Advancing Energy Equity in Grid Planning

PNNL Team

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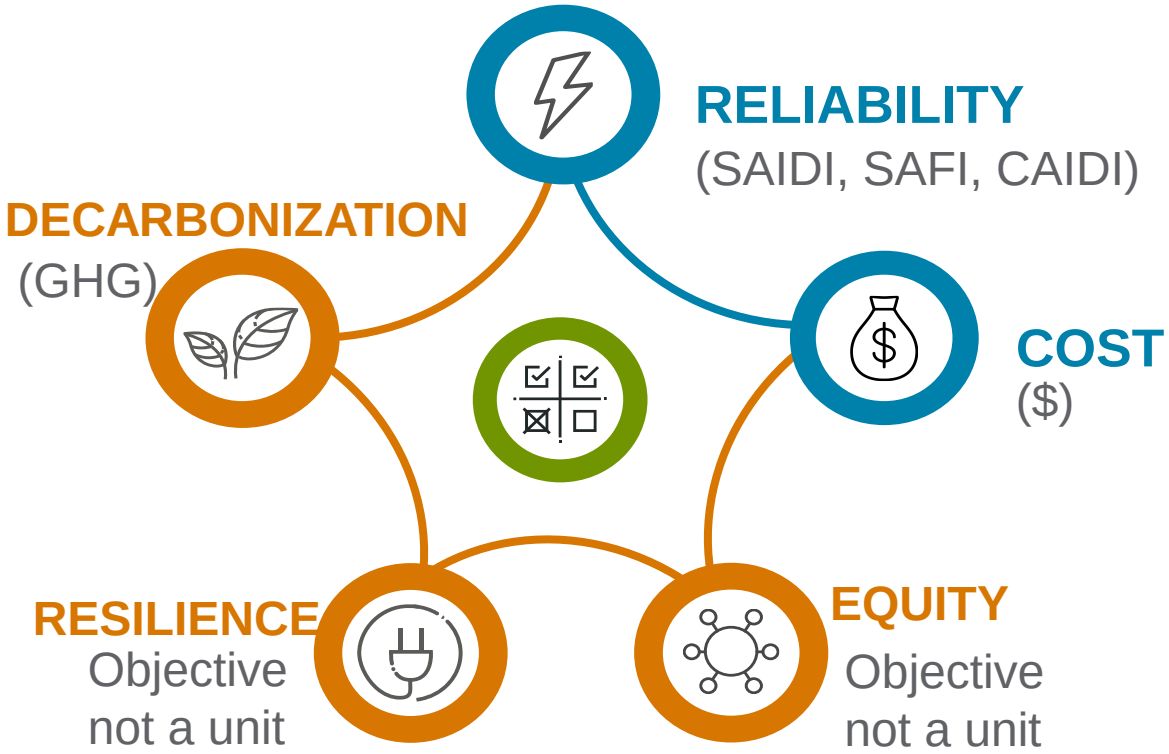
Emerging Objectives in Grid Planning

