State of Rhode Island
Division of Public
Utilities & Carriers

October 31, 2018

Luly E. Massaro, Commission Clerk
Rhode Island Public Utilities Commission
89 Jefferson Blvd.
Warwick, RI 02888

RE: Docket 4600 Framework Methodology

Dear Ms. Massaro:

The Division of Public Utilities and Carriers is pleased to circulate for discussion among interested stakeholders the accompanying draft report from the Division's consultant, Synapse Economics, entitled, "The Rhode Island Cost-Effectiveness Framework: Methodologies for Developing Inputs for Distributed Energy Resources".

This draft report is developed in response to the July 31, 2017 Order 22851 of the Public Utilities Commission which requested that the Division undertake a series of ongoing refinements to the Framework developed by stakeholders in Docket 4600.

The Division looks forward to receiving comments on this draft from interested stakeholders and to making additional refinements as a part of an ongoing process to improve evaluation of benefits and costs in Rhode Island's energy system.

Respectfully,

Jonathan Schrag /KLDA

Jonathan Schrag
Deputy Administrator

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The Rhode Island Cost-Effectiveness Framework

Methodologies for Developing Inputs for Distributed Energy Resources

Prepared for the Rhode Island Division of Public Utilities and Carriers

October 29, 2018

DRAFT – FOR REVIEW AND DISCUSSION ONLY

AUTHORS

Tim Woolf
Jenn Kallay
Melissa Whited

Synapse Energy Economics, Inc.

485 Massachusetts Avenue, Suite 2
Cambridge, Massachusetts 02139

617.661.3248 | www.synapse-energy.com

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1. Executive Summary

In Docket 4600 the Rhode Island Public Utility Commission (the Commission) approved a new framework for assessing the cost-effectiveness of electric and gas utility investments in Rhode Island (the Framework). The Framework is designed to create a consistent approach for assessing the costs and benefits of all types of utility investments, particularly investments and programs related to energy efficiency, demand response, distributed generation, distributed storage, electric vehicle infrastructure, and other gird modernization technologies.

This report offers a set of recommendations to help the Commission, National Grid (the Company), and other stakeholders apply the new cost-effectiveness Framework. The goal of this report is to provide clarity, consistency, and transparency in the assumptions, sources, and methodologies used to evaluate future utility investments.

This report offers guidance and recommendations on several important aspects of the framework. In summary, this report

1. Presents the Rhode Island Framework as approved by the Commission. See Appendix A.
2. Identifies which impacts represent costs and which represent benefits. See Table 1.
3. Consolidates several of the overlapping impacts. See Table 1.
4. Presents a simplified version of the Rhode Island Framework, based on the three items above. See Table 2.
5. Recommends sources and methodologies for developing inputs for assessing energy efficiency programs. Much of this is based on what National Grid has already done in the Annual Energy Efficiency Plan for 2019. See Table 3.
6. Recommends sources and methodologies for developing inputs for assessing other types of DERs. See Table 4.
7. Identifies those inputs that require additional analysis before they can be used in the framework. See Tables 4 and 5.
8. Recommends how to prioritize the development of new inputs. See Table 5.
9. Recommends a set of proxy values that can be used to account for some important inputs that are hard to quantify at this time. See Tables 4 and 6.

The recommendations in this report should be considered straw proposals. We hope these proposals promote further dialog among Rhode Island stakeholders, and ultimately lead to a more complete set of methodologies and inputs for conducting cost-effectiveness analyses.

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2. Introduction

Background

Synapse Energy Economics, Inc. has been tasked by the Rhode Island Division of Public Utilities and Carriers (DPUC) to describe the methodologies that should be used to determine inputs to the Rhode Island Cost-Effectiveness Framework (the Framework) that was developed as part of Docket 4600.[1] This report is the first iteration of a working document, which should be updated periodically to reflect new information, sources, and methodologies.

To apply the Framework for modeling purposes, we simplified its structure by consolidating some elements and distinguishing between costs and benefits. In Section 2, we provide an overview of the Framework, and present a consolidated version that we use to structure the rest of this report. In Section 3, we provide tables summarizing next steps, including the recommended methodologies for distributed energy resources (DERs), including demand response, distributed generation, electric vehicles, storage technologies and more.

In Sections 4 and 5 we discuss each of the costs and benefits included in the consolidated Framework. For each cost or benefit, we (a) describe what it is; (b) provide details on the methodology currently used to estimate the cost or benefit for energy efficiency along with any recommendations for improvement; and (c) propose a methodology to develop the cost or benefit for other distributed energy resources (DERs).

Sources

There are several sources that we reference regularly throughout this document. In Attachment 4 of its 2019 Energy Efficiency and System Reliability Procurement Plans, National Grid describes the methodologies and sources for assessing the cost-effectiveness of energy efficiency programs.[2] We draw extensively from this document for methodological descriptions and application to energy efficiency in sections 4 and 5. We then provide additional guidance on how those methodologies should be applied to other types of distributed energy resources.

