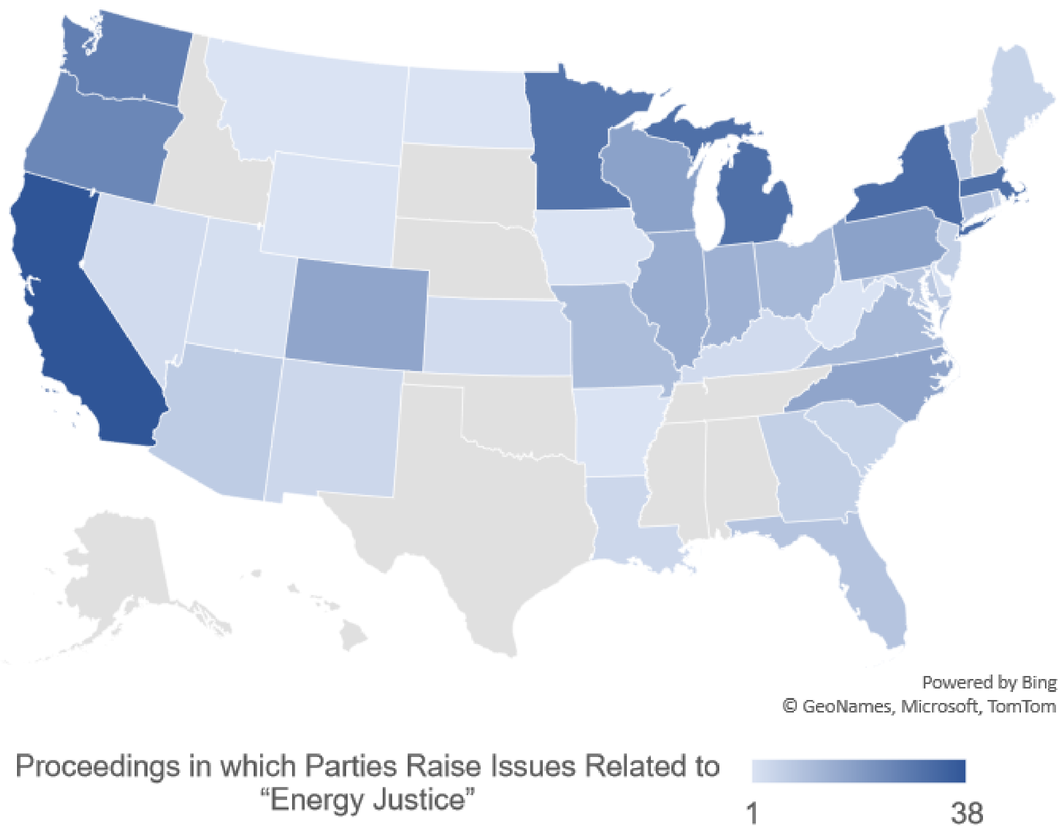
Dimensions of Energy Justice (prominent examples, not exhaustive)

Recognitional (who?)	Procedural (how?)	Distributional (what?)	Restorative (why?)
Extensive data availability	*Many best practices, few quantitative measures*	*Some data availability, more needed*	*Mostly qualitative, without possible measures*
Geographically identified communities (e.g., disadvantaged communities)	Increasing access to decision-making spaces	Energy burden, affordability	Addressing systemic factors in housing (e.g., redlining)
Communities of color	Giving stakeholders a voice, representation	Access to technology and supporting infrastructure	Addressing systemic factors in U.S.-Tribal policy
Tribal communities	Empowering impacted communities	Exposure to environmental and public health impacts	Addressing systemic factors in economic opportunity
Populations identified by resources (e.g., low-income)	Avenues for redress and accountability	Risk of reliability, resilience, and shutoffs	Addressing historic/ cumulative impacts of the energy system
Rural vs. Urban	Access to data and information	Access to economic benefits, ownership, jobs	Addressing economic dependence on energy
Energy infrastructure host communities	Resources to participate	Impacts along the energy technology supply chain	Restoring relationships

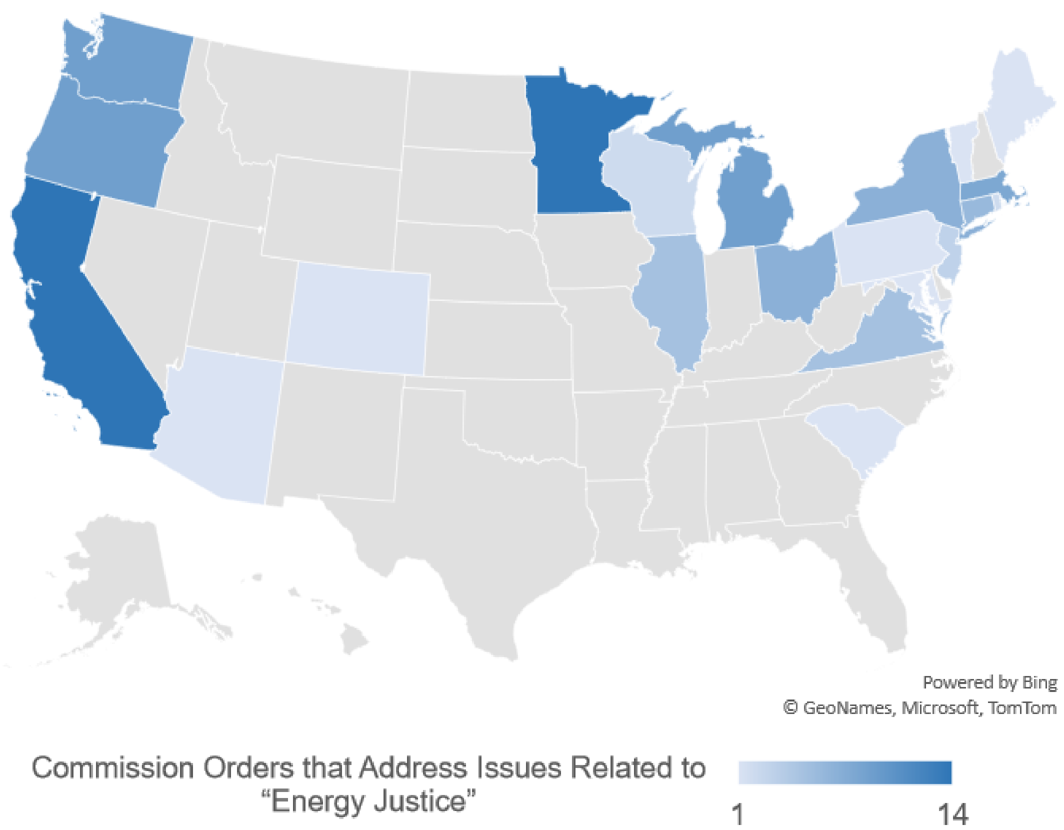
Regulatory Proceedings Engaging with Energy Justice



