Cost-Effectiveness of Net Energy Metering:

Building Off of DSM Cost-Effectiveness Practices

Utah NEM Work Group

Meeting #3

June 25

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Outline of Presentation

- Overview of the DSM cost-effectiveness tests.
  - With an emphasis on issues pertaining to NEM
- How the DSM tests could be applied to NEM.
  - The same framework can be used
  - With some different costs and benefits, and
  - With some different assumptions
- How to account for the impacts on non-participants.
  - How to account for the rate impacts.
- The same framework can be applied to other NEM policies.

Overview of DSM Benefit-Cost Analysis:

With an Emphasis on Issues that Affect NEM

DSM Cost-Benefit Analysis Goals

- Primary goal: to identify those DSM resources where the benefits exceed the costs.
  - Also to indicate net benefits to customers
  - Also to inform program design
- A separate but related goal: To assess the rate impacts of DSM
  - In other words, to assess the impact on non-participants
  - In other words, to assess customer equity concerns
- These two goals are frequently conflated.

- These same goals apply to NEM cost-benefit analysis.

Key Concepts

There are two fundamentally different types of costs at issue:

Historical costs.

- Have already been incurred by the utility.
- Are embedded in electricity rates.
- Cannot be avoided.

Future costs.

- Costs associated with supply-side, DSM, DG resources, etc. in the future.
- Can be incurred or avoided.
- Are the focus of resource planning.

Different analyses are needed to assess these two types of costs:

- Rate and Bill Analysis (RBA)
- Benefit-Cost Analysis (BCA)

Standard DSM Screening Tests: Costs

	Participant Test	RIM Test	Utility Test	TRC Test	Societal Test
Program Administrator Costs	---	Yes	Yes	Yes	Yes
EE Measure Cost: Financial Incentive to Participant	---	Yes	Yes	Yes	Yes
EE Measure Cost: Participant Contribution	Yes	---	---	Yes	Yes
Lost Contribution to Fixed Costs (i.e., lost revenues)	---	Yes	---	---	---

Standard DSM Screening Tests: Benefits

	Participant Test	RIM Test	Utility Test	TRC Test	Societal Test
Avoided Energy Costs	---	Yes	Yes	Yes	Yes
Avoided Capacity Costs	---	Yes	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes	Yes
Avoided Line Losses	---	Yes	Yes	Yes	Yes
Wholesale Market Price Suppression Effects	---	Yes	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes	Yes
Avoided Cost of RPS Compliance	---	Yes	Yes	Yes	Yes
Reduced Risk	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (utility perspective)	---	Yes	Yes	Yes	Yes
Non-Energy Benefits (participant perspective)	Yes	---	---	Yes	Yes
Non-Energy Benefits (societal perspective)	---	---	---	---	Yes
Customer Bill Savings	Yes	---	---	---	---
Efficiency Tax Incentives	Yes	---	---	---	---

Implications of the Utility Cost Test

- The Utility Cost test offers the simplest, most direct indication of the ability of energy efficiency to reduce costs and bills.
- It is also most consistent with how supply-side resources are evaluated.
- It does not account for energy policy benefits.
  For example, it does not account for:
  - The benefits of low-income efficiency programs.
  - The benefits of promoting customer equity.
  - The benefits of avoiding lost opportunities.
  - The benefits of maintaining continuity of efficiency programs.
- Used in Utah for screening DSM.

Implications of the Total Resource Cost Test

- The TRC test is often described as measuring the impact on the utility and program participants.

  However:

  - In practice, it does not capture participant non-energy benefits well.
    - Most states ignore or undervalue participant NEBs.
  - In theory, it does not capture participant energy benefits properly.
    - Participants benefit from bill reductions, i.e., avoided prices.
    - But the TRC test uses avoided costs as the benefits.
  - It would be more accurate to say that the TRC test is a "partial societal cost test."
    - It includes total resource costs, but not total resource benefits.
    - This is true even if participant NEBs are included, because societal benefits are excluded by design.

Implications of the Participant Cost Test

- The Participant Cost test is useful for specific purposes:
  - Useful for program design and marketing purposes, as it indicates how likely customers are to participate.
  - Useful “in the field” for providing individual customers with information about which measures to adopt.
- Efficiency programs that pass any of the other tests typically pass the Participant Cost test, with flying colors.
- In other words, DSM program participants are always better off.
  - This has important implications for the value of the TRC test.

Implications of the RIM Test

- The RIM test indicates whether a DSM resource will increase or decrease rates over the long-term.
  - If the BCR>1 rates will go down.
  - If the BCR<1 rates will go up.
- It does not provide much information on rate bill impacts:
  - It does not indicate how much rates will increase by.
  - It does not put rate impacts into a useful context (e.g., percent of bills)
  - It does not provide any information on net costs or benefits of DSM.
- The RIM test is identical to the Utility Cost test, except that it includes lost revenues (lost contribution to fixed costs).
  - The fixed costs that must be recovered through rate increases are embedded in rates, and thus have already been incurred.
  - This additional cost is a historical, “sunk” cost.