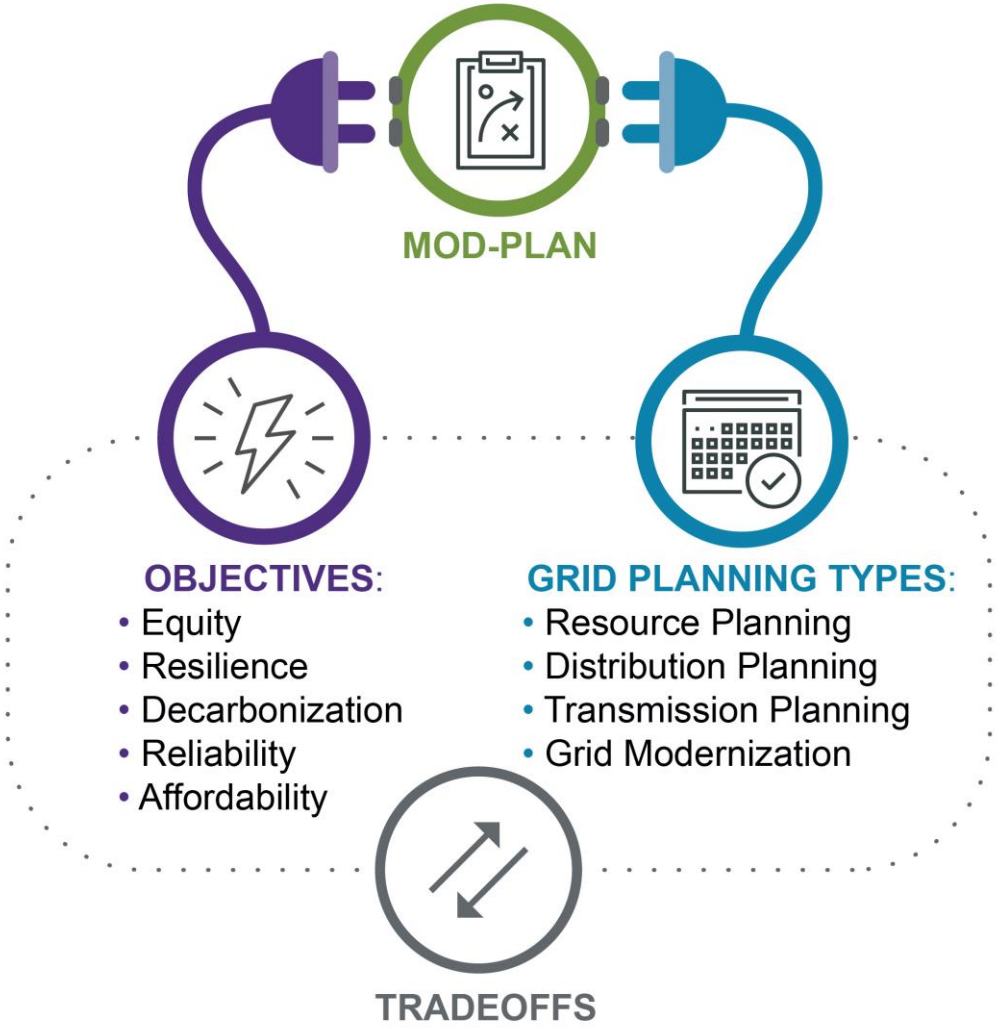
- Traditionally electric grid planning strives to maintain **safe, reliable, efficient, and affordable** service for current and future customers.
- As policies, social preferences, and the threat landscape evolve, additional considerations for power system planners are emerging, including **decarbonization, resilience, and energy equity and justice**.
- Relative to traditional objectives, these emerging objectives are not well integrated into grid planning paradigms.



