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

(NSPM for DERs)

Overview

February 2021

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 energy efficiency (EE) and other distributed energy resources (DERs).

Products include:

- NSPM for EE (2017)
- NSPM for DERs (2020)
- Database of Screening Practices (DSP)

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

1. Why an NSPM for DERs?
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. NESP 2021 Planned Activities and Resources

Why an NSPM for DERs?

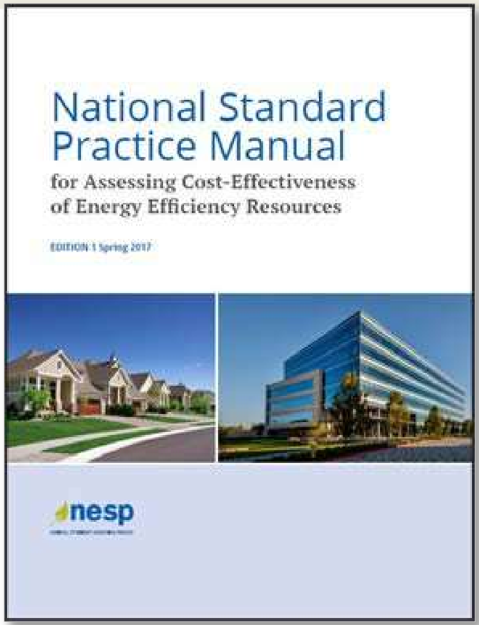
- Traditional cost-effectiveness tests often do not address pertinent jurisdictional/state policies.
- Traditional tests are often modified by states in an ad-hoc manner, without clear principles or guidelines.
- DERs are treated inconsistently in many BCAs or valuations (i.e., in context of programs, 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 - Background

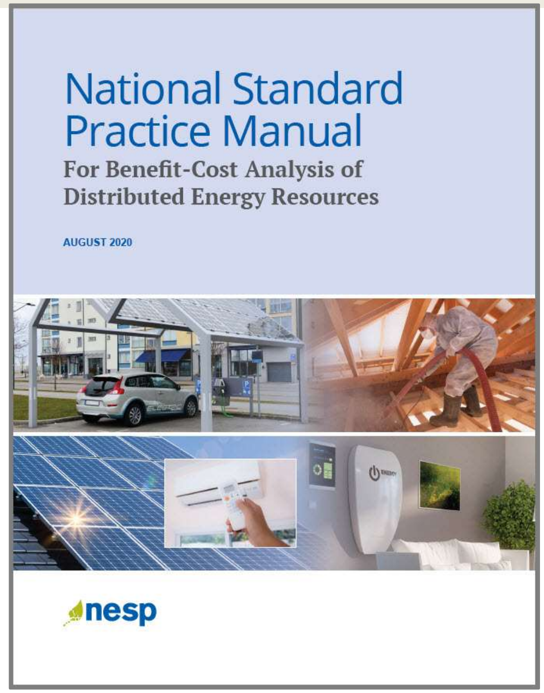
- Managed and funded by E4TheFuture (with support from US DOE via LBNL)
- Multiple co-authors
  - Extensive understanding of regulatory economics
  - Specialized expertise with different DERs
- Advisory Group
  - 45+ individuals
  - Diversity of perspectives
  - Input on Manual outline and drafts
- NSPM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

NSPM for EE
May 2017



NSPM for DERs
August 2020

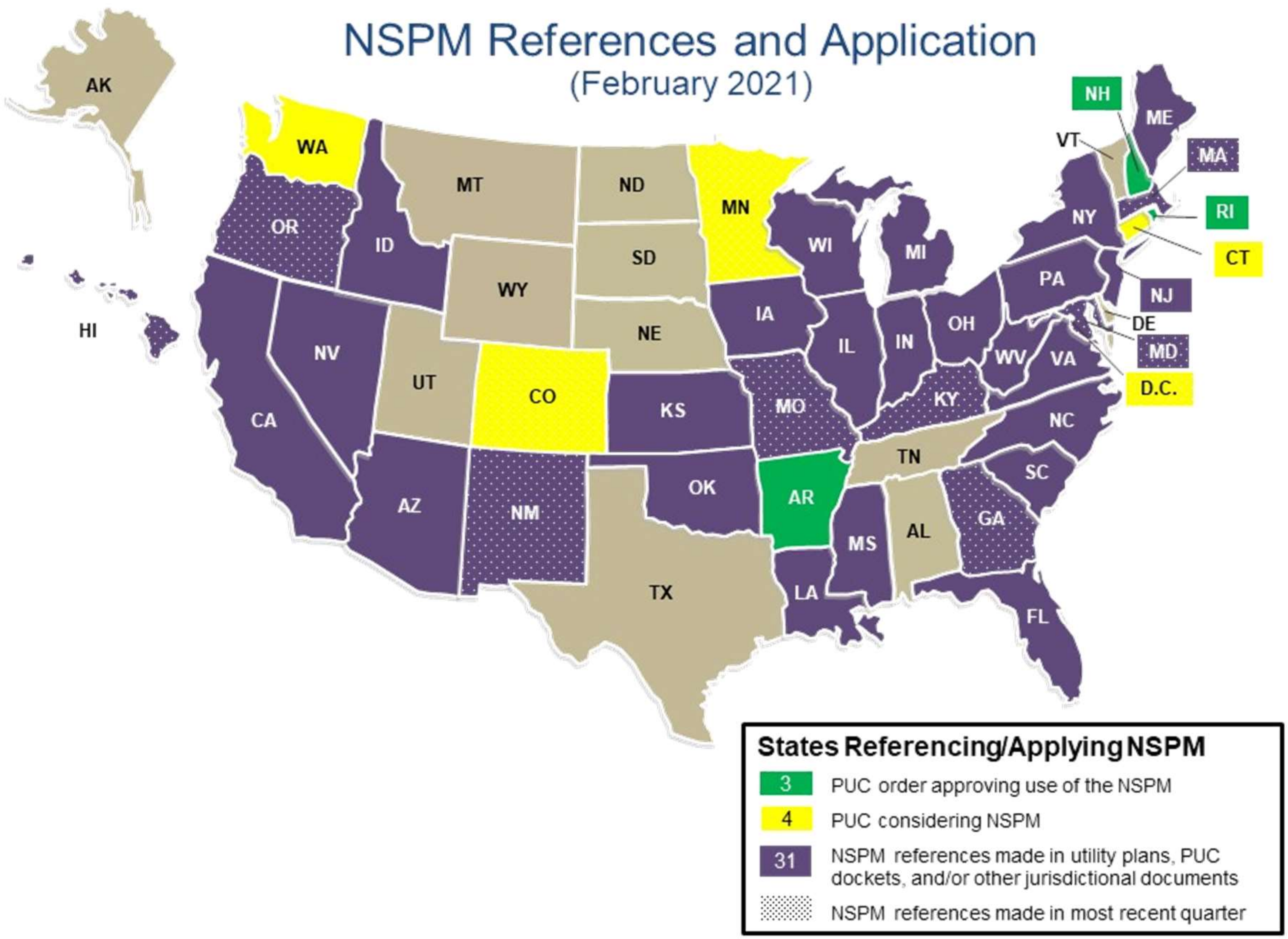


The NSPM for DERs incorporates and expands on the NSPM for EE. See comparison

NSPM for EE (2017) →	NSPM for DERs (2020)
'Resource Value Framework'	'NSPM BCA Framework'
'Resource Value Test'	'Jurisdiction-Specific Test' (JST)
6 Principles	8 Principles
7-step process to develop primary test	5-step process to develop primary test
Single DER analysis	Single- and multi-DER analyses
DERs covered: energy efficiency only	DERs covered: EE, DR, DG, DS, Electrification

NSPM References and Application

(February 2021)



NSPM for DERs - Project Team

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NSPM for DERs - Advisory Group

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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:

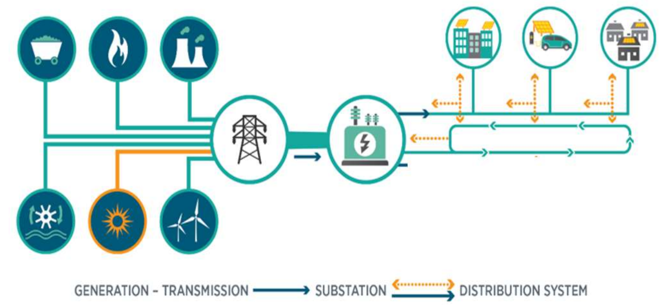
- **Programs**: initiatives and policies implemented by utilities or other entities to encourage adoption of DERs
- **Procurements:** initiatives to procure DERs, whether built by a utility or procured from third-party vendors, e.g., competitive procurement
- **Pricing Mechanisms**: such as those designed 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 for DERs - Contents