Concerns About Using the RIM Test

- The RIM test is not appropriate for making future resource decisions, because it includes sunk costs.
  - Basic economic principle: do not use sunk costs in BCA
- The RIM test is misleading because it suggests that DSM increases costs. For example:
  - If the RIM BCR<1
  - Then RIM net benefits are negative (e.g., -50 million dollars)
  - This suggests that future costs will go up, but they will not.
- The RIM test does not provide information needed.
  - How much will rates go up by?
- The RIM test can result in perverse outcomes.
  - Utilities may forgo large cost reductions for *de minimis* rate impacts

A Better Approach to Rate Impact Assessment

- **The rate impact analysis must be separate from the BCA**.
- A thorough understanding of rate impacts requires a comprehensive analysis of three important factors:
  - **Rate impacts**, to indicate the extent to which rates will change for all customers.
  - **Bill impacts**, to indicate the extent to which customer bills will be reduced for DSM participants.
  - **Participation levels**, to indicate the portion of customers that will experience bill reductions.
- Taken together, these three factors indicate the extent to which customers will benefit from energy efficiency resources.
- Participation impacts are also key to understanding whether customers are being underserved.
  - So that programs can be designed to serve them.

Cross-Subsidization in Perspective

- The fundamental concern about rate impacts is based on customer equity and cross-subsidization.
- Cross subsidization occurs in many ways in the electricity industry:
  - **New power plants**: All customers pay for the costs of new power plants; even customers that do not cause load growth.
  - **New transmission lines**: All customers pay for new transmission lines; even though some may be in areas not served by those lines.
  - **New distribution systems:** All customers pay for new distribution lines; even though some impose more costs than others, e.g.,
    - Urban versus suburban versus rural customers
    - A new residential subdivision
    - A new industrial park
  - **Rate designs**: Flat rates result in some customers paying more/less than the costs they impose on the system.

What Can be Done About Cross-Subsidization?

- It is not possible to eliminate all cross-subsidization.
- It is not desirable to plan for resources in a way that results in no cross-subsidization at all:
  - This can lead to perverse outcomes
- Utilities and regulators must balance the goals of:
  - Providing low-cost, reliable service and
  - Mitigating customer inequity
- Achieving this balance requires a thorough understanding of:
  - The impacts on costs, and
  - The impacts on rates and bills

DSM Benefit-Cost Analysis Concepts:

As Applied to NEM

NEM Cost-Effectiveness Test: Costs

	Participant Test	Utility Test	TRC Test	Societal Test
Program Administrator Costs	---	Yes	Yes	Yes
PV Installed Cost: Utility Contribution	---	Yes (0)	Yes (0)	Yes (0)
PV Installed Cost: Customer Contribution	Yes	---	Yes	Yes
System Integration Costs*	---	Yes	Yes	Yes
Customer NEM Credits*	---	Yes	Yes	Yes

*Indicates a cost that is relevant for NEM but not for DSM

NEM Cost-Effectiveness Test: Benefits

	Participant Test	Utility Test	TRC Test	Societal Test
Avoided Energy Costs	---	Yes	Yes	Yes
Avoided Capacity Costs	---	Yes	Yes	Yes
Avoided Transmission and Distribution Costs	---	Yes	Yes	Yes
Avoided Line Losses	---	Yes	Yes	Yes
Wholesale Market Price Suppression Effects	---	Yes	Yes	Yes
Avoided Cost of Environmental Compliance	---	Yes	Yes	Yes
Avoided Cost of RPS Compliance	---	Yes	Yes	Yes
Reduced Risk	---	Yes	Yes	Yes
Grid Support*	---	Yes	Yes	Yes
Non-Energy Benefits (utility perspective)	---	Yes	Yes	Yes
Non-Energy Benefits (participant perspective)	Yes	---	Yes	Yes
DG/Renewable Energy Tax Incentives	Yes	---	Yes	---
Customer Bill Savings (retail rate)	Yes	---	---	---
Customer NEM Credits*	Yes	---	---	---
Renewable Energy Credit Revenues*	Yes	---	---	---