Regulatory Proceedings Engaging with Energy Justice

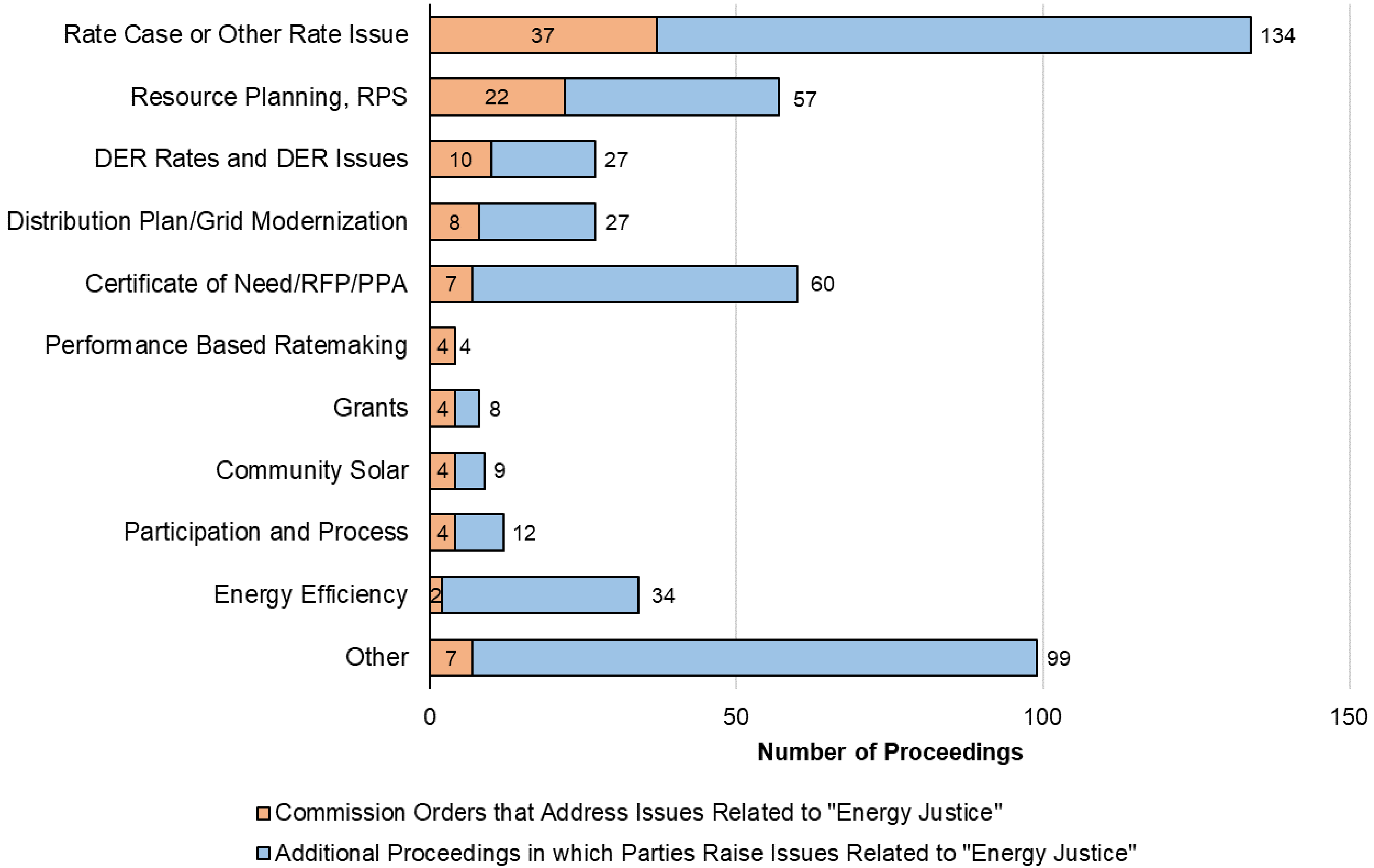


Proceedings in which Parties Raise Energy Justice



Proceedings in which Commission Orders Address Energy Justice

Regulatory Proceedings Engaging with Energy Justice



Frameworks for Energy Justice Metrics

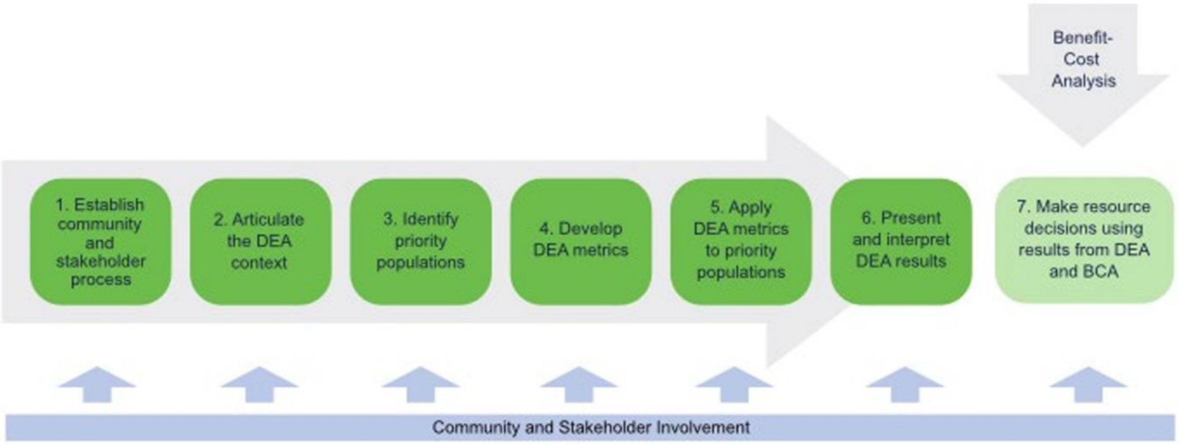
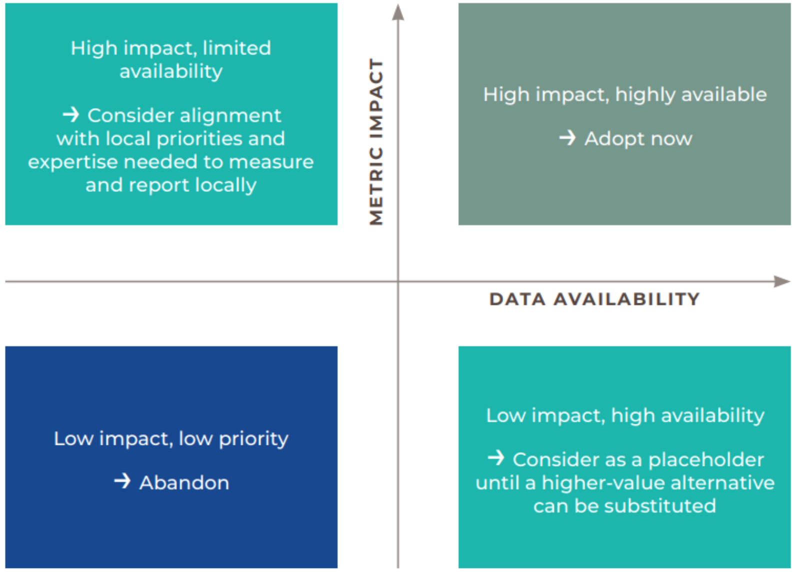