Three Tiers of DER Analysis

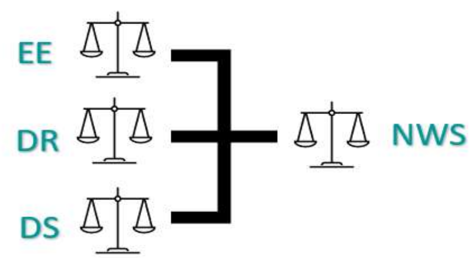
Level Three: Multiple DERs + Utility System

- Assessing ***multiple DER types*** relative to a ***dynamic set*** of alternative resources; goal to optimize both DERs and utility-scale resources



Level Two: Multiple DERs*

- Assessing ***more than one DER type*** at the same time, relative to a ***static or dynamic*** set of alternative resources



Level One: Single DER*

- Assessing ***one DER type*** in isolation from other DER types, relative to a ***static*** set of alternative resources

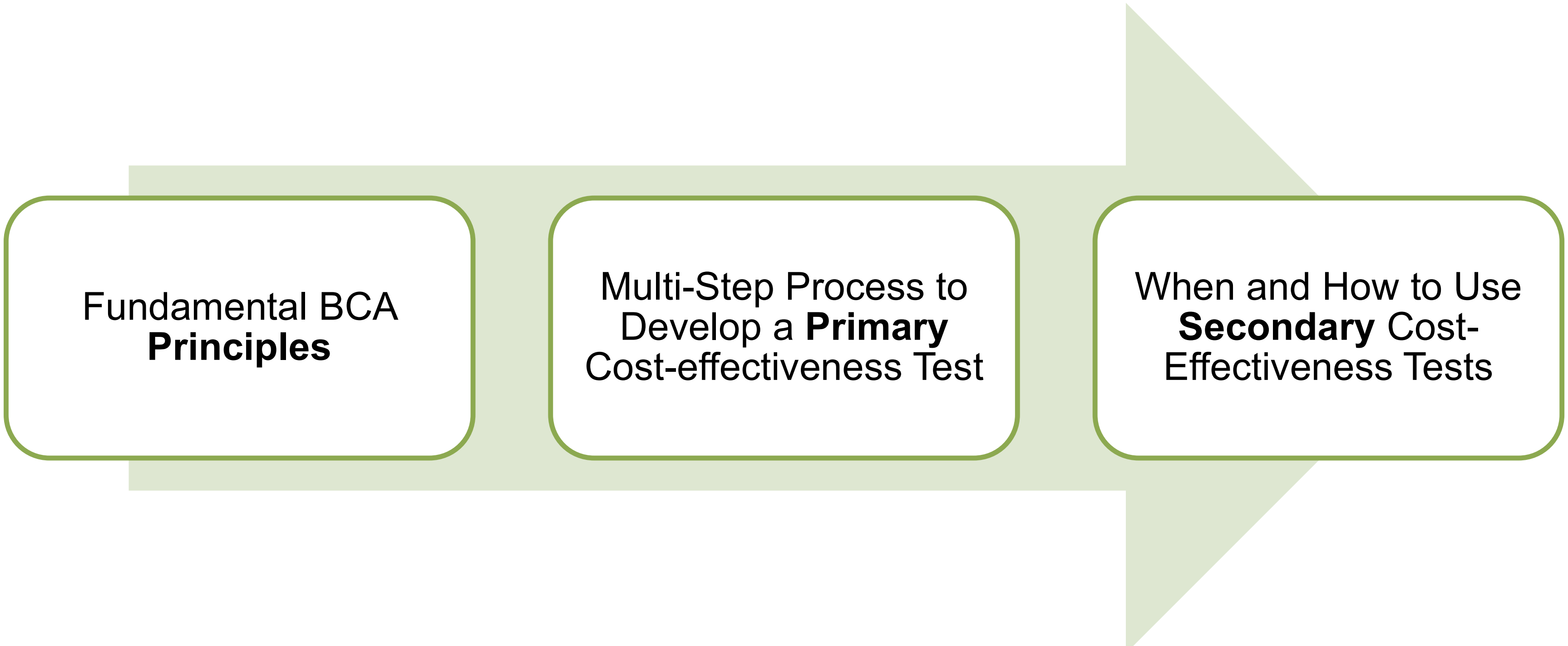
Adapted from LBNL 2020 and US DOE Solar Energy Technologies Office

** NSPM addresses primarily Levels 1-2*

NSPM for DERs – PART I

The NSPM Benefit-Cost Analysis Framework

NSPM BCA Framework



NSPM BCA Principles

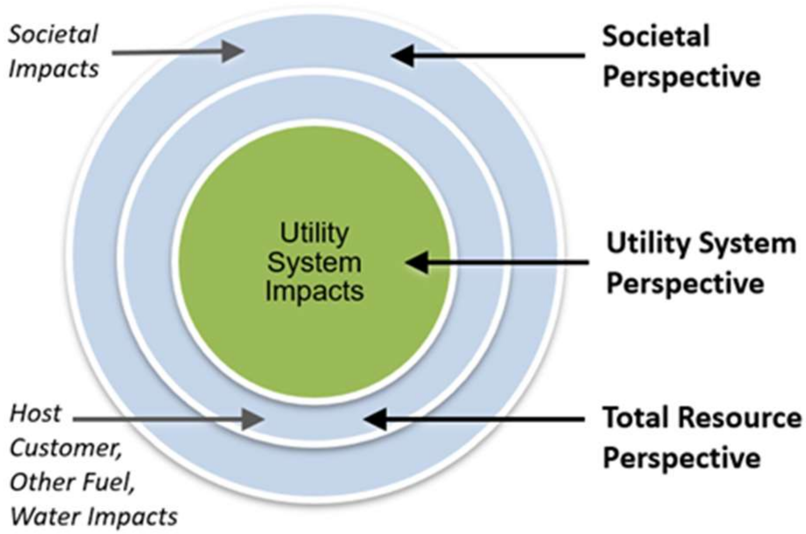
1. Recognize that DERs can provide energy/power system needs and should be compared with other energy resources and treated consistently for BCA.
2. Align primary test with jurisdiction's applicable policy goals.
3. Ensure symmetry across costs and benefits.
4. Account for all relevant, material impacts (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

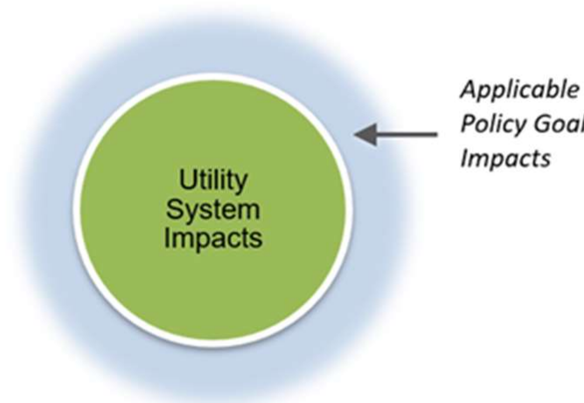
NSPM for DERs

Traditional Perspectives



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

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.

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?

Defining Your 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.

STEPS 1-3: Articulate Policy Goals and Identify Relevant Impacts

Example Goals: as articulated in statute, regulations, decisions, etc.