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[1] Rhode Island Public Utilities Commission, Investigation into the Changing Electric Distribution System and the Modernization of Rates in Light of the Changing Distribution System, Docket No. 4600, Report and Order, July 31, 2017, page 26.

[2] Narragansett Electric Company d/b/a National Grid, *Annual Energy Efficiency Plan for 2019*, Settlement of the Parties, Attachment 4, Docket No. 4888.

We also take advantage of methodological descriptions from the 2018 New England Avoided Energy Supply Cost (AESC) study.[3] This study was prepared by all the electric and gas energy efficiency program administrators in New England, under the guidance of stakeholders from all six states.

In addition, the National Standard Practice Manual[4] provides useful descriptions for several of the costs and benefits in the Framework. It also provides some useful principles regarding cost-effectiveness methodologies.

Further Analysis

Additional analyses, beyond the scope of this report, will be required to develop methodologies for several of the inputs to the Framework. We identify where this is the case and note instances where a specific impact is expected to have a substantial cost or benefit.

In a few cases where specific quantitative inputs are not available, we recommend using proxies as an initial approximation of the likely impact. While proxies are less desirable than specific quantitative estimates, they are nonetheless useful for those impacts that are expected to have a significant effect on the cost-effectiveness results.[5] In other words, using an approximation for an impact is preferable to assuming that the impact does not exist or has no value.[6] The proxies recommended here should be viewed as straw proposals, to begin a discussion in Rhode Island regarding (a) whether different proxy values should be used, and (b) whether studies should be undertaken to determine a more specific, quantitative value.

There are several places throughout this report where we recommend that National Grid develop or propose a methodology or a specific input. National Grid is the logical entity for this because it has the expertise, the resources, and the need for the information. We expect that any proposal or recommendations from National Grid will be subject to input and review by Rhode Island stakeholders, especially the Public Service Commission, the DPUC, and the Office of Energy Resources.

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3 The most recent study is *Avoided Energy Supply Costs in New England: 2018 Report*, prepared for the Avoided-Energy-Supply-Component (AESC) Study Group, Synapse Energy Economics, Resource Insight, Les Deman Consulting, North Side Energy, and Sustainable Energy Advantage. originally released March 30, 2018, amended June 1, 2018, and re-released October 24, 2018. (AESC 2018) Available at: http://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf

4 *National Standard Practice Manual for Assessing Cost-Effectiveness of Energy Efficiency Resources*, prepared by the National Efficiency Screening Project, May 18, 2017, available at: https://nationalefficiencyscreening.org/wp-content/uploads/2017/05/NSPM_May-2017_final.pdf

5 For a useful summary of proxies and other methodologies used to account for hard-to-quantify impacts, see: Northeast Energy Efficiency Partnership, *Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond*, June 2017.

6 National Standard Practice Manual, pp. 11-12.

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3. The Rhode Island Cost-Effectiveness Framework

The original Rhode Island Framework approved by the Commission in Docket 4600 is presented in Appendix A. In order to apply the Framework for modeling purposes, we recommend simplifying the structure of the Framework, in three ways.

First, the costs and benefits of the original Framework included impacts that were either costs, or benefits, or both. For the purpose of modeling, the impacts need to be identified as either costs or benefits. For each impact in the Framework, i.e., each row, we have identified whether it is a cost, a benefit, or both. The consolidated Framework presents all the costs separately from all the benefits.

Second, there are many impacts in the original Framework that overlap with each other. For example, in the original Framework there is five different rows related to distribution system impacts. In the consolidated Framework these are grouped into distribution system benefits and distribution system costs. These two rows of distribution impacts are intended to include all the distribution impacts from the original Framework, to the extent that the information is relevant and available.

Third, there are several impacts that can be both a cost and a benefit, but are most efficiently modeled as a net effect, i.e., counting the cost and benefit as one input. For example, job and economic development studies typically present the *net* job and economic impact of energy efficiency, which includes both job gains and job losses. These impacts are best modeled as a single input.

There are other impacts that can be a benefit for one type of DER and a cost for another. For example, energy efficiency resources will reduce electricity consumption leading to reduced energy costs, whereas distributed storage resources might increase electricity consumption leading to increased energy costs. For simplicity, we define an impact as a cost or a benefit on the basis of how it is most frequently applied, e.g., reduced energy costs are more frequently a DER benefit than a cost.

Table 1 identifies how each row of the original Framework was characterized as a cost or a benefit and consolidated with other rows. For each of the rows in the original Framework, we (a) identified whether the row was a cost, a benefit, or both, and (b) consolidated several costs and benefits where applicable. Table 2 presents the results of the consolidation.