Figure ES-1. Key Stages in the Distributional Equity Analysis Framework

NESP & LBNL, 2024

Approach to Metric Impact vs Availability



Ideally, many of the measures selected in an energy equity plan will be both high impact and highly available.

Univ. of Michigan, 2022

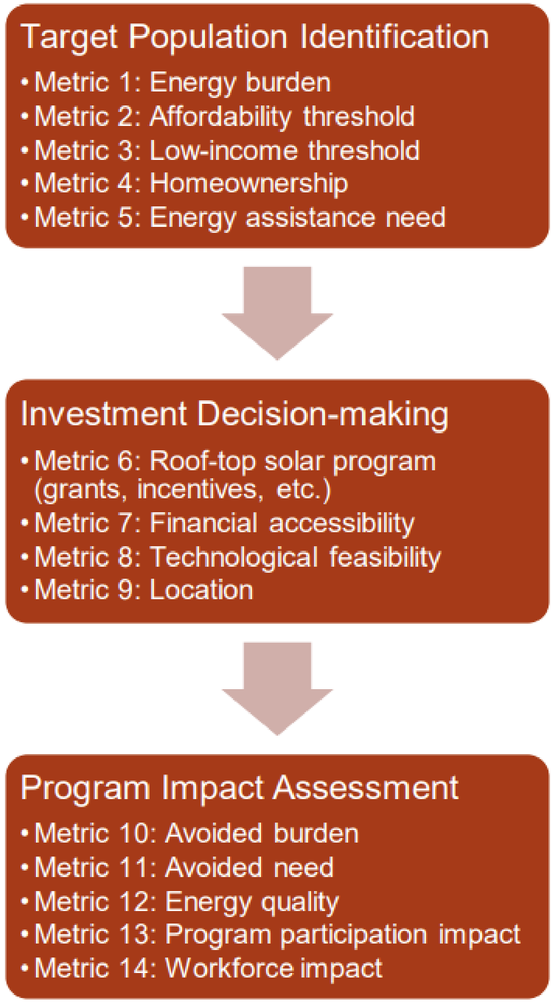


Figure 1. Equity measurement process.

PNNL, 2021

Takeaways

- An Energy Justice lens requires a much **broader scope** than traditional, technocratic decision making.
  - Oversimplification can undermine important elements of equity analysis *(e.g., limiting the scope of affordability analysis to energy bills alone could miss that households shift their budgets away from other important goods to be able to pay for energy: 20% of households in 2020 reduced or forewent basic necessities to pay for energy)* (EIA, 2022)
  - Energy regulation is generally authorized to incorporate a wider set of social policy concerns than it does in practice. (Chan & Klass, 2025)
- The **right scale** of Energy Justice analysis (societal, community, neighborhood, household, individual) isn't always clear and might be limited by today's available data.
  - Equity analysis at the wrong scale could lead to over-inclusion *(missed opportunity to direct resources to people in need)* or under-inclusion *(continued marginalization of people)*.
- Metrics cannot address **all aspects** of Energy Justice. Metrics might best be suited for recognitional justice *(e.g., CEC Energy Equity Indicators)* and to a lesser extent, distributional justice. Quantitative metrics don't generally exist for procedural justice and might not be possible for restorative justice.
  - "The process of developing the Energy Equity Framework has also highlighted the importance of focusing on guiding principles and qualitative best practices, particularly given the data limitations that emerged." (EEP, 2022)
- Developing Energy Justice metrics requires ongoing community engagement but is only one aspect of how to move forward. Metrics also need targets. But an Energy Justice lens also suggests **deeper, systemic changes**.

Additional References

- PNNL. 2021. *Review of Energy Equity Metrics*. (report; paper)
- NESP & LBNL. 2024. *Distributional Equity Analysis for Energy Efficiency and Other Distributed Energy Resources*. (report)
- University of Michigan. 2022. *Energy Equity Project Report*. (report)
- Gabriel Chan & Alexandra Klass. 2022. "Regulating for Energy Justice." *NYU Law Review*. (paper)
- Gabriel Chan & Alexandra Klass. 2024. "Reckoning with Social Policy in Utility Regulation." *BU Law Review*, forthcoming (paper)

Thank You

Contact: gabechan@umn.edu

Expanding the Concept of Non Energy Benefits and Social Costs

Stephanie Pincetl
Professor, Institute of the Environment and Sustainability
UCLA
Director, California Center for Sustainable Communities
March 13, 2025