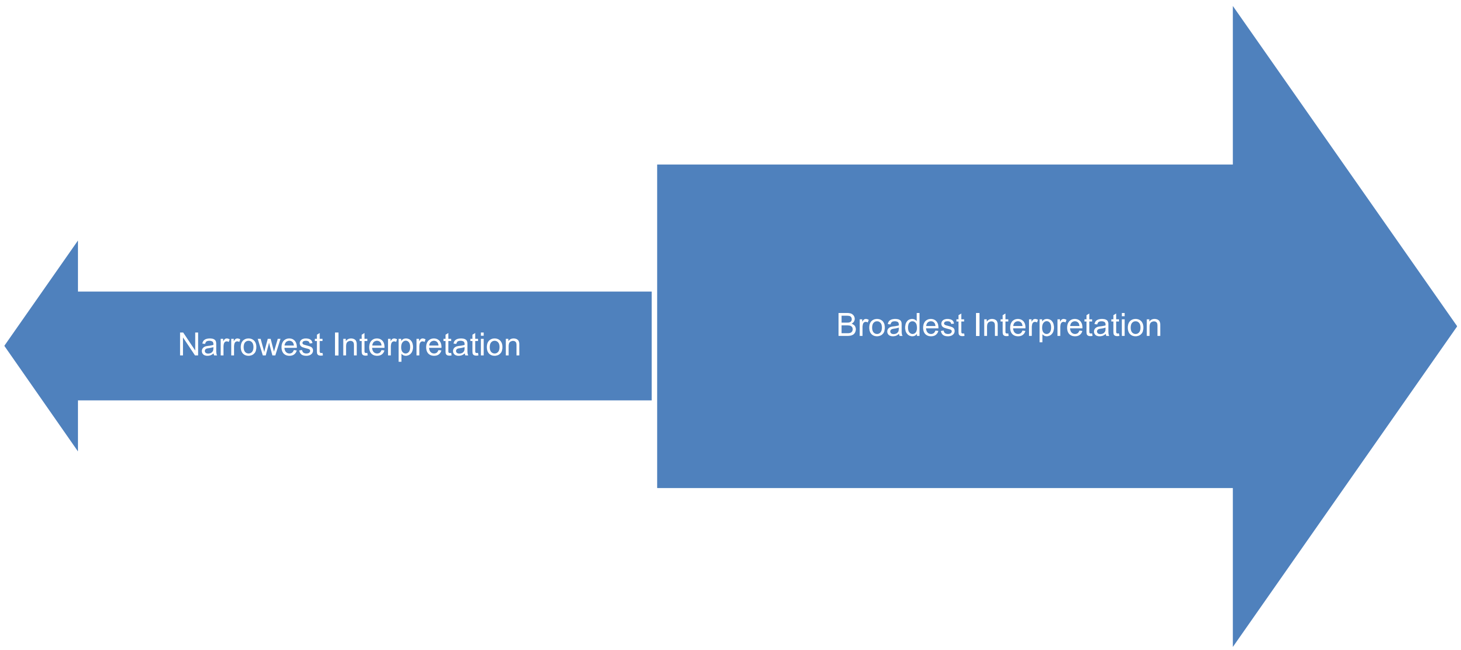
Common Overarching Goals: Provide safe, reliable, reasonably priced electricity and gas services; support fair and equitable economic returns for utilities; promote customer equity; protect/reduce energy burden for low-income and vulnerable customers.

Resource Goals: Reduce electricity and gas system costs; develop least-cost energy resources; improve system reliability and resiliency; reduce system risk; promote resource diversity; increase energy independence; reduce price volatility; provide demand flexibility.

Other Applicable Goals: Ensure stable energy markets; reduce environmental impact of energy consumption; promote jobs and local economic development; improve health associated with reduced air emissions and better indoor air quality.

Articulate Policy Goals and Identify Relevant Impacts

Broad or narrow interpretation of applicable goals (or something in-between)?



Articulate Policy Goals and Identify Relevant Impacts

Hypothetical Simplified Example

Jurisdiction's Applicable Policies Statutes, Regulations, Plans, Orders, etc.	**Electric Utility System Impacts**	**Goals Reflected in Policies**			
		Other Fuels	**Reduce GHG Emissions**	**Create Jobs**	**Protect Low Income Customers**
Net Metering	DG	DG	DG	DG	
IRP Regulations	All DERs	All DERs	All DERs		All DERs
EE/DR Statute	EE, DR	EE, DR	EE, DR		EE, DR
What impacts would you account for in your Primary Test?					
Option 1: Broadest interpretation of Policy Goals	X	X	X	X	X
Option 2: Narrowest interpretation of Policy Goals	X	X	X		
Option 3: Somewhere **in-between** broadest and narrowest	X	X	X		X

See Template Policy Inventory Tables

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

Ensure Symmetry of Benefits & Costs

Illustrative Example: Treatment of Host Customer Costs and Benefits

Costs and Benefits	Asymmetry	Symmetry	
	A. Host Customer Costs **Included,** Benefits **Excluded**	B. Host Customer Costs and Benefits **Both Included**	C. Host Customer Costs and Benefits **Both Excluded**
DER Costs			
Utility System Costs:			
- Rebate/Incentive	$1,875	$1,875	$1,875
- Administrative Costs	$1,500	$1,500	$1,500
Host Customer Costs:	$5,625	$5,625	not included
Total Costs Accounted for:	$9,000	$9,000	$3,375
DER Benefits			
Utility System Avoided Costs	$6,000	$6,000	$6,000
Host Customer Non-Energy Benefits	not included	$4,000	not included
Total Benefits Accounted for:	$6,000	$10,000	$6,000
Net Benefit/Cost	($3,000)	$1,000	$2,625
Benefit-Cost Ratio (BCR):	0.67	1.11	1.78
Treatment of Host Customer Impacts	X Asymmetrical	✓ Symmetrical	✓

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

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.

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

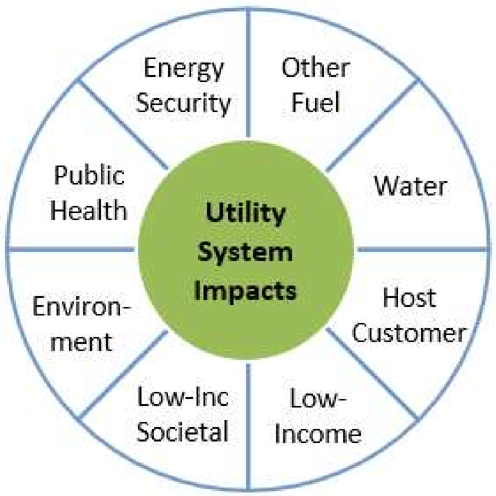
Jurisdiction Specific Test (JST) Compared with Traditional Tests

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

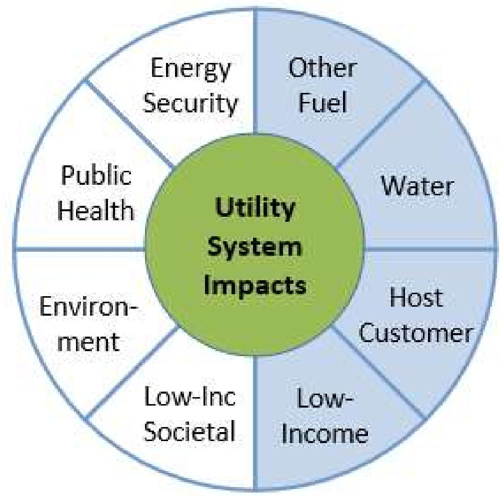
Primary Test = Jurisdiction Specific Test (JST)

Hypothetical JSTs as compared to traditional tests

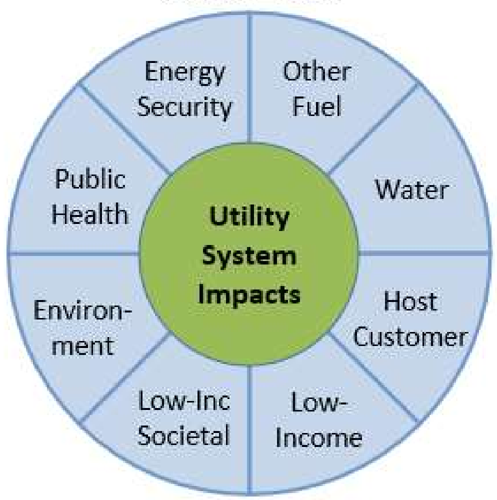
JST 1 = UCT/PACT



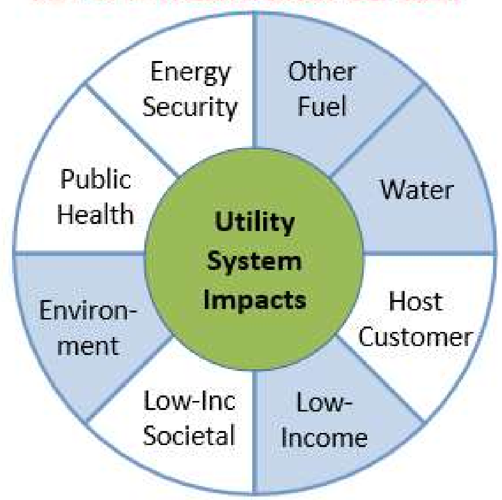
JST 2 = TRC Test



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.