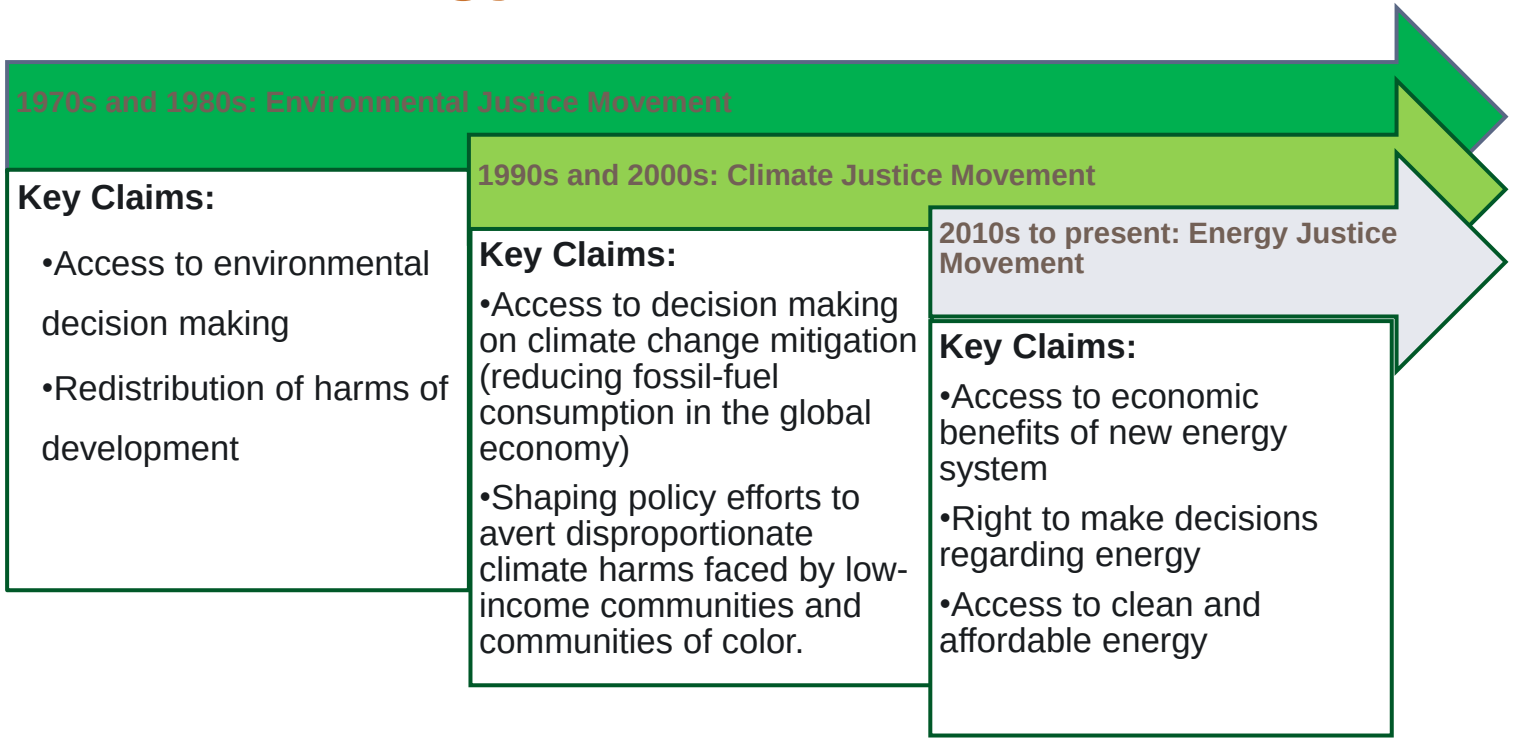
MOD-Plan: Multi-Objective Decision-making

Funded by the Office of Electricity

- **Planning frameworks with stakeholder roles.** Develop a framework that applies multiple emerging objectives in the electric grid planning processes with stakeholder roles throughout
- **Emerging objectives and trade-offs.** Advance innovative and practical methods for formulating planning objectives for decarbonization, resilience, and energy equity to indicate trade-offs
- **Metrics for success.** Develop and report on metrics that can measure the performance of the grid with respect to these emerging objectives



Movements of Environmental, Climate, and Energy Justice



Energy justice refers to 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 ("frontline communities"). Energy justice explicitly centers the concerns of marginalized communities and aims to make energy more accessible, affordable, and clean and democratically managed for all communities.

https://iejusa.org/section-1-defining-energy-justice/

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. **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

Definitions and Approaches for Energy Justice and Equity

Distributive Justice (where?)

- The unequal allocation of benefits and burdens and unequal distribution of the consequences

Recognition Justice (who?)

- The practice of cultural domination, disregard of people and their concerns, and misrecognition

Procedural Justice (how?)

- The fairness of the decision-making process

Restorative Justice

- The response to those impacted by the burdens of energy projects

Key Principles:

- Availability
- Transparency and accountability
- Due process
- Intergenerational equity
- Affordability
- Sustainability
- Intragenerational equity
- Responsibility

Key Terms	Definition
Energy Burden	Percent of household income spent to cover energy cost.
Energy Insecurity	The inability to meet basic household energy needs.
Energy Poverty	A lack of access to basic, life-sustaining energy.
Energy Vulnerability	The propensity of a household to suffer from a lack of adequate energy services in the home.

Energy Justice and Equity in Grid Planning
Current Practice

Remain tied to decarbonization goals and/or environmental justice.