CCSC at UCLA

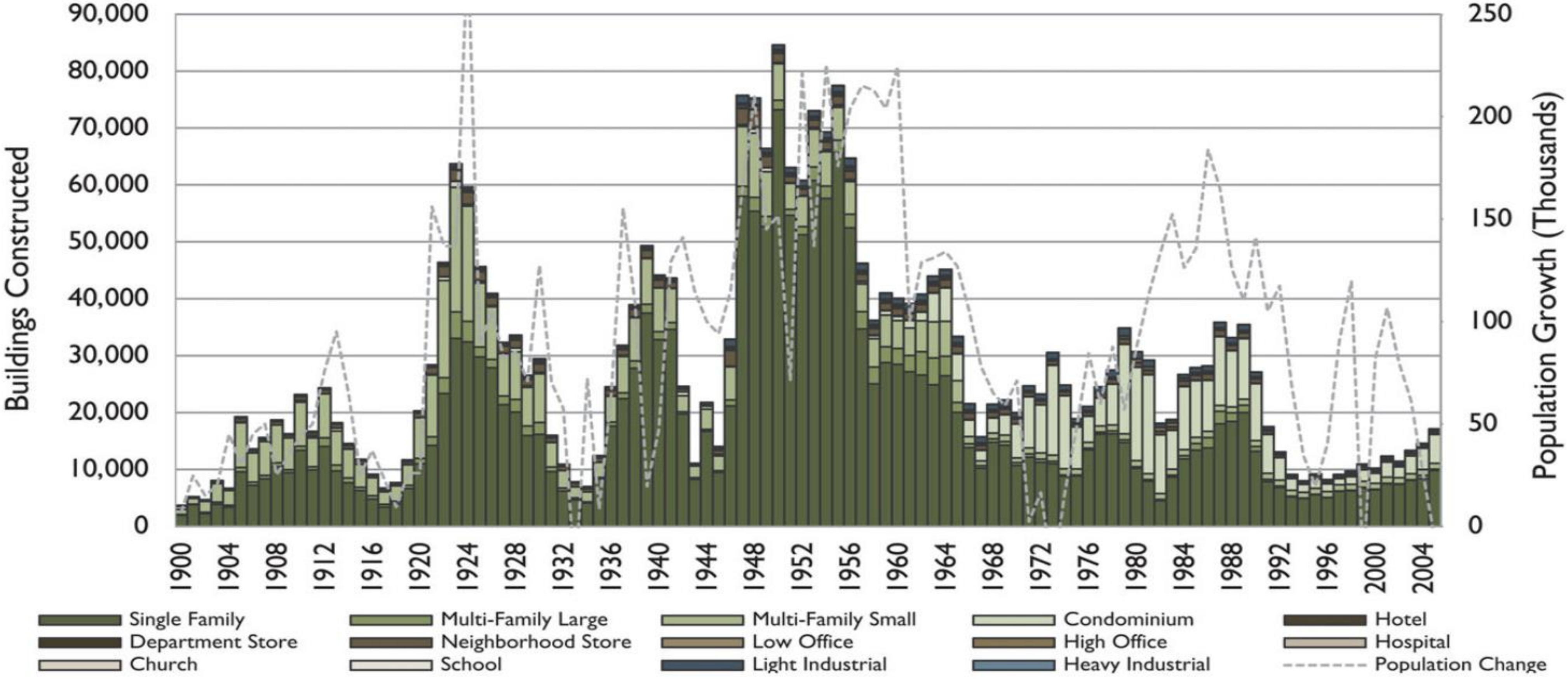
UCLA Institute of the Environment and Sustainability

ioes.ucla.edu/ccsc

Non-Energy Impacts

- Societal vulnerability
- Systems fragility
- Non-reversible land transformations
- Lifecycle costs and Materials costs

Societal Vulnerability: Older Building Stock – Exposure to high heat in Los Angeles.

- 

Reyna J. Chester M. 2014. The growth of urban building stock: unintended-lock-in an embedded environmental effects. Journal of Industrial Ecology: 19.

High heat

- Older buildings during heat waves in the inland valleys of Los Angeles, do not cool down more than 85 degrees at night during heat waves.
- Impacts sleep and well being.
- Buildings don’t retain coolness and don’t cool down either.
- Better insulated buildings (+ windows) will keep cooler, and need less energy inputs if they become air conditioned.
- Electricity bills will be more affordable.

What would the costs of extensive existing building retrofits be relative to mitigating additional generation over time, and costs of energy?

Systems Fragility

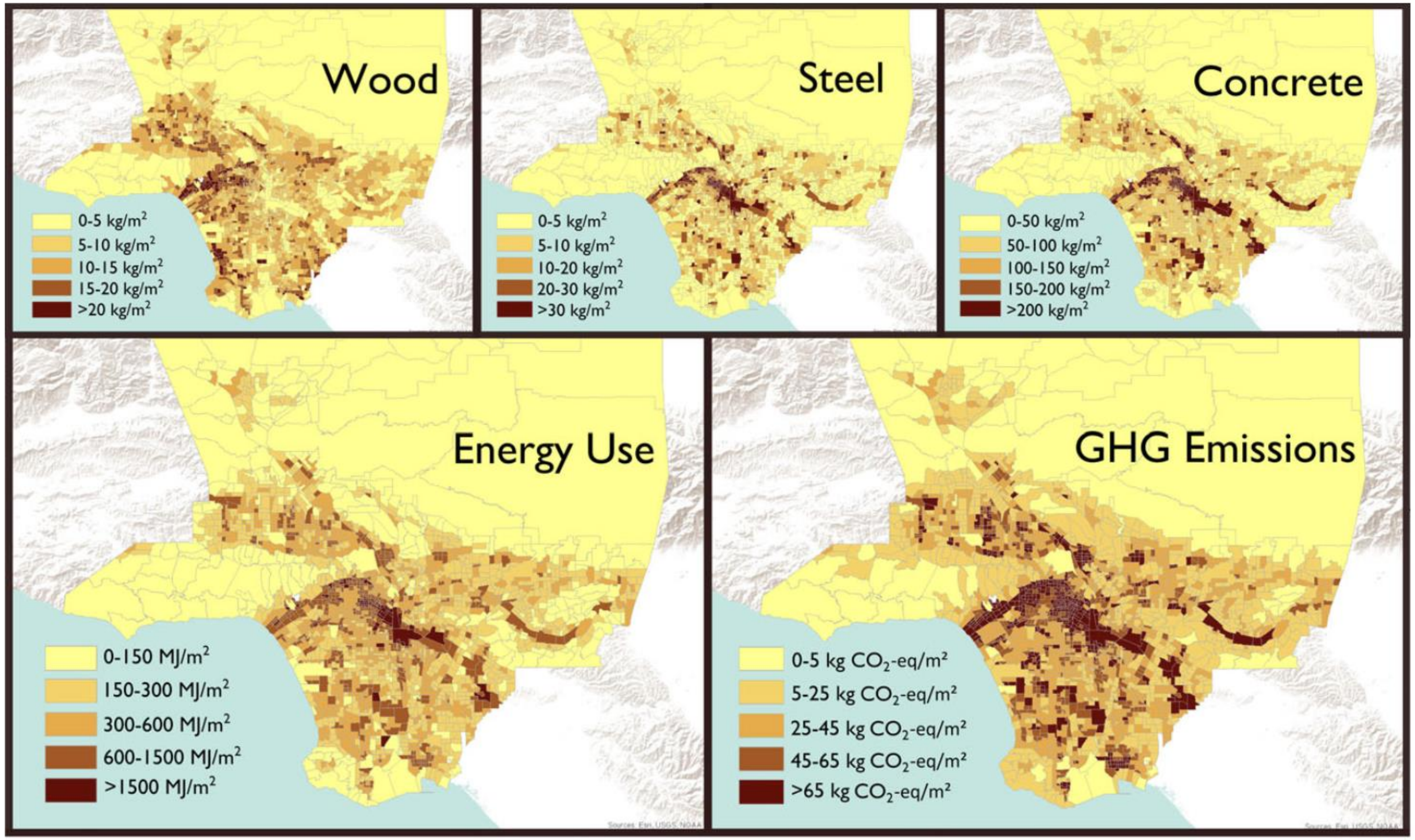
Burned homes can be seen in an aerial view of Camarillo Estates on Thursday. (Maxar)

Big Wire Transmission is Fragile as is Extensive Suburbanization

- Most of the big fires in California have been due to transmission. Eaton fire in LA yet another example.
- Suburban dwelling exposes more people to greater fire hazard.
  - Poorly defensible
  - Extensive perimeters to defend
  - Higher risk of ignitions due to the extent of the WUI.