*Indicates a benefit that is relevant for NEM but not for DSM

Rate and Bill Impact Analyses for NEM

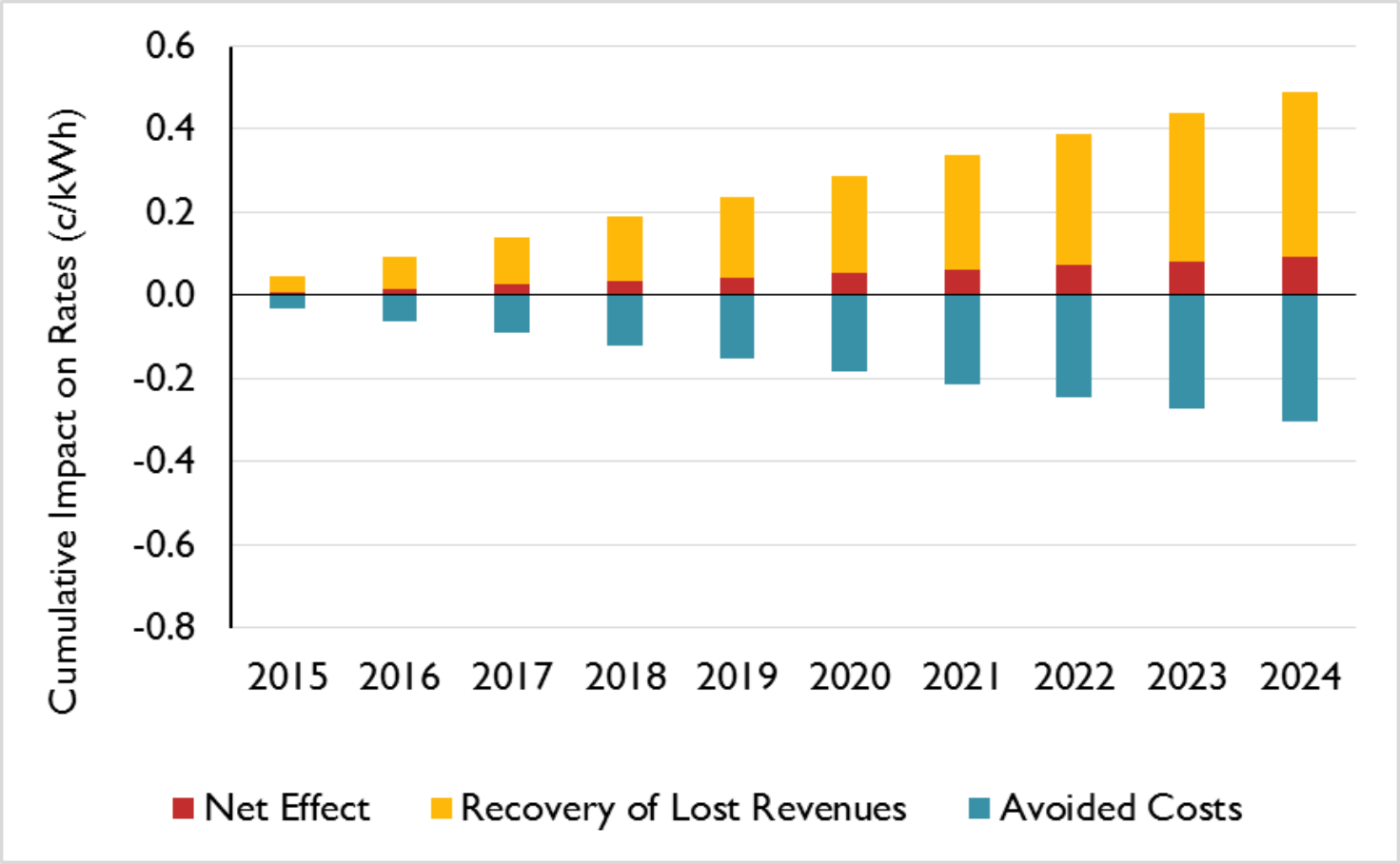
- Study period: long enough to include savings (e.g. 20-30 years).
- Start with current rates, by customer class.
- Develop a Reference Case:
  - Forecast rates, costs and sales through study period
- Develop a NEM Case:
  - Estimate energy savings from DG PV
  - Estimate change in sales from DG PV
  - Estimate impacts of avoided costs from DG PV
  - Estimate impacts of lost contribution to fixed costs from DG PV
  - Develop new forecast of rates
- Compare rates in both cases.
  - In terms of percent of bills, dollars per customer, or ¢/kWh.

Illustrative Estimate – Input Assumptions

KEY DG PV ASSUMPTIONS:	
DG PV Unit capacity (kW)	5
DG PV Unit capacity factor (%)	18%
DG PV Unit generation (MWh)	7,884
DG PV added per year (percent of customers)	0.5%
Number of years DG PV added	10
DG PV penetration after 10 years (percent of customers)	5.0%
OTHER RELVANT ASSUMPTIONS:	
Current Residential Energy Rate (c/kWh)	10.03
Levelized Avoided Costs (c/kwh) [low]	8.0
Levelized Avoided Costs (c/kWh) [high]	14.0