- **Michigan**: 2020 Executive Order requires PUC to expand its environmental review of IRPs to evaluate whether utilities are meeting state decarbonization goals
    - Also requires PUC to assess whether IRPs consider environmental justice and health impacts
- **Washington**: 2019 Clean Energy Transformation Act requires IRPs to include an assessment of energy and non-energy benefits and reductions of burdens to vulnerable populations
- **Connecticut**: 2019 Executive Order requires the Public Utilities Regulatory Authority to analyze decarbonization pathways consistent w/ the state's goal of 100% carbon-free electricity by 2040
    - EO also calls for PURA oversight to ensure energy affordability and equity for all ratepayers during the resource planning process (but this is loosely outlined)
- **California**: 2018 CPUC decision requires IRPs with LSEs to assess their impacts on disadvantaged communities
    - CA defines disadvantaged communities as those w/ the highest pollution burden (top 25% statewide)

Planning Paradigm	Treatment of Equity Within Paradigm
Integrated Resource Planning	**Limited**
Transmission Planning	**None**
Distribution System Planning	**None**
Reliability Planning	**None**
EE & DSM Planning	**Limited**
Integrated Distribution Planning	**Limited**

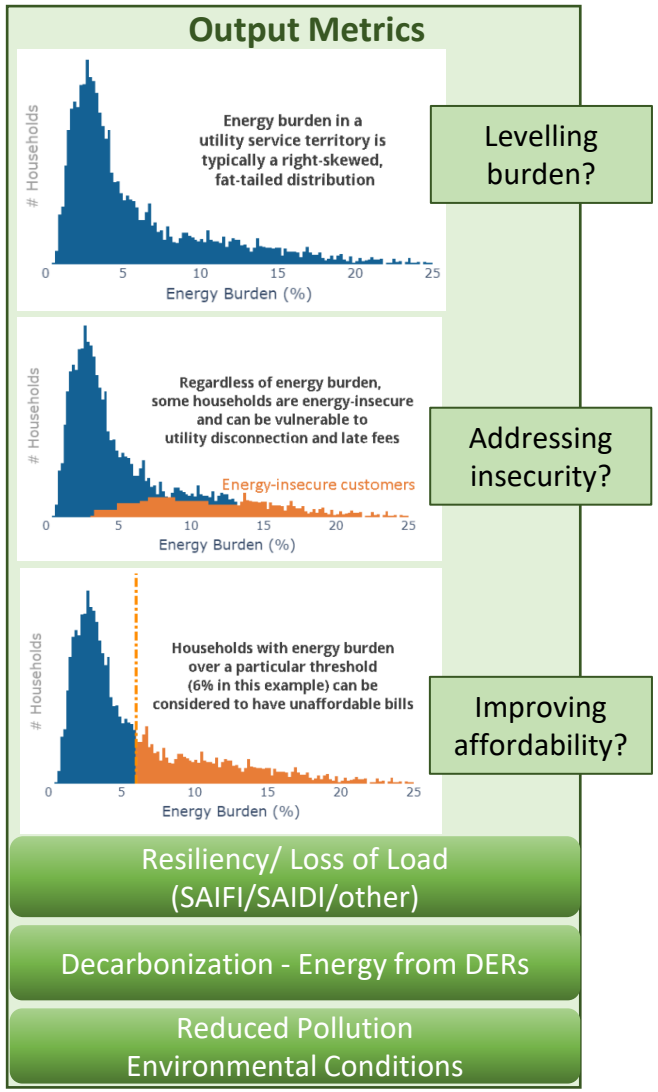
Energy Justice and Equity in Transmission Planning Current Practice

Transmission planning processes incorporate elements of procedural justice (through stakeholder engagement), but have never been tasked with addressing equity considerations such as:

- Cost allocation as it relates to customer rates and household energy burden and energy insecurity in disadvantaged communities (DACs).
- NERC TPL-001 standards and impacts to DACs.
- Comprehensive evaluation of siting impacts (beyond disruptions to viewsheds and land value), such as resettlement and tribal and cultural impacts.
- Transmission expansions to support renewable energy generation and electrification of transportation requiring redesigning of existing infrastructure to meet demands — impacts to DACs.