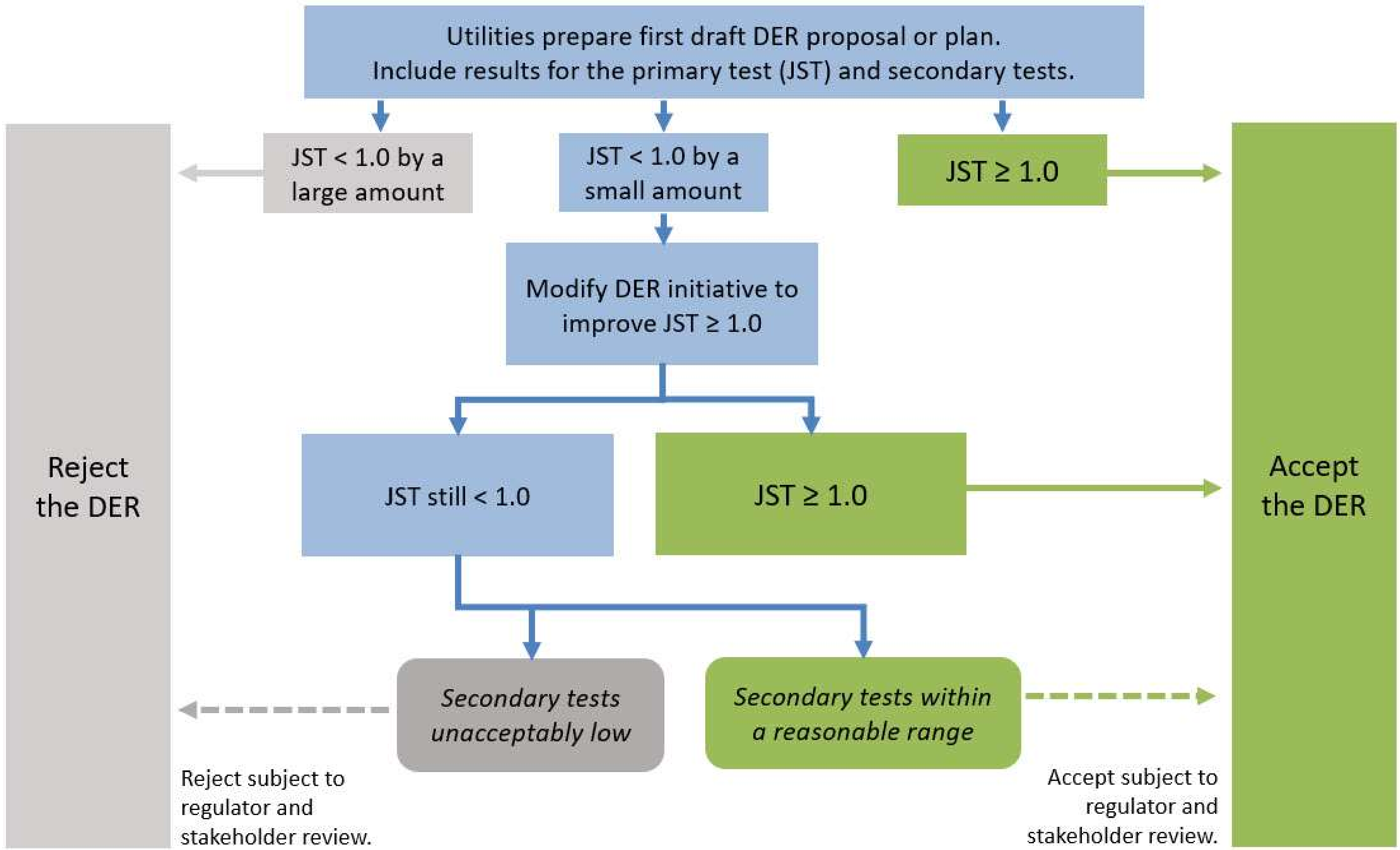
Use of Secondary Tests

NSPM provides guidance on **when and how to use secondary 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;
- inform decisions regarding marginally non- and/or cost-effective DERs; and
- encourage consistency across DER types.

Example Use of Secondary Tests for Marginally Cost-Effective DERs



PART II

DER Impacts and Cross-Cutting Issues

DER Benefits & Costs

Electric Utility System Impacts

Type	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

DER Benefits & Costs

Gas Utility or Other Fuel Impacts

Type	Gas Utility or Other Fuel Impact	Description
Energy	Fuel and Variable O&M	The fuel and O&M impacts associated with gas or other fuels.
	Capacity	The gas capacity required to meet forecasted peak load.
	Environmental Compliance	Actions required to comply with environmental regulations.
	Market Price Effects	The decrease (or increase) in wholesale prices as a result of reduced (or increased) customer consumption.
General	Financial Incentives	Utility financial support provided to DER host customers or other market actors to encourage DER implementation.
	Program Administration Costs	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 Costs	Bad debt, disconnections, reconnections.
	Risk	Uncertainty including operational, technology, cybersecurity, financial, legal, reputational, and regulatory risks.
	Reliability	Maintaining the gas or other fuel 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.

DER Benefits & Costs

Utility System Impacts (foundational to all BCAs)

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

● (green) = typically a benefit
● (red) = typically a cost
● (orange) = either a benefit or cost depending on application
○ = not relevant for resource type

DER Benefits & Costs (cont.)

Host Customer Impacts

(inclusion depends on policy goals)

Type	Host Customer Impact	Description
Host Customer	Host portion of DER costs	Costs incurred to install and operate DERs
	Host transaction costs	Other costs incurred to install and operate DERs
	Interconnection fees	Costs paid by host customer to interconnect DERs to the electricity grid
	Risk	Uncertainty including price volatility, power quality, outages, and operational risk related to failure of installed DER equipment and user error; this type of risk may depend on the type of DER
	Reliability	The ability to prevent or reduce the duration of host customer outages
	Resilience	The ability to anticipate, prepare for, and adapt to changing conditions and withstand, respond to, and recover rapidly from disruptions
	Tax incentives	Federal, state, and local tax incentives provided to host customers to defray the costs of some DERs
	Non-energy Impacts	Benefits and costs of DERs that are separate from energy-related impacts
	Low-income non-energy impacts	Non-energy benefits and costs that affect low-income DER host customers

Host Customer NEI	Summary Description
Transaction costs	Costs incurred to adopt DERs, beyond those related to the technology or service itself (e.g., application fees, time spent researching, paperwork)
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., changes 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 or school, reduced medical costs, improved indoor air quality, reduced deaths)
Empowerment & control	The satisfaction of being able to control one's energy consumption and energy bill
Satisfaction & pride	The satisfaction of helping to reduce environmental impacts (e.g., one of the reasons why residential customers install rooftop PV)

DER Benefits & Costs (cont.)

Societal Impacts

(inclusion depends on policy goals)

Type	Societal Impact	Description
Societal	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
	Low Income: Society	Poverty alleviation, environmental justice, and reduced home foreclosures
	Energy Security	Energy imports and energy independence

Key Factors that Affect DER Impacts

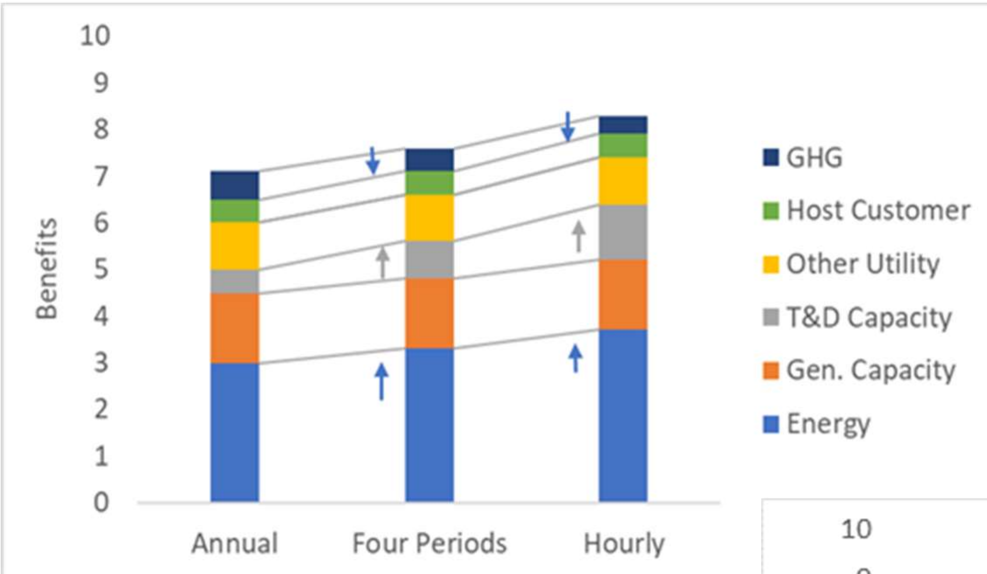
Depends on specific DERs and use cases:

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

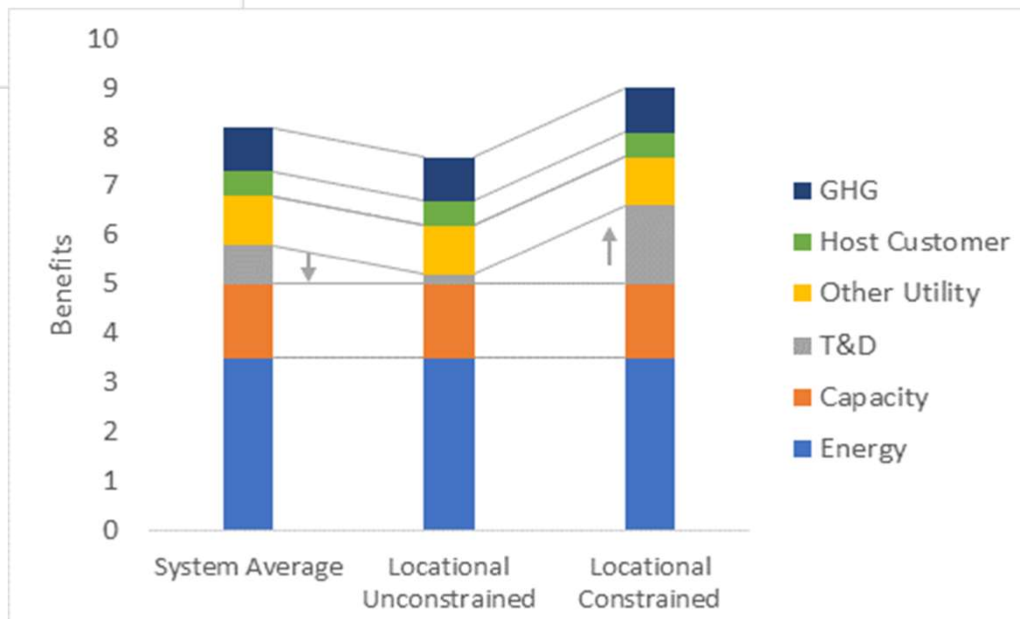
Cross-Cutting Considerations

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

Temporal Impacts on EE Benefits Hypothetical Example



Location Impacts on DR Benefits Hypothetical Example



NSPM for DERs – PART III

Guidance on BCA for Specific DER Technologies

NSPM for DERs
DER-Specific Chapters

- Energy Efficiency Resources
- Demand Response Resources
- Distributed Generation Resources
- Distributed Storage Resources
- Electrification

Each chapter covers:

- Benefits and costs of the specific resource
- Key factors that affect impacts
- Common challenges in estimating benefits and costs

Example: Chapter 9 - Storage

Headings Pages Results

- 9. Distributed Storage Resources
  - 9.1 Summary of Key Points
  - 9.2 Introduction
  - 9.3 Benefits and Costs of Distributed Storage Resources
  - 9.4 Key Factors that Affect Distributed Storage Impacts
    - 9.4.1 Technology Characteristics
    - 9.4.2 Technology Operating Profile
    - 9.4.3 Other Fuel Impacts
    - 9.4.4 Host Customer Non-Energy Impacts
    - 9.4.5 Air Emissions Impacts
    - 9.4.6 Interconnection Location and Process
    - 9.4.7 Compensation Mechanisms
    - 9.4.8 Resource Ownership and Control
  - 9.5 Common Challenges for Determining Storage Benefits and Costs
    - 9.5.1 Determining the Operating Profile
    - 9.5.2 Determining the Counterfactual Host Customer Baseline
    - 9.5.3 Accounting for Provision of Multiple Services
  - 9.6 Lost Revenues and Rate Impacts

Example: Storage Impacts

Benefit or Cost (or 'Depends')

Table 9-1. Potential Impacts of Distributed Storage: Electric Utility System

Type	Utility System Impact	Benefit or Cost	Notes, or Typical Applicability
Generation	Energy Generation	🔴	A cost because storage technologies generally require more energy to charge than what they discharge
	Generation Capacity	🟠	A benefit, depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, a cost if storage device charges during peak periods
	Environmental Compliance	🟠	A benefit or cost depending upon system environmental profile during charging and discharging times
	RPS/CES Compliance	🔴	A cost because storage technologies generally require more energy to charge than what they discharge
	Market Price Response	🟠	A benefit or cost depending upon market conditions during charging and discharging times
	Ancillary Services	🟠	A benefit or cost depending upon the storage use case and the electric utility's ability to affect the operation of the storage device
Transmission	Transmission Capacity	🟠	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, potentially costs if storage device charges during transmission peak periods
	Transmission Line Losses	🟠	
Distribution	Distribution Capacity	🟠	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage device; otherwise, potentially costs if storage device charges during distribution peak periods
	Distribution Line Losses	🟠	
	Distribution O&M	🟠	
	Distribution Voltage	🟠	
General	Financial Incentives	🔴	Typically costs to the extent they are relevant
	Program Administration Costs	🔴	
	Utility Performance Incentives	🔴	
	Credit and Collection Costs	🟢	A benefit because customer savings make bill payment easier, especially for low-income customers
	Risk	🟢	Potentially benefits depending upon the storage use case and the electric utility's ability to affect the operation of the storage technology during peak or emergency periods
	Reliability	🟢	
	Resilience	🟢	

🟢 = 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; O = not relevant for this resource type.

DER Comparison Tables

For Utility System, Host Customer and Societal Impacts

Example: Host Customer Impacts

Table S-7. Potential Benefits and Costs of DERs: DER Host Customer

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

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

NSPM for DERs – PART IV

Guidance on BCA for Multiple DERs

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

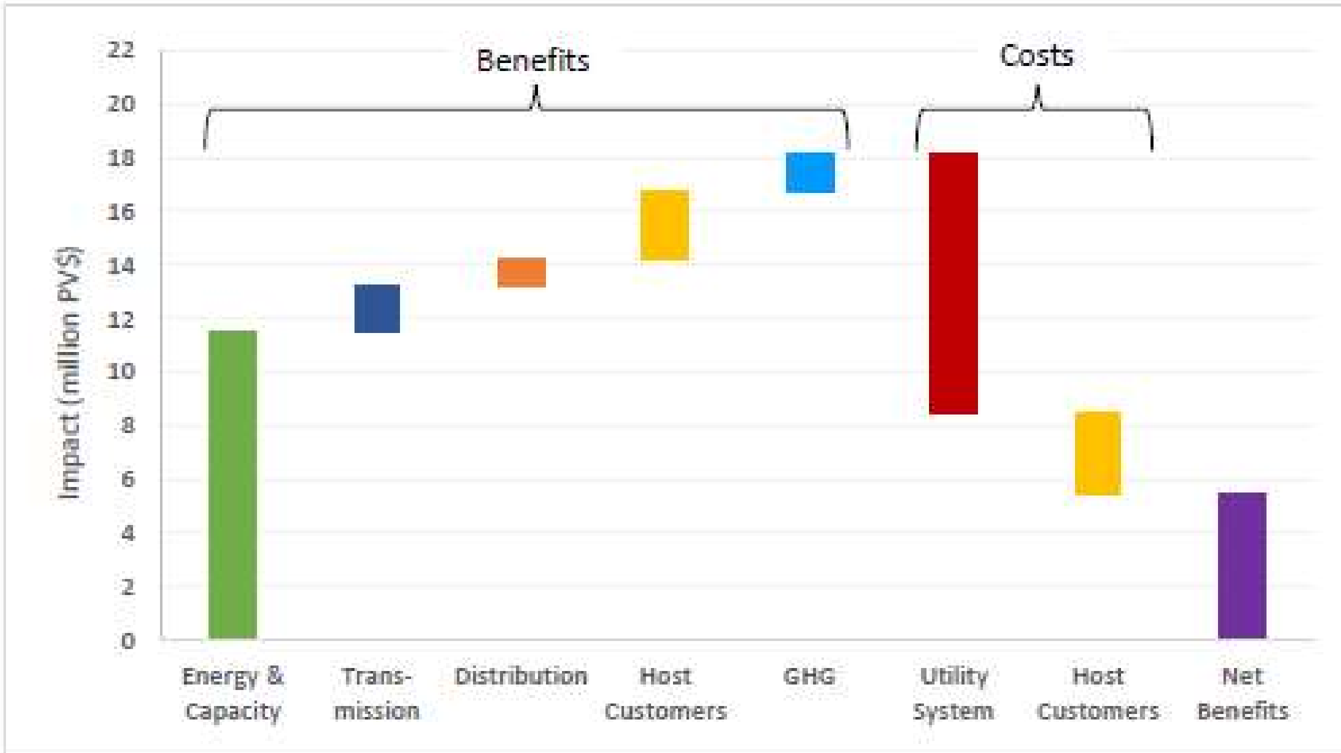
- Multiple on-site DERs span residential, commercial, and community levels, including buildings, facilities, campuses, etc.
  - Emerging focus: grid-interactive efficient buildings (GEBs), also relevant to microgrids and smart communities/neighborhoods.
- Factors that affect BCA of multiple on-site DERs: 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, where 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 output profile and store any excess generation for later discharge.

