National Standard Practice Manual for Benefit-Cost Analysis of Distributed Energy Resources

(NSPM for DERs)

Overview

November 2023

About NESP

The National Energy Screening Project (NESP) is a stakeholder organization that is open to all organizations and individuals with an interest in working collaboratively to improve cost-effectiveness screening practices for distributed energy resources (DERs).

Products include:

- NSPM for EE (2017)
- NSPM for DERs (2020)
- Database of Screening Practices (DSP)
- Methods, Tools and Resources (MTR) Handbook for Quantifying DER Impacts (2022)

NESP work is managed by E4TheFuture, with coordinated state outreach via key partners.

NESP work is funded by E4TheFuture and in part by US DOE.

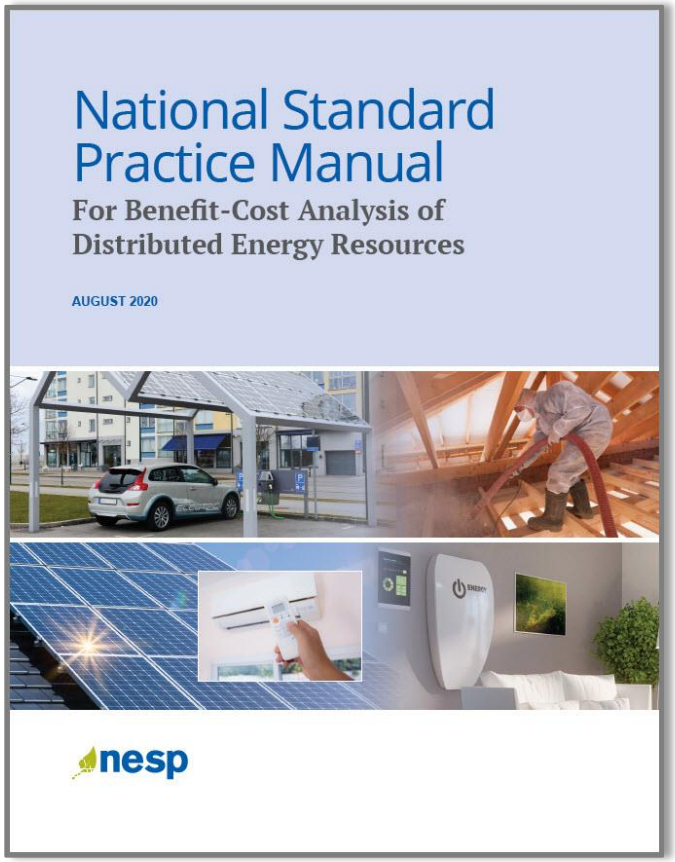
https://nationalenergyscreeningproject.org/

Overview of Presentation

1. NSPM Background and State Use
2. Part I - NSPM BCA Framework
3. Part II – DER Impacts and Cross-Cutting Issues
3. Part III – Guidance on BCA for Specific DER Technologies
4. Part IV – Guidance on BCA for Multiple DERs
5. Energy Equity and BCA

NSPM for DERs - Background

- Managed and funded by E4TheFuture (with support from US DOE via LBNL)
- Multiple co-authors
  - Extensive understanding of regulatory economics
  - Specialized expertise with different DERs
- Advisory Group
  - 45+ individuals
  - Diversity of perspectives
  - Input on Manual outline and drafts
- NSPM for DERs builds on NSPM for EE (2017)



NSPM is a 'living document' and will be updated and improved over time, adding case studies, addressing gaps, etc. contingent upon funding.

Why an NSPM for DERs?

- Traditional cost-effectiveness tests often do not address pertinent jurisdictional/state policies.
- Traditional tests are often modified by states in an ad-hoc manner, without clear principles or guidelines.
- DERs are treated inconsistently in many BCAs or valuations (i.e., in context of programs, procurement, pricing mechanisms, distribution planning, IRP, etc.)
- DERs are often not accurately valued.
- There is a lack of transparency on why tests are chosen and how they are applied.

NSPM for DERs – Audience and Uses

Audience: All entities overseeing/guiding DER decision (PUCs, SEOs, utilities, DER reps, evaluators, consumer advocates, and others)

Purpose: Guidance for valuing DER opportunities to inform policies and strategies that support state goals/objectives, such as:

- expanding EE/DR plans, strategies, and programs to a broader set of DERs;
- evaluating and planning for non-wires/pipes solutions;
- incorporating DERs into distribution system planning;
- achieving electrification goals, including EV goals;
- achieving environmental and carbon emission objectives.

Applies to:

- **Programs**: initiatives and policies implemented by utilities or other entities to encourage adoption of DERs
- **Procurements:** initiatives to procure DERs, whether built by a utility or procured from third-party vendors, e.g., competitive procurement
- **Pricing Mechanisms**: such as those designed to compensate DERs for their value to grid or to achieve other policy objectives (e.g., time-of-use rates, peak time rebates, critical peak pricing)

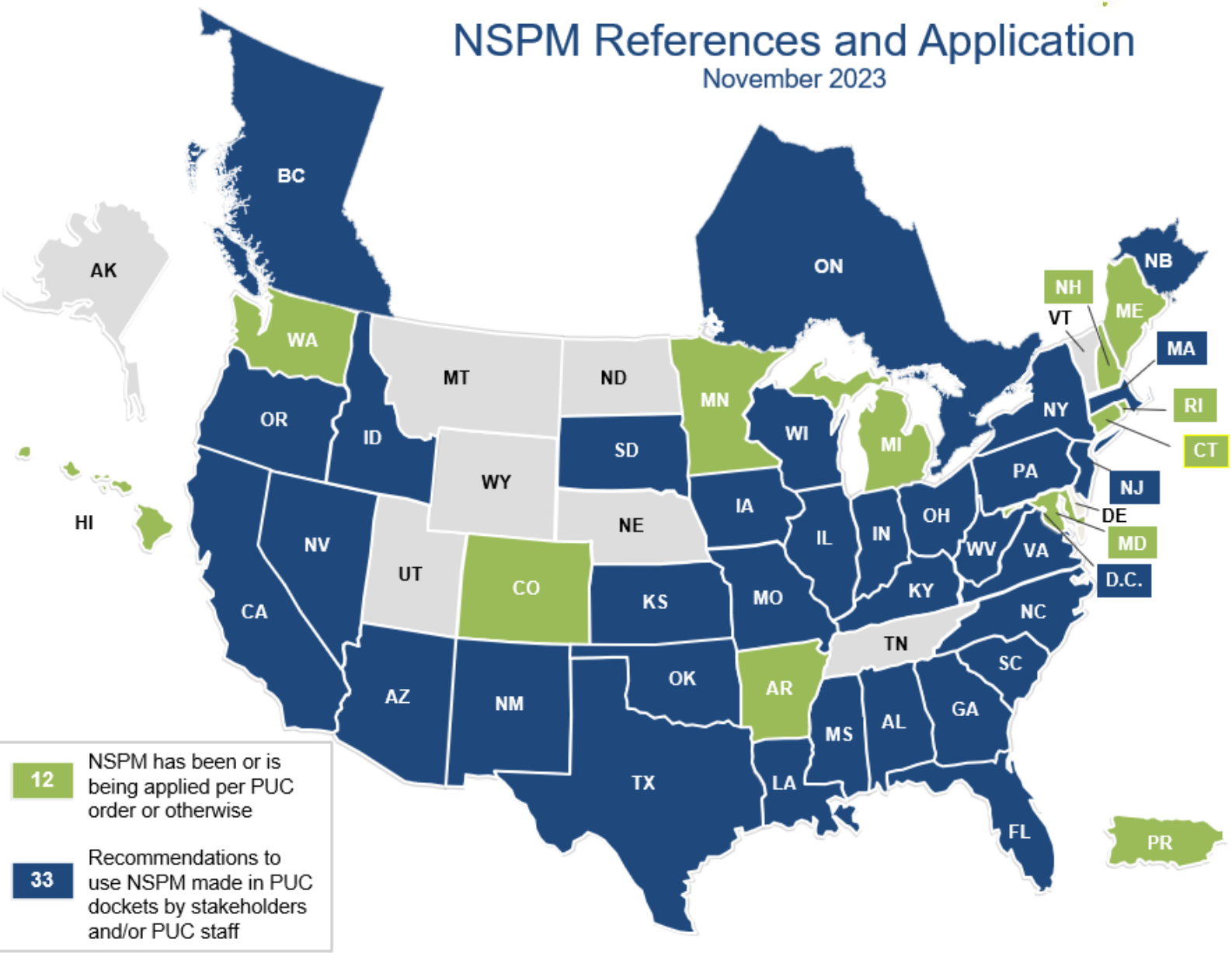
NSPM Applies to Various Regulatory Contexts/Mechanisms:

Context	Application	Goal of BCA	Role of Costs & Benefits
Programs	EE, DR, DG, Storage, EVs	determine whether to implement the program	compare program benefits to costs
Procurement	DERs, NWAs, PPAs,	determine the ceiling price	ceiling price should equal the benefits of the procurement
Pricing	Rate design	estimate long-run marginal costs	long-run marginal costs should equal the benefits of modifying consumption
	DER compensation	determine the value of DER	value of DER is the sum of benefits
Planning	Optimize DERs	identify optimal DER portfolio	compare portfolio benefits to costs
	DP, IDP, IRP, IGP	identify preferred resource scenario	compare scenario benefits to costs
	GHG plans	achieve GHG goals at low cost	compare GHG plan benefits to costs
	State Energy Plans	identify resources to meet state goals	compare state plan benefits to costs
Infrastructure Investments	Grid Mod, AMI, EV infrastructure, etc.	determine whether to make the investment	compare investment benefits to investment costs
Prudence Reviews	Retrospective review	determine whether past utility decision was appropriate	compare benefits and costs using test in place at the time the decision was made
	Prospective review	determine whether proposed utility decision is appropriate	compare benefits and costs using test currently in place

Definitions, assumptions and values of costs and benefits should be consistent same across all regulatory contexts/mechanisms

NSPM References and Application

November 2023



Examples: NSPM Applications in U.S.

