

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

Workshop NCEP Meeting

December 9, 2020

NSPM for DERs – Overview

Poll Question #2: *How familiar are you with the NSPM?*

NSPM for DERs - TOC

Principal focus today

Executive Summary

Part I: BCA Framework

1. Introduction
2. Principles
3. Developing BCA Tests

Part II: DER Benefits and Costs

4. DER Benefits and Costs
5. Cross-Cutting Issues

Part III: BCA for Specific DERs

6. Energy Efficiency
7. Demand Response
8. Distributed Generation
9. Distributed Storage
10. Electrification

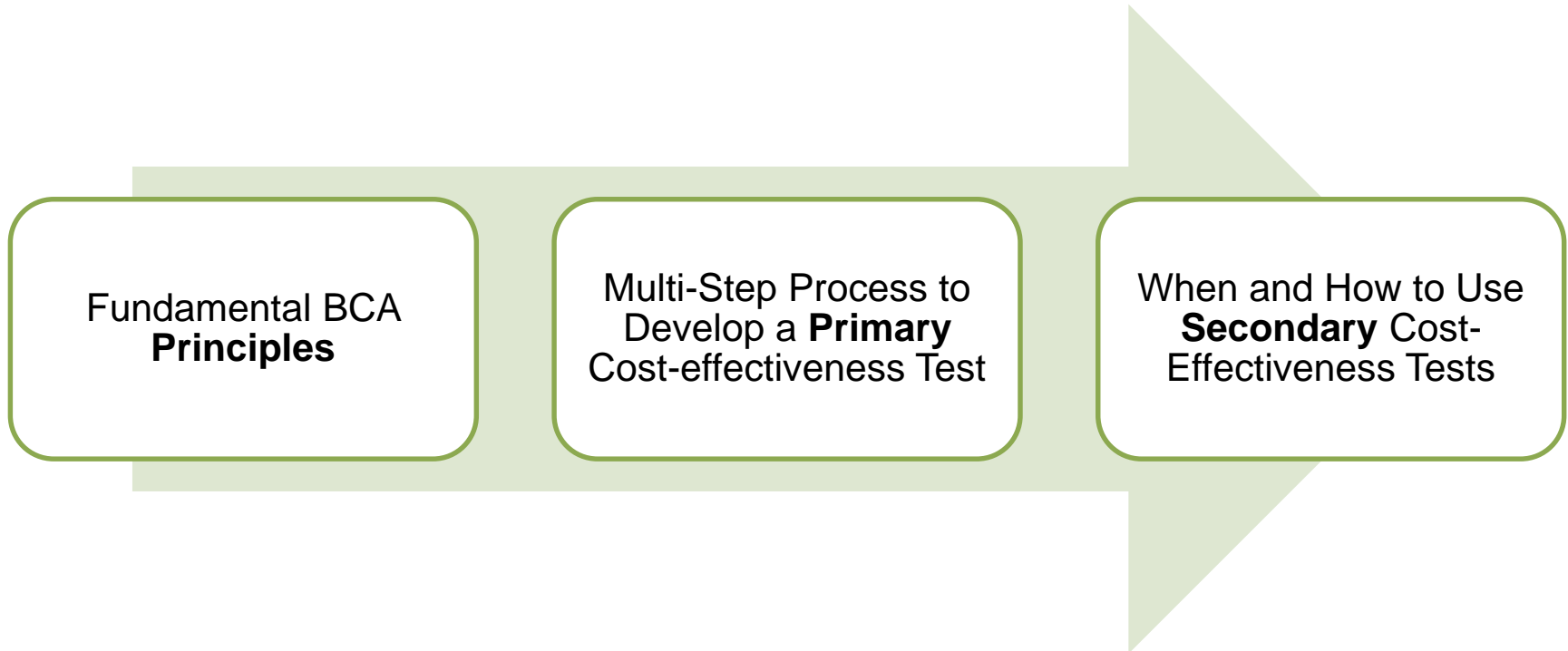
Part IV: BCA for Multiple DERs

11. Multiple On-Site DERs
12. Non-Wires Solutions
13. System-Wide DER Portfolios
14. Dynamic System Planning

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

Part I: 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

Tradeoffs between certain principles may be necessary

Defining the 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?

Developing your Primary Test (the Jurisdiction Specific Test)

STEP 1 **Articulate Applicable Policy Goals**

STEP 2 **Include All Utility System Impacts**

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

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

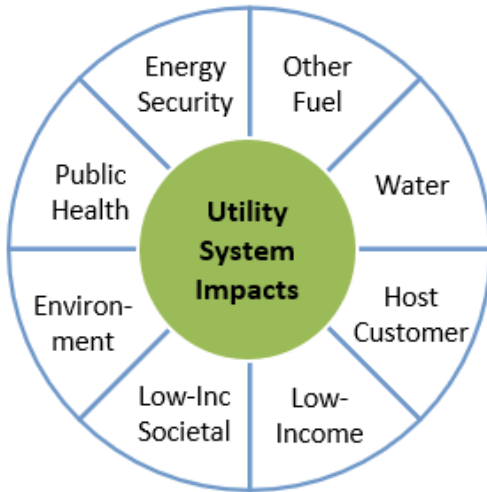
STEP 5 **Establish Comprehensive, Transparent Documentation**

Principles are applied throughout multi-step process.

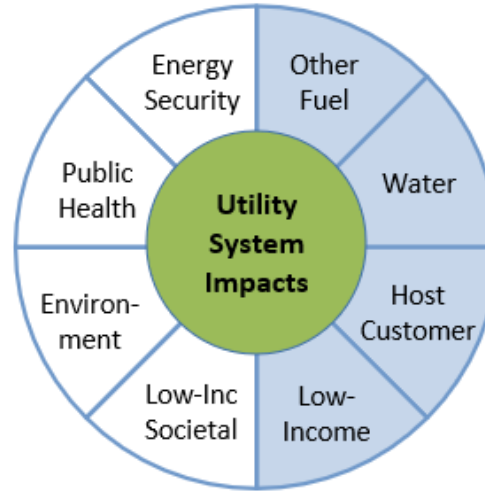
Primary Test = Jurisdiction Specific Test (JST)

Hypothetical JSTs as compared to traditional tests

JST 1 = UCT/PACT



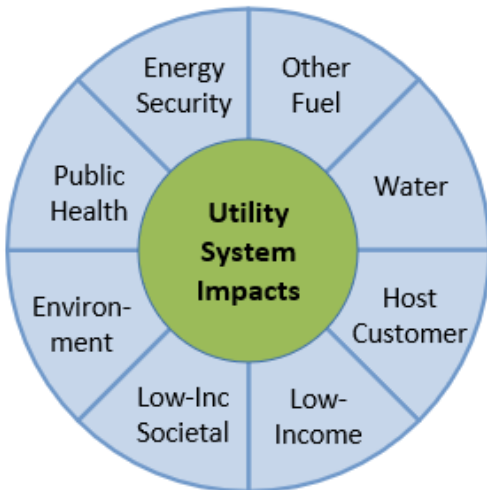
JST 2 = TRC Test



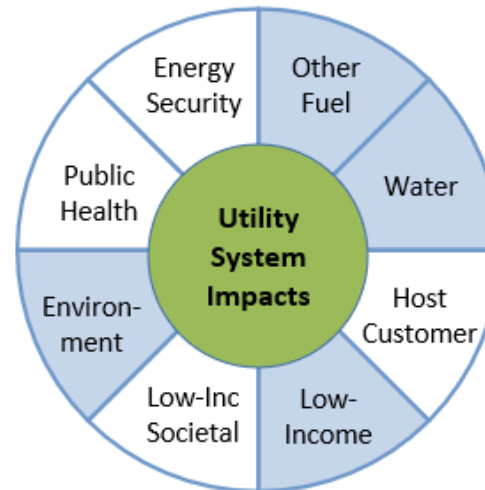
UCT = Utility Cost Test (or PACT = Program Admin Cost Test)
TRC = Total Resource Cost Test
SCT = Societal Cost Test

- All utility system impacts included
- Non-utility system impacts included
- Non-utility system impacts *not* included

JST 3 = SCT



JST 4 ≠ traditional CE test *



**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 also 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:

- *Address situations where there are inconsistent policy goals across different DER types*
- *Address DERs that are marginally cost-effective*
- *Assess implications of achieving policy goals*