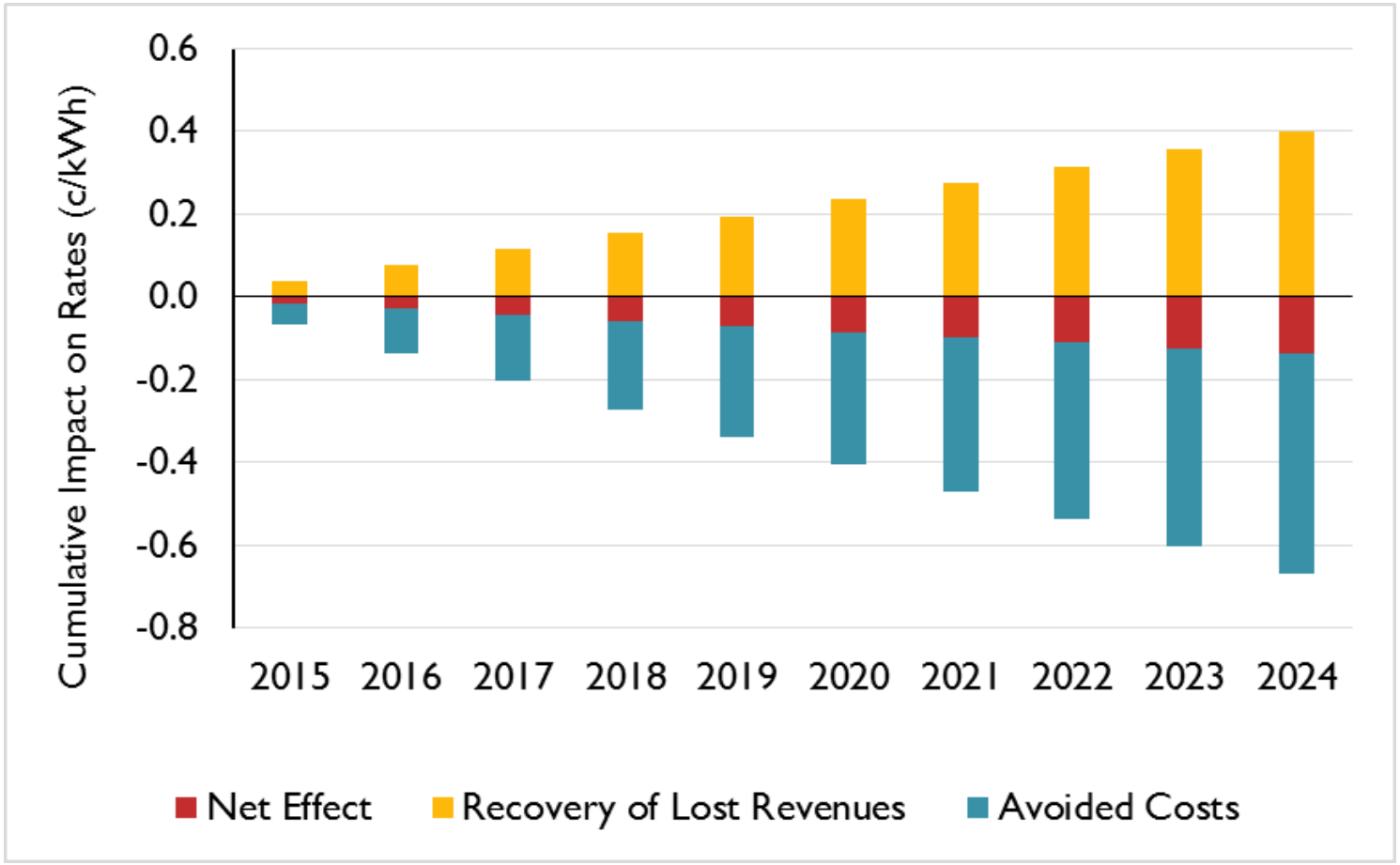
Illustrative Results (Low Avoided Costs)

Residential sector only.
Impacts of avoided costs nearly balance out the impacts of lost revenue recovery.



Illustrative Results (High Avoided Costs)

Residential sector only.
Impacts of avoided costs nearly balance out the impacts of lost revenue recovery.



Balancing Cost Impacts and Rate Impacts

What are the cost impacts?

- Using the results of the benefit-cost analysis
- Net benefits, in terms of PVRR

What are the rate impacts?

- Using the results of the rate impact analysis
- Rate impacts:
  - In terms of percentage increase in rates, or
  - In terms of ¢/kWh increase in rates

Are cost impacts (net benefits PVRR) sufficient to justify the rate impacts (percent increase in rates)?

The framework described here (cost impacts vs. rate impacts) can be applied to other NEM designs, or to other rate designs.

