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Equity Metrics and Outcomes for Resilience

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Rebecca Tapio
Energy Systems Analyst

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What is energy equity?

- 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.
- An equitable energy system is one where the economic, health, and social benefits of participation extend to all levels of society, regardless of ability, race, or socioeconomic status.

Justice tenet	Scope	Example in the energy system
1. Distributive	How are benefits and burdens distributed?	Spatial and sociodemographic variations in electricity quality, rate affordability, exposure to pollution, and customer access to programs
2. Procedural	How fair is the energy decision-making process?	Inclusiveness, transparency, and representativeness of planning and regulatory processes
3. Recognition	Who partakes in the benefits, burdens, and governance process?	Specific representation of communities that have been historically marginalized and recognition of the needs and capacities of disadvantaged communities
4. Restorative	What inequities have occurred in the past, and how can they be restored or prevented in the future?	Impact assessments that inform the planning process to avoid potential damages to people and the environment and repair past harm.

From Barlow et al.: https://doi.org/10.1016/j.tej.2022.107208

Energy Equity Repository

- Energy Equity in Grid Planning **Resources Repository**
  - Contains all Department of Energy (DOE) funded reports, datasets, and tools related to energy equity in grid planning and operations.
  - Developed through a Grid-Modernization Laboratory Consortium project led by the Pacific Northwest National Laboratory and Lawrence Berkeley National Laboratory.

https://www.pnnl.gov/projects/advancing-equity-grid-planning-and-operations/resources

- Resources can be sorted by a number of topic areas, including:
  - Community engagement and perceptions; decarbonization; energy burden; energy communities in transition; energy equity capabilities; energy storage; EVs and EV infrastructure; infrastructure siting; integrated and distribution system planning; interconnection; metrics; program design; regulation and policy; resilience; and transmission planning.

Definitions and Examples of Metrics

- A **metric** is a quantitative measurement for a qualitative phenomenon that can help measure a specific equity outcome.
  - **Tracking Metric-** Reports the state of a phenomenon

    Ex: System Average Interruption Duration Index (SAIDI) or SAIDI examined against a demographic overlay
  - **Performance Metric-** Quantitatively informs progress toward a target

    Ex: SAIDI with utility target value of X in Year
- Other metric examples:
  - **Qualitative** (from people, surveys, observations)
  - **Quantitative** (from system data or attributes, measurements)
- Metrics traditionally created ‘top down’ and focuses on Quantitative
- Opportunities to co-develop metrics with communities and incorporate Qualitative metrics
- The California PUC defines disadvantaged communities as communities scoring in the top 20 percent for climate burden/vulnerability on CalEnviroScreen 3.0 or the top 25 percent on CalEnviroScreen 4.0.

Barlow, J., Tapio, R., Tarekegne, B (2022), The Electricity Journal
Tarekegne, B (2021), Review of Energy Equity Metrics
https://water.ca.gov/-/media/DWR-Website/Web-Pages/About/Tribal/Files/IRWM/URC-Nomenclature-Whitepaper.pdf

How utilities are addressing climate adaptation and equity

Category	Equity actions for climate adaptation
Metrics and Mapping	Develop maps that provide utility infrastructure system information overlaid with socioeconomic context Move beyond traditional system-level reliability metrics to identify areas experiencing disproportionate reliability problems Compare utility spending in environmental justice communities to other areas Develop and report on equity metrics, including those that address investment, participation, costs, reliability, accessibility, health and well-being, environmental impacts, social indicators, and economic indicators
Distribution of benefits	Identify which resilience measures benefit disadvantaged communities Set goals for the percentage of investments that should benefit disadvantaged communities (e.g., 40% consistent with EJ40)
Community engagement	Develop and follow community engagement plans when conducting resilience or climate vulnerability assessments Implement stakeholder working groups or community groups Provide onboarding and education for working group members
Targeted infrastructure deployment	Consider strategically placed microgrids or long-duration mobile energy storage to support areas with reliability or resilience challenges When weighing potential investments, develop a process to flag where investments would support environmental justice communities and use that to help identify and prioritize projects
Equity in planning	Develop engagement principles to guide getting feedback on major projects and actions Incorporate community resilience in multi-criteria decisional analysis
Partnering with Communities	Team up with other community organizations to support community resilience activities