Multiple On-site DERs

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

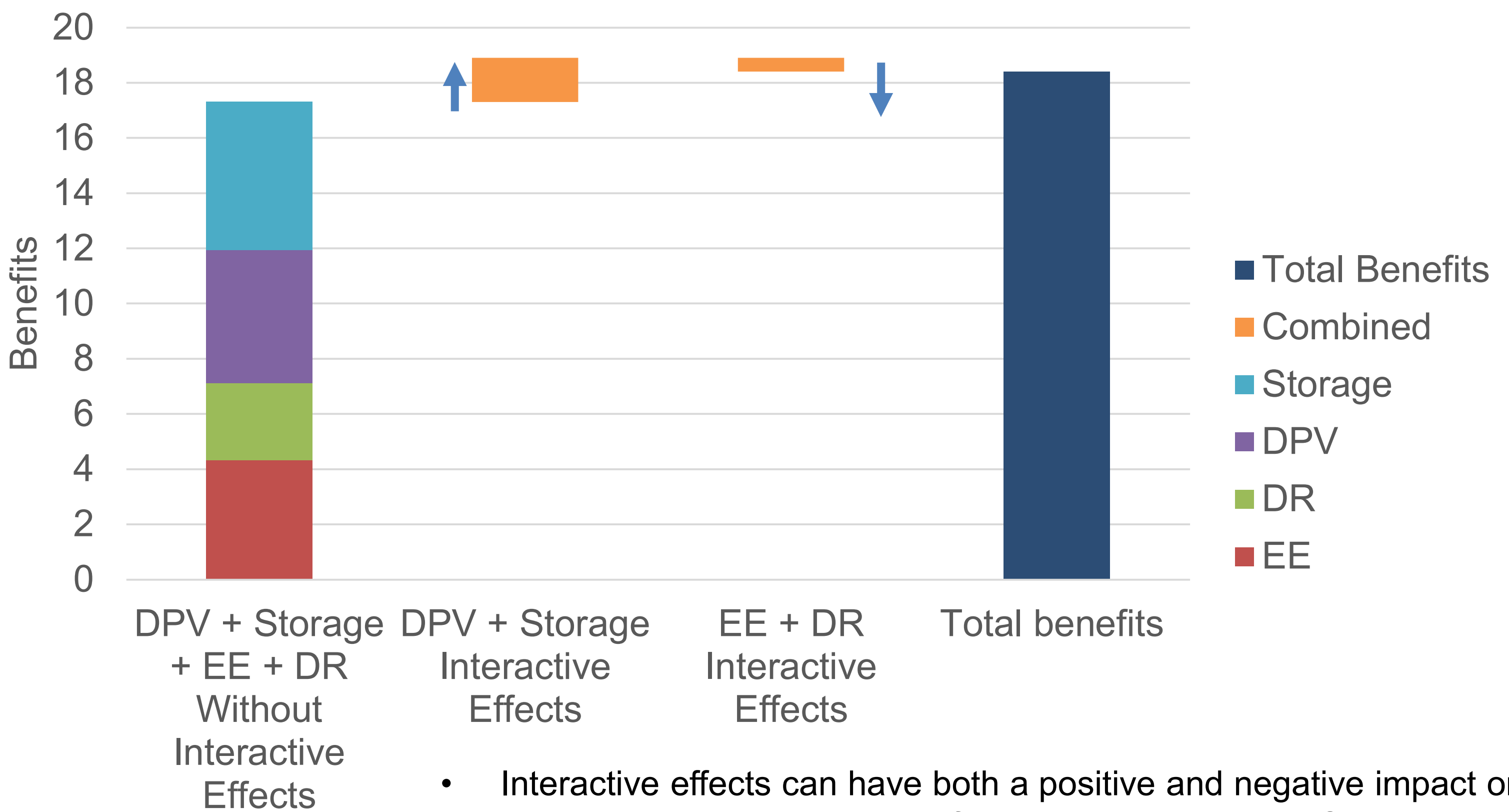
Assumes utility program leverages commercial GEBs to provide demand flexibility and integrate clean resources during system peak hours to meet the jurisdiction's GHG emissions reduction goal.

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

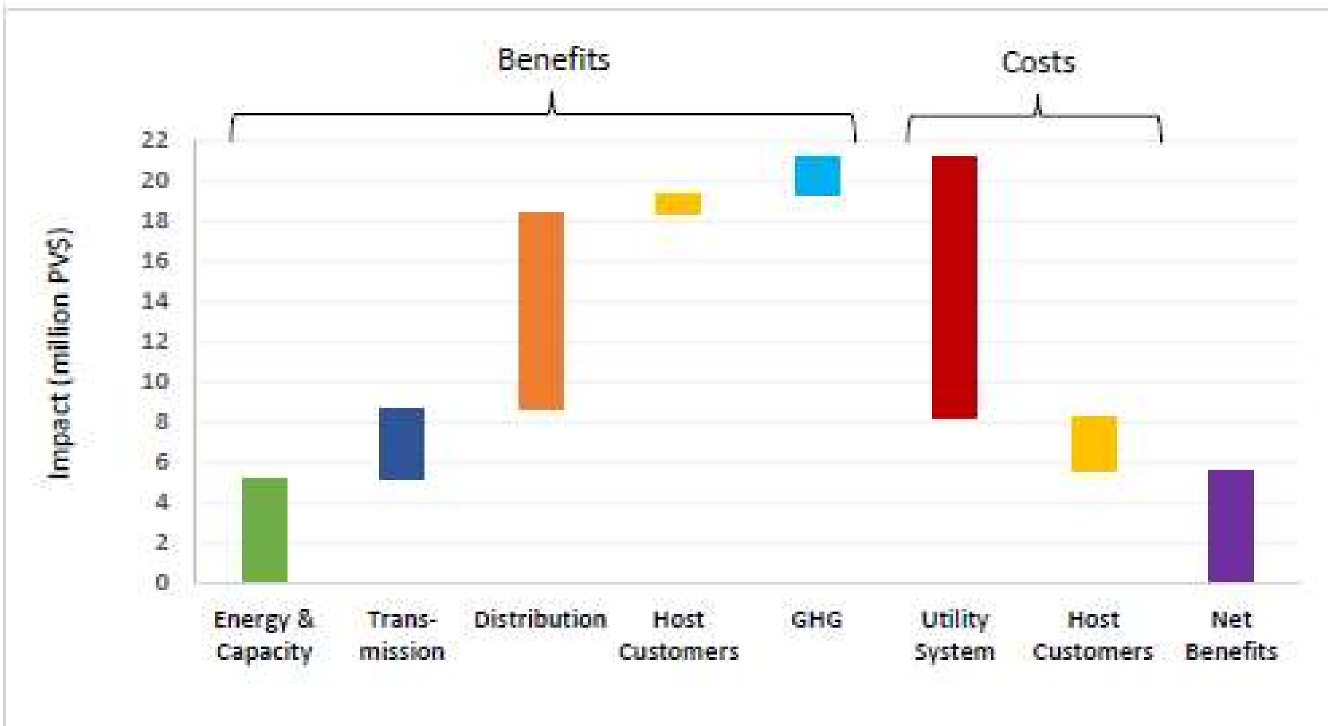
The assessment of NWS cost-effectiveness depends on **where** the program or DERs are located, **when** they provide services, and the resulting benefits and costs.

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

Consider:

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?*

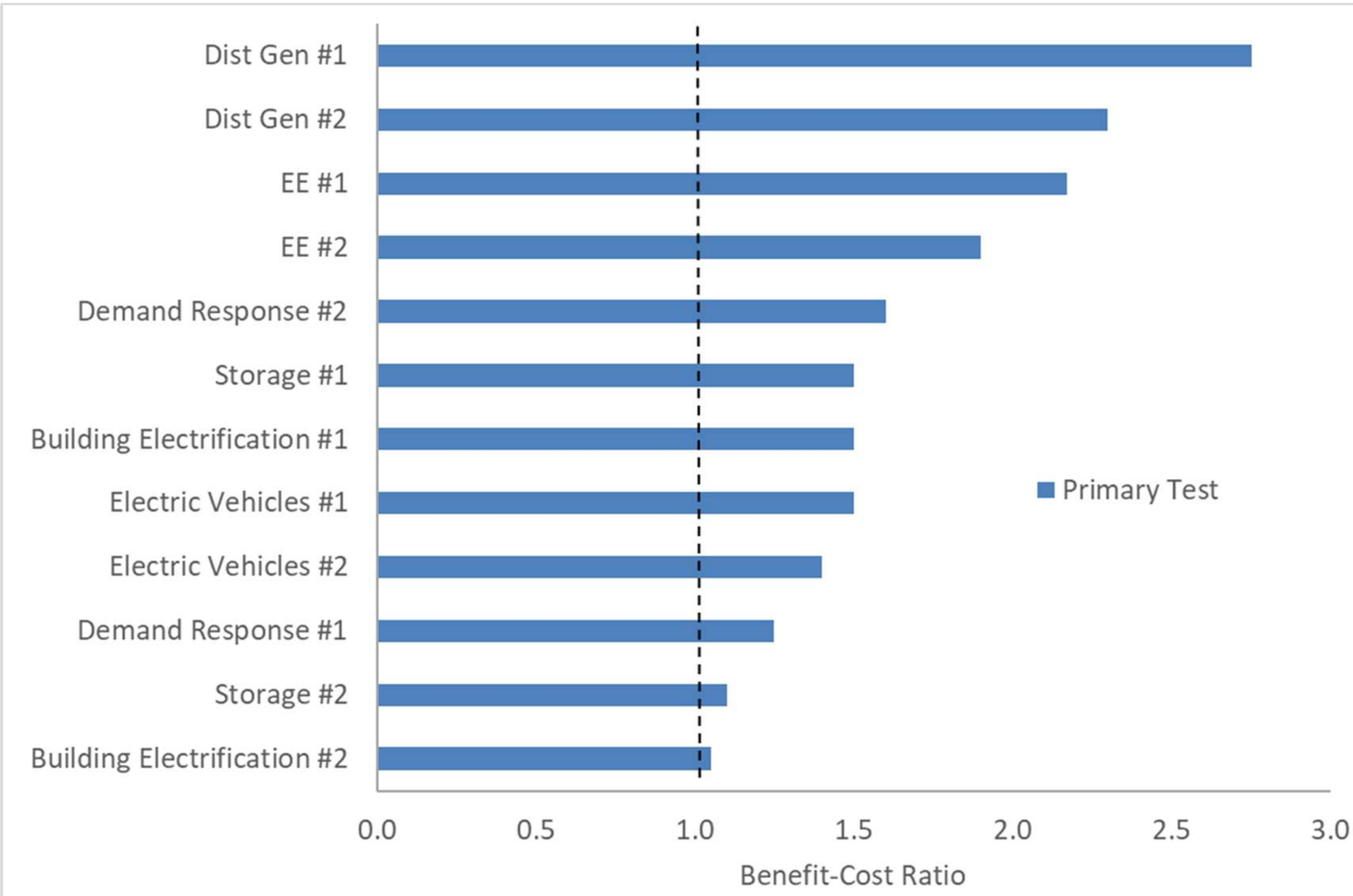
Prioritizing Across DERs

In order to prioritize across different DER types, it is important to establish planning objectives.

In this hypothetical case, the jurisdiction does not require or expect utilities to implement all cost-effective DERs

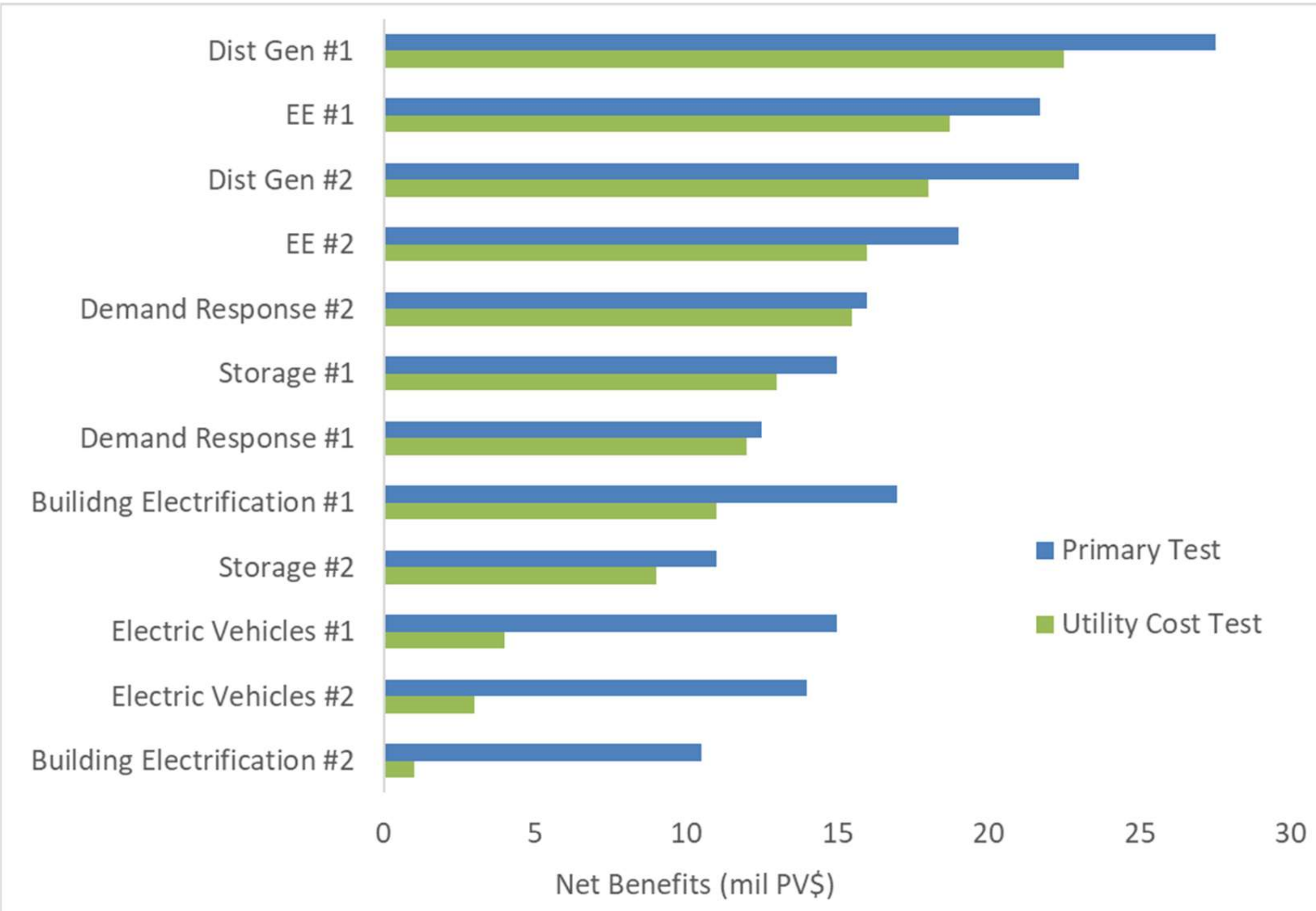
Potential Objectives	**Example Jurisdiction**
Implement the most cost-effective DERs	✓
Maximize net benefits	
Reduce customer bills	✓
Avoid unreasonable rate impacts	✓
Achieve GHG goals at lowest cost	✓
Encourage a diverse range of DER technologies	
Other	