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Table 1: Rhode Island Cost-Effectiveness Framework

Level	Mixed Cost or Benefit Category from Original Framework	Description of Benefits Versus Costs
Power Sector	Energy Supply & Transmission Operating Value of Energy Provided or Saved (Time- & Location-specific LMP)	Benefit: Reduced Energy Costs
	Renewable Energy Credit Cost / Value	Benefit: Reduced REC Costs
	Retail Supplier Risk Premium	Benefit: Reduced Energy Costs
	Forward Commitment: Capacity Value	Benefit: Reduced Generation Capacity Costs
	Forward Commitment: Avoided Ancillary Services Value	Benefit: Reduced Ancillary Services Costs
	Utility / Third Party Developer Renewable Energy, Efficiency, or DER costs	Cost: Utility Administration and Measure Costs Cost: Third Party Developer Costs
	Electric Transmission Capacity Costs / Value	Benefit: Reduced Transmission Costs
	Electric transmission infrastructure costs for Site Specific Resources	Cost: Increased Transmission Costs
	Net risk benefits to utility system operations (generation, transmission, distribution) from DER flexibility and diversity.	Benefit: Reduced Risk
	Option value of individual resources	Benefit: Reduced Risk
	Investment under Uncertainty: Real Options Cost / Value	Benefit: Reduced Risk
	Energy Demand Reduction Induced Price Effect	Benefit: Wholesale Market Price Suppression Effect
	Greenhouse gas (GHG) compliance costs	Benefit: Reduced GHG Compliance Costs
	Criteria air pollutant and other envt'l compliance costs	Benefit: Reduced Environmental Compliance Costs
	Innovation and Learning by Doing	Benefit: Innovation and Market Transformation
	Distribution capacity costs	Benefit: Reduced Distribution Costs Cost: Increased Distribution Costs
	Distribution delivery costs	Benefit: Reduced Distribution Costs Cost: Increased Distribution Costs
	Distribution system performance	Benefit: Reduced Distribution Costs Cost: Increased Distribution Costs
	Utility low income	Benefit: Utility Non-Energy Benefits
	Distribution system and customer reliability / resilience impacts	Benefit: Reduced Distribution Costs Cost: Increased Distribution Costs
	Distribution system safety loss/gain	Benefit: Reduced Distribution Costs Cost: Increased Distribution Costs
Customer	Program participant / prosumer benefits / costs	Cost: Participant Measure Costs Cost: Participant Non-Energy Costs Benefit: Participant Non-Energy Benefits
	Participant non-energy costs/benefits: Oil, Gas, Water, Waste Water	Cost: Increased Water and Other Fuel Use Benefit: Reduced Water and Other Fuel Use
	Low-Income Participant Benefits	Benefit: Low-Income Participant Non-Energy Benefits
	Consumer Empowerment & Choice	Benefit: Customer Empowerment
	Non-participant (equity) rate and bill impacts	Not an input to the cost-effectiveness analysis.
Societal	Greenhouse gas externality costs	Benefit: Reduced GHG Impacts
	Criteria air pollutant and other envt'l externality costs	Benefit: Reduced Environmental Impacts (non-GHG)
	Conservation and community benefits	Benefit: Reduced Environmental Impacts (non-GHG)
	Non-energy costs/benefits: Economic Development	Benefit: Economic Development Impacts
	Innovation and knowledge spillover (Related to demonstration projects and other RD&D)	Benefit: Innovation and Market Transformation (included in the Power Sector)
	Societal Low-Income Impacts	Benefit: Societal Low-Income Benefits
	Public Health	Benefit: Public Health Benefits
	National Security and US international influence	Benefit: Energy Security Benefits

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Table 2. The Simplified Cost-Effectiveness Framework

Level of Impact	Cost or Benefit
Costs	
Power Sector	Utility Administration Costs
	Utility Measure Costs
	Utility Shareholder Incentives
	Increased Transmission Costs
	Increased Distribution Costs
Customer	Participant Measure Costs
	Participant Non-Energy Costs
Societal	Third Party Developer Costs
	(Other costs included in net societal benefits)
Benefits	
Power Sector	Reduced Energy Costs
	Reduced Generation Capacity Costs
	Reduced Transmission Costs
	Reduced Distribution Costs
	Reduced Ancillary Services Costs
	Wholesale Market Price Suppression Effect
	Reduced REC Costs
	Reduced GHG Compliance Costs
	Reduced Environmental Compliance Costs
	Reduced Risk
	Utility Non-Energy Benefits
	Innovation and Market Transformation
Customer	Participant Water and Other Fuels Impacts
	Participant Non-Energy Benefits
	Low-Income Participant Non-Energy Benefits
	Customer Empowerment
Societal	Reduced GHG Emissions
	Reduced Environmental Impacts
	Economic Development Impacts
	Societal Low-Income Benefits
	Public Health Benefits
	Energy Security Benefits

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4. Summary of Methodologies and Sources

The tables below summarize the recommended methodologies for developing inputs for energy efficiency and other DERs.