From forthcoming PNNL report: **Climate Adaptation Approaches for Water and Electric Utilities: A compendium of existing strategies in a changing climate**
Van Dyke et al. 2024

Equity metrics can be used to track progress on engagement and outcomes

- Once engagement/participation practices have been put in place, the volume and type of engagement can be tracked and measured to ensure it's representative and meets people where they are.
- Engagement can and should inform structures, programs, and processes taken by utilities and regulators in California.
- Quantitative metrics that measure changes in equity and outcomes over time help reveal the effectiveness of engagement and actions taken or changes made.
  - Measuring equity allows organizations to track the progress of their goals and adjust accordingly.
  - Because equity outcomes are impacted by other confounding variables, particularly historic and current policy and socioeconomic factors external to the energy system, it can be difficult to isolate the cause of improvements.
  - The goals and desired outcomes of state and utility stakeholders may not be the same as those of the community.

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Recently released journal article

ELSEVIER

The Electricity Journal

Volume 37, Issues 7–10, August–December 2024, 107442

Folding community engagement into decision making: A continuous process to increase equity in the energy system

Rebecca Tapio, Juliet Homer, Kendall Mongird, Jason Eisdorfer

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https://doi.org/10.1016/j.tej.2024.107442

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Abstract

Utilities and state energy regulators have historically incorporated community participation late in the process of creating programs and policies, often after most or all decisions have already been made. As more organizations seek to address energy inequity, they have engaged stakeholders in a variety of ways and at different stages of program development with varying levels of success. In this paper, we propose a continuous participation and feedback approach to system equity improvements and

VOICE AND CHOICE

Increasing a community's ability to participate or be represented in decision making can contribute to the alleviation of cost-, access-, quality-, and externality impact-based inequities

COST

The cost of energy service and factors related to the user's ability to pay for it

ACCESS

The user's access to electricity services and utility programs

QUALITY

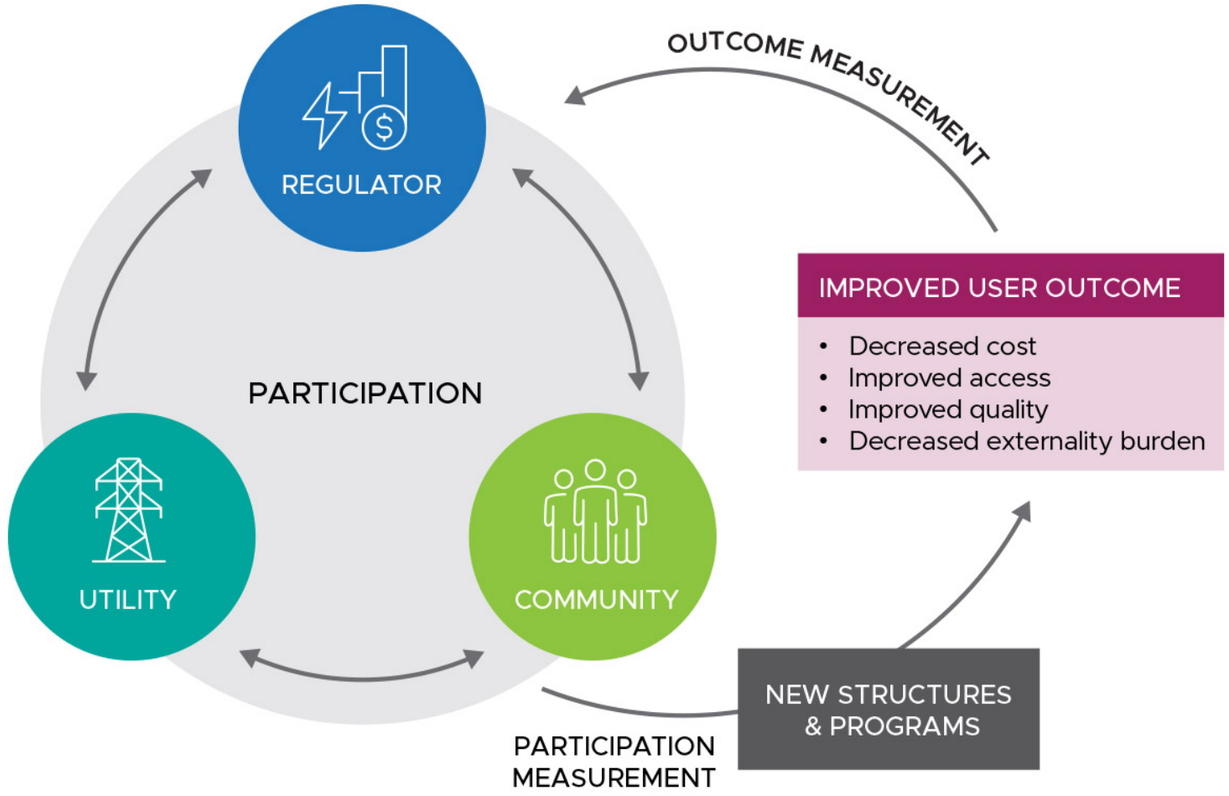
The reliability, caliber, and condition of the delivered service to users