State	DER Type	Description and Links	State	DER Type	Description and Links
AR*	EE	The AR PSC directed the Parties Working Collaboratively (PWC) to consider the NSPM guidance to inform its next three-year cycle for utility energy efficiency plans. In its Docket 13-002-U Order No. 48 and Docket 10-100-R Order No. 31 the commission accepted the NSPM Case Study and supporting appendices and rules.(2018)	MI*	All DERs	MI PSC directed utilities to develop a BCA for DER pilots using the NSPM. Utilities submitted this proposed BCA using the NSPM on which intervenors commented on, followed by a commission decision to adopted a new BCA test. (2022-23)
CO	All DERs	As part of Docket 2OR-0516E requiring utilities to develop distribution system plans and evaluate non-wires alternatives, the CO PUC directed Xcel to apply the NSPM principles to develop a BCA methodology as part of the utility's competitive procurement processes. (2022)	MN*	EE	The MN Dept of Commerce convened a stakeholder group to apply the NSPM to update benefit-cost analysis (BCA) practice for its EE programs, which led to adoption of a MN Cost Test. (2022-23)
CT	EE	CT DEEP's determination approving the utilities' 2022-24 energy efficiency plan set forth a new Connecticut Efficiency Test (CTET). DEEP reviewed and reevaluated the primary test used to assess the Conservation and Load Management (CL&M) programs using the NSPM BCA framework to ensure consistency and integrity in the state's CL&M programs.	NH**	EE	The NH PUC retained a consultant to facilitate a stakeholder process using the NSPM framework for energy efficiency programs, which led to the development of a Granite State Test that the PUC adopted in Order 26,322. The utilities apply the Granite State Test to develop their Statewide Energy Efficiency plan.(2019)
HI	All DERs	With regard to its DER policies, the HI PUC required in Order Number 39335 that the utilities use the NSPM framework when modeling DER avoided costs and value streams in their BCA. (2023)	PR**	EE	The PR Energy Bureau directed stakeholders to use the NSPM to develop a Puerto Rico Benefit Cost Test for demand response and energy efficiency programs, which was then adopted in Case NEPR-MI-2021-0009. (2021)
ME**	DG	The ME Governor's Energy Office commissioned consultants to develop an Interim Report and Final Report analyzing the cost-effectiveness of distributed generation in Maine. As part of this process, technical workshops using the NSPM framework were held to develop a Maine Test (Appendix A3 final report). (2022-23)	RI	All DERs	The RI PUC opened Docket 4600 to develop a cost-effectiveness framework that could be applied consistently across different types of recourses and programs. In 2017, a Stakeholder Working Group used the NSPM BCA principles to develop a Rhode Island Test, which was approved by the Commission, and is reflected in the state's Least Cost Procurement Standards. (2016-17)
MD**	All DERs	The MD PSC opened Case No. 9674 to develop a Unified BCA for all DERs in Maryland, and then issued Order 90212 in 2022 to convene a Unified BCA workgroup to develop a new BCA test following the NSPM framework. (2022-23)	WA*	All DERs	The WA UTC opened Docket 210804 to develop a BCA test for all DERs using the NSPM. A stakeholder process was held in 2022 that informed an initial BCA proposal; however, the docket is on hold as the UTC considers expanding the scope from electric to also gas.

*Technical assistance on NSPM provided to state commission staff and/or stakeholder group via Lawrence Berkeley National Lab and/or NESP (E4TheFuture).

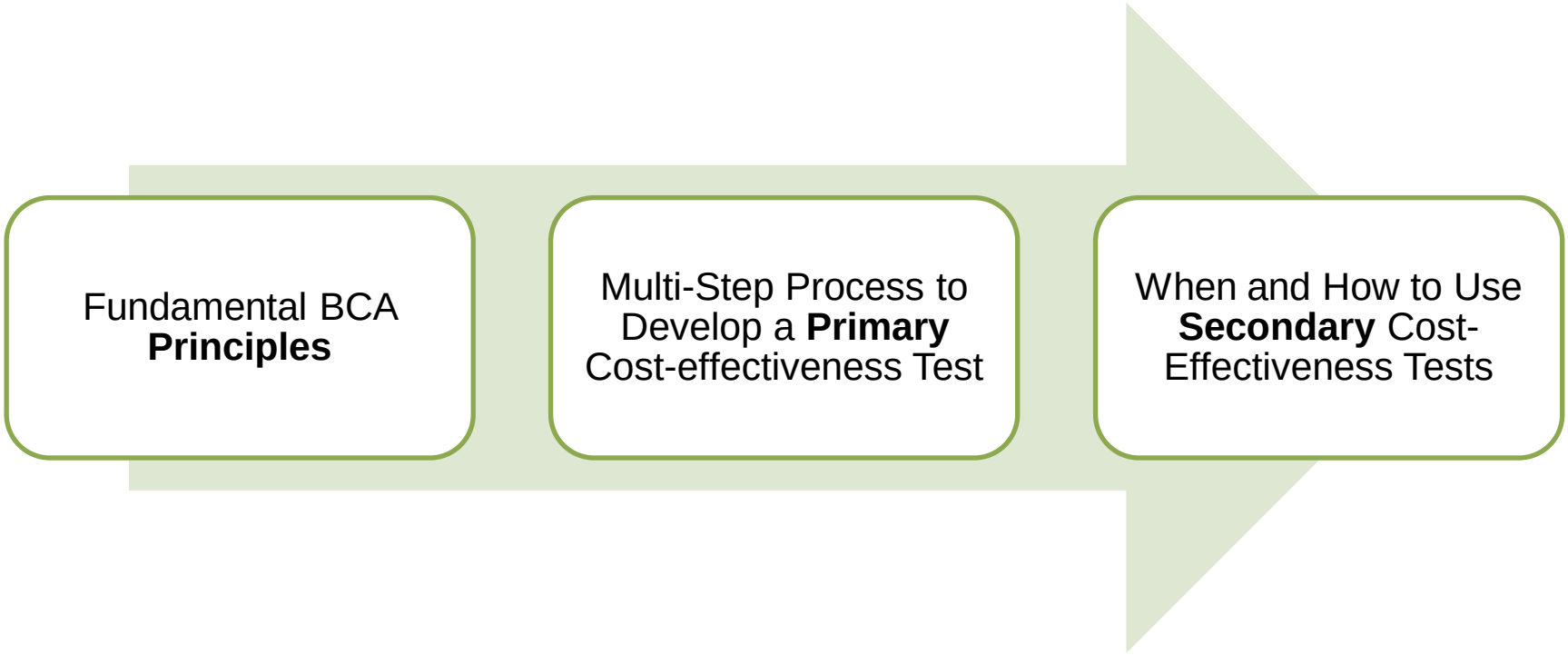
**Commission issued RFP for technical and facilitation services to apply the NSPM multi-step process and develop a draft and final BCA proposal/report.

NSPM for DERs - Contents

NSPM for DERs – PART I

The NSPM Benefit-Cost Analysis Framework

NSPM BCA Framework



Defining Your Primary BCA Test

What question does a Primary Test answer?

Which resources have benefits that exceed costs and therefore merit utility acquisition or support on behalf of their customers?

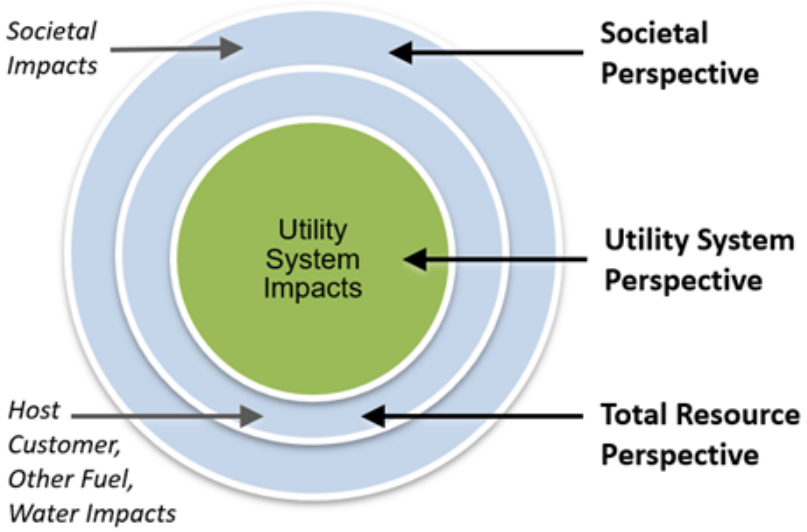
NSPM BCA Principles

1. Recognize that DERs can provide energy/power system needs and should be compared with other energy resources and treated consistently for BCA.
2. Align primary test with jurisdiction's applicable policy goals.
3. Ensure symmetry across costs and benefits.
4. Account for all relevant, material impacts (based on applicable policies), even if hard to quantify.
5. Conduct a forward-looking, long-term analysis that captures incremental impacts of DER investments.
6. Avoid double-counting through clearly defined impacts.
7. Ensure transparency in presenting the benefit-cost analysis and results.
8. Conduct BCA separate from Rate Impact Analyses because they answer different questions.