Planning Paradigm	Treatment of Equity Within Paradigm
Transmission Planning	**None**

Translating Energy Equity Policy for an Equitable Grid



- **New Analytical Framework Required:** Different from siting a facility or a discrete decision under environmental justice framework
- **Grid Planning Scales:** Distribution system planning is useful first framework – spatial in nature, closely connected to community experience
- **Missing Insights on Investments to Effects:** No one single attribute of the grid is sufficient for energy equity – may be composite or index until clearer insights about which are the most meaningful in practice
- **Tradeoffs and Co-Optimization:** Strong relationships, including tradeoffs, with other objectives

Measuring Equity

Target Population Identification

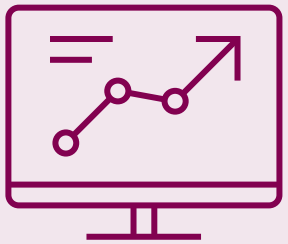
- Program equity index
- Program accessibility
- Energy cost index
- Energy burden index
- Late payment index
- Appliance performance
- Household-human development index

Investment Decision Making

- Community acceptance rating
- Program funding impact
- Energy use impacts
- Energy quality
- Workforce impact

Program Impact Assessment

- Profits
- Program acceptance rate
- Energy savings (MWh)
- Energy cost savings ($)
- Energy burden change
- Change in household-human development index score



See *Review of Energy Equity Metrics*
https://www.pnnl.gov/main/publications/external/technical_reports/PNNL-32179.pdf

Effects and More Equitable Outcomes

Recognition	• Ending disconnections (e.g., commitment to reduce or end disconnections, moratorium on shutoffs for customers with severe or extreme energy burdens) • Maximizing resilience, minimizing vulnerabilities (e.g., targeted program investments for communities and households facing severe climate and health risks)
Distributive	• Maximizing co-enrollments in affordable rates, payment plans, and clean energy programs (e.g., notify disadvantaged customers of the programs they qualify for) • Enabling energy affordability (e.g., commitment for reducing the distribution of high energy burdens)
Restorative	• Integration in cross-sector and long-term planning (e.g., quantitative and qualitative treatment of equity in long term plans and models) • Wealth building (e.g., on-bill financing with special terms for disadvantaged customers, no caps on DERs and storage)
Procedural	• Enabling participation (e.g., participation stipends, intervenor funding for disadvantaged community engagement) • Unbiased evaluation (e.g., no conflict-of-interest w/ third party evaluators, evaluation open for public input, access to original data)

Extending Energy Equity Metrics

Procedural and Recognition (due process and accountability)	**Distributive** (affordability and availability)	**Restorative** (intra- and inter-generational sustainability and responsibility
• Representativeness and inclusiveness of planning processes for all affected stakeholders • Responsiveness of planning processes to public participation and fairness of decisions • Transparency of planning processes and decisions	• Electricity cost burden (i.e., household electricity bills/income) • Electricity affordability gap • Electricity quality (e.g., geographic disaggregation of outage frequency/severity; restoration efficiency) • Electricity program (e.g., tax credits; energy efficiency) and technology (e.g., BTM solar and storage) accessibility and performance (e.g., participation/investment demographics; distribution of savings/costs, reliability/resilience, or other benefits/burdens) • Social burden (i.e., effort and ability to access critical services)	• Economic (e.g., job training/job quality; energy resource ownership/governance; reparation of electricity cost burden shouldered by energy burdened communities) • Environmental (e.g., natural resource replenishment; generation/storage resource siting) • Social (e.g., improvements in household-human development index; establishment of safeguard/grievance redress mechanisms)

Advancing Recognition and Procedural Justice: Creating Transparent Process with Stakeholders

Pacific Northwest NATIONAL LABORATORY

Sandia National Laboratories

Identify Stakeholders

- Community members
- Customers
- Disadvantaged Communities
- National Agencies
- Regional Agencies
- State Agencies
- Local Agencies
- Policy Makers
- Regulators
- Utilities
- Consumer Advocates
- Environmental Advocates
- Industry Experts

Roles & Responsibilities

- Meet with stakeholders to:
  - Define roles for each stakeholder
  - Identify responsibilities for stakeholders in relation to timing in IDSP process

Iterative Feedback Process

- Incorporate stakeholder feedback in creation of iterative process
- Include policy and regulation schedules
- Address accessibility of community members in feedback process (ex: transportation, technology, language, etc.)
- Incorporate feedback into policies

Implementation into Planning Objectives & Criteria

- Transparency and communication of the following:
  - Final policies and regulations
  - Planning objectives and timing of implementation
  - Criteria, metrics, and reporting
  - Performance and feedback to stakeholders