EXTERNALITY IMPACT

The user's relative share of positive or negative system externalities

A continuous process of engagement

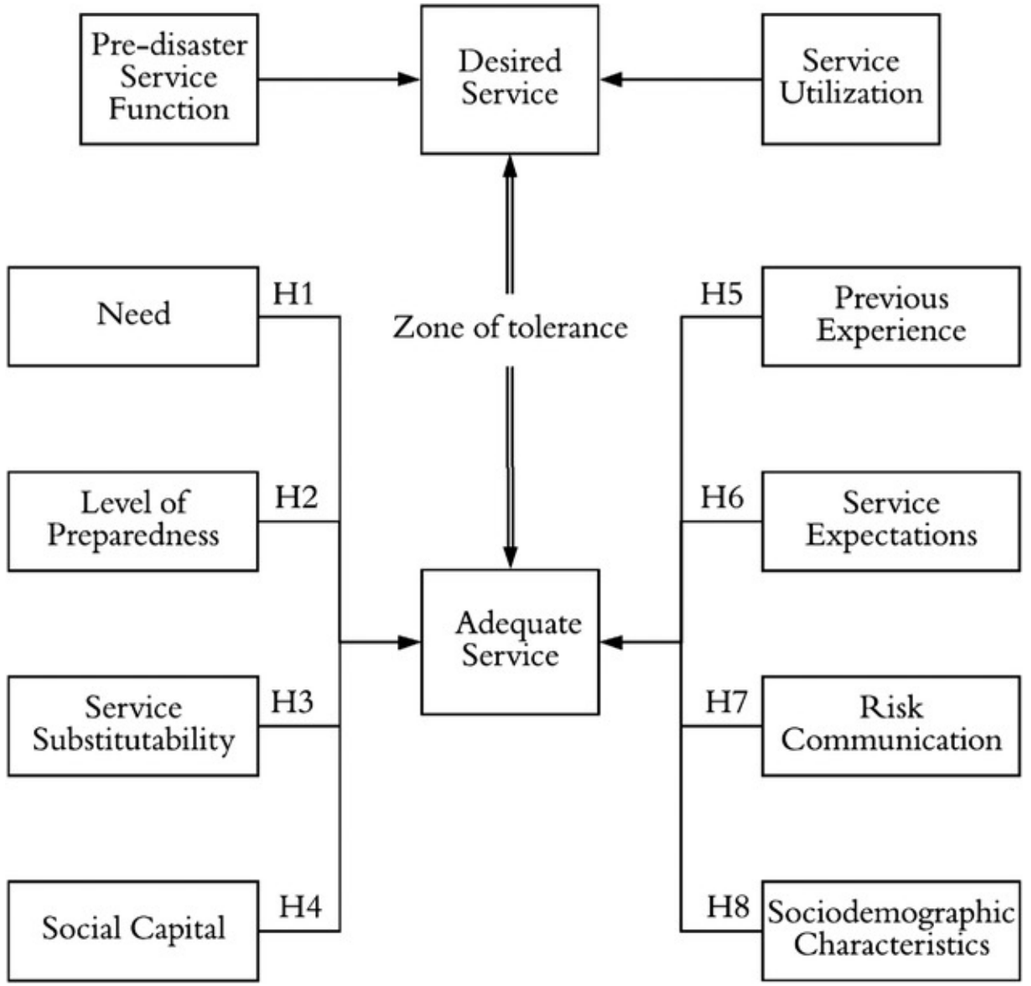
- **Number of groups/individuals participating in proceedings** and meetings, by topic and stakeholder type, including tribes, and energy equity and environmental justice groups
- **% of consumers involved in decision-making activities** in utility planning processes disaggregated by all consumers groups
- **Number of projects proposed** based on community participation and feedback
- **Intervenor/participation funding provided to participants** in proceedings and advisory groups, particularly marginalized and vulnerable communities
- **Number of educational offerings and trainings**
- **Variability in meeting times** for public input meetings
- **Availability of culturally and linguistically-responsive** public meetings and outreach materials
- **Number/type of direct communications** to different consumer groups regarding decision-making processes
- **Number of surveys issued** to targeted communities
- **% of surveyed participants** who report knowing of meaningful engagement opportunities and feel that their voices are being heard