Part II: DER Benefits & Costs

Utility System Impacts (foundational to BCA)

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	●	●	●	●	○

● = typically a benefit

● = typically a cost

● = either a benefit or cost depending on application

○ = not relevant for 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
- Others

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

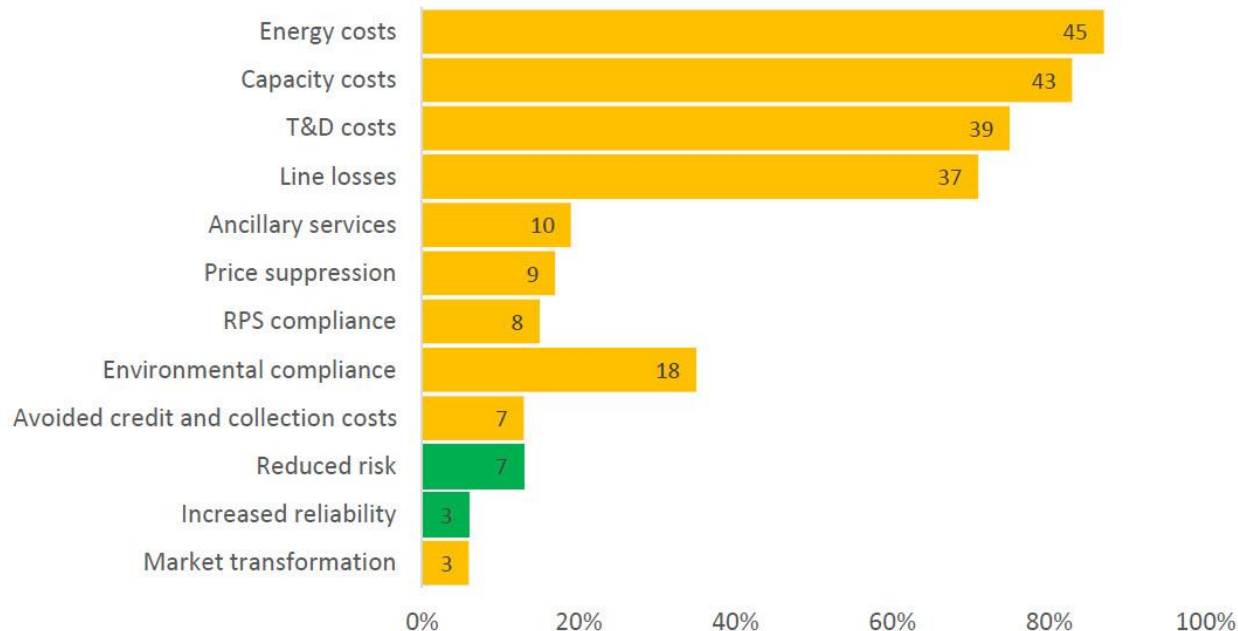
(inclusion depends on policy goals)

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

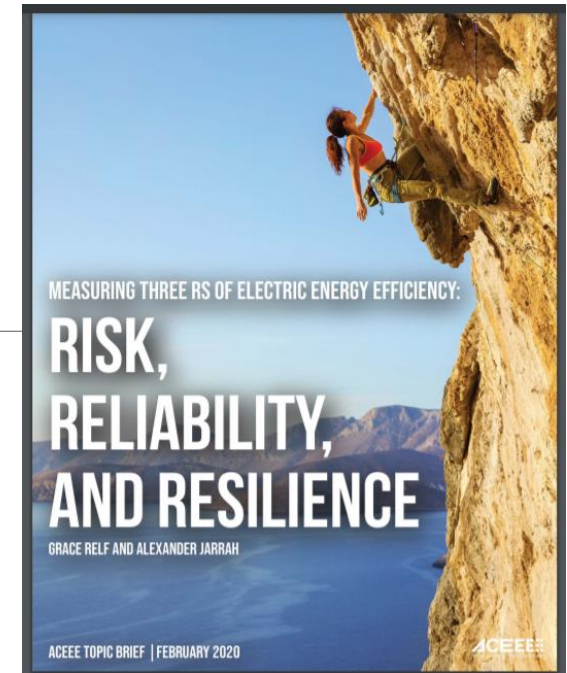
Accounting for Risk, Reliability and Resilience

- EE and other DERs address “3Rs” in variety of ways, critical to grid performance
- Associated with utility system, host customer and/or societal impacts
- Challenging to account for in BCA – very few states currently do...

Number of states accounting for utility-system benefits of energy efficiency.



Source: NESP 2019.



<https://www.aceee.org/topic-brief/measuring-three-rs>

Peter Larson, LBNL Presentation

Deep Dive Sessions

1. Developing a Jurisdiction's **Primary Test** for all DERs
2. Use of **Secondary Tests** and **Prioritizing DERs**
3. Addressing **Rate Impacts**

About 25-35 min for each topic with a mix of presentation, polling, Q&A via chat and discussion.

Stretch sessions at your discretion 😊

Multi-Step Process for Defining Your Primary 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.

STEPS 1-3: Articulate Policy Goals to Identify Relevant Impacts - *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

Poll #3: What impacts would you account for in your primary 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 4: Ensure Symmetry of Benefits & Costs

Costs and Benefits	<u>Asymmetrical</u>	<u>Symmetrical</u>	
	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	\$7,500		
• Rebate/incentive	\$1,875	\$1,875	\$1,875
• Administrative Costs	\$1,500	\$1,500	\$1,500
Host Customer Costs	\$5,625	\$5,625	
Total Costs Accounted for:	\$9,000	\$9,000	\$3,375
DER Benefits			
Utility System Benefits		\$6,000	\$6,000
Host Customer Non-Energy Benefits	\$6,000	\$4,000	
Total Benefits Accounted for:	\$6,000	\$10,000	\$6,000
Net Benefit	(\$3,000)	\$1,000	\$2,625
Benefit-Cost Ratio:	0.67	1.11	1.78

Primary Test: Key Takeaways

Enter in chat your one key takeaway from this deep dive.

Use of Secondary BCA Tests

Role of Secondary Tests

Primary JST should be used in most BCA situations.

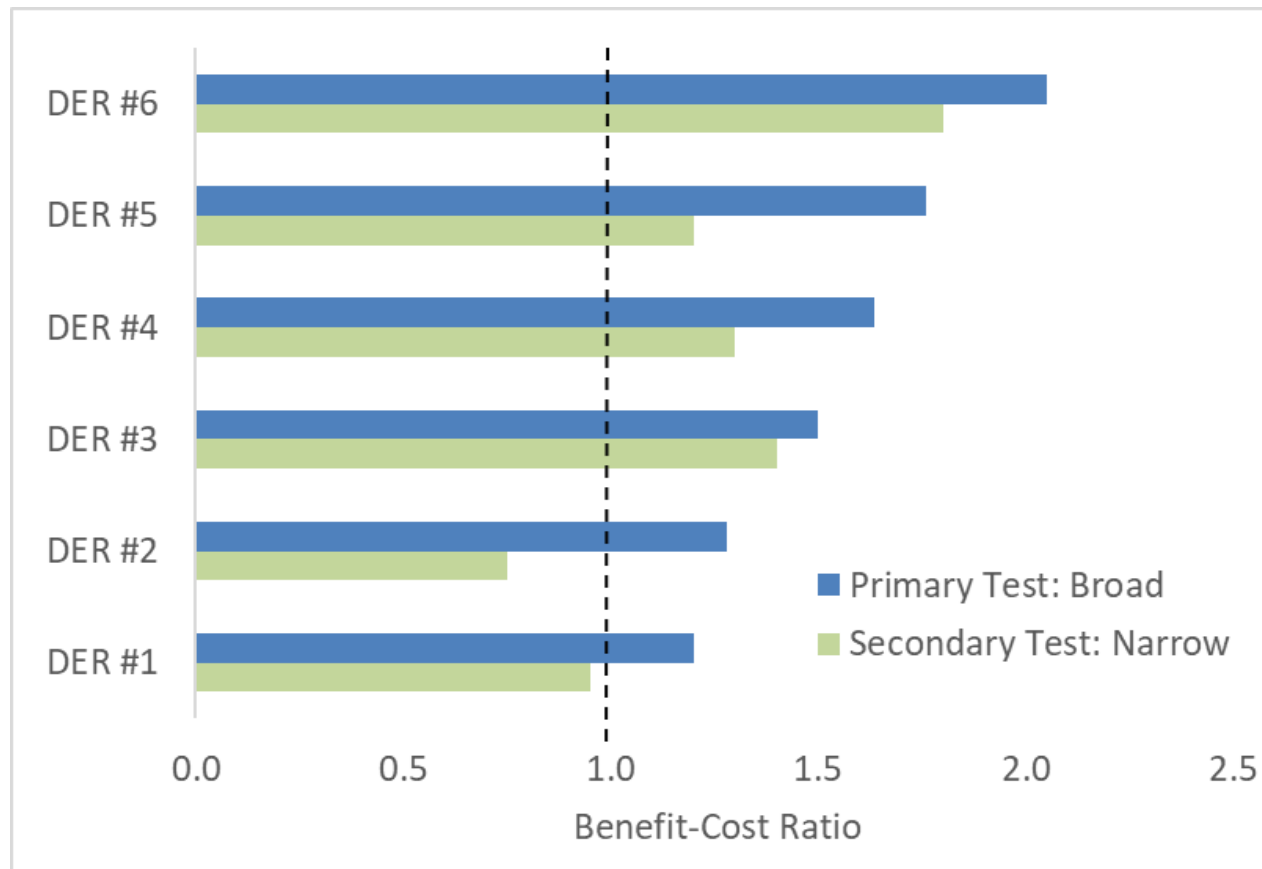
But in some cases, jurisdictions may need secondary test to address additional questions such as:

1. *How to address situations where there are inconsistent policy goals across different DER types?*
2. *How to assess implications of achieving policy goals?*
3. *How to address DERs that are marginally cost-effective?*

Next slides provide examples to demonstrate each of the above, with audience input...

Application of Secondary Tests #1a: When Different DER Types have Inconsistent Policy Goals

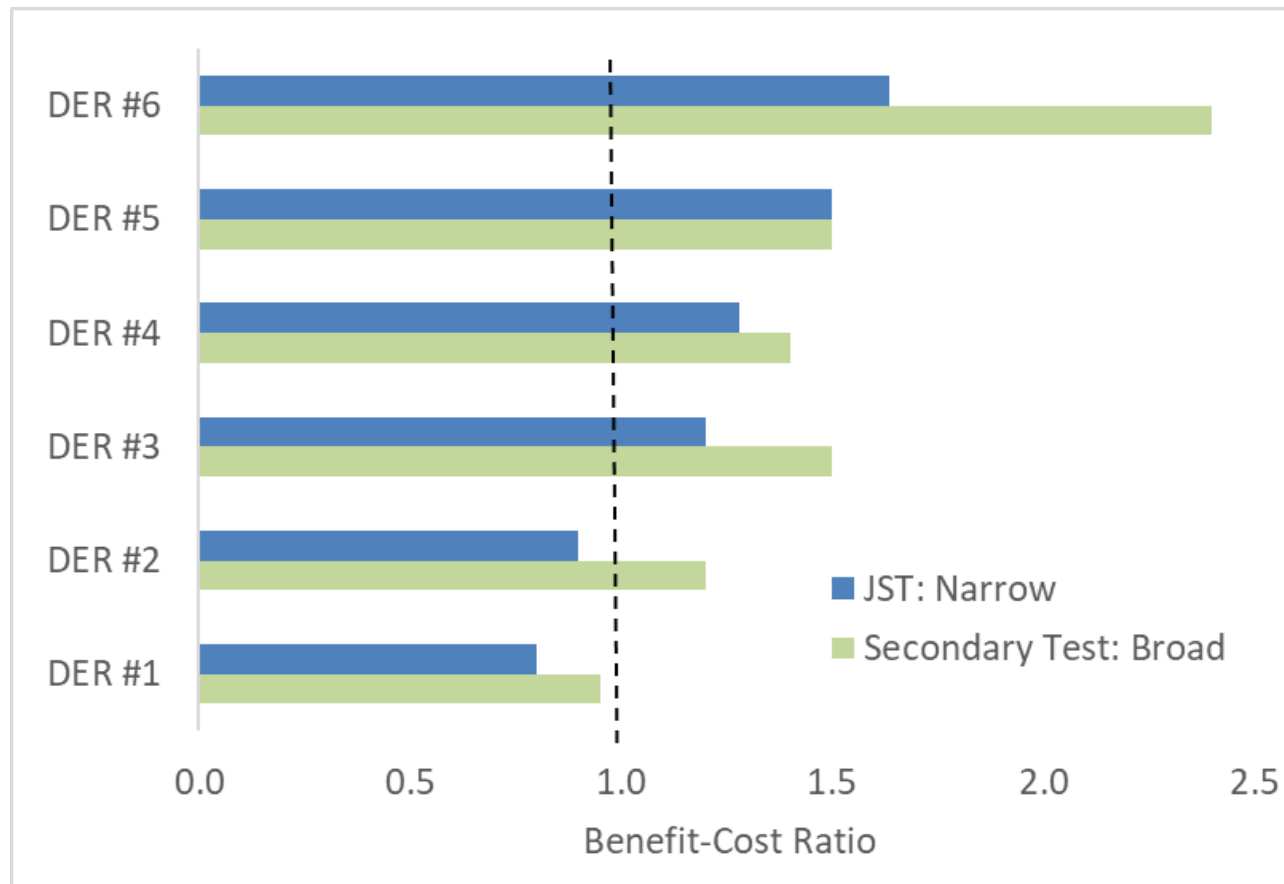
Broadly-defined Primary Test with
Narrowly-defined Secondary Test



Poll #4: Which of these DERs would you consider cost-effective?

Application of Secondary Tests #1b: When Different DER Types have Inconsistent Policy Goals

Narrowly-defined Primary Test vs
Broadly-defined Secondary Test

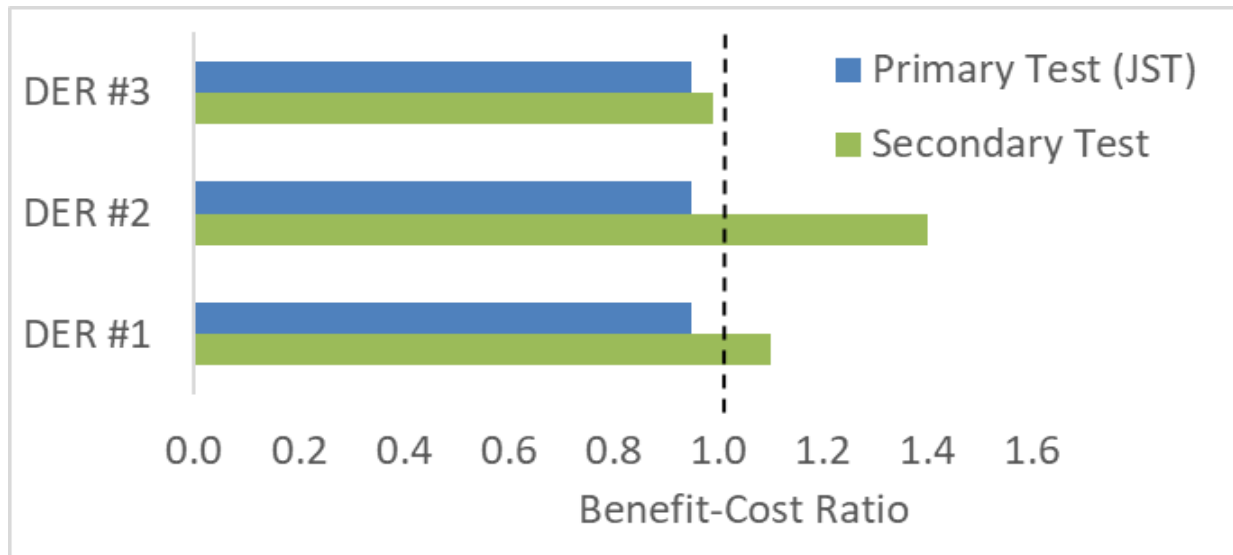


Poll #5: Which of these DERs would you consider cost-effective?