Principles are not mutually exclusive.

Cost-Effectiveness Perspectives

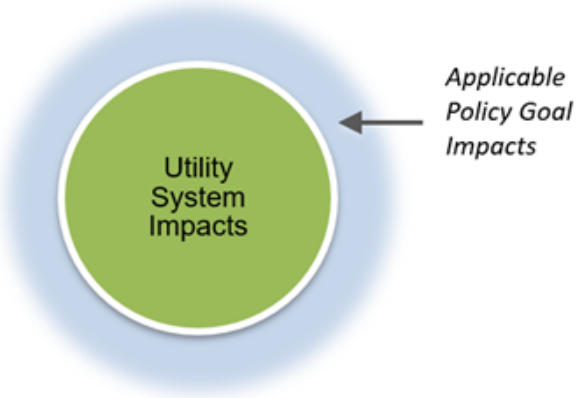
Traditional Perspectives



- Three perspectives define the scope of impacts to include in the most common traditional cost-effectiveness tests.

NSPM for DERs

Regulatory Perspective



- Perspective of public utility commissions, legislators, muni/coop boards, public power authorities, and other relevant decision-makers.
- Accounts for utility system plus impacts relevant to a jurisdiction's applicable policy goals (which may or may not include host customer impacts).
- Can align with one of the traditional test perspectives, but not necessarily.

NSPM 5-step Process

Defining a Primary Cost-Effectiveness Test

STEP 1 **Articulate Applicable Policy Goals**

Articulate the jurisdiction's applicable policy goals related to DERs.

STEP 2 **Include All Utility System Impacts**

Identify and include the full range of utility system impacts in the primary test, and all BCA tests.

STEP 3 **Decide Which Non-Utility System Impacts to Include**

Identify those non-utility system impacts to include in the primary test based on applicable policy goals identified in Step 1:

- Determine whether to include host customer impacts, low-income impacts, other fuel and water impacts, and/or societal impacts.

STEP 4 **Ensure that Benefits and Costs are Properly Addressed**

Ensure that the impacts identified in Steps 2 and 3 are properly addressed, where:

- Benefits and costs are treated symmetrically;
- Relevant and material impacts are included, even if hard to quantify;
- Benefits and costs are not double-counted; and
- Benefits and costs are treated consistently across DER types

STEP 5 **Establish Comprehensive, Transparent Documentation**

Establish comprehensive, transparent documentation and reporting, whereby:

- The process used to determine the primary test is fully documented; and
- Reporting requirements and/or use of templates for presenting assumptions and results are developed.

STEP 1 Articulate Applicable Policy Goals

Articulate the jurisdiction's applicable policy goals related to DERs

Policy Goals come in many forms:

- Statutes
- Commission orders
- State energy plans
- Executive orders
- Other sources

Statutory goals sometimes require interpretation

- First by stakeholders and Commission staff, ultimately by the Commission
- Statutes sometimes do not address issues that need to be resolved for BCA purposes

Policy goals can evolve over time

- Goals are not static – new legislation is passed, new regulatory decisions made, etc.

STEP 2 Include all Utility System Impacts

Foundational to BCA, always include *even though impact may not be applicable to a particular DER*

Type	Electric Utility System Impact	Description
Generation	Energy Generation	The production or procurement of energy (kWh) from generation resources on behalf of customers
	Capacity	The generation capacity (kW) required to meet the forecasted system peak load
	Environmental Compliance	Actions to comply with environmental regulations
	RPS/CES Compliance	Actions to comply with renewable portfolio standards or clean energy standards
	Market Price Effects	The decrease (or increase) in wholesale market prices as a result of reduced (or increased) customer consumption
	Ancillary Services	Services required to maintain electric grid stability and power quality
Transmission	Transmission Capacity	Maintaining the availability of the transmission system to transport electricity safely and reliably
	Transmission System Losses	Electricity or gas lost through the transmission system
Distribution	Distribution Capacity	Maintaining the availability of the distribution system to transport electricity or gas safely and reliably
	Distribution System Losses	Electricity lost through the distribution system
	Distribution O&M	Operating and maintaining the distribution system
	Distribution Voltage	Maintaining voltage levels within an acceptable range to ensure that both real and reactive power production are matched with demand
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation
	Program Administration	Utility outreach to trade allies, technical training, marketing, and administration and management of DERs
	Utility Performance Incentives	Incentives offered to utilities to encourage successful, effective implementation of DER programs
	Credit and Collection	Bad debt, disconnections, reconnections
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks
	Reliability	Maintaining generation, transmission, and distribution system to withstand instability, uncontrolled events, cascading failures, or unanticipated loss of system components
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions

STEP 2 Include all Utility System Impacts cont.

Foundational to any BCA – include *even though an impact may not be applicable to every DER or use case*

When a gas utility is implementing DER:

Type	Gas Utility System Impact
Energy/Supply	Fuel / Commodity
	Capacity and storage
	Environmental compliance
	Market price effects
Transportation	Pipeline capacity
	Pipeline losses
Delivery	Local delivery capacity
	Local delivery line losses
General	Financial incentives
	Program admin costs
	Performance incentives
	Credit and collection costs
	Risk, reliability, resilience
Other	Other - specify

STEP 3 Identify Relevant Non-Utility System Impacts

(Inclusion depends on alignment with applicable policy goals)

Other Fuel Impacts

Type	Impacts
Oil, Propane, Wood, Gasoline, etc.	Fuel and O&M
	Delivery Costs
	Environmental Compliance
	Market Price Effects

For DERs implemented by **electric utilities**, other fuels include:

- **Gas** utility system impacts
- Oil, propane, wood, gasoline, etc.

For DERs implemented by **gas utilities**, other fuels include:

- **Electric** utility system impacts
- Oil, propane, wood, gasoline, etc.

STEP 3 Identify Relevant Non-Utility System Impacts (2)

Societal Impacts - examples

(Inclusion depends on applicable policy goals)

Societal Impact	Description
Resilience	Resilience impacts beyond those experienced by utilities or host customers
GHG Emissions	GHG emissions created by fossil-fueled energy resources
Other Environmental	Other air emissions, solid waste, land, water, and other environmental impacts
Economic and Jobs	Incremental economic development and job impacts
Public Health	Health impacts, medical costs, and productivity affected by health
Poverty/energy equity	Poverty alleviation, environmental justice, reduced home foreclosures, etc.
Energy Security	Energy imports and energy independence

STEP 3 Identify Applicable Non-Utility System Impacts (3)

Host Customer Impacts

Inclusion depends on applicable policy goals. Ensure symmetrical treatment of costs & benefits

Type	Host Customer Impact
Host Customer	Host portion of DER costs
	Host transaction costs
	Interconnection fees
	Risk
	Reliability
	Resilience
	Tax incentives
	Non-energy Impacts
	Low-income non-energy impacts

Host Customer Impact	Non-Energy Impacts (NEIs)
Transaction costs	Costs incurred to adopt DERs, beyond those related to installing or operating the DER itself (e.g., application fees, customer time spent researching DERs, paperwork, etc.)
Asset value	Changes in the value of a home or business as a result of the DER (e.g., increased building value, improved equipment value, extended equipment life)
Productivity	Changes in a customer's productivity (e.g., in labor costs, operational flexibility, O&M costs, reduced waste streams, reduced spoilage)
Economic well-being	Economic impacts beyond bill savings (e.g., reduced complaints about bills, reduced terminations and reconnections, reduced foreclosures—especially for low-income customers)
Comfort	Changes in comfort level (e.g., thermal, noise, and lighting impacts)
Health & safety	Changes in customer health or safety (e.g., fewer sick days from work, reduced medical costs, improved indoor air quality, reduced deaths)
Empowerment & control	Satisfaction of being able to control one's energy consumption and energy bill
Satisfaction & pride	Satisfaction of helping to reduce environmental impacts (e.g., key reason why residential customers install rooftop PV)
Reduced Utility Bills	Only relevant if using a *Participant Cost Test*

STEP 4:
Ensure that Impacts are Properly Addressed

Ensure that the impacts identified in Steps 2 and 3 are properly addressed, where:

- Benefits and costs are treated symmetrically;
- Relevant and material impacts are included, even if hard to quantify;
- Benefits and costs are not double-counted; and
- Benefits and costs are treated consistently across DER types

STEP 5:
Establish Comprehensive, Transparent Documentation

- Development of primary test - process should be transparent to all interested stakeholders
- Stakeholder input can be achieved through a variety of means:
  - Rulemaking process
  - Generic jurisdiction-wide docket
  - Working groups or technical sessions
- Address objectives based on current jurisdiction policies
  - Flexibility needed to incorporate evolution of policies over time
- Review of policy goals may require consultation with other government agencies
  - Environmental protection
  - Transportation
  - Health and human services
  - Economic development

Methodologies to Account for All Relevant Impacts
(Including Hard-to-Quantify Impacts)

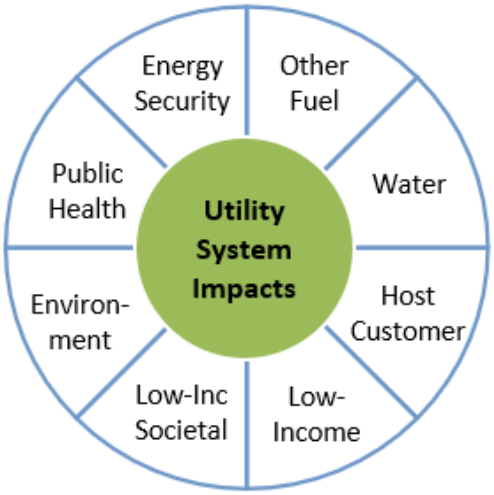
Once a Primary JST is defined using NSPM process, next phase is for stakeholders and commission staff to identify appropriate methods or approaches to account for full range of utility system impacts and relevant non-utility system impacts – where impacts are ideally monetized, but may be quantified (not monetized) or addressed qualitatively.

