

# **Benefit-Cost Analysis For Investments in the Modern Grid**

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**Recent trends in how to determine whether grid  
modernization investments will deliver value to customers**

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**Tim Woolf  
Synapse Energy Economics**

# Overview

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- Increasing demand for benefit-cost analysis (BCA):
  - Grid modernization
  - Distributed energy resources (DERs): energy efficiency, demand response, distributed solar, storage, electric vehicles, strategic electrification.
  - IRP, distribution planning, iDER assessments.
- Very different practices are being used:
  - Across technologies
  - Across states
- Benefit-cost analyses show very different results.
  - Creates challenges in how to interpret the results
- Some positive trends are emerging.
- Much more progress is needed.

# California Standard Practice Manual

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- The CA Manual has been universally used for energy efficiency
  - But most states apply it differently.
- Describes five standard cost-effectiveness tests:
  - Utility Cost test: impacts on the utility system
  - Total Resource Cost test: impacts on the utility system and program participants
  - Societal Cost test: impacts on society
  - Participant test: impacts on program participants
  - Rate Impact Measure test: impacts on rates
- These tests are increasingly being used to assess grid modernization, DERs, and related initiatives.
- But the CA Manual does not address current needs:
  - Does not address energy policy goals
  - Does not address rate impacts well
  - Has been interpreted inconsistently
  - Does not address some key DER issues

# National Standard Practice Manual

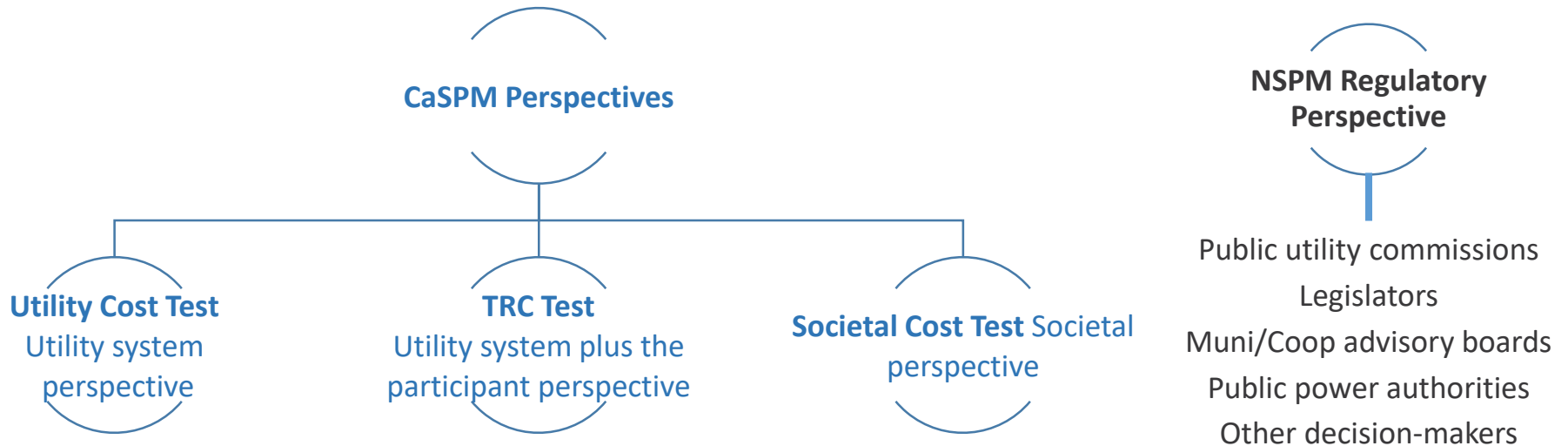
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- Designed to update, improve, and replace the CA SPM.
- Includes a set of fundamental BCA principles.
- Acknowledges the importance of policy goals in BCAs.
- Provides an framework for determining a state BCA test.
- Distinguishes between primary and secondary tests.
- Provides guidance on whether and how to include participant impacts.
- Provides guidance on key BCA inputs:
  - Discount rates
  - Avoided costs
  - Study period
  - End effects