Community Engagement for Equitable Participation

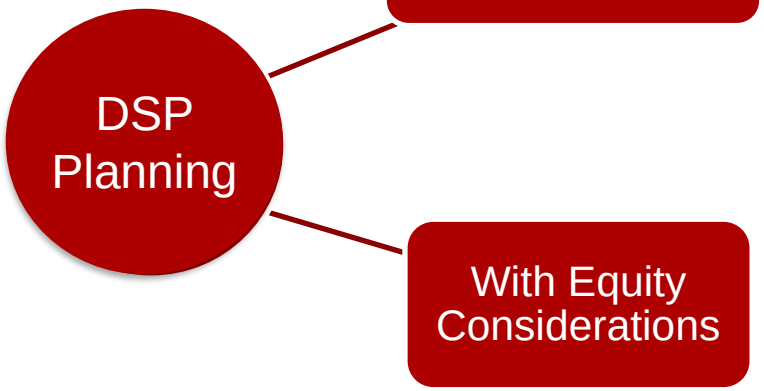
Opportunities to Identify and Include Disadvantaged Communities (DAC)

- Recognition of communities not participating
- Addressing processes that impact equity
- Education of processes to participate

Identify Key DAC Equity Considerations

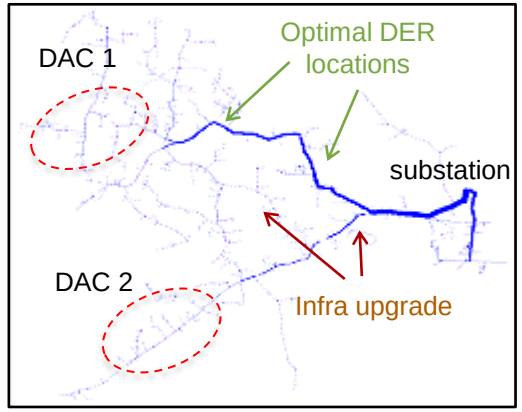
- Gather stakeholder feedback for defining equity considerations
- Consolidate identified equity considerations
- Incorporate equity considerations in planning process

Potential Impact of Integrating Equity in Grid Planning



Impact on Outcome

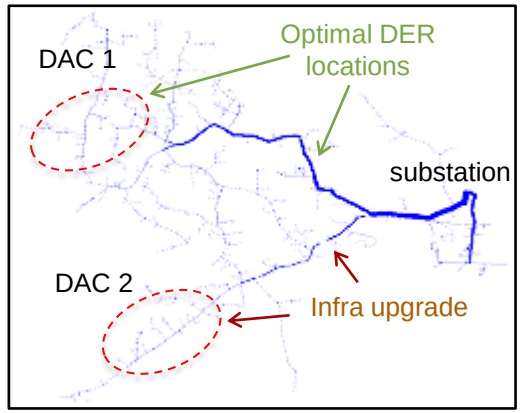
Major focus on cost and reliability



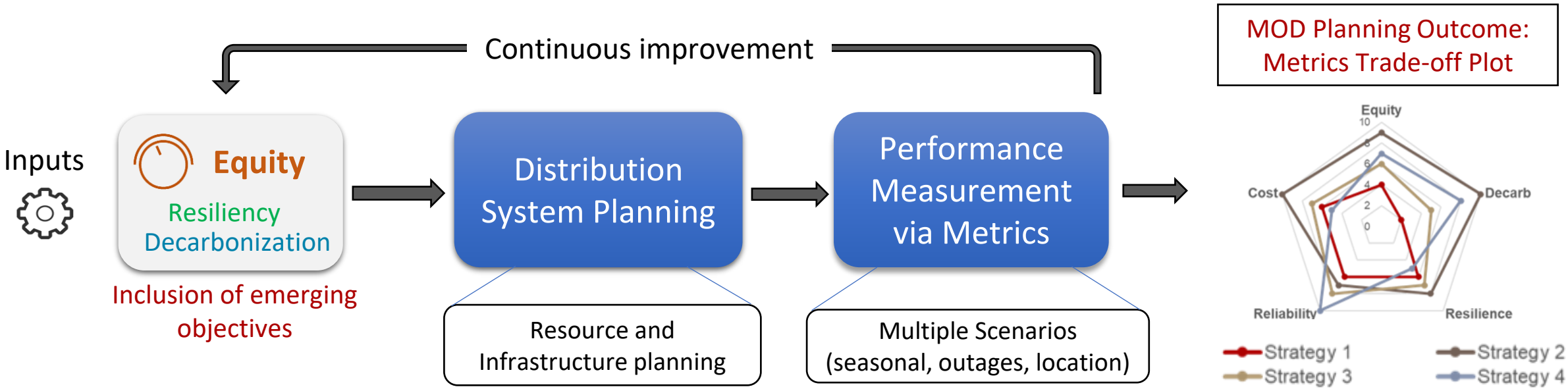
Potentially different investment strategy