Table 3 focuses on energy efficiency. Many of the recommended methodologies for energy efficiency are currently applied in practice and rely heavily upon the 2018 AESC Study, some require updates to current practice, and a few are not yet developed.

Table 4 focuses on the methodologies for developing inputs for other types of DERs. Some of the recommended methodologies for other types of DERs can be developed using information that is currently available. For example, the 2018 AESC Study provides avoided costs on an hourly basis, so that they can be applied to the hourly load profiles of different types of DERs.

Other methodologies are not yet developed. As an example, distribution system impacts from other types of DERs, both increased and reduced distribution costs, are one of the more important and challenging impacts that remain to be developed. Ideally, the distribution system costs and benefits would reflect the DER locational values and the DER temporal values. We recommend that developing methodologies to estimate distribution system costs and benefits be given a high priority.

Table 5 summarizes the sources and methodologies that are not yet developed for either energy efficiency or other types of DERs. It also presents our recommended priority levels for developing the remaining methodologies, as well as the rationale for the prioritization. For each cost or benefit we estimate whether it is likely to have a low, medium, or high magnitude; as well as whether it is likely to be easy, medium, or hard to estimate a monetary value. Our recommendations for priorities are based on these estimates. Our recommended priorities are as follows:

- High priorities: utility costs (other DERs); distribution costs (other DERs); locational distribution benefits (all DERs); temporal distribution benefits (all DERs).
- Medium priorities: participant non-energy costs (all DERs); economic development impacts (all DERs); societal low-income benefits (all DERs); public health benefits (all DERs).
- Low priorities: transmission costs (other DERs); ancillary service benefits (all DERs); customer empowerment benefits (all DERs).

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Table 3. Summary of Methodologies and Sources for Energy Efficiency Inputs

Level of Impact	Cost or Benefit	Methodology/Source For Energy Efficiency
Costs		
Power Sector	Utility Administration Costs	Currently applied. From National Grid (NG).
	Utility Measure Costs	Currently applied. From NG.
	Utility Shareholder Incentives	Currently applied. From NG.
	Increased Transmission Costs	Not applicable.
	Increased Distribution Costs	Not applicable.
Customer	Participant Measure Costs	Currently applied. From NG.
	Participant Non-Energy Costs	Not applicable.
Societal	Third Party Developer Costs	Not applicable.
	(Societal costs included in net societal benefits)	See net benefits below.
Benefits		
Power Sector	Reduced Energy Costs	Currently applied. From AESC.
	Reduced Generation Capacity Costs	Currently applied. From AESC.
	Reduced Transmission Costs	Pooled: Currently applied. From AESC.
		Not pooled: Currently applied. From AESC.
	Reduced Distribution Costs	Currently applied. From AESC.
	Reduced Ancillary Services Costs	Not applied. No longer available in AESC.
	Wholesale Market Price Suppression Effect	Currently applied. From AESC.
	Reduced REC Costs	Currently applied. From AESC.
	Reduced GHG Compliance Costs	Currently applied. Embedded costs from AESC.
	Reduced Environmental Compliance Costs	Currently applied. From AESC.
	Reduced Risk	Fuel price hedge: Currently applied. From LBNL 2002.
		Improved reliability: Currently applied. From AESC.
	Utility Non-Energy Benefits	Currently applied. Various sources and assumptions.
	Innovation and Market Transformation	To be developed (TBD).
Customer	Participant Water and Other Fuels Impacts	Currently applied. From AESC.
	Participant Non-Energy Benefits	Currently applied. Various sources and assumptions.
	Low-Income Participant Non-Energy Benefits	Currently applied. Various sources and assumptions.
	Customer Empowerment	TBD.
Societal	Reduced GHG Emissions	Currently applied. Non-embedded costs from AESC.
	Reduced Environmental Impacts	NO_X: Currently applied. From AESC.
	Economic Development Impacts	TBD.
	Societal Low-Income Benefits	TBD.
	Public Health Benefits	TBD.
	Energy Security Benefits	Currently applied. From MA sources and assumptions.

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Table 4. Summary of Sources and Methodologies for Other Distributed Energy Resource Inputs

Level of Impact	Cost or Benefit	Sources/Methodology For Other DERs
Costs		
Power Sector	Utility Administration Cost	To be developed (TBD).
	Utility Measure Cost	TBD.
	Utility Shareholder Incentive	TBD.
	Increased Transmission Costs	Not applicable for DR. TBD for other DERs.
	Increased Distribution Costs	Not applicable for DR. TBD for other DERs.
Customer	Participant Measure Costs	TBD.
	Participant