# NSPM: Principles

<b>Efficiency as a Resource</b>	EE is one of many resources that can be deployed to meet customers' needs and therefore should be compared with other energy resources (both supply-side and demand-side) in a consistent and comprehensive manner.
<b>Policy Goals</b>	A jurisdiction's primary cost-effectiveness test should account for its energy and other applicable policy goals and objectives. These goals and objectives may be articulated in legislation, commission orders, regulations, advisory board decisions, guidelines, etc., and are often dynamic and evolving.
<b>Hard-to-Quantify Impacts</b>	Cost-effectiveness practices should account for all relevant, substantive impacts (as identified based on policy goals,) even those that are difficult to quantify and monetize. Using best-available information, proxies, alternative thresholds, or qualitative considerations to approximate hard-to-monetize impacts is preferable to assuming those costs and benefits do not exist or have no value.
<b>Symmetry</b>	Cost-effectiveness practices should be symmetrical, where both costs and benefits are included for each relevant type of impact.
<b>Forward-Looking Analysis</b>	Analysis of the impacts of resource investments should be forward-looking, capturing the difference between costs and benefits that would occur over the life of the subject resources as compared to the costs and benefits that would occur absent the resource investments.
<b>Transparency</b>	Cost-effectiveness practices should be completely transparent and should fully document all relevant inputs, assumptions, methodologies, and results.

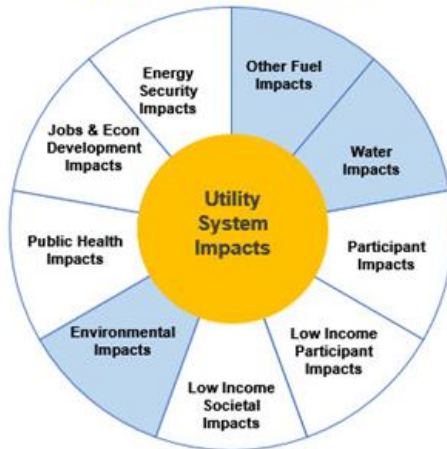
# NSPM: Cost-Effectiveness Perspectives



- California Standard Practice Manual (CaSPM) – test perspectives are used to define the scope of impacts to include in the ‘traditional’ cost-effectiveness tests
- NPSM introduces the ‘regulatory’ perspective, which is guided by the jurisdiction’s energy and other applicable policy goals