What are the system vulnerability trade – offs of different land use configurations and greater localized energy generation?

Lifecycle costs and Material Costs



Reyna and Chester 2014.

Different Materials Have Higher Embedded GHGs and Extraction Impacts

- Long term, important to quantify embedded GHGs in building materials and to encourage experimentation in low GHG building materials.
- Flexibilize code for such materials (e.g. new adobe type materials)
- Quantify impacts of high GHG materials such as glass.
- What are the lifecycle costs of these materials?

Non-reversible land transformations – a few among many

Lithium

Copper

Gravel

Nickel (a Tesla battery contains 45kg of nickel)

CEC to encourage minimizing materials that have high extractive impacts.

- Modesty in batteries – medium range for vehicles.
- What are the materials needed for long range transmission versus higher amounts of distributed energy generation?
- Which have the most probability of recyclability?
- Corelate high energy use with materials use to develop policies to curb energy use excess.

Embedded resources should not be neglected to respect limits and ensure human well being

- Need to make existing building stock perform better to protect people's health and well being. This will reduce energy needs, though will be up front very costly – this requires trading off short term costs with long term benefits
- Expanding the grid increases system fragility: need to become more energy sufficient locally and to reduce consumption: address energy use excess
- Re examine materials and use & develop low GHG materials (e.g. Earth and wood)
- Realize there is no free lunch. Resources are extracted at high environmental and social costs, destroying local livelihoods and ecosystems.
- Greater quantification: life cycle analysis, materials flows analysis, and assessing human exposure to high heat and ability to mitigate through improving thermal performance

WARP to Resilience

Weather-Adapted Resource Planning

Incorporating Resilience in Grid Planning and Decision-Making: Key Observations

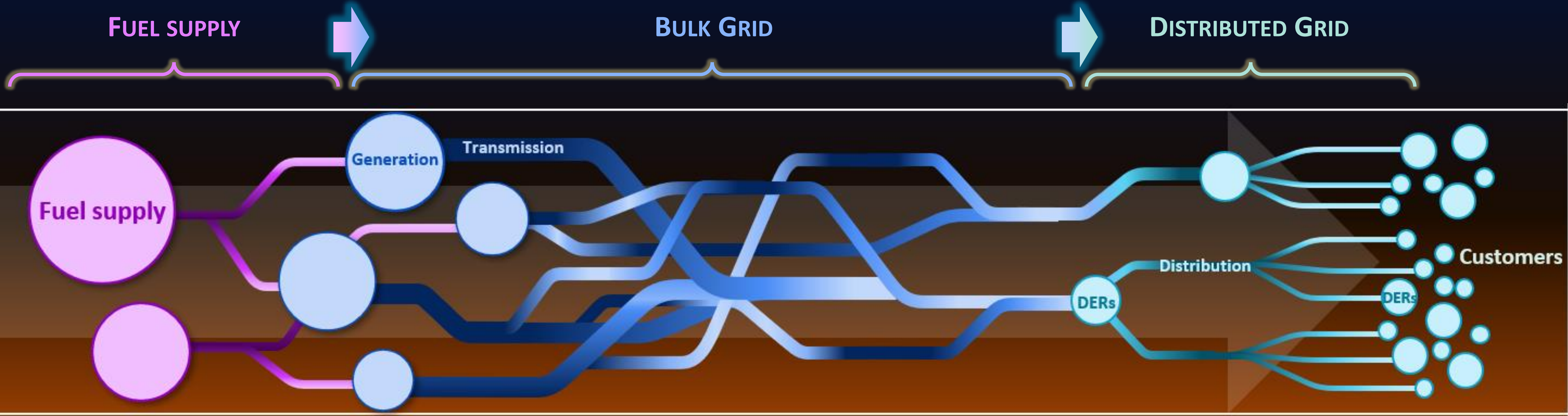
Presented by MARIKO GERONIMO AYDIN

Prepared for the **CALIFORNIA ENERGY COMMISSION** Scoping Workshop for the Informational Proceeding on Non-Energy Benefits and Social Costs (24-OIIP-03)

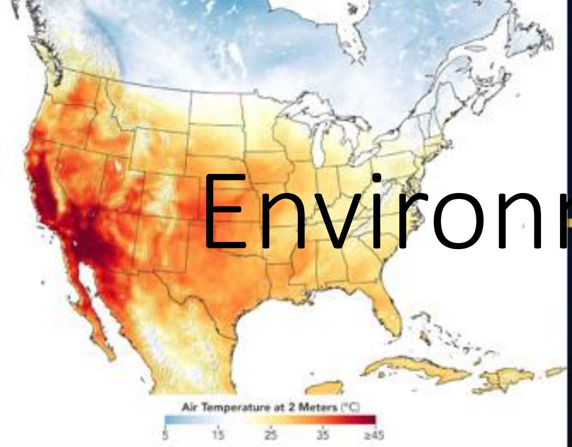
March 13, 2025

Lumen ENERGY STRATEGY

Image credit: NASA.


FUEL SUPPLY
BULK GRID
DISTRIBUTED GRID
Fuel supply
Generation
Transmission
DERs
Distribution
DERs
Customers

Environmental Hazard Impact on Grid



Western Heat Wave (2020)

Rotating blackouts in CA affecting hundreds of thousands of customers lasting several hours

Near miss in 2022 with even higher temps in CA

Extreme Drought

Compounding factor

Extreme Wildfires

(2007) 80k San Diego customers on outage, some for weeks, due to damage on Southwest Powerlink transmission

(2019) Multiple day outages due to PSPS, affecting millions of customers + Saddleridge fire severely impacting transmission into LADWP

Cold Snap, TBD

Is CA's natural gas system vulnerable to cold snaps?