Insights into what part of the feeder needs to be prioritized

Insights into how to reduce energy burden and increase DAC resiliency



Process of Integrating Equity in Grid Planning



Different investment strategies can be analyzed by adjusting the dial of emerging objective considerations — business as usual vs with equity consideration.

Equity in Distribution System Planning Process

	Equity Characteristics		Planning process	Potential Impact on Outcome
1	Energy assistance/demand response to DAC	→	Load Forecast	Reduced energy burden for DAC
2	DER incentives/rebates	→	DER adoption	Increased DER adoption in DAC
3	$x\%$ of DAC load served from DER	→	Utility DER locational distribution	Improved energy access and security
4	A community center with black-start DER units for outages	→	Utility DER locational distribution/ microgrid planning	Improved resiliency in DAC and reduced energy vulnerability
5	Necessary infra upgrade to host DERs in DAC regions	→	Infrastructure upgrade planning	Improved resiliency in DAC

Performance Metrics to Measure Equity Outcomes

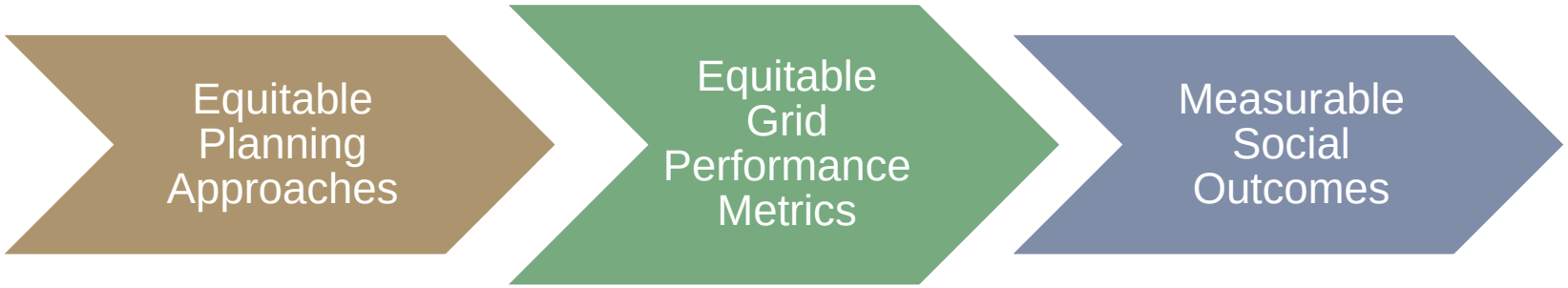
Energy Burden	*Equity*
Energy Vulnerability to Outages	*Resiliency, Equity*
Access to black-start DERs	*Resiliency, Equity*
Loss of load (SAIFI/SAIDI)	*Reliability, Equity*
Energy Served from DERs	*Decarb, Equity*
Cost of Assets Upgrade	*Cost, Equity*
Impact on Energy Consumption due to Energy Efficiency Program	*Efficiency, Equity*