# NSPM: Relationship Of Different Tests

JURISDICTION 1: RVT



JURISDICTION 2: RVT



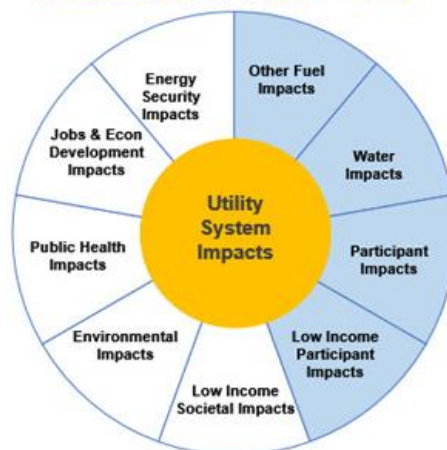
JURISDICTION 3: RVT



JURISDICTION 4: RVT = UCT



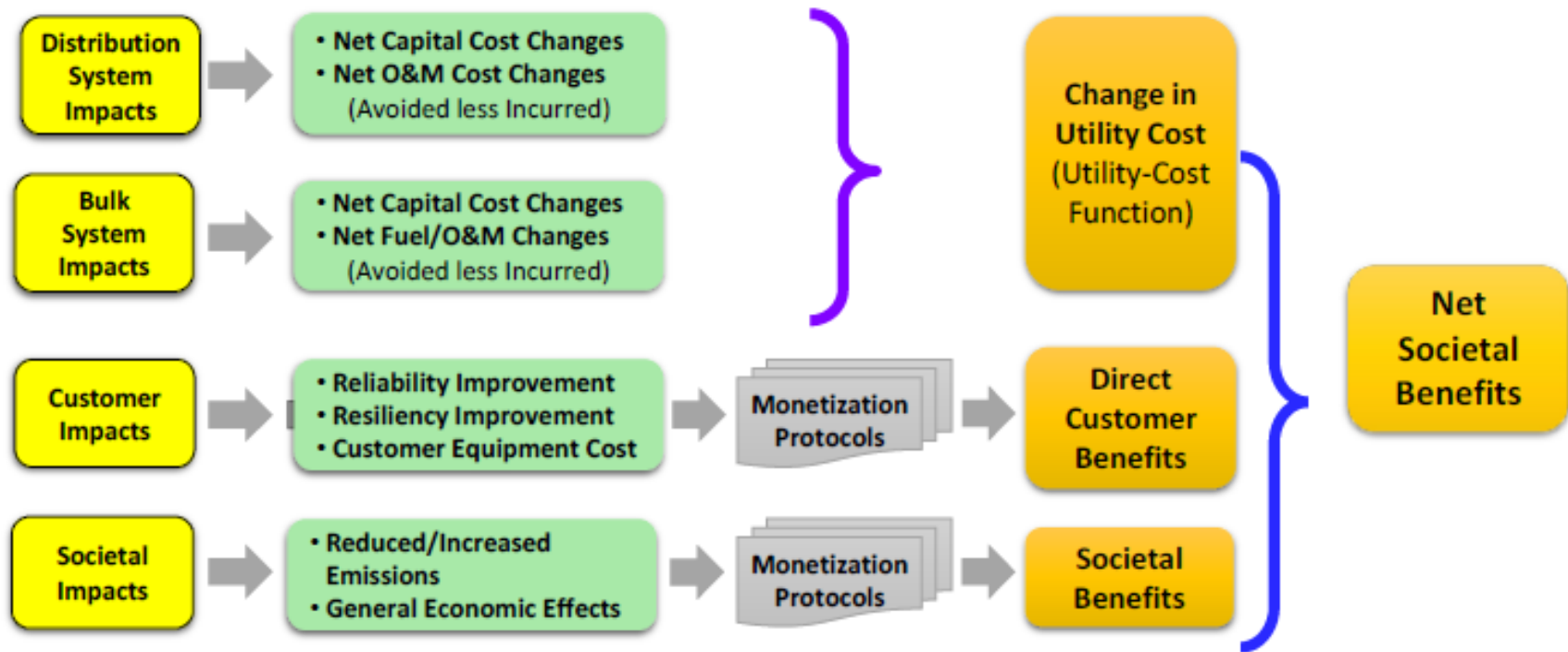
JURISDICTION 5: RVT = TRC



JURISDICTION 6: RVT = SCT



# EPRI: Benefit-Cost Framework for the Integrated Grid



Source: Electric Power Research Institute, *The Integrated Grid: A Benefit-Cost Framework*, February 2015, page 9-3.

EPRI report explains the rationale for the utility and societal perspectives.  
No mention of a Total Resource Cost test.  
No mention of lost revenues or a RIM test.



# U.S. Department of Energy: Modern Distribution Grid

DOE divides modern grid expenditures into four types:

1. Expenditures to replace aging infrastructure
  - Apply a least-cost/best-fit approach or the Utility Cost test
2. Expenditures to maintain reliable operations
  - Apply a least-cost/best-fit approach or the Utility Cost test
3. Expenditures to enable public policy or societal benefits
  - Apply the Societal Cost test
4. Expenditures that will be paid for by customers
  - No need to analyze because they do not require regulatory approval

*Source: US Department of Energy, Modern Distributed Grid, Decision Guide, Volume III, June 8, 2017, pages 39-44.*

No mention of a Total Resource Cost test.

No mention of lost revenues or a RIM test.

# New York Reforming Energy Vision (REV) BCA Order

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- The Societal Cost test should be the primary test.
- The Utility Cost test should play a subsidiary role.
- The RIM test should play a subsidiary role.
  - But a more sophisticated rate and bill impact analysis is needed
- The Societal Cost test should include environmental externalities.
  - Based on the EPA Social Cost of Carbon
- Non-energy benefits:
  - Should be monetized on a location-specific or project-specific basis, where possible
  - NEBs that cannot be monetized should be considered on a qualitative basis

# California Trends

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- Regarding energy efficiency cost-effectiveness
  - In 2017 commission staff proposed a partial societal cost test
  - Accounts for the benefits of reducing GHG emissions
  - Reflects aggressive state energy policy goals to reduce GHG emissions
- Regarding grid modernization