Extreme Smoke (2020)

Near miss when smoke tripped 4,000 MW California-Oregon Intertie, forcing 1,500 MW of de-rate on Pacific DC Intertie

Storms, Floods (2022/23)

Rain, snow, wind, floods, mudslides

Full outage extent tbd; likely >= hundreds of thousands of people, lasting days

Image notes and credits, clockwise from top left: September 6, 2020 temperatures across California (NASA/Joshua Stevens); Lake Oroville in 2020 (AP/Ethan Swope); 2021 Caldor fire (AP/Ethan Swope); vehicle in flood water during 2022/23 winter storms in California (Robert Tong/Marin Independent Journal); downed tree from 2022/23 winter storms in California (Sara Nevis/AP); person shoveling snow from 2022/23 winter storms in California (Jae C. Hong/AP); smoke from 2020 August Complex fire (CNN/Harmeet Kaur).

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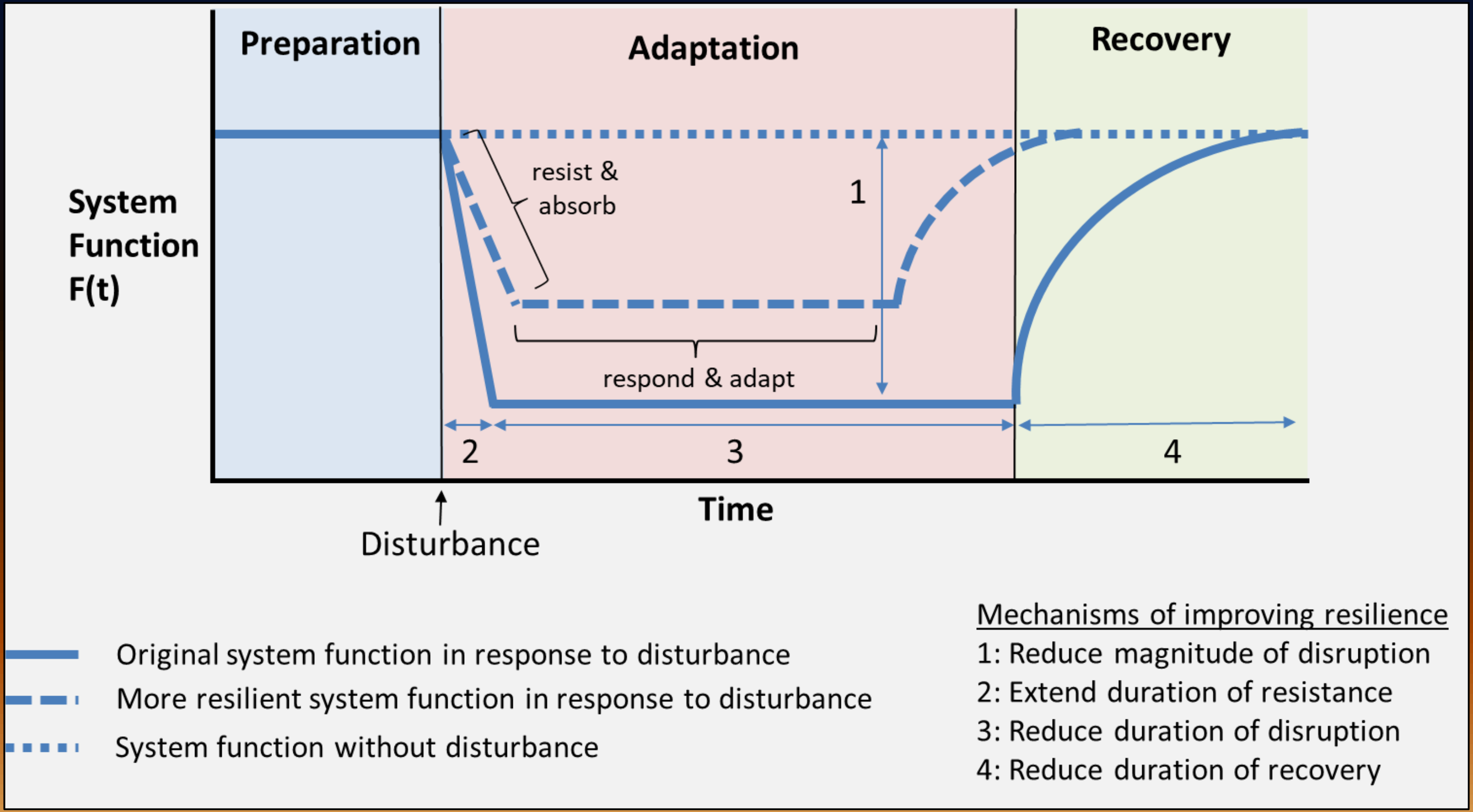
Resilience: Withstand, Reduce Impacts, Recover



Source: Resilience trapezoid adapted from Panteli, et al. (2017); T. Ding, Y. Lin, G. Li, et al. (2017); T. Ding, Y. Lin, Z. Bie, et al. (2017); and as presented in CPUC, Information Session: Introduction to the CPUC Equitable Resiliency Study, Grid Resiliency and Microgrids Team, Energy Division, September 10, 2024.

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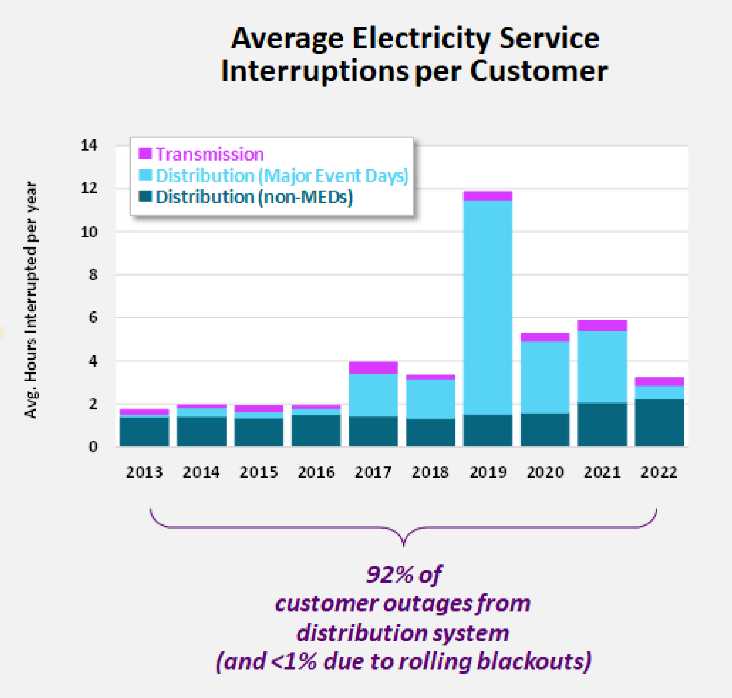
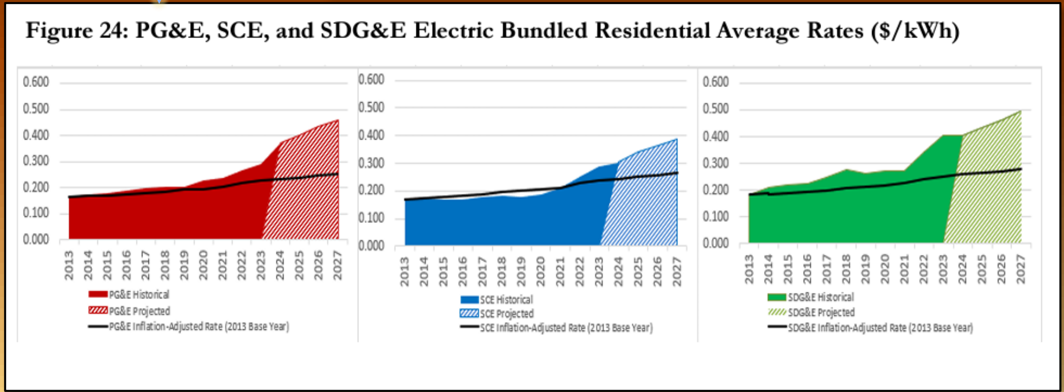
Observations from Resilience-Related Work