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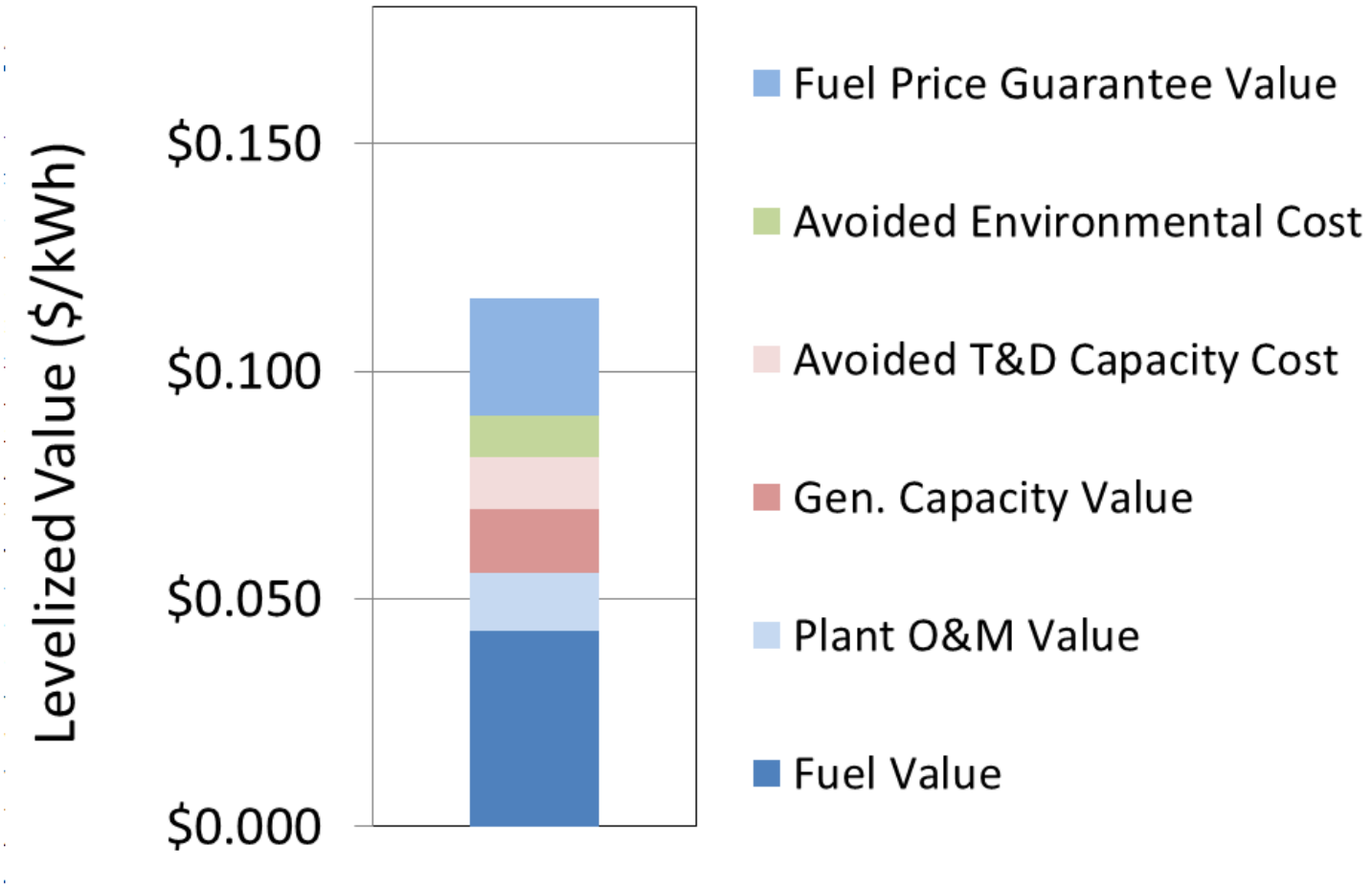
Appendix

Appendix

Illustrative Avoided Costs – From CPR Study



Getting the Discount Rates Correct:

How Much are Future Benefits Worth?

Conventional Wisdom on EE Discount Rates

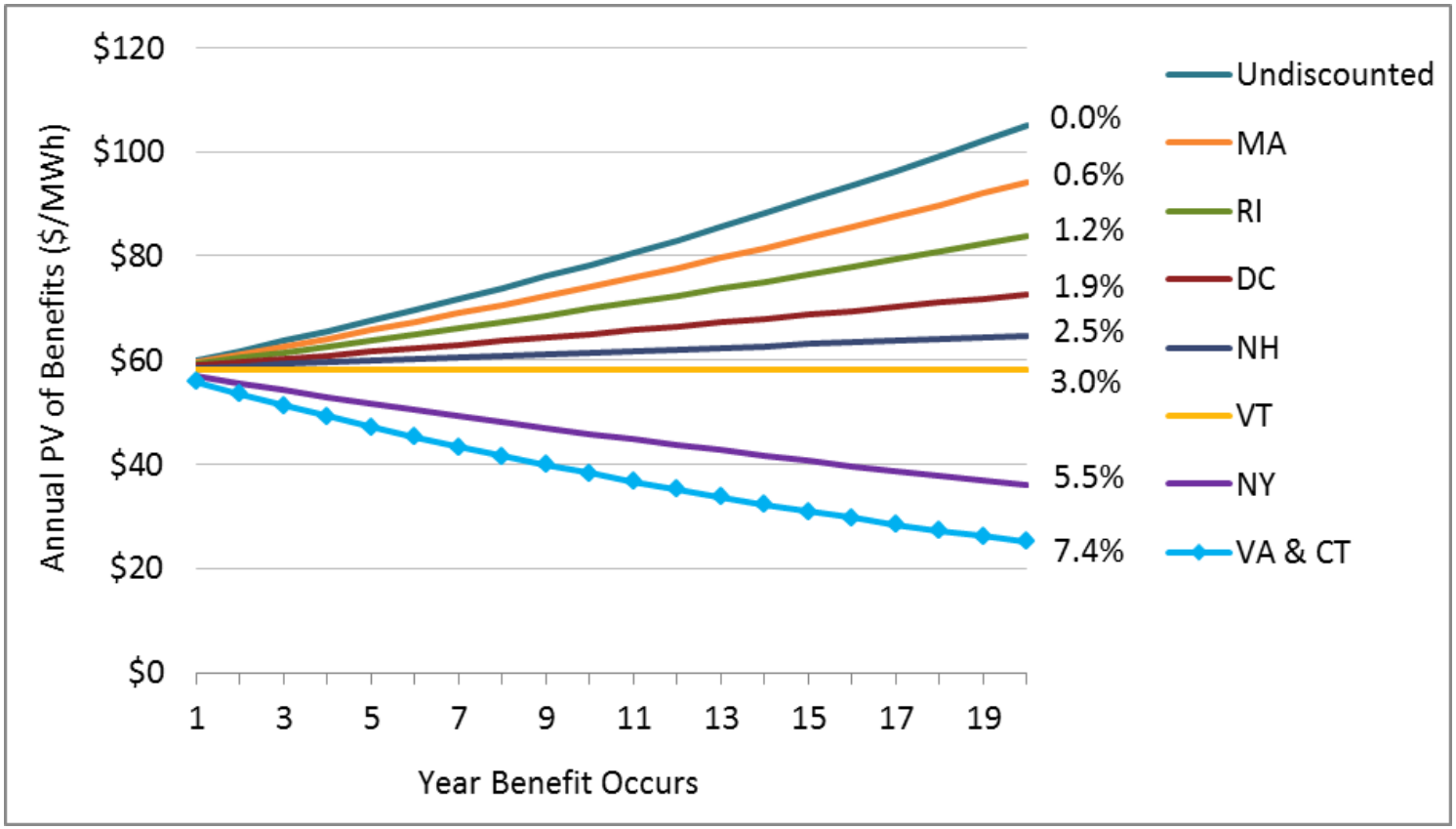
- Total Resource Cost Test:
  - Utility Weighted Average Cost of Capital
- Utility Cost Test:
  - Utility Weighted Average Cost of Capital
- Ratepayer Impact Measure Test:
  - Utility Weighted Average Cost of Capital
- Participant Test:
  - Participant Discount Rate (wide range)
- Societal Cost Test:
  - Societal Discount Rate