Approach	Application
Jurisdiction-specific studies	Best approach for estimating and monetizing relevant impacts.
Studies from other jurisdictions	Often reasonable to extrapolate from other jurisdiction studies when local studies not available.
Proxies	If no relevant studies of monetized impacts, proxies can be used.
Alternative thresholds	Benefit-cost thresholds different from 1.0 can be used to account for relevant impacts that are not monetized.
Other considerations	Relevant quantitative and qualitative information can be used to consider impacts that cannot or should not be monetized.

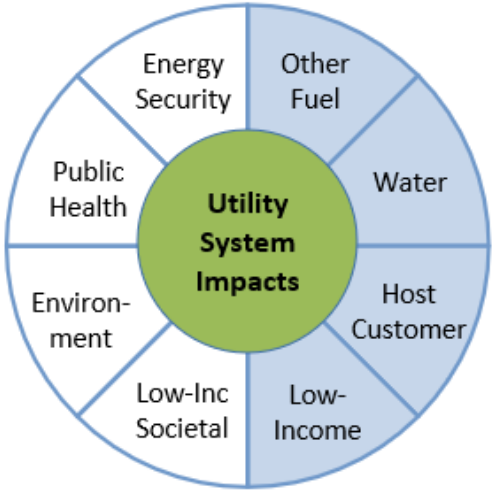
Primary Test = Jurisdiction Specific Test (JST)

Hypothetical JSTs as compared to traditional tests

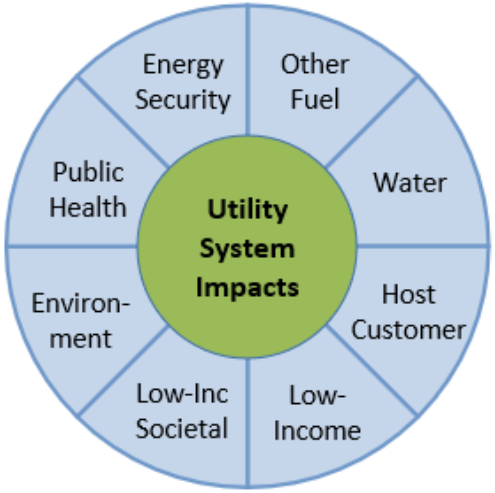
JST 1 = UCT/PACT



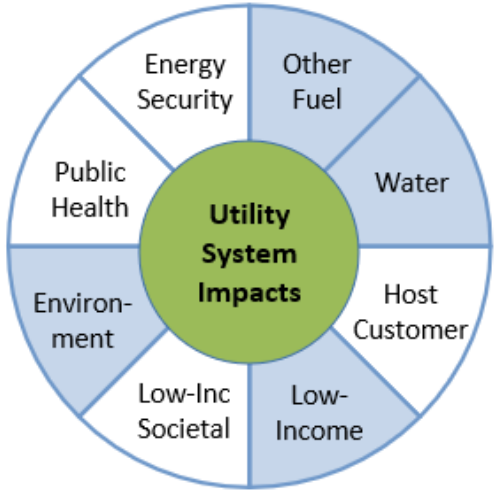
JST 2 = TRC Test



JST 3 = SCT



JST 4 ≠ traditional CE test *



UCT = Utility Cost Test (or PACT = Program Admin Cost Test)
TRC = Total Resource Cost Test
SCT = Societal Cost Test

All utility system impacts included

Non-utility system impacts included

Non-utility system impacts *not* included

*JST 4 includes a different set of non-utility system impacts based on *its applicable policies.*

JSTs may or may not align with traditional tests.

Jurisdiction Specific Test (JST) Compared with Traditional BCA Tests

Test	Perspective	Key Question Answered	Categories of Benefits and Costs Included
Jurisdiction-Specific Test	Regulators or decision-makers	Will the cost of meeting utility system needs, while achieving applicable policy goals, be reduced?	Includes the utility system impacts, and those impacts associated with achieving applicable policy goals
Utility Cost Test*	The utility system	Will utility system costs be reduced?	Includes the utility system impacts
Total Resource Cost Test	The utility system plus host customers	Will utility system costs and host customers' costs collectively be reduced?	Includes the utility system impacts, and host customer impacts
Societal Cost	Society as a whole	Will total costs to society be reduced?	Includes the utility system impacts, host customer impacts, and societal impacts such as environmental and economic development impacts

Use of Secondary Tests

NSPM provides guidance on **when and how to use secondary cost-effectiveness tests.**

While a jurisdiction's primary test informs whether to fund or otherwise support DERs, secondary tests can help to:

- inform decisions on how to prioritize DERs (based on priority goals/objectives, as well as different considering perspectives (e.g., host customer/participant, utility);
- inform decisions regarding marginally non- and/or cost-effective DERs; and
- encourage consistency across DER types.

Conduct BCA Separately from Rate Impact Analysis (NSPM Principle #8)

The two analyses answer different questions

	Benefit-Cost Analysis	Rate Impact Analysis
Purpose	To identify which DERs utilities should invest in or otherwise support on behalf of their customers	To identify how DERs will affect rates, in order to assess equity concerns
Questions Answered	What are the future costs and benefits of DERs?	Will customer rates increase or decrease, and by how much?
Results Presented	• Cumulative costs (PV$) • Cumulative benefits (PV$) • Cumulative net benefits (PV$) • Benefit-cost ratios	• Rate impacts (c/kWh, %) • Bill impacts ($/month, %) • Participation rates (#, %)

The Rate Impact Measure (RIM) Test combines the two analyses and therefore makes it difficult to answer either question

Components of BCA and Rate Impact Analyses

	Include in Benefit-Cost Analysis	Include in Rate, Bill, Participant Analysis
Utility system impacts	✓	✓
Host customer impacts	depends on policy goals	do not affect rates
Social impacts	depends on policy goals	do not affect rates
Lost revenues	do not affect costs	✓
Increased revenues	do not affect costs	✓
Net metering bill credits	do not affect costs	✓

See NSPM for DERs Appendix A on Rate Impact Analyses

Rate Impacts ≠ Cost-Effectiveness

- They include different things…
  - Cost-effectiveness: total new costs vs. total new cost savings
  - Rate impacts: include past/sunk costs, no value to avoided energy costs
- …to answer very different questions:
  - Cost-effectiveness: Do total costs go down? By how much?
  - Rate impacts: Do rates go up?
- Costs can go up even if rates go down (and vice versa)
  - 1100 kWh * $0.10/kWh = $110
  - 900 kWh * $0.11/kWh = $ 99
- Bottom line: DER rate impacts are concern about equity, not cost
  - Equity between DER program participants and non-participants

Rate Impacts = Equity Issue

- A legitimate consideration for how much DER, which DER
  - Separate from (or in addition to) cost-effectiveness
- But should be quantified, considered in context
  - Magnitude of rate impact
  - % of customers with rate impact, but no offsetting savings (non-participants)
  - Magnitude of EE benefit
- Example: Synapse 2014 Study of Vermont EE Programs
  - 20-year time horizon for aggressive EE
  - 95% of Res customers participate, see ~7% avg. bill reduction
  - 5% of Res customers non-participants, 4-5% bill increase

Is this trade-off acceptable?

- Are trade-offs made for DER investments same as those made on supply investments? If different, why?
  - for substation upgrade, do all customers pay or just those driving the need?

Rate, Bill and Participant Impacts

A thorough understanding of rate impacts requires an analysis of three important factors:

- **Rate impacts**, provide an indication of the extent to which rates for all customers might increase.
- **Bill impacts**, provide an indication of the extent to which customer bills might be reduced for those customers that install DERs.
- **Participation impacts**, provide an indication of the portion of customers that will experience bill reductions or bill increases.
    - Participation impacts are also key to understanding the extent to which customers are adopting DERs based on DER policies.

For more information on addressing equity, see slides 53-59 below.