Observation	**Calls for:**
The **grid's purpose** is an anchor	Customer outages as a key metric
Not all kWh served—and interrupted—are **equal**	Customer and community characteristics incl. equity, health, other non-energy impacts Outage characteristics esp. multi-day
Most **resilience failures** are on the distribution system	Solutions at or downstream of dx wire e.g., DERs and wires
Retail rate and **energy affordability pressures** are high and rising	Innovative cost-controlling solutions e.g., better utilize existing system; value-stack services from new & existing resources
Distributed resilience solutions yield privately-accrued resilience benefits; some can also provide **energy and capacity benefits to ratepayers** (value-stack)	Understanding and representing DER market availability in grid planning models





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Recommendations

- **Define resilience with enough specificity to analyze**
- **Use climate projections to inform future hazards and weather variants**
- **Work towards a clearer view of the distributed system & opportunities**
  - Outside of bulk system models, trends, patterns, and diversity of resilience problems & likely operating patterns of resilience solutions (informed by community guidance, see below)
  - In bulk system models, aggregate DER market availability
- **Consider how we can enable and leverage investments where most resilience failures are happening (distribution system and distributed energy resources)**
- **Decisions through the lens of how electricity service to the end-use customer is affected**
- **But lean on communities to set their own resilience priorities**
  - To guide utility investments
  - Recognizing limits to generalizing these prioritizations at the state or bulk grid level

THANK YOU

LEARN MORE ABOUT *WARP TO RESILIENCE* AND JOIN OUR MAILING LIST FOR STUDY UPDATES
www.lumenenergystrategy.com/resilience

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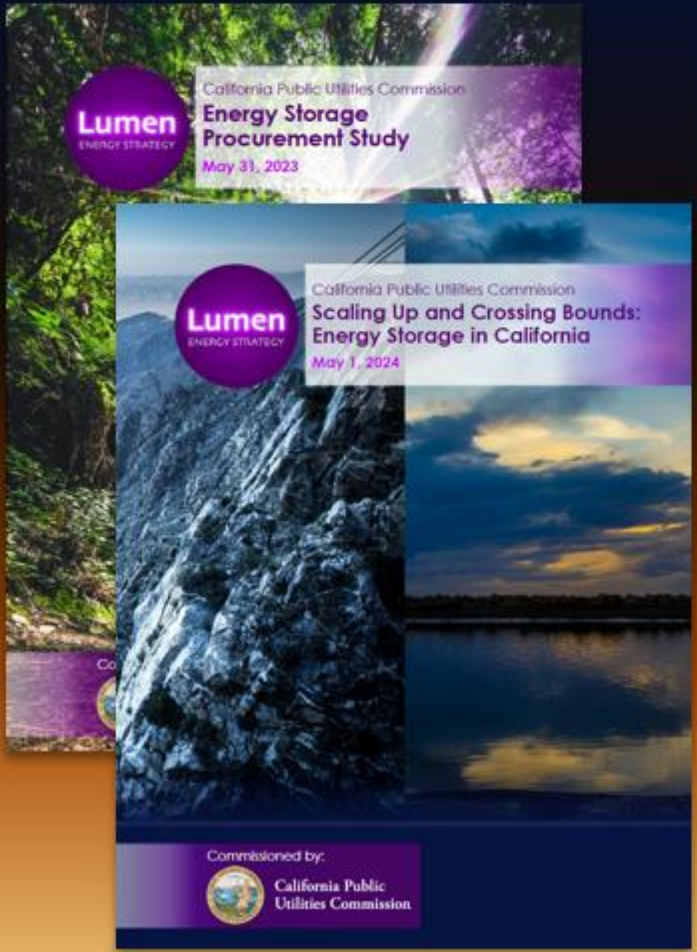
Lumen's Resilience-Related Work

Energy Storage Studies



Resilience Framework

Microgrids Proceeding R.19-09-009
Value of Resiliency

Resiliency Standards: Definitions and Metrics
Lumen Energy Strategy – Climate Resilience in Integrated Resource Planning

Resiliency Standards: Metrics

Lumen Energy Strategy – *WARP to Resilience*: Climate Resilience in Integrated Resource Planning

Resiliency Standards: Methodologies

Improving Resilience in Integrated Resource Planning, *Lumen Energy Strategy*

Grid Resiliency and Microgrids Team, Energy Division
November 8, 2023, 9:00am – 12:00 pm

California Public Utilities Commission

Resilience Index

Information Session: Introduction to the CPUC Equitable Resiliency Study

Grid Resiliency and Microgrids Team, Energy Division
September 10, 2024 10:00 AM–12:00 PM Pacific

Lumen x SIG

California Public Utilities Commission

Demand Forecast

Development of future weather variants for demand forecast
Presented by Onur Aydin
IEPR Commissioner Workshop on Load Modifier Scenario Development
August 18, 2023

Projected climate trends and patterns of interest to California's energy system
Presented by Mariko Geronimo Aydin
CEC IEPR Commissioner Workshop on Load Modifier Scenario Development
August 18, 2023

Key findings in climate data analyses for demand forecast integration
Presented by Mariko Geronimo Aydin and Onur Aydin
CEC IEPR Commissioner Workshop on the California Energy Demand Forecast Results Part II
December 19, 2023