From Tapio et al.: https://doi.org/10.1016/j.tej.2024.107442

Considerations for Oregon Resilience Guidelines: Zone of Tolerance

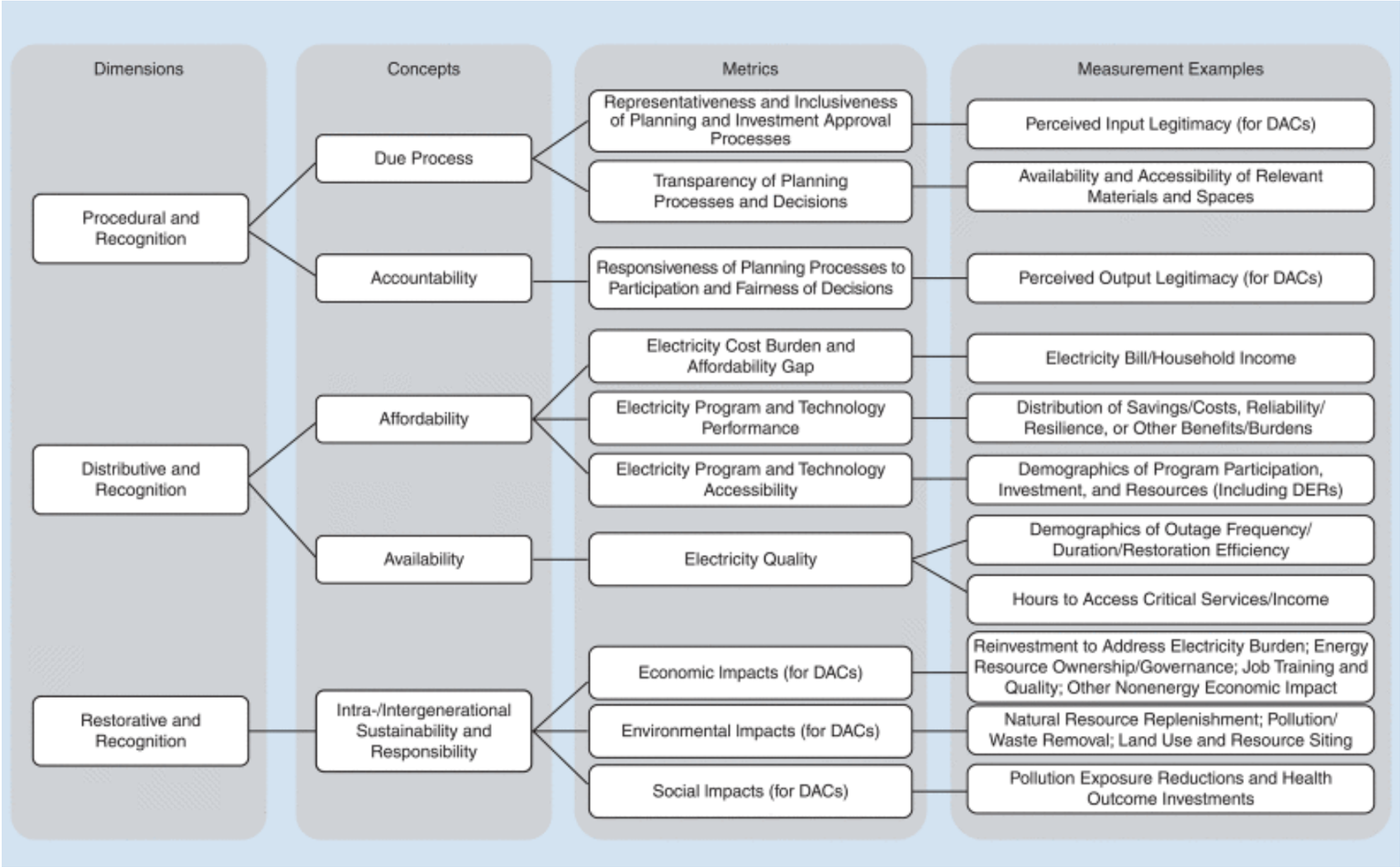
- While preparing resilience considerations for the Oregon Public Utility Commission in 2022, one concept that emerged to account for different capabilities of households and communities to endure the adverse impacts of service disruptions was the **Zone of Tolerance.**
- Esmalian et al. (2021) assesses and identifies factors affecting risk disparity due to infrastructure service disruptions in extreme weather events.
- They propose a household service gap model that characterizes societal risks at the household level by examining service disruptions as threats, level of tolerance of households to disruptions as susceptibility, and experienced hardship as an indicator for the realized impacts of risk.



From Esmalian et al. 2021. Determinants of Risk Disparity Due to Infrastructure Service Losses in Disasters: A Household Service Gap Model

Quantifying Energy Justice Goals in the Power Sector: Developing and Using Metrics

- O'Neil et al. described decisionmaker knowledge of equity metrics in the power sector
- They characterized existing energy equity metrics and developed case studies on their application to inform equity decisions
- They also detailed strategies to facilitate the effective use of equity metrics within power sector business strategies



From Kazimierczuk et al. (2023): https://www.pnnl.gov/sites/default/files/media/file/MOD-Plan%20Equity%20Paper%20Final.pdf

Tailored equity metrics for different parts of the energy system

- Twitchell et al. identify opportunities for incorporating equity objectives into transmission planning through a framework guided by two planning phases—the foundational (or pre-planning) phase and the formal planning phase.
  - Principles for Equitable Transmission Planning (2024): https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-35256.pdf
- O'Neil et al. examined current practices in energy justice and equity in grid planning, including metrics, equitable outcomes and processes for integrating equity into existing system structures.
  - Advancing Energy Equity in Grid Planning (2022): https://www.pnnl.gov/sites/default/files/media/file/Advancing%20Energy%20Equity%20in%20Grid%20Planning.pdf
- Bharati et al. proposed an iterative framework for advancing energy equity as an objective of the distribution system planning process, showing how measurement strategies, or metrics can be applied to benchmark equity performance at various stages.
  - Advancing Energy Equity Considerations in Distribution Systems Planning (2023): https://www.pnnl.gov/sites/default/files/media/file/Advancing_Energy_Equity_Considerations_in_Distribution_Systems_Planning%20%281%29.pdf