Application of Secondary Tests #2:

To decide on DERs that are marginally cost-effective

	Primary Test	Secondary Test
DER #3	.95	.98
DER #2	.95	1.4
DER #1	.95	1.1

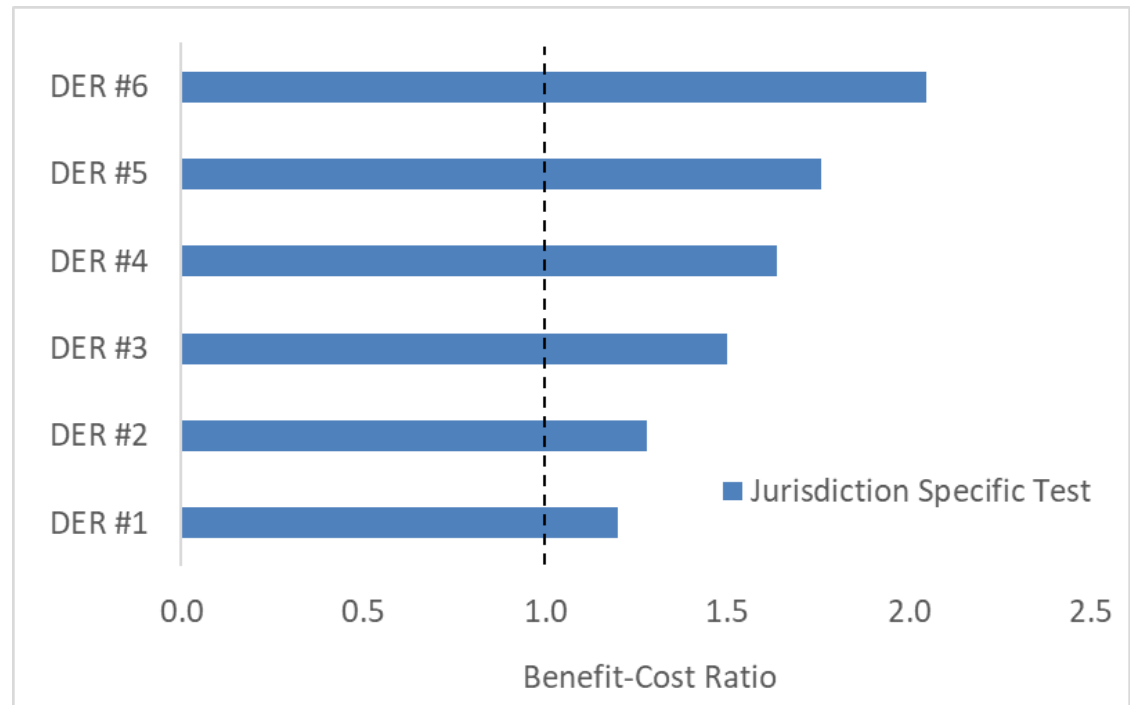
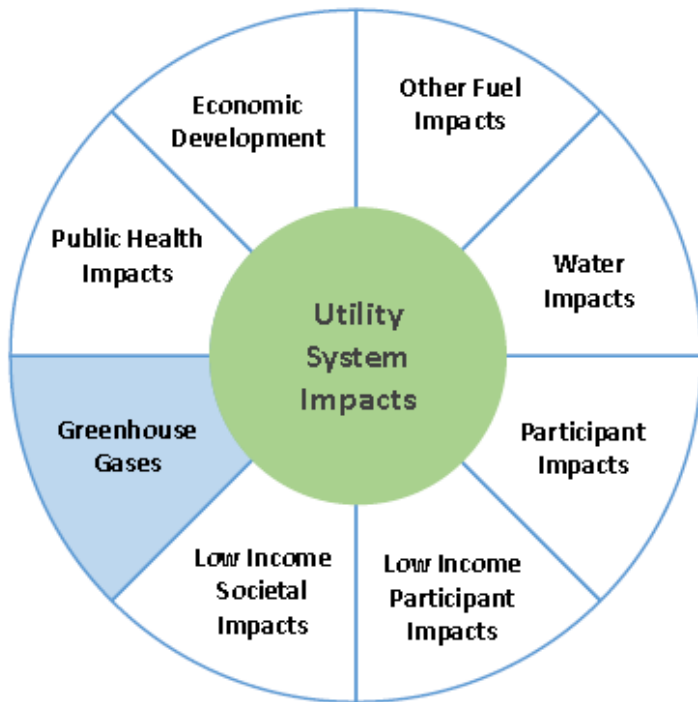


Poll #6: Which of these DERs would you consider cost-effective?

Application of Secondary Tests #3: To Assess the Impacts of Achieving Policy Goals

Hypothetical jurisdiction has established a JST that includes utility system impacts & GHG impacts. The six DERs below all pass the JST.

However, the Commission has expressed concern that the utility might be spending too much of customer funding to pay for the GHG benefits.



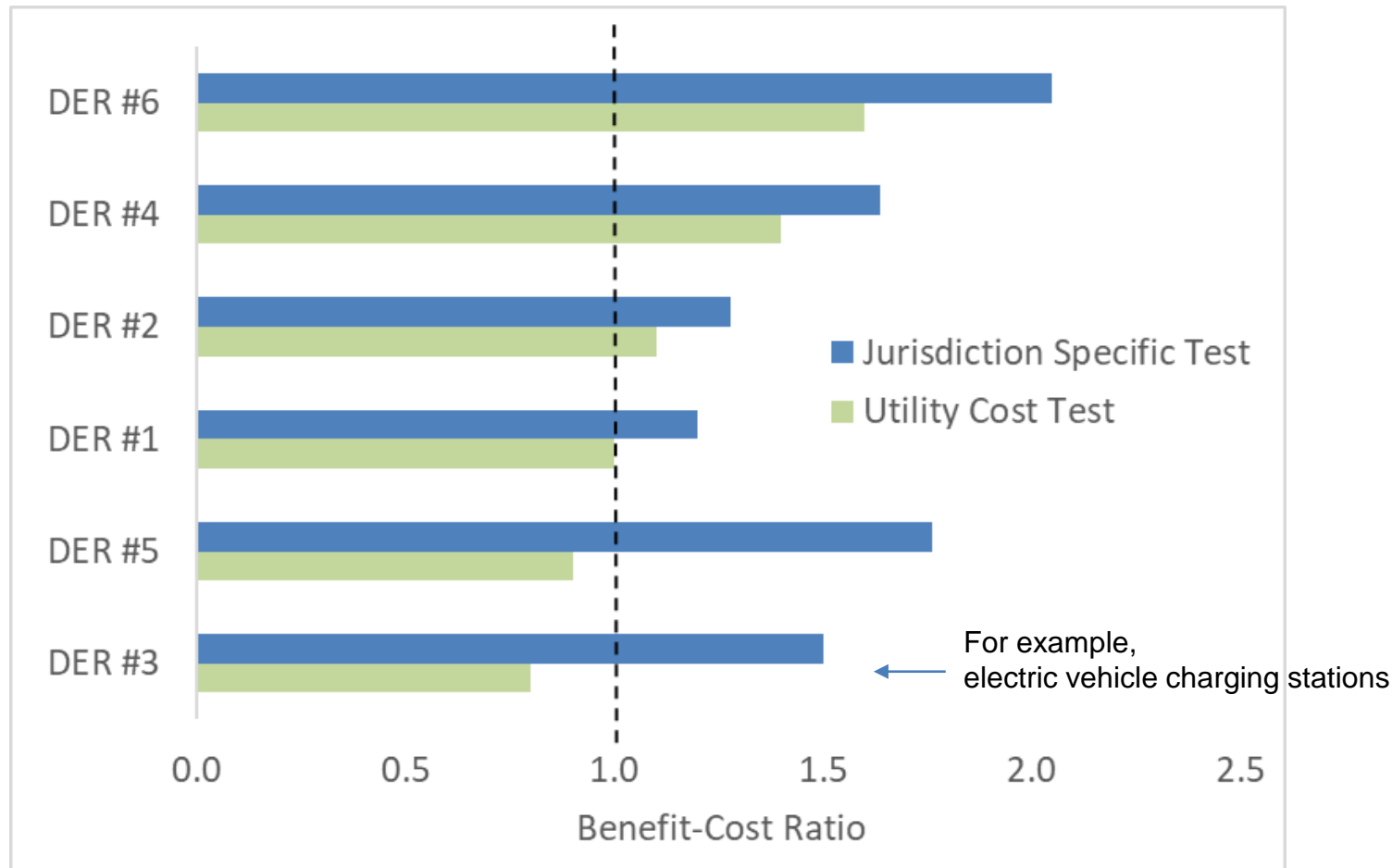
Application of Secondary Tests #3: To Assess the Impacts of Achieving Policy Goals

Potential Secondary Test	YES or NO
Utility Cost Test	
Total Resource Cost Test	
Societal Cost Test	
Participant Impact Test	
Rate Impact Measure Test	
Other: Secondary JST	

Poll #7: Which test would you use as secondary test in this situation?