Development of future weather variants for demand forecast
Presented by Onur Aydin and Mariko Geronimo Aydin
CEC IEPR Commissioner Workshop
July 30, 2024

Selected references

Aydin, Mariko Geronimo, and Cevat Onur Aydin. 2024. *California Public Utilities Commission scaling up and crossing bounds: energy storage in California.* Lumen Energy Strategy, LLC. Prepared for the California Public Utilities Commission. May 1, 2024. www.lumenenergystrategy.com/energystorage

Brockway, Anna M., Jennifer Conde, and Duncan Callaway. 2021. "Inequitable access to distributed energy resources due to grid infrastructure limits in California." *Nature Energy*. September 13, 2021. https://doi.org/10.1038/s41560-021-00887-6

CPUC. 2024. *2024 Senate Bill 695 report: report to the Governor and Legislature on actions to limit utility cost and rate increases pursuant to Public Utilities Code Section 913.1.* July, 2024. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/office-of-governmental-affairs-division/reports/2024/2024-sb-695-report.pdf

CPUC Staff. 2020. *Microgrids and resiliency staff concept paper*. Pursuant to Senate Bill 1339 (2018) and R.19-09-009. July 22, 2020. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M344/K038/344038386.PDF

Dugan, Jesse, Dahlia Byles, and Salman Mohagheghi. 2023. "Social vulnerability to long-duration power outages." *International Journal of Disaster Risk Reduction*. 85 (2023) 103501. https://doi.org/10.1016/j.ijdrr.2022.103501

Sparti, Chelsi, Peter Larsen, and Tyler Huntington. 2023. *The value of sharing and consolidating critical community, electricity, and natural hazard information*. Lawrence Berkeley National Laboratory Electricity Markets & Policy Energy Analysis & Environmental Impacts Division. Prepared for the California Public Utilities Commission. August 2023. https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/resiliency-and-microgrids/resiliency-and-microgrids-events-and-materials/lbnldoe-data-sharing-reportaug20.pdf

See Also:

Other CPUC Resiliency and Microgrids workshops and materials, including 4 Pillars Methodology: https://www.cpuc.ca.gov/resiliencyandmicrogrids

All other references to Lumen’s resilience-related work available via: www.lumenenergystrategy.com

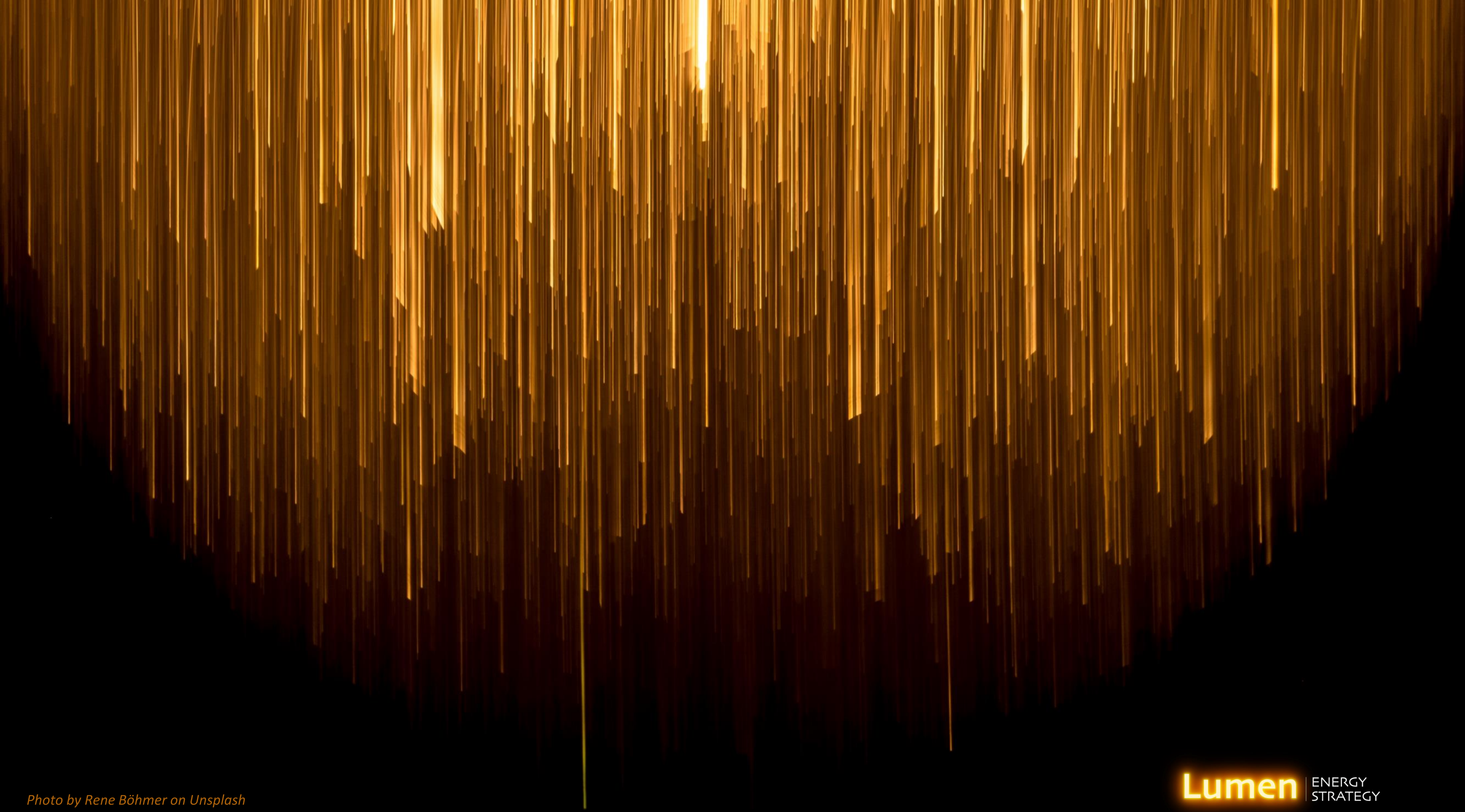


Photo by Rene Böhmer on Unsplash

Questions from the Dais (4/4)

Questions from the Public (4/4)

Public Comments

Zoom:

- Use the “raise hand” feature.

Telephone:

- Dial *9 to raise your hand.
- Dial *6 to mute/unmute your phone line. You may also use the mute feature on your phone.

Zoom/phone participants, when called upon:

- Your microphone will be opened.
- Unmute your line.
- State and spell your name for the record, and then begin speaking.

Limited to one representative per organization.

Three-Minute Timer

Closing Remarks