3. NPSM for DERs: PARTS II-IV

DER Impacts and Cross-Cutting Issues

BCA for Specific DER Technologies

BCA for Multiple DERs

DER Benefits and Costs (Impacts)

Utility System Impacts

- Electric
- Gas
- Other Fuels

Non-Utility System Impacts

- Host Customer
- Societal

DER Utility System Impacts

Type	Utility System Impact	EE	DR	DG	Storage	Electrification
Generation	Energy Generation	●	●	●	●	●
	Capacity	●	●	●	●	●
	Environmental Compliance	●	●	●	●	●
	RPS/CES Compliance	●	●	●	●	●
	Market Price Effects	●	●	●	●	●
	Ancillary Services	●	●	●	●	●
Transmission	Transmission Capacity	●	●	●	●	●
	Transmission System Losses	●	●	●	●	●
Distribution	Distribution Capacity	●	●	●	●	●
	Distribution System Losses	●	●	●	●	●
	Distribution O&M	●	●	●	●	●
	Distribution Voltage	●	●	●	●	●
General	Financial Incentives	●	●	●	●	●
	Program Administration Costs	●	●	●	●	●
	Utility Performance Incentives	●	●	●	●	●
	Credit and Collection Costs	●	●	●	●	●
	Risk	●	●	●	●	●
	Reliability	●	●	●	●	●
	Resilience	●	●	●	●	○

Impact can be a benefit or cost or will 'depend' on key factors

● = *typically a benefit*
● = *typically a cost*
● = *either a benefit or cost depending on application*
○ = *not relevant for resource type*

DER Host Customer Impacts

Impact can be a benefit or cost or will 'depend' on key factors

Type	Host Customer Impact	EE	DR	DG	Storage	Electrification
Host Customer	Host portion of DER costs	●	●	●	●	●
	Interconnection fees	○	○	●	●	○
	Risk	●	○	●	●	●
	Reliability	●	●	●	●	●
	Resilience	●	●	●	●	●
	Tax Incentives	●	●	●	●	●
	Host Customer NEIs	●	●	●	●	●
	Low-income NEIs	●	●	●	●	●

● = typically a benefit for this resource type; ● = typically a cost for this resource type; ● = either a benefit or cost for this resource type, depending upon the application of the resource; ○ = not relevant for this resource type

DER Societal Impacts

Impact can be a benefit or cost or will 'depend' on key factors

Type	Societal Impact	EE	DR	DG	Storage	Electrification
Societal	Resilience	●	●	●	●	●
	GHG Emissions	●	●	●	●	●
	Other Environmental	●	●	●	●	●
	Economic and Jobs	●	●	●	●	●
	Public Health	●	●	●	●	●
	Low Income: Society	●	●	●	●	●
	Energy Security	●	●	●	●	●

● = typically a benefit for this resource type; ● = typically a cost for this resource type; ● = either a benefit or cost for this resource type, depending upon the application of the resource; ○ = not relevant for this resource type

Key Factors that Affect DER Impacts

Depends on specific DERs and use cases:

- DER technology characteristics, operating profile
- Resource ownership/control
- Temporal and locational impacts
- Interactive effects
- Behind-the-Meter versus Front-of-the-Meter

Cross-Cutting Considerations:

- Air Emission Impacts
- Transfer Payments and Offsetting Impacts
- Variable Renewable Generation Impacts
- Wholesale Market Revenues
- Free Riders and Spillover Impacts
- Discount Rates

NSPM for DERs
Multi-DER Chapters

Chapters:

- Multiple on-site DER types – such as grid-integrated efficient buildings (GEBs)
- Non-wires solutions (NWS) - Multiple DER types in a specific geographic location
- System-wide DER Portfolios multiple DER types across a utility service territory
- Dynamic system planning practices that can be used to optimize DERs and alternative resources (IGP, IDP, IRP)

Content in each Chapter:

- Summary of key points
- Description of how the multiple DER types might be used together
- Discussion of key factors in determining benefits and costs for each approach
- Guidance on how to address common challenges in determining benefits and costs in multi-DER use cases
- Case studies (not all chapters)

BCA for Multiple On-site DERs

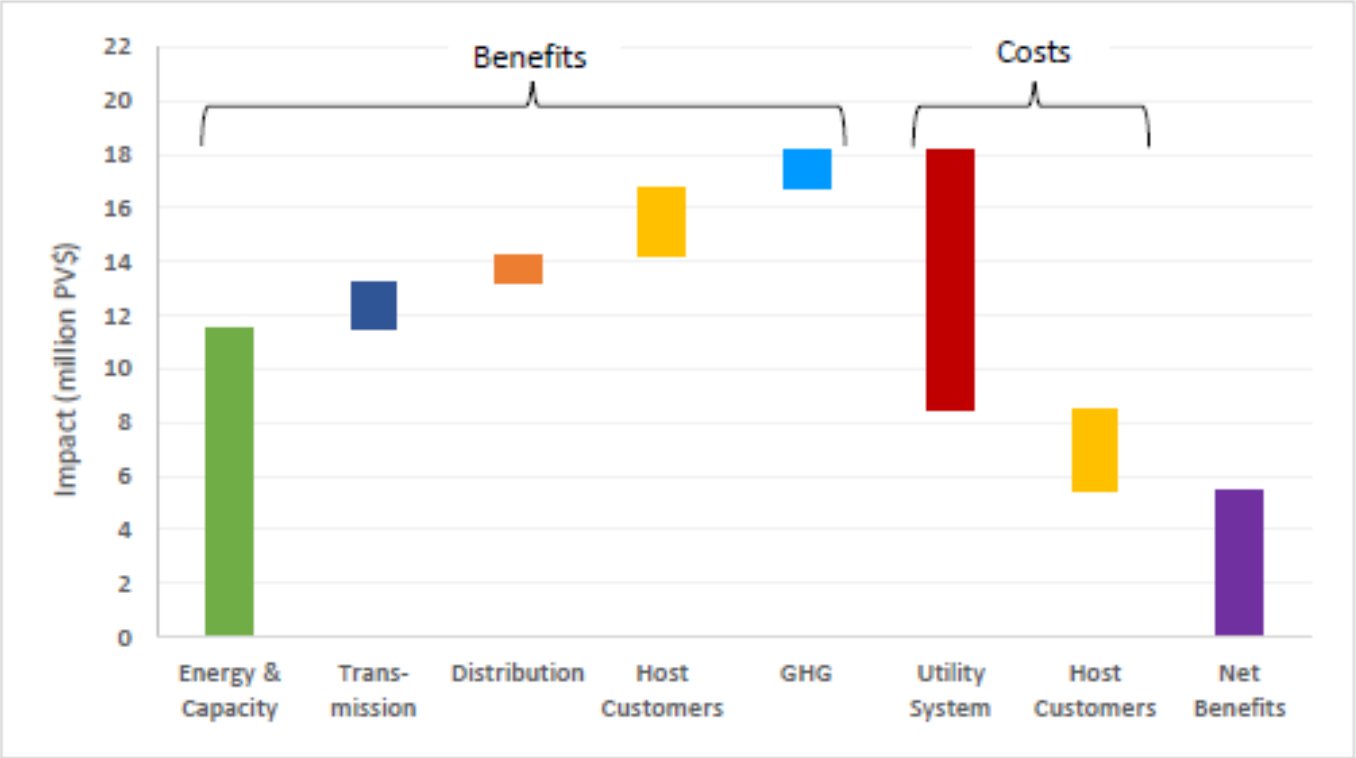
- Multiple on-site DERs span residential, commercial, and community levels, including buildings, facilities, campuses, etc.
  - Examples: Grid-interactive efficient buildings (GEBs), microgrids and smart communities/neighborhoods.
- Factors that affect BCA of multiple on-site DERs: types of DERs deployed and their capabilities, specific locational and temporal impacts, who owns/operates DERs, interactive effects between DERs.
- Major types of interactive effects:
  - Impact on marginal system costs, where significant penetration of DERs in one area affects avoided costs of other DERs in that same area
  - Energy and capacity, where one DER affects kWh or kW impacts of other DERs e.g., EE measure lowers host customer load but also reduces DR kW potential
  - Enabling effects: one DER makes it easier or more cost-effective to adopt other DERs e.g., combined solar plus storage, where adding storage to solar project can help firm up PV profile and store excess generation for later discharge.

Multiple On-site DERs

Case Study: Commercial Grid-Interactive Efficient Building (GEB)

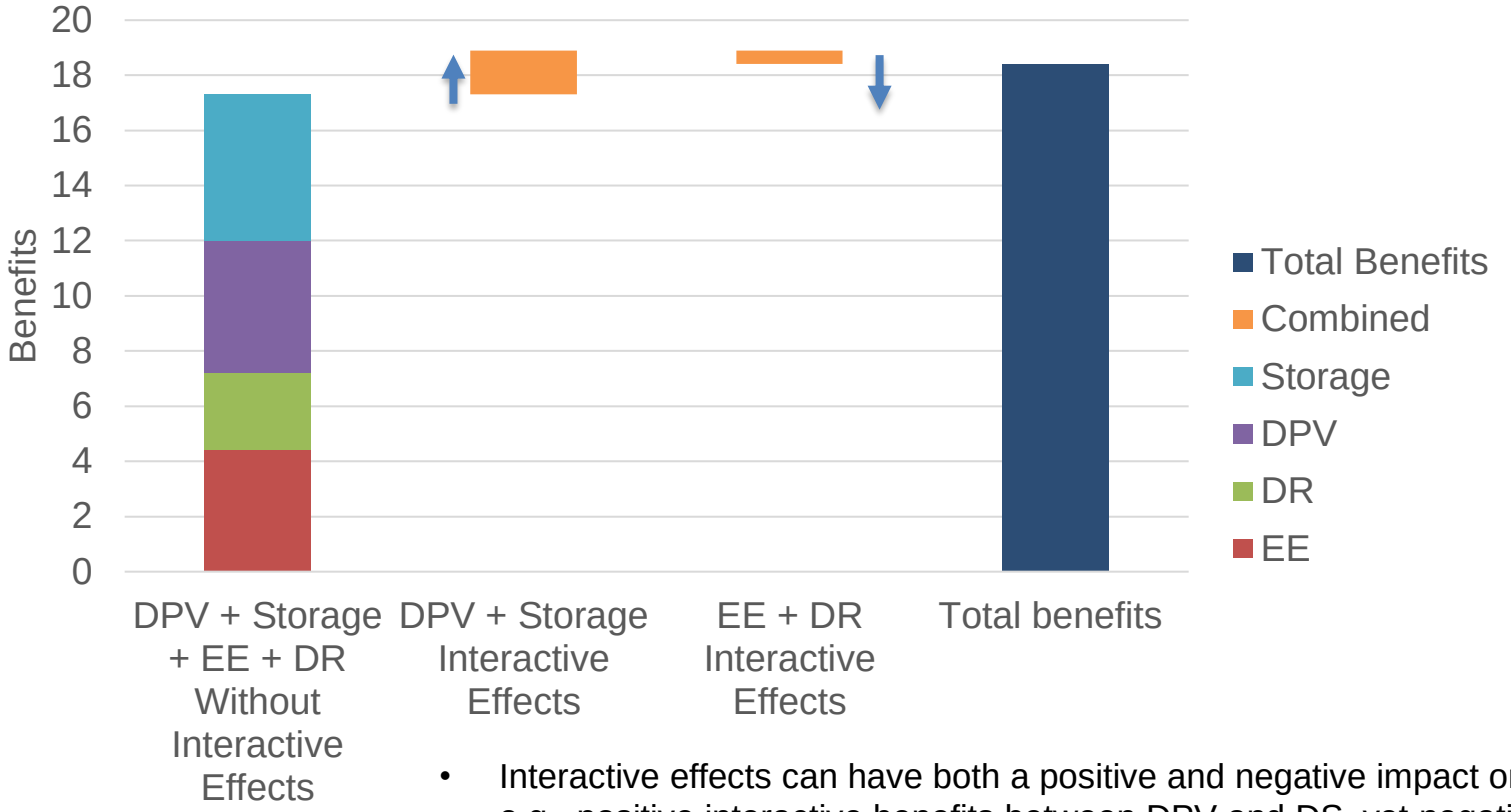
Assumes utility program leverages commercial GEBs to provide demand flexibility and integrate clean resources during system peak hours to meet the jurisdiction's GHG emissions reduction goal.