Application of Secondary Tests #3 cont. To Assess the Impacts of Achieving Policy Goals

The Utility Cost Test is helpful for this purpose



Secondary Tests: Key Takeaways

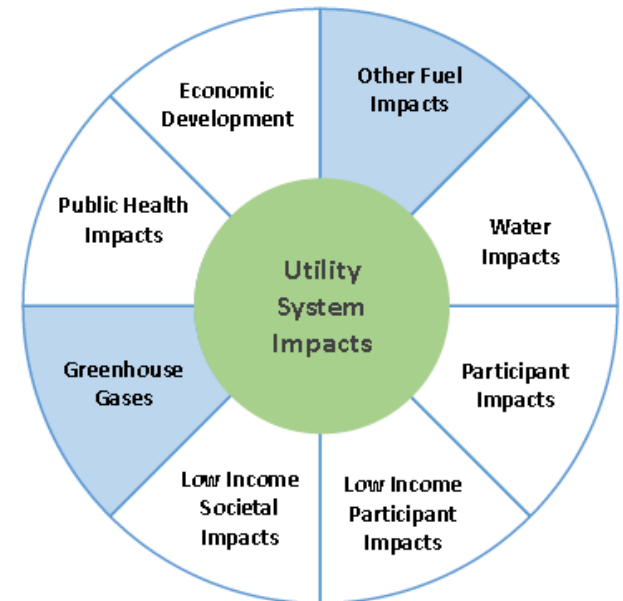
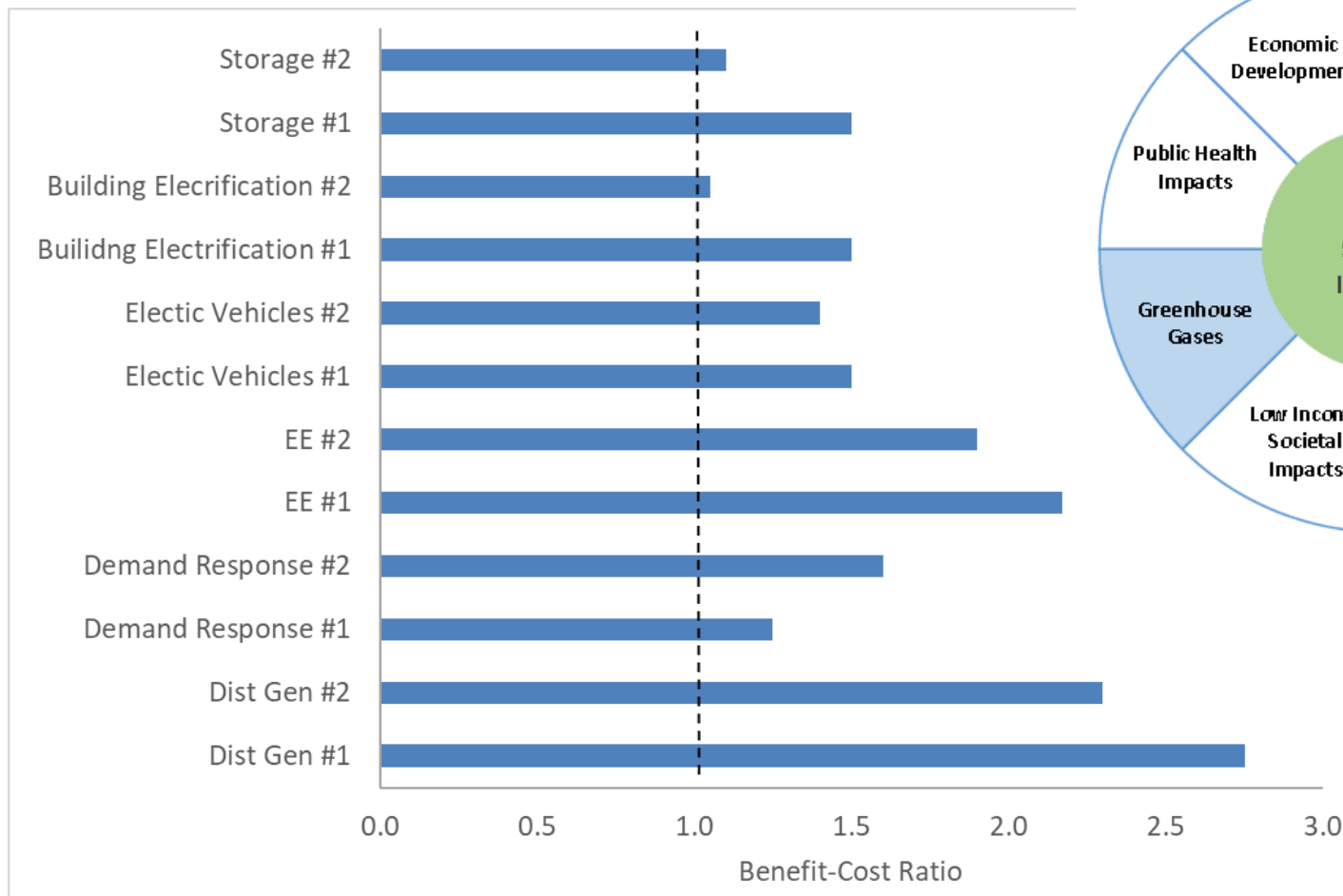
Enter in chat your one key takeaway from this deep dive.

Prioritizing Across DERs

- In order to compare across different DER types, it is important to establish a primary test that can be used consistently across them all.
 - Ideally, this would include just one test.
 - In some cases, it might require secondary tests as well.
- Even with a single primary test, there may be questions about how to prioritize across all DERs.
- In these cases, how should utilities and others prioritize across the full range of DERs?
- Below we present several examples of how the BCA data can be used to help prioritize.
- Note that in all cases the results should be for the full DER BCA study period (e.g., 25 years)

Prioritizing the Full Range of DERs

Hypothetical Primary Test: Includes utility system, other fuels, & GHG impacts.
All these illustrative DERS pass this primary test.



Prioritizing Across DERs

Questions:

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?*

What information can be used to answer these questions?