See, for example, NAPEE, November 2008.

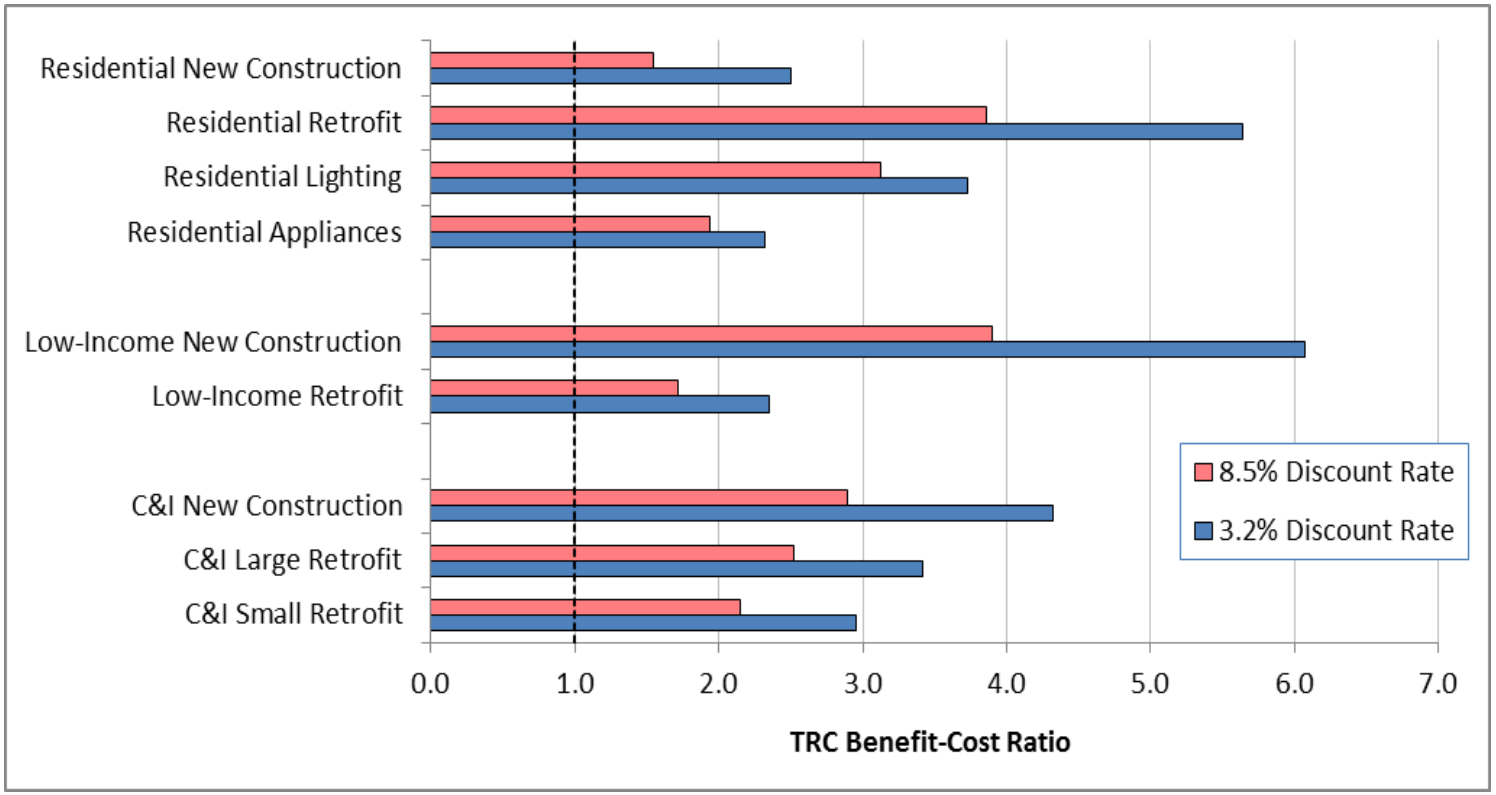
EE Discount Rates from Select States

	Primary Test							
	UCT	Total Resource Cost Test					Societal Cost Test	
	CT	NY	NH	RI	MA	DE	VT	DC
Basis for Discount Rate	Utility WACC	Utility WACC	Prime Rate	Low-Risk 10 yr Treasury	Low-Risk 10 yr Treasury	Societal Treasury Rate	Societal	Societal 10 yr Treasury
Current Discount Rate (Real)	7.43%	5.50%	2.46%	1.15%	0.55%	TBD	3.00%	1.87%

Implications of Discount Rate Assumptions



Impacts of Discount Rates on Cost-Effectiveness



Discount Rate - Concepts

- The discount rate should reflect the appropriate "time preference."
  - i.e., the relative importance of short- versus long-term benefits.
- The purpose of the benefit-cost analysis is to identify those resources that meet a set of regulatory goals:
  - Reduced costs, maintaining reliability, increased system efficiency, mitigating risks, reducing carbon emissions.
- The discount rate chosen must reflect a time preference that is consistent with these regulatory goals.
  - Otherwise, the BCA will not lead to resources that meet these goals.
- The discount rate chosen must reflect a time preference that is relevant to all utility customers as a whole:
  - Not the utility investors' time preference.
  - Not any one customer's time preference.
  - Should be a time preference determined by regulators, i.e., what is in the public interest?

Discount Rates – Recommendations

- The utility weighted average cost of capital should not be used to set the discount rate for energy efficiency screening.
  - The utility investors' time preference is different than the time preference relevant for choosing new electricity resources.
- Risk benefits should be considered in choosing a discount rate.
  - Efficiency is a low-risk resource, relative to supply-side resources.
  - Efficiency also helps to reduce risk through portfolio diversity.
  - There is no financial risk (i.e., the cost of capital is very low).
- A low-risk discount rate be used for efficiency screening.
  - Based on 10-year US Treasury Bills.
  - Tends to range from 1% to 3%, real.
- The low-risk discount rate should be used for all of the screening tests.
- A participant discount rate can be used for the Participant Cost test.

The Resource Value Framework:

The State of the Art on Energy Efficiency Cost-Effectiveness?

The California Standard Practice Manual

- The CA Standard Practice Manual is inadequate for today's needs:
  - Energy policy goals are explicitly not addressed.
    - Despite a clear statement that policy goals are important (see p. 7.)
  - Non-energy benefits are explicitly not addressed.
  - The difference between the TRC and Societal tests is not well defined.
  - The RIM test does not provide useful information for screening.
- Many states deviate from the Standard Practice Manual:
  - Including California.
- Bottom Line:
  - States should not be confined by the standard tests in the CA Manual.
  - States should apply the tests thoughtfully:
    - Consider the implications of each test.

The Resource Value Framework

1. Developed through the National Efficiency Screening Project.
2. Builds off of the existing screening tests; but is not confined to any one of them.
3. Allows flexibility for each state to determine an efficiency screening test that best meets its goals and interests.
   - But requires states to adhere to key principles.
4. Clarifies the objective of efficiency screening: to identify resources that are in the public interest.
5. The framework is "policy neutral."
   - Each state should apply its own policies to the framework.
   - It is designed to be relevant nation-wide.

- It is still a work-in-progress.
  - See nhpci.org/caimpaigns.html for more information.