GEB program uses EE, DR, DPV and DS.



- Distribution system peak is non-coincident with the overall system peak.
- Most benefits for GEB program center on energy and capacity benefits, since GEBs operate during overall system peak.
- GHG benefits also captured, since that impact is included in the Jurisdiction-Specific Test.

Multiple On-site DERs
Example of GEB Interactive Effects



- Interactive effects can have both a positive and negative impact on BCA; e.g., positive interactive benefits between DPV and DS, yet negative interactive effects between EE and DR.
- In analyzing combined net interactive effects, total benefits are higher overall than without interactive effects, but not as high as if only DPV and DS interactive effects were accounted for.
- It is key to ensure that BCAs fully capture the net potential interactive effects.

Non-Wires Solutions

BCA Considerations and Challenges

Considerations

- Geo-targeting of DERs in high-value location
- Characteristics of traditional infrastructure project (type, timing, etc.)
- NWS technology characteristics
- Impacts beyond the targeted T&D deferral

Challenges

- Deriving granular locational and temporal values
- Accounting for option value
- Interactive effects between DERs
- Evaluating and measuring NWS impacts
- Accounting for system reliability and risk

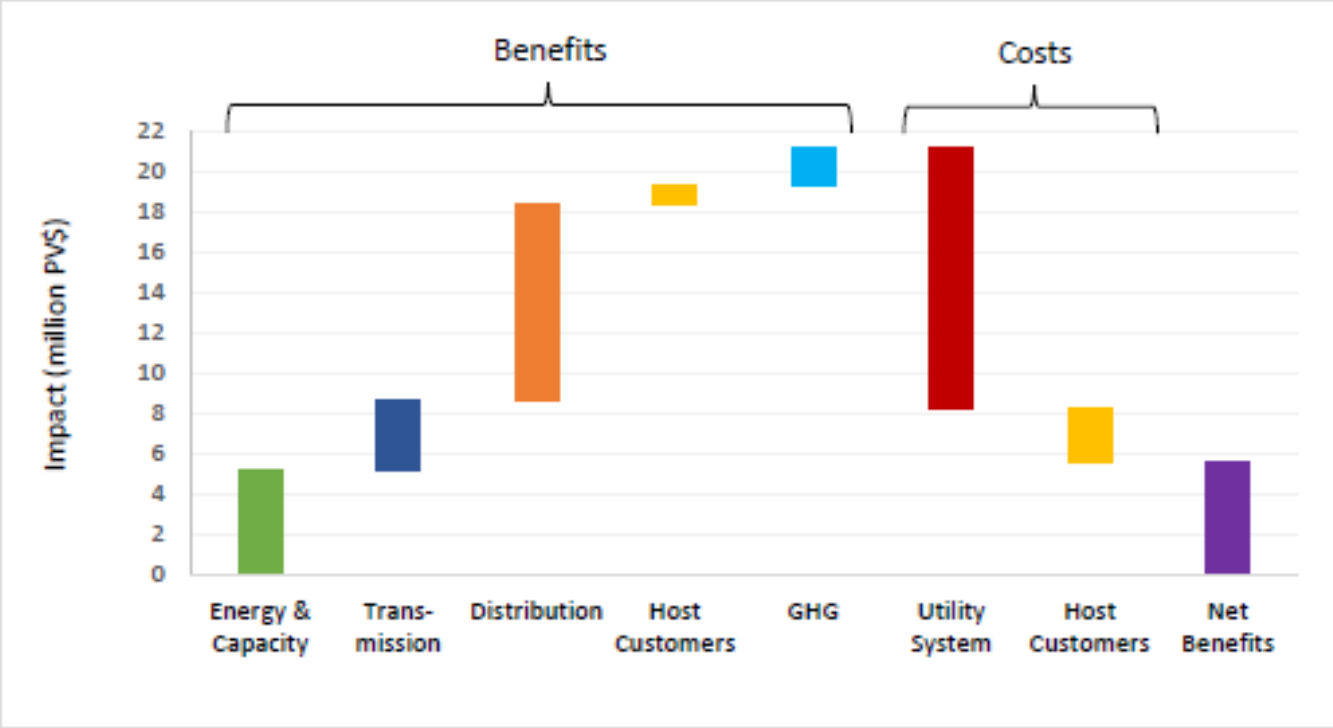
The assessment of NWS cost-effectiveness depends on **where** the program or DERs are located, **when** they provide services, and the resulting benefits and costs.

Non-Wires Solutions

Case Study – NWS Distribution Need

DERs: EE lighting and controls; DR Wi-Fi-enabled thermostats; DPV; and DS (thermal and battery storage)

- Assumes non-coincident with overall system peak (e.g., constrained distribution feeder peaks at 1-5pm, while system peaks at 5-9pm)
- Assumes system-peak hours entail higher marginal emissions rates than NWS = delivers GHG benefits.
- Assumes DER operating profiles where:
  - Storage charges and discharges during system off-peak hours
  - DR reduces and shifts load during system off-peak hours
  - Solar contributes to distribution and some system-peak needs
  - EE has a general downward trajectory on usage



System-Wide DER Portfolios

How should any one utility optimize all DER types?

- What to do in the absence of integrated distribution system planning?

Ideally, each jurisdiction should use a single primary BCA test for all DER types

- May require reconciling different policy goals for different DER types

Then, the jurisdiction should identify planning objectives such as:

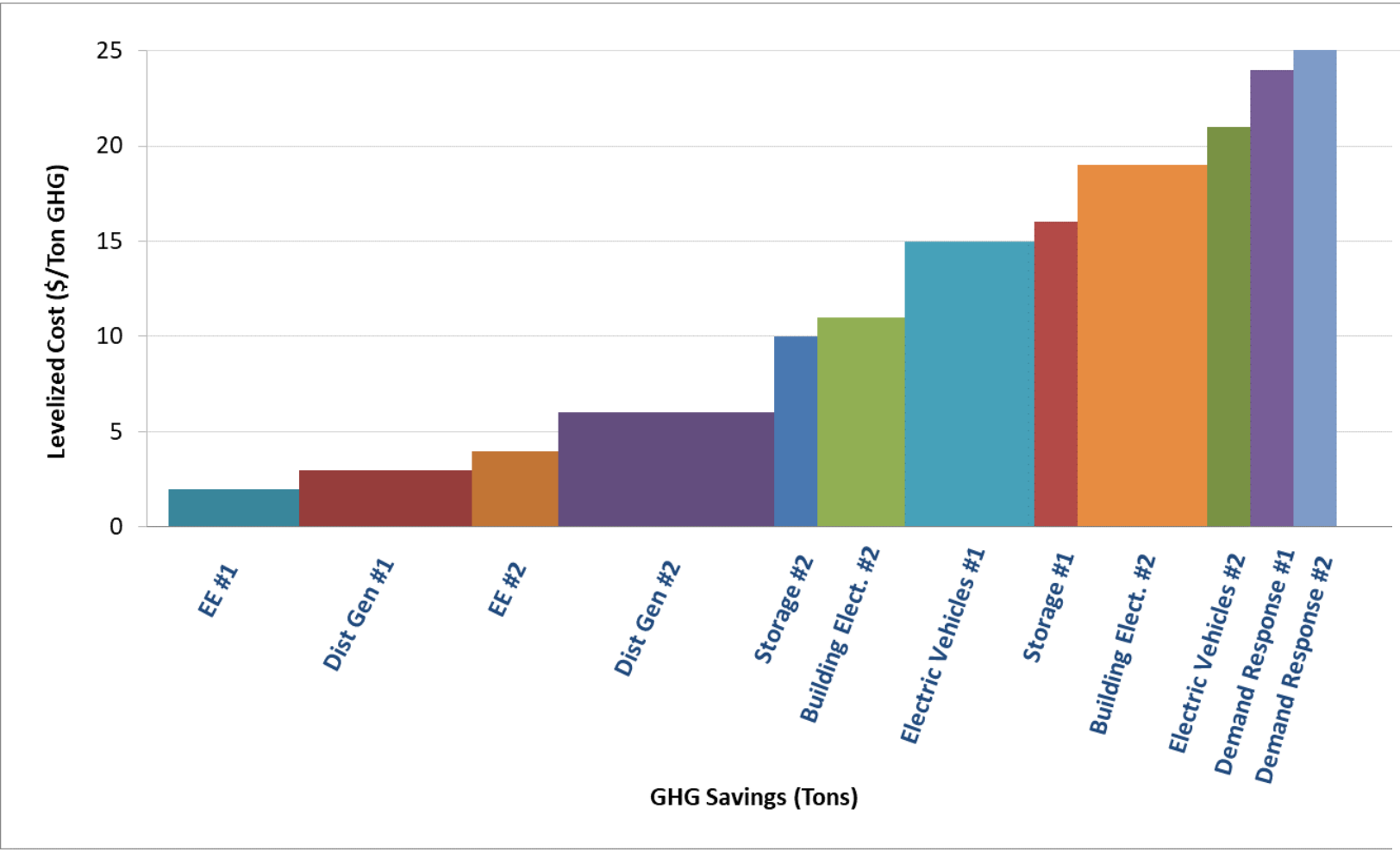
- Implement the most cost-effective DERs
- Encourage a diverse range of DER technologies
- Encourage customer equity
- Achieve GHG goals at lowest cost
- Avoid unreasonable rate impacts
- Implement all cost-effective DERs
- Achieve multiple planning objectives