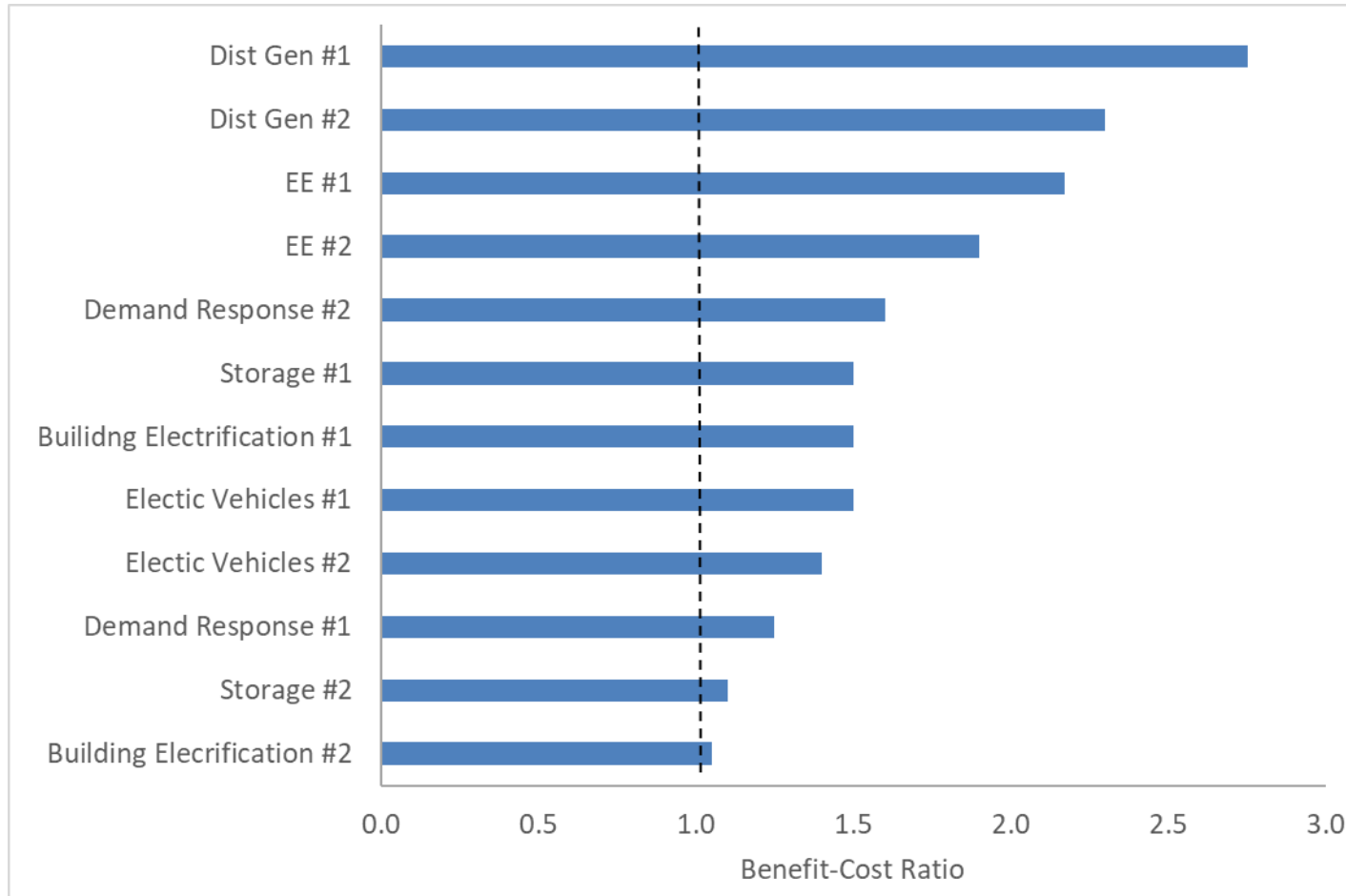
Prioritizing Across DERs

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

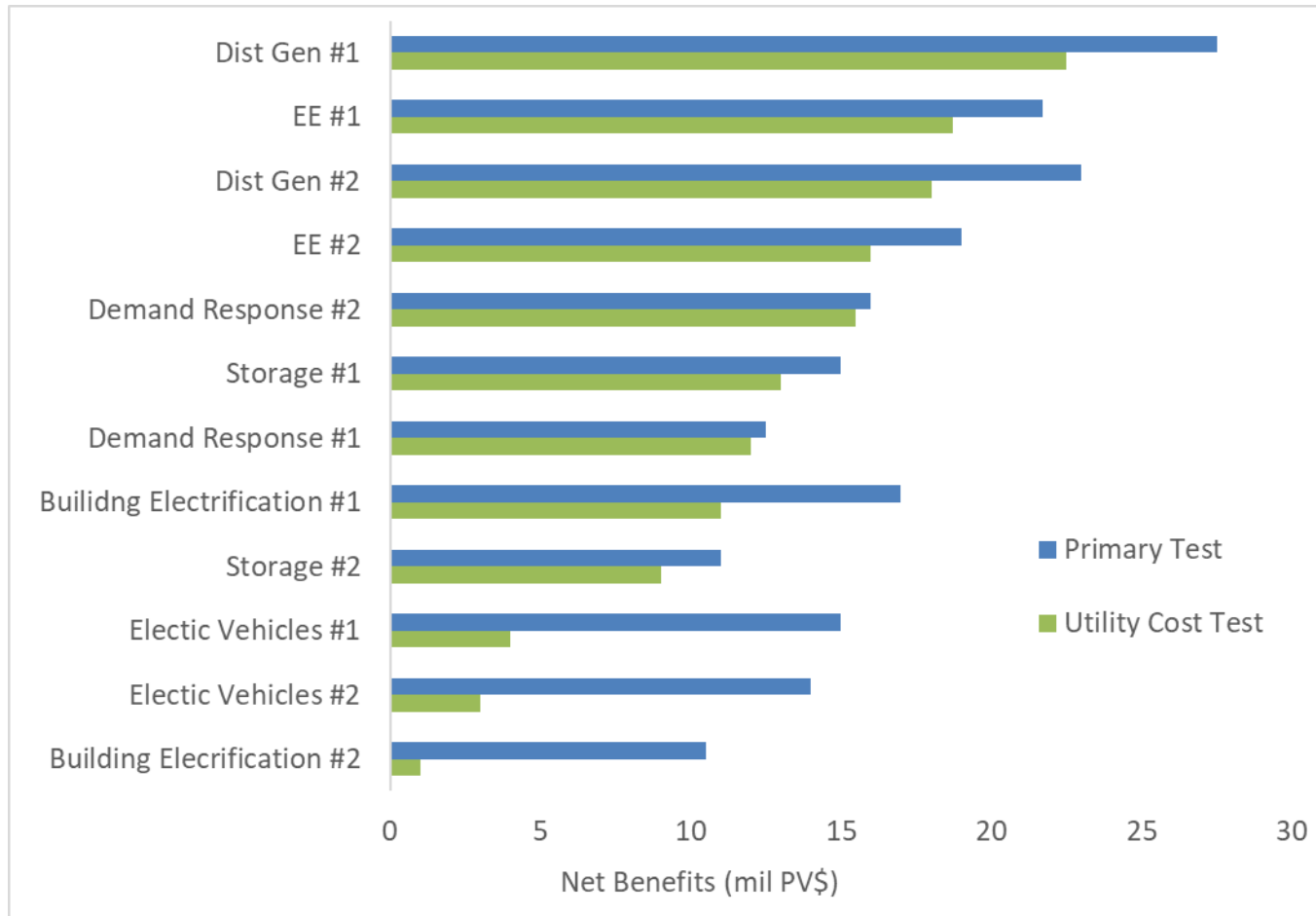
Potential Objectives	Example Jurisdiction
Implement the most cost-effective DERs	✓
Maximize net benefits	
Reduce customer bills	✓
Avoid unreasonable rate impacts	✓
Achieve GHG goals at lowest cost	✓
Encourage a diverse range of DER technologies	
Other	