Resources

Advancing the state of energy equity metrics

Energy Equity in Grid Planning Resources Repository

Review of Energy Equity Metrics

Folding community engagement into decision making: A continuous process to increase equity in the energy system

Determinants of Risk Disparity Due to Infrastructure Service Losses in Disasters: A Household Service Gap Model

Equitable Electric Grid: Defining, Measuring, and Integrating Equity into Electricity Sector Policy and Planning

Principles for Equitable Transmission Planning

Advancing Energy Equity in Grid Planning

Advancing Energy Equity Considerations in Distribution Systems Planning

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Thank you

For questions, contact:
Rebecca.Tapio@pnnl.gov

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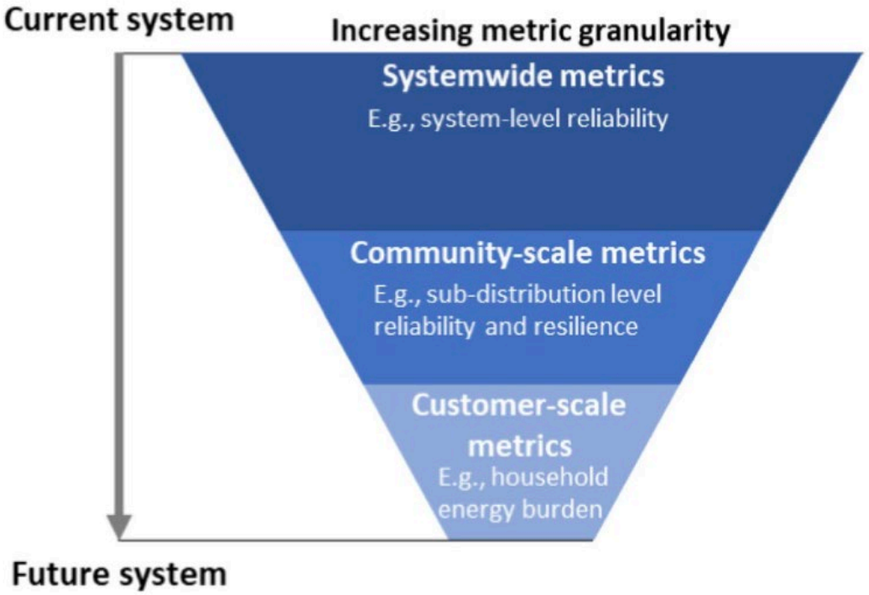
Opportunities for new approaches in developing and managing metrics and increasing community stakeholder engagement

- **Increase pathways for multi-stakeholder and community collaboration & co-development**
- **Common understanding of terminologies and definitions when developing metrics**
  - Disadvantaged Community
    - ✓ Developing through DOE ED and Justice40:
    - ✓ 36 burden indicators (ex: Transportation burden, housing costs, fossil energy employment, job access, outage events, outage duration, climate hazards, etc.)
- **Data granularity**
  - Census tract data is used but may leave out customer level inequities
  - Move metrics from Utility Scale to Community Scale
  - Shift metrics from Solely Cost or Operations Measurements to Socioeconomic Factors
- **Consideration of uncontrollable socioeconomic factors**
  - Develop more Tracking Metrics to compliment Performance Metrics
- **Regulatory processes can be downscaled and accessible**



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https://www.energy.gov/diversity/justice40-initiative
Parker, K., Barlow, J., Eisdorfer, J., Kazimierczuk, K., (2023) Springer Journal, Observations of an Evolving Grid: Resilience and Equity Performance Metrics