Prioritizing Across DERs

Key considerations:

1. *Should the utility implement all these DERs?*
2. *If not, which DERs should be maintained, and which should be rejected?*
3. *How to ensure that key policy goals are being met?*
4. *How to ensure that customers are not paying too much for policy goals?*
5. *How to ensure that any rate impacts are reasonable?*

Example of Prioritizing DERs
Objective: to achieve GHG goals at lowest cost



Estimate levelized costs.

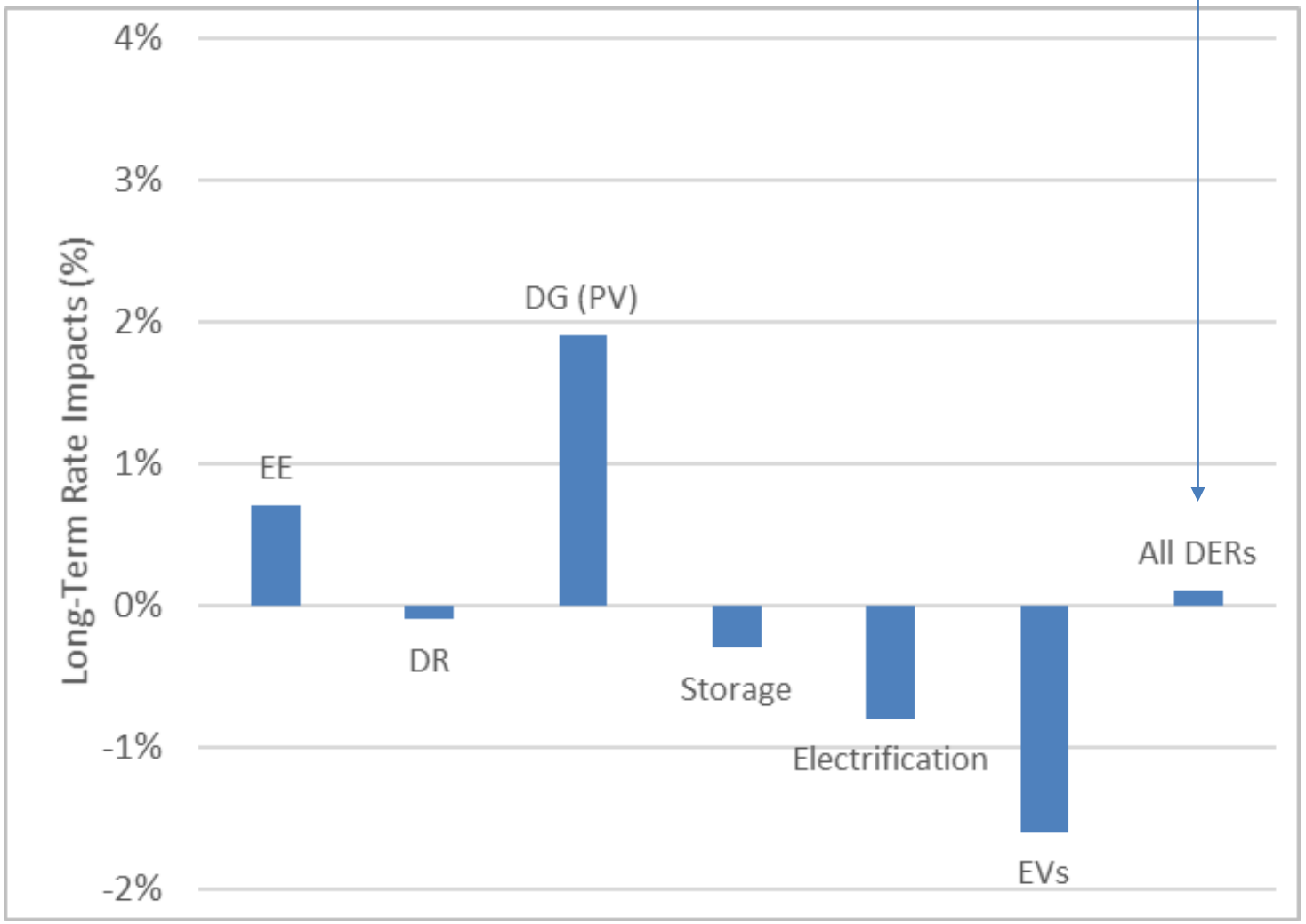
Sort from lowest to highest cost.

Estimate the magnitude of GHG savings by DER.

Use results to determine which DERs will help reach GHG targets.

Example of Prioritizing DERs (2)
Objective: Avoid unreasonable rate impacts

Rate impact analyses should account for combined effect of all DER types



Supporting NSPM Resources

Methods, Tools & Resources – A Handbook for Quantifying DER Impacts in Benefit-Cost Analysis

"MTR Handbook" - published March 2022

Companion guidance to the NSPM, where the NSPM provides guidance on *what* impacts to include in a jurisdiction's primary cost-effectiveness test, the MTR Handbook provides guidance on *how* to quantify DER impacts, including:

- Full range of utility system impacts (electric, gas, and other fuels)
- Non-utility system impacts (host customer and societal)
- Energy Equity
- Risk and uncertainty
- Reliability and resilience
- Developing DER Load Profiles, Savings Load Shapes
- Offers pros and cons of different methodological approaches
- Addresses how impacts are relevant for different DER types
- Provides public tools and resources to develop BCA inputs

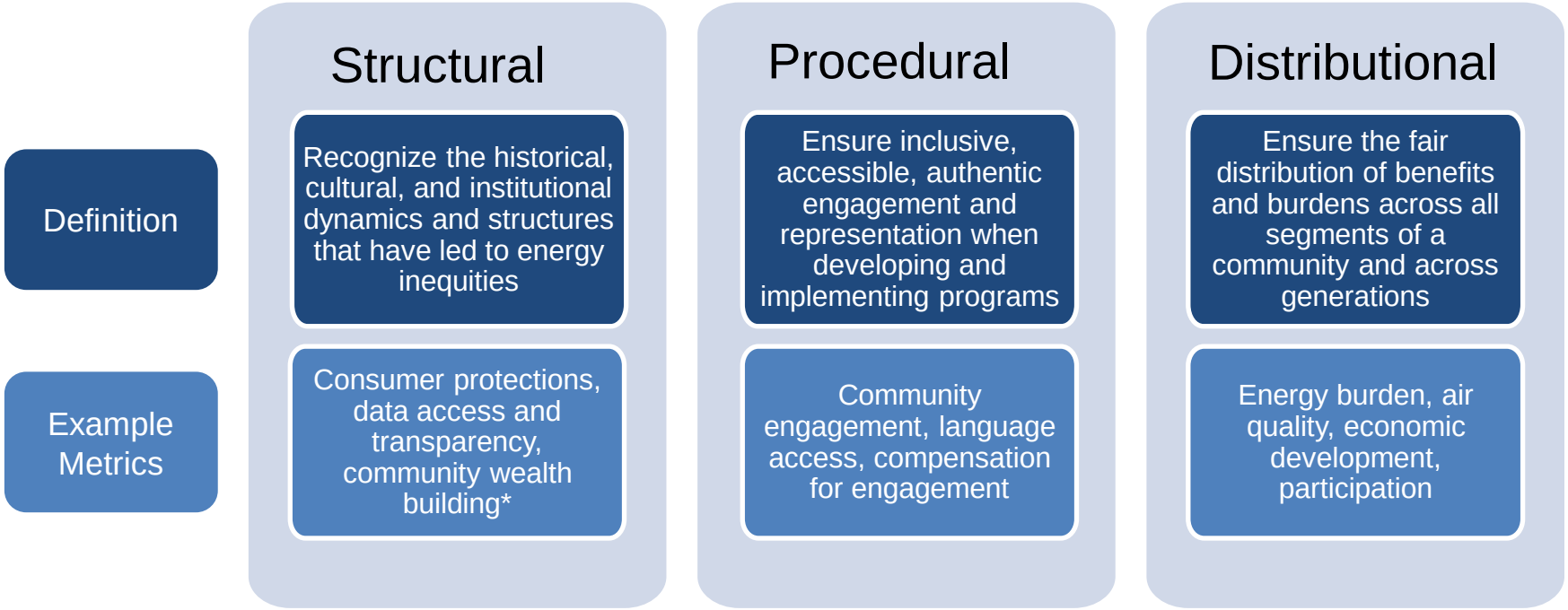
Benefit Cost Analysis (BCA) and Distributional Equity Analysis (DEA)

Energy Equity

Energy equity recognizes the historical and cumulative burdens of the energy system borne by frontline and low-income communities and by Black, Brown and Native people in particular. To eliminate these disparities, energy equity centers the voices of frontline communities in energy planning and decision-making and ensures the fair distribution of clean energy benefits and ownership.