Objective: Implement the most cost-effective DERs



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

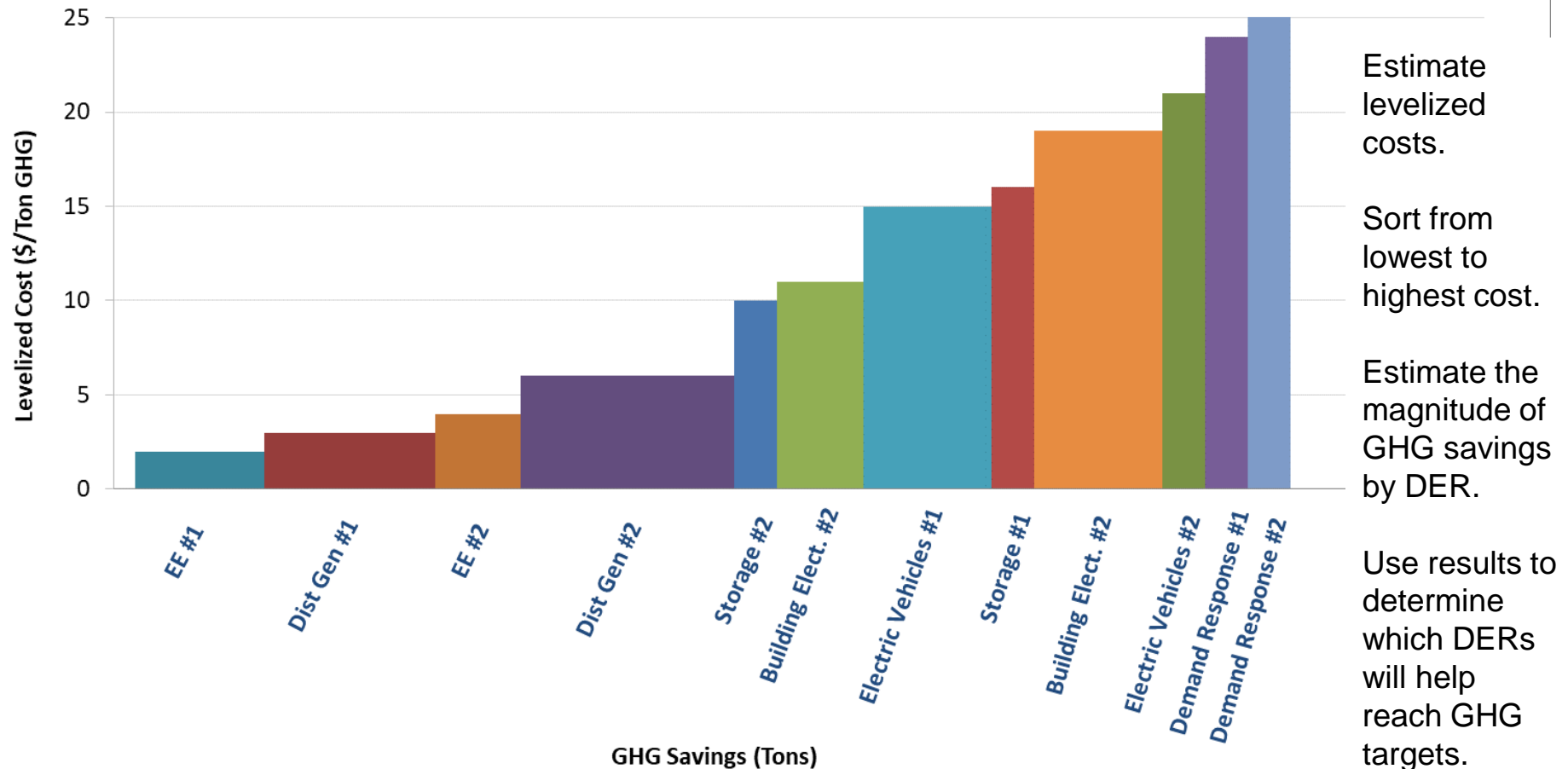
Objective: Implement programs that reduce bills the most



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



Poll #8: What would you consider the top three objectives for your state?

Priority Objectives in Your Jurisdiction	Select Three
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	

Prioritizing DERs: Key Takeaways

Enter in chat your one key takeaway from this deep dive.

5 min Break – then...

Deep Dive into
Addressing Rate Impacts

Addressing Rate Impacts

Principle #8: Conduct BCA separately from Rate Impact Analysis

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	<ul style="list-style-type: none"> • Cumulative costs (PV\$) • Cumulative benefits (PV\$) • Cumulative net benefits (PV\$) • Benefit-cost ratios 	<ul style="list-style-type: none"> • 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 Impact Analysis
Utility system impacts	✓	✓
Host customer impacts	depends on policy goals	x
Social impacts	depends on policy goals	x
Lost revenues	x	✓
Increased revenues	x	✓
Net metering bill credits	x	✓

Components of Rate Impact Analyses

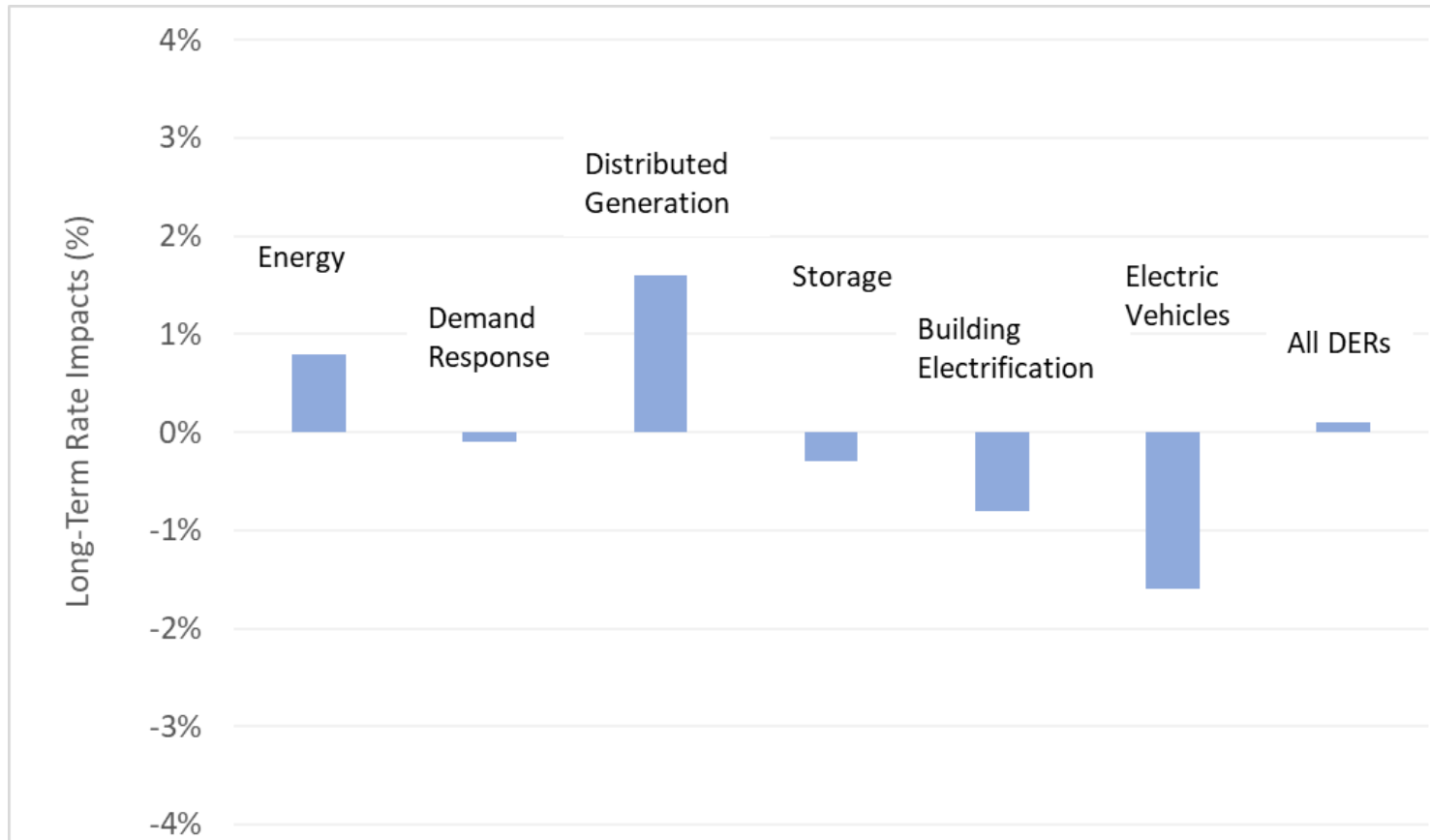
A thorough understanding of rate impacts requires an analysis of three important factors:

- **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.