Objective:
Implement the most cost-effective DERs



Sort by benefit-cost ratio and pick those DERs with the highest ratios

Objective:
Implement programs that reduce bills the most

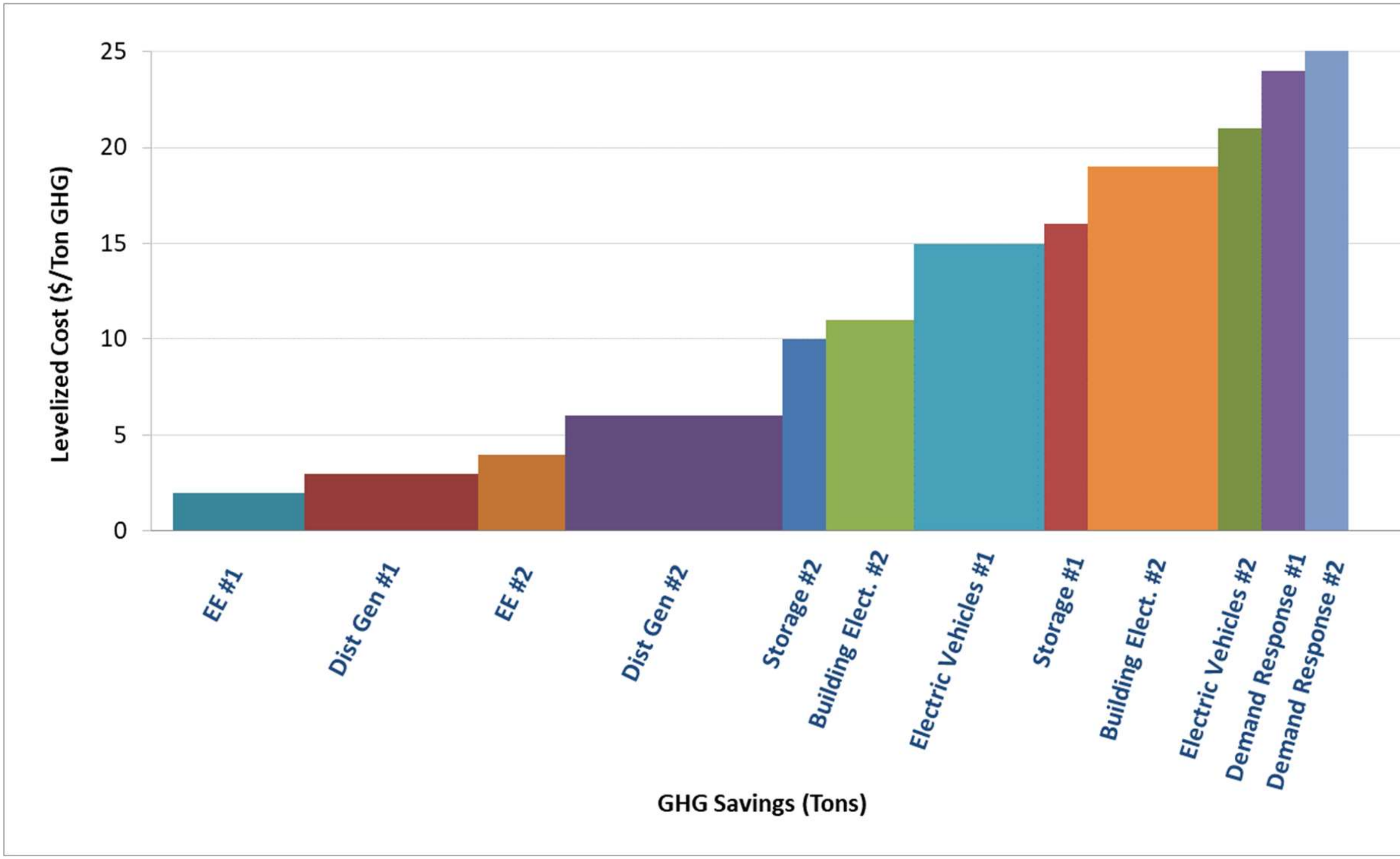


National Standard Practice Manual

Sort by utility cost test.

Those DERs with the greatest net benefits by the utility cost test will reduce average bills the most.

Objective:
Achieve GHG goals at lowest cost



Estimate levelized costs.

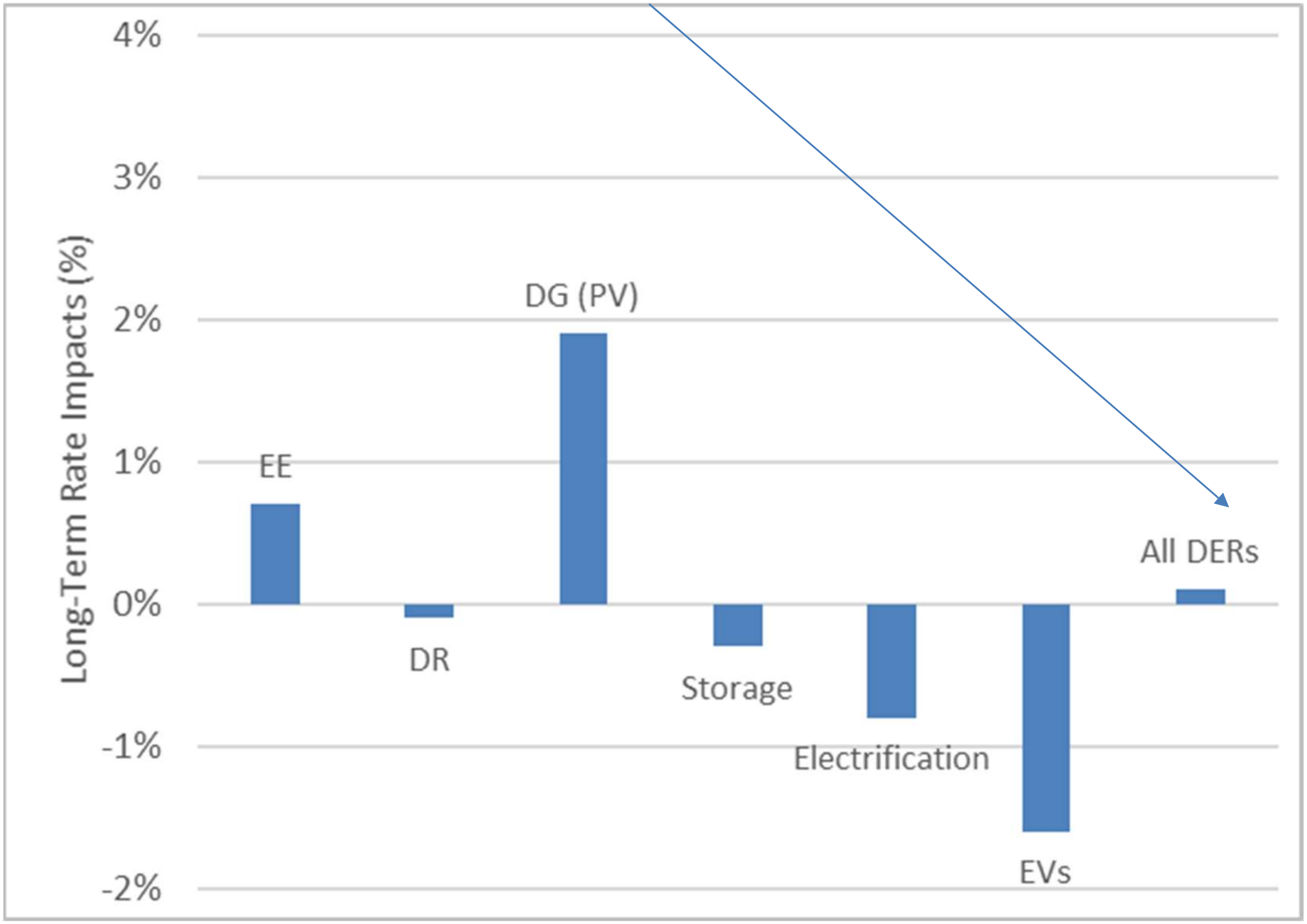
Sort from lowest to highest cost.

Estimate the magnitude of GHG savings by DER.

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

Objective: Avoid unreasonable rate impacts

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



Dynamic System Planning

- The scope of utility system planning is expanding to manage the increasing complexity of the electricity system, while addressing evolving state policy objectives, changing customer priorities, and increased DER deployment.
- Dynamic system planning involves assessing *multiple DER types* relative to a *dynamic set* of alternative resources, with goal of optimizing DERs and utility-scale resources
- Each of these types of planning practices **uses some form of BCA** for comparing and optimizing different resources.

Type of Utility System	Planning Practice	Planning Practice Accounts for:			
		Distribution System	DERs	Transmission System	Utility-Scale Generation
Distribution-only & vertically-integrated	Traditional distribution planning	✓	-	-	-
	Integrated distribution planning	✓	✓	-	-
Vertically-integrated	Transmission planning	-	-	✓	-
	Integrated resource planning	-	✓	-	✓
	Integrated grid planning	✓	✓	✓	✓

NSPM for DER - Appendices

A. Rate Impacts

B. Template NSPM Tables

C. Approaches to Quantifying Impacts

D. Presenting BCA Results

E. Traditional Cost-Effectiveness Tests

F. Transfer Payments

G. Discount Rates

H. Additional EE Guidance

NESP Resources (1)

Case Study examples of NSPM application

NSPM Resources (2)

Database of Screening Practices (DSP) for electric and natural gas EE programs

Summary of States | Single State | Test & Application | Utility System Impacts | Non-Utility System Impacts | Impacts Summary

View electric or natural gas?
- (•) Electric
- ( ) Natural Gas

Select State: (Multiple values)

Note: Users should click on Tooltips to view hyperlinks.

Test & Application

	Arkansas	California	Colorado	Connecticut	Delaware	District of Columbia	Florida	Georgia	Hawaii	Idaho
Primary Test	TRC	TRC	TRC	UCT	TRC	SCT	RIM	TRC	TRC	UCT
Secondary Tests	UCT, PCT, RIM	UCT	UCT, PCT, SCT, RIM	Modified UCT, TRC	RIM	None	TRC, PCT	UCT, PCT, SCT, RIM	None	TRC, PCT
Primary Assessment Level	Program	Portfolio	Program	Program	Program	Portfolio	Program	Program	Program	Program
Other Assessment Levels	Portfolio, Measure	Program	Measure	None	None	None	None	Portfolio, Measure	Portfolio	Measure
Discount Rate	WACC	WACC	WACC	Low-risk	Low-Risk	Low-Risk	WACC	WACC	Uncertain	WACC
Analysis period	Measure Life	Measure Life	Measure Life	Model limitations	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life	Measure Life

Plus: Catalog of reports, studies and tools on quantifying utility & non-utility system impacts

NSPM 2021 Planned Efforts

- Repository of methods, tools and techniques for quantifying utility and non-utility system impacts
- BCA algorithm catalog
- ‘Real world' DER BCA use case examples
- BCA on-line training for regulators, evaluators, others
- Technical assistance to support application of the NSPM in selected states

Check out NESP Events for BCA/NSPM topical webinars

Stay informed with the NESP Quarterly Newsletter

Questions?

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