In 2017 commission staff proposed several options:

  - Option 1: develop a BCA methodology by individual technology
  - Option 2: develop a BCA methodology for grid modernization
  - Option 3: apply a least-cost/best-fit approach for grid modernization
  - Option 4: assess ratepayer benefits as a sensitivity in IRP optimization

# General Trends in BCA for DERs

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- Increased interest in accounting for policy goals.
- Increased flexibility in choice of tests/perspectives.
- General emphasis on:
  - Utility system impacts
  - Societal impacts
- Less emphasis on:
  - Participant impacts
  - The Rate Impact Measure test
- Lack of consistency
  - Different tests for different DERs
- Increased complexity
  - Especially for optimizing across DERs

# Contact Information

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Synapse Energy Economics is a research and consulting firm specializing in energy, economic, and environmental topics. Since its inception in 1996, Synapse has grown to become a leader in providing rigorous analysis of the electric power and natural gas sectors for public interest and governmental clients.

**Tim Woolf**

Vice-President, Synapse Energy Economics

617-453-7031

[twoolf@synapse-energy.com](mailto:twoolf@synapse-energy.com)

[www.synapse-energy.com](http://www.synapse-energy.com)

# CA Manual: Traditional Tests

Test	Perspective	Key Question Answered	Summary Approach
<b>Utility Cost</b>	The utility system	Will utility system costs be reduced?	Includes the costs and benefits experienced by the utility system
<b>Total Resource Cost</b>	The utility system plus participating customers	Will utility system costs plus program participants' costs be reduced?	Includes the costs and benefits experienced by the utility system, plus costs and benefits to program participants
<b>Societal Cost</b>	Society as a whole	Will total costs to society be reduced?	Includes the costs and benefits experienced by society as a whole
<b>Participant Cost</b>	Customers who participate in an efficiency program	Will program participants' costs be reduced?	Includes the costs and benefits experienced by the customers who participate in the program
<b>Rate Impact Measure</b>	Impact on rates paid by all customers	Will utility rates be reduced?	Includes the costs and benefits that will affect utility rates, including utility system costs and benefits plus lost revenues

# California Manual:

Components of  
the traditional  
tests in the  
California Standard  
Practice Manual

	UCT	TRC Test	SCT	Participant Cost Test	RIM Test
<b>EE Costs:</b>					
Efficiency Program Costs	Yes	Yes	Yes	---	Yes
Efficiency Portfolio Costs	Yes	Yes	Yes	---	Yes
Financial Incentive Provided to Participant	Yes	Yes	Yes	---	Yes
Participant Financial Cost of Efficiency	---	Yes	Yes	Yes	---
Participant Non-Financial Cost of Efficiency	---	Yes	Yes	Yes	---
Participant Increased Resource Consumption	---	Yes	Yes	Yes	---
Societal costs (environmental, health, etc.)	---	---	Yes	---	---
Lost Revenues	---	---	---	---	Yes
<b>EE Benefits:</b>					
Avoided Energy Costs	Yes	Yes	Yes	---	Yes
Avoided Generation Capacity Costs	Yes	Yes	Yes	---	Yes
Avoided T&D Capacity Costs	Yes	Yes	Yes	---	Yes
Avoided T&D Losses	Yes	Yes	Yes	---	Yes
Wholesale Market Price Suppression Effects	Yes	Yes	If applicable	---	Yes
Avoided Environmental Compliance Costs	Yes	Yes	Yes	---	Yes
Avoided RPS Compliance Costs	Yes	Yes	Yes	---	Yes
Avoided Credit and Collection Costs	Yes	Yes	Yes	---	Yes
Participant Resource Savings (fuel, water)	---	Yes	Yes	Yes	---
Participant Non-Resource Benefits	---	Yes	Yes	Yes	---
Reduce Low-income Energy Burden	---	---	Yes	---	---
Environmental Benefits	---	---	Yes	---	---
Jobs and Economic Development Benefits	---	---	Yes	---	---
Societal Health Care Benefits	---	---	Yes	---	---
Increased energy security	---	---	Yes	---	---
Customer Bill Savings	---	---	---	Yes	---