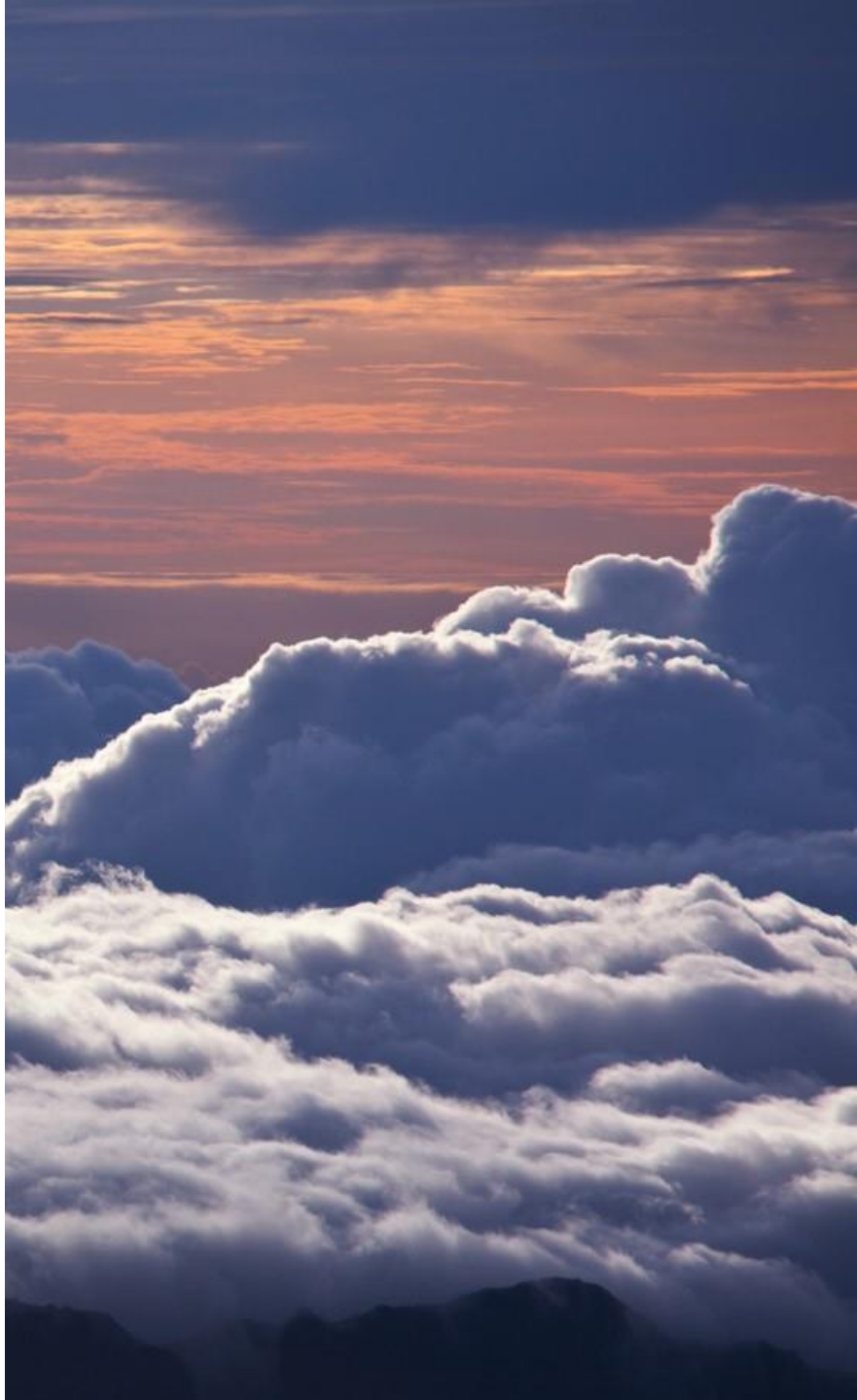
Example Metrics	
Energy Burden	$\frac{Annual\ utility\ bills}{Annual\ household\ income}$
SAIFI	$\frac{Total\ \#\ of\ customers\ interrupted}{Total\ \#\ of\ customers\ served}$
E3B Investment*	% of $low\ income\ population$ × $Total\ residential\ EE\ investment$ ($)

*Energy Efficiency Equity Baseline (E3B)

MOD-Plan Work Ahead

- Identify measurable effects to underserved communities, connected to operational change that can occur within a grid planning and investment context.
- Incremental and idealized approaches needed: address low-data-quality simpler distribution system plans as well as integrated planning paradigms.
- Complexity in the multi-objective tradeoffs space: where laboratory contribution and insights can be strong
- Case studies, pilots, and other external partnerships for validation will be material to project outcomes





Acknowledgment and Resources

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