Rate Impacts

1. Present rate impacts in terms of long-term averages.
2. Consider rate impacts of all DER types.

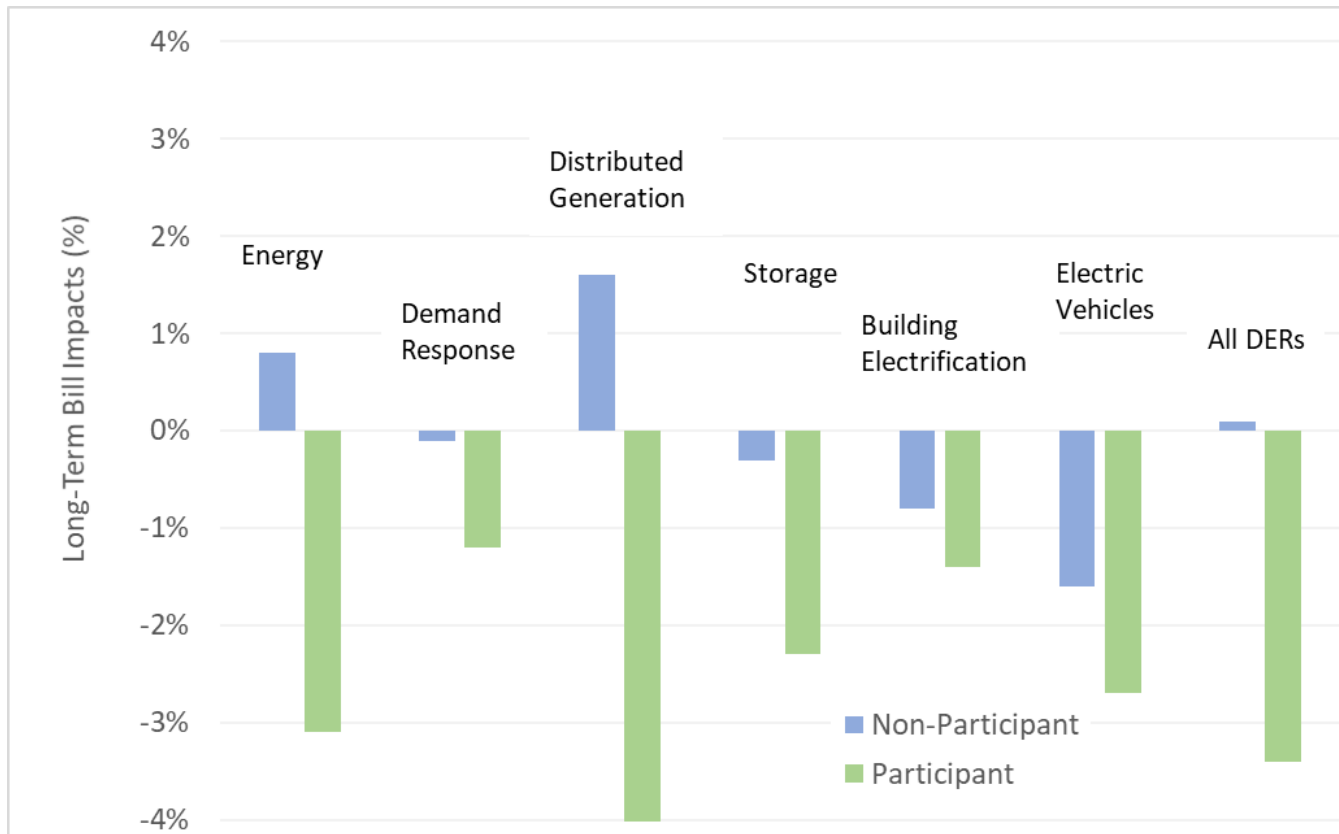
Illustrative Examples:



Bill Impacts

1. Present bill impacts in terms of long-term averages.
2. Consider bill impacts of all DER types.
3. Consider participant and non-participant bill impacts.

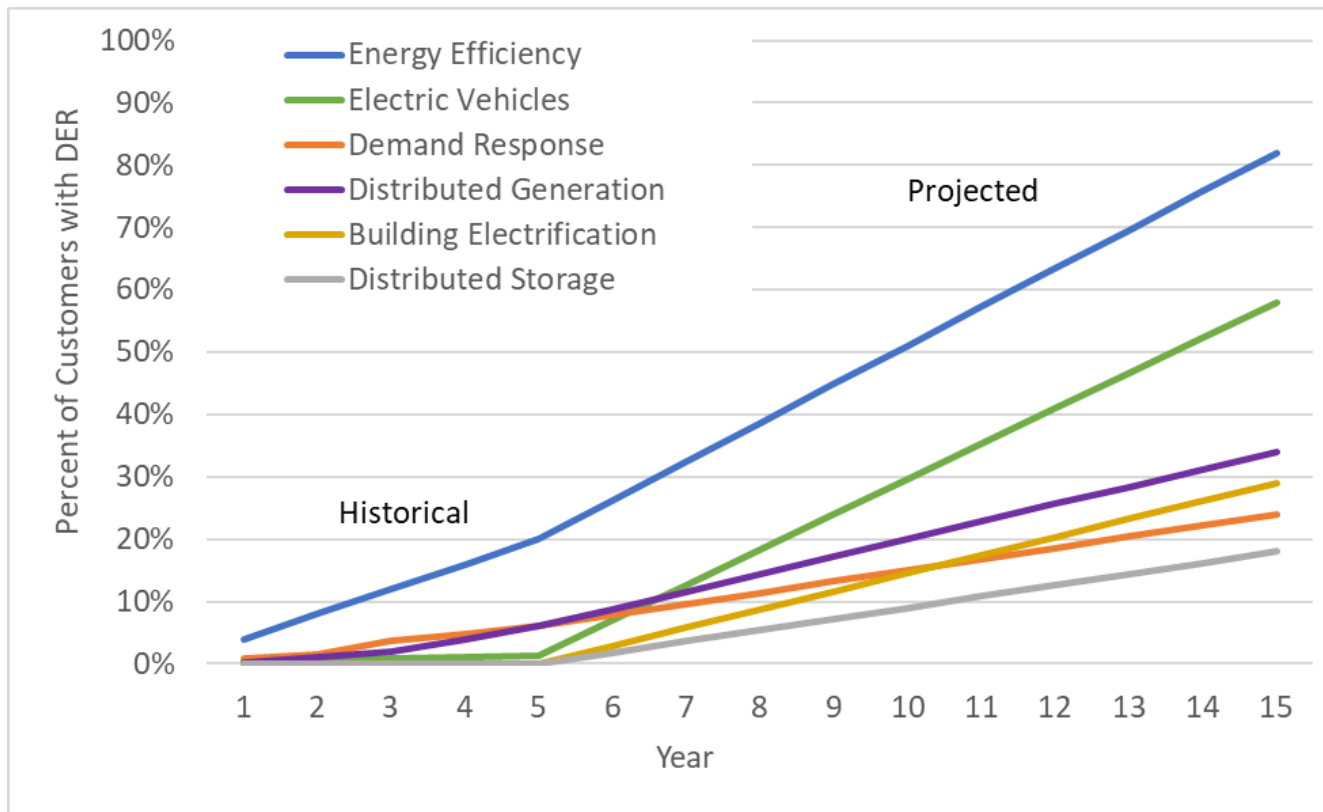
Illustrative Examples:



Participation Rates

1. Present long-term participation rates.
2. Present participation rates of all DER types.

Illustrative Examples:



Consider Both BCA and Rate Impact Analysis

Sometimes it is necessary to make tradeoffs between reduced costs and higher rates.

Illustrative example: Energy Efficiency Portfolio

Benefit-Cost Analysis	Net Benefits (mil PV\$)	85
	Benefit-Cost Ratio	2.1
Rate Impact Analysis	Rate Impacts (%)	1.3
	Bill Impacts Participants (%)	-3.4
	Participation Rate (%)	68
	Participation Low-Income (%)	56
Additional Considerations	GHG Goal Achieved (%)	28

← significant net benefits...

← but rates increase...

← but many customers participate and see lower bills.

← and there is a big impact on key policy goal

Consider Both BCA and Rate Impact Analysis

Sometimes there are no tradeoffs.

Illustrative Example: Demand Response Portfolio

Benefit-Cost Analysis	Net Benefits (mil PV\$)	15	← some net benefits...
	Benefit-Cost Ratio	1.4	
Rate Impact Analysis	Rate Impacts (%)	-0.1	← and rates decrease...
	Bill Impacts Participants (%)	-1.2	
	Participation Rate (%)	24	← but fewer customers participate...
	Participation Low-Income (%)	13	
Additional Considerations	GHG Goal Achieved (%)	3	← and not much impact on key policy goal

Consider Both BCA and Rate Impact Analysis

Consider combined effect of all DER types:

- EE, DR, DG, Storage, Electrification, EVs

Illustrative Example: Impacts of all DERs combined

Benefit-Cost Analysis	Net Benefits (mil PV\$)	305	← very large net benefits...
	Benefit-Cost Ratio	1.6	
Rate Impact Analysis	Rate Impacts (%)	0.5	← modest rate increase...
	Bill Impacts Participants (%)	-3.4	
	Participation Total (%) Participation Low-Income (%)	73 64	← many customers participate and see lower bills...
Additional Considerations	GHG Goal Achieved (%)	86	← and large impact on key policy goal

Addressing Rate Impacts: Key Takeaways

Enter in chat your one key takeaway from this deep dive.

Review Key Takeaways for Each Session

And final poll...

Poll #9: What are other topics of interest for future learning on BCA topics?

Thank you.

NSPM for DERs and supporting Resources:

<http://www.nationalenergyscreeningproject.org/>

Questions?

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