Benefit-Cost Analysis For Investments in the Modern Grid

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

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Overview

• 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.
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

• 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

<table>
<thead>
<tr>
<th>Efficiency as a Resource</th>
<th>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.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Policy Goals</td>
<td>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.</td>
</tr>
<tr>
<td>Hard-to-Quantify Impacts</td>
<td>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.</td>
</tr>
<tr>
<td>Symmetry</td>
<td>Cost-effectiveness practices should be symmetrical, where both costs and benefits are included for each relevant type of impact.</td>
</tr>
<tr>
<td>Forward-Looking Analysis</td>
<td>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.</td>
</tr>
<tr>
<td>Transparency</td>
<td>Cost-effectiveness practices should be completely transparent and should fully document all relevant inputs, assumptions, methodologies, and results.</td>
</tr>
</tbody>
</table>
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
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


No mention of a Total Resource Cost test.
No mention of lost revenues or a RIM test.
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

• 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

• 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
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.

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## CA Manual: Traditional Tests

<table>
<thead>
<tr>
<th>Test</th>
<th>Perspective</th>
<th>Key Question Answered</th>
<th>Summary Approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utility Cost</td>
<td>The utility system</td>
<td>Will utility system costs be reduced?</td>
<td>Includes the costs and benefits experienced by the utility system</td>
</tr>
<tr>
<td>Total Resource Cost</td>
<td>The utility system plus participating customers</td>
<td>Will utility system costs plus program participants’ costs be reduced?</td>
<td>Includes the costs and benefits experienced by the utility system, plus costs and benefits to program participants</td>
</tr>
<tr>
<td>Societal Cost</td>
<td>Society as a whole</td>
<td>Will total costs to society be reduced?</td>
<td>Includes the costs and benefits experienced by society as a whole</td>
</tr>
<tr>
<td>Participant Cost</td>
<td>Customers who participate in an efficiency program</td>
<td>Will program participants’ costs be reduced?</td>
<td>Includes the costs and benefits experienced by the customers who participate in the program</td>
</tr>
<tr>
<td>Rate Impact Measure</td>
<td>Impact on rates paid by all customers</td>
<td>Will utility rates be reduced?</td>
<td>Includes the costs and benefits that will affect utility rates, including utility system costs and benefits plus lost revenues</td>
</tr>
</tbody>
</table>
Components of the traditional tests in the California Standard Practice Manual

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