Energy Equity Project - https://energyequityproject.com/

Dimensions of Equity



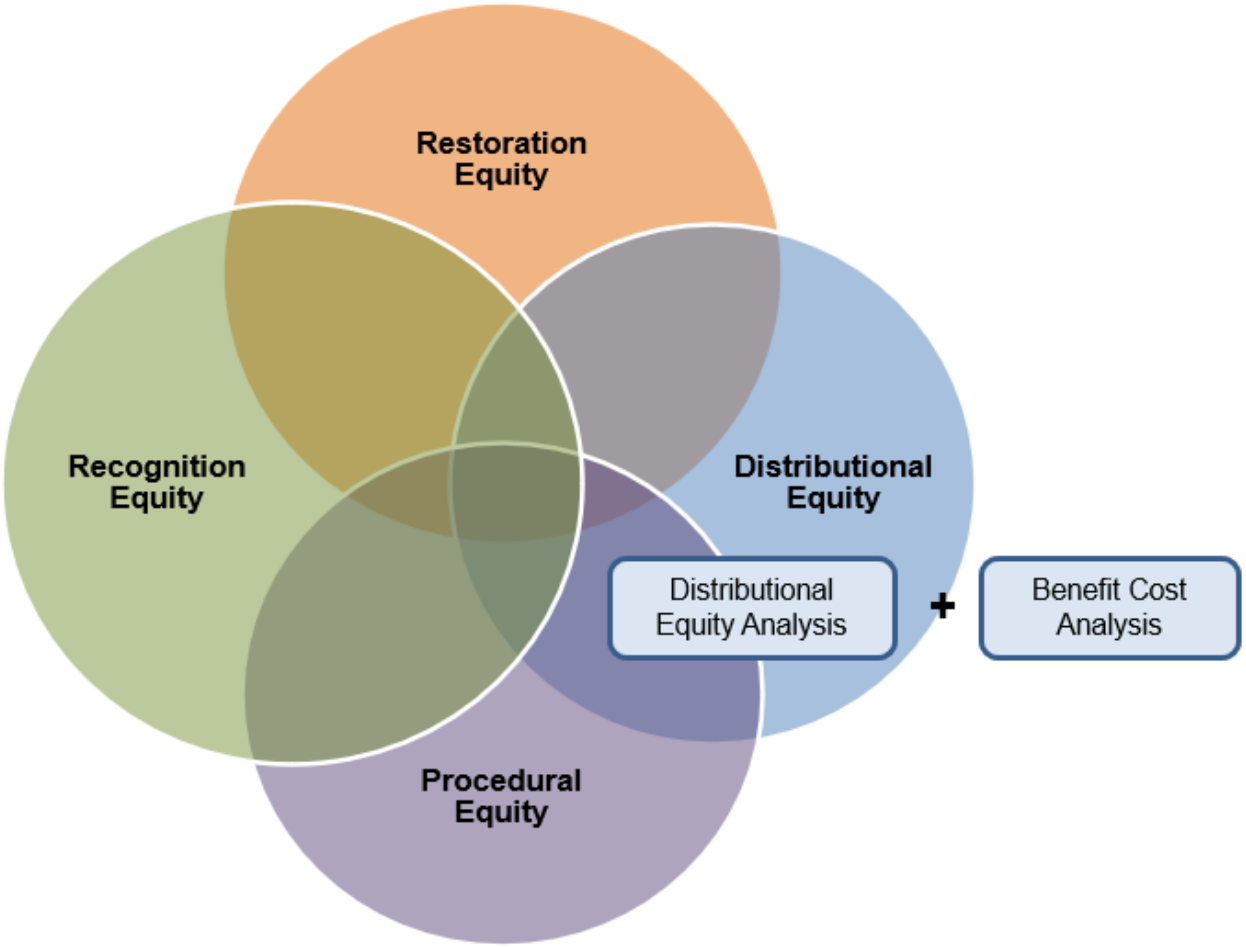
*Many structural/recognition metrics, like building community wealth, don't necessarily intersect with a regulatory process.

Adapted from ACEEE's *Leading with Equity White Paper*

BCA and Limits in Addressing Equity

- BCA is not designed to address equity between customers because it measures impacts on *average* across customers.
  - Costs – typically recovered across all customers or all customers within a customer class (residential, commercial)
  - Benefits – typically a blend of avoided costs experienced by all customers
- BCA cannot distinguish impacts on specific customers of interest.
  - Except for programs designed to serve specific customers (e.g., low-income programs)
- BCA focuses mostly on monetary results.
  - Many equity metrics cannot be put into monetary terms.
- BCA does not – and should not be used to – account for rate, bill, or participation impacts – the analyses answer different questions.
  - This is a key NSPM principle
  - Rate Impact Measure (RIM) Test combines BCA results with rate impact results, making it difficult to understand either result
  - Instead, rate, bill, and participation impacts should be analyzed separately from BCAs.
  - Rate, bill and participation analyses help to address equity.

Dimensions of Equity



Systemwide equity (all 4 dimensions) broadly addresses how to eliminate inequities in all utility services.

BCA and DEA address one aspect of distributional equity:

Which new DERs should utilities invest given their impacts on equity?

BCA and DEA together serve as broader decision framework for DER investments

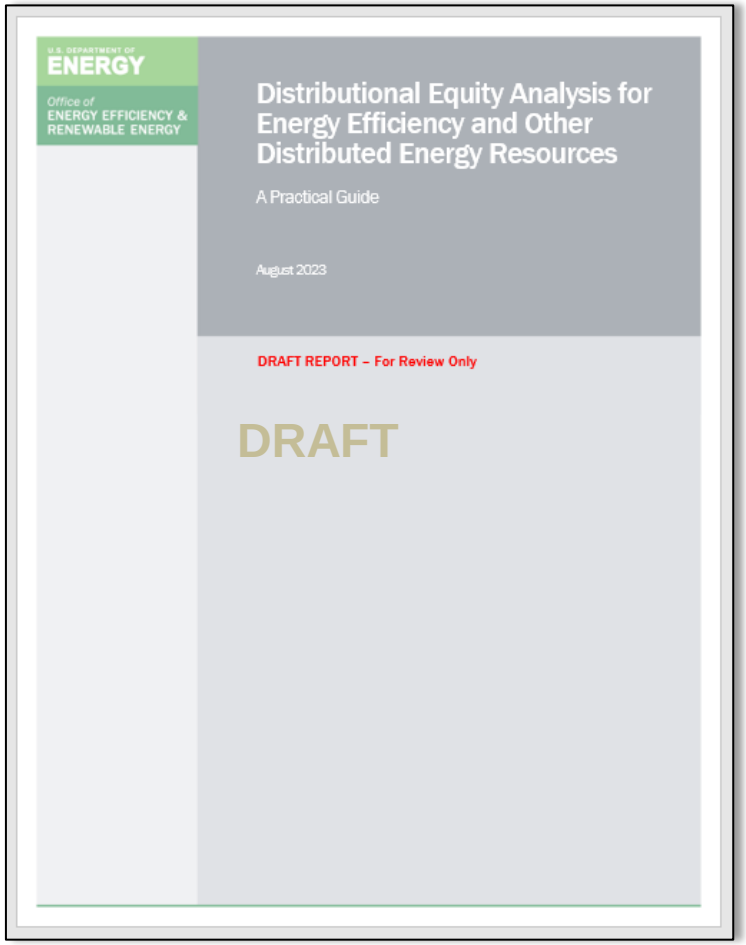
Summary - Differences Between BCA and DEA

	Benefit-Cost Analyses	Distributional Equity Analyses
Purpose	To identify in which DER programs utilities should invest	To identify how DER programs impact priority populations relative to other populations
Costs and Benefits	Costs and benefits across all customers on average	Costs and benefits for priority populations compared to costs and benefits for other customers
Impacts Analyzed	• Utility system impacts • Participant impacts • Societal impacts	Depends on choice of DEA metrics
Metrics	• Costs (PV$) • Benefits (PV$) • Net present value (NPV) • Benefit-cost ratio (BCR)	Examples: • Rates ($/kWh) • Bills ($/month) • Participation rates (% of eligible customers) • Energy burden (% of income spent on energy bills) • Reliability impacts (% change in CEMI*) • Service shutoffs (% change) • Health impacts (ER visits for asthma) • Environmental impacts (PM 2.5 emissions)

*Customers Experiencing Multiple Interruptions

Forthcoming DEA Guide – Fall 2023

- **Distributional Equity Analysis of Distributed Energy Resources: A Practical Guide**
  - Funded by US DOE Buildings Technologies Office and E4TheFuture
  - Led by Lawrence Berkeley National Laboratory
  - Informed by a diverse advisory committee
  - Prepared by Synapse Energy Economics
  - More information is available **here**



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