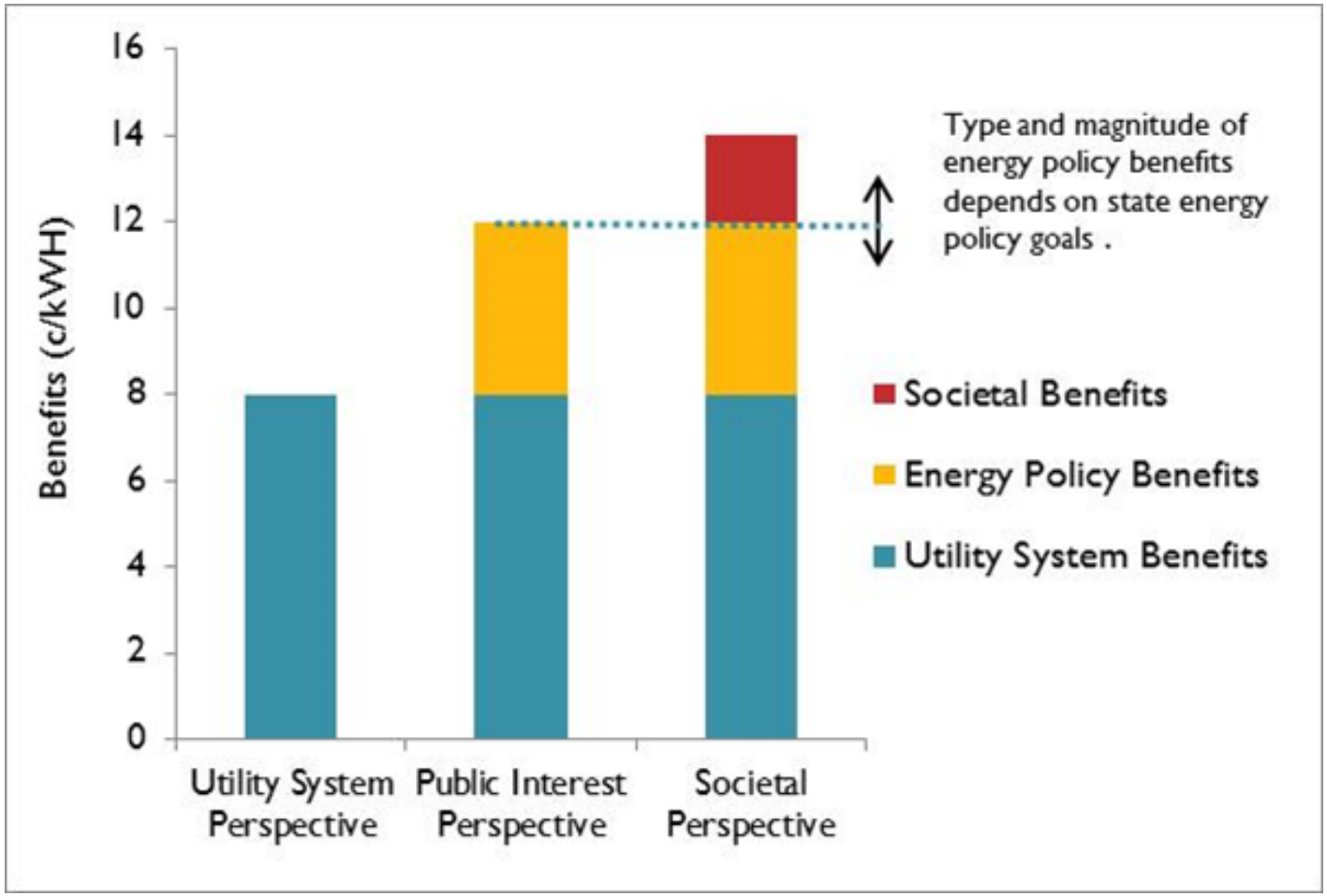
Key Principles of the RVF

- The Public Interest. The ultimate objective of efficiency screening is to determine whether a particular energy efficiency resource is in the public interest.
- Energy Policy Goals. Efficiency screening practices should account for the energy policy goals of each state, as articulated in legislation, commission orders, regulations, guidelines and other policy directives.
- Symmetry. Efficiency screening practices should ensure that tests are applied symmetrically, where both relevant costs and relevant benefits are included in the screening analysis.
- Hard-to-Quantify Benefits. Efficiency screening practices should not exclude relevant benefits on the grounds that they are difficult to quantify and monetize.
- Transparency. Efficiency program administrators should use a standard template to explicitly identify their state's energy policy goals and to document their assumptions and methodologies.
- Applicability. In general, the Resource Value Framework can be used by regulators in any state to determine if customer-funded energy efficiency resources are cost-effective.

The Importance of Addressing Energy Policy Goals

- Most, maybe all, states have already established energy policy goals that efficiency resources will affect. Examples include:
  - Reduce electricity and gas bills.
  - Assist low-income customers with high energy burdens.
  - Promote customer equity.
  - Reduce environmental impacts. Address climate change.
  - Promote local job growth and economic development.
  - Increase the reliability of electricity and gas systems.
  - Reduce the risks associated with electricity and gas systems.
  - Reduce the consumption of fossil fuels, or imported fuels.
- These goals are articulated in many ways:
  - Statutes; Regulations; Commission Orders; EE Guidelines; EE Standards; and others.
- Many states blindly apply the standard EE screening tests, without recognizing these policy goals. But they are critical in determining whether EE resources are in the public interest.
- These goals evolve over time.
  - Efficiency advocates can work to improve state energy policy goals.
  - Screening practices should account for the most recent policy goals.

The Public Interest vs the Societal Perspective



NESP Members (as of 2014)

National Home Performance Council / Home Performance Coalition. Alliance to Save Energy. American Council for an Energy Efficient Economy. Arkansas Advanced Energy Association. Arkansas Advanced Energy Association. Association for Energy Affordability. Bki. Building Performance Contractors Association. Building Performance Institute Clinton Foundation: Home Energy Affordability Program. Conservation Services Group. Democracy and Regulation. Efficiency First. Energy Federation Inc. Environment America. Environment Northeast. Habitat for Humanity. Home Performance Guild of Oregon. Local Energy Alliance Program. MaGrann Associates. National Home Performance Council / Home Performance Coalition. National Housing Trust. Natural Resources Defense Council. Northeast Energy Efficiency Council. Performance Systems Development. Retrofit Software. Sealed. Sierra Club. Southeast Energy Efficiency Alliance. Southern Environmental Law Center. Truveon Corporation. Wisconsin Energy Center.

Customer Bill Savings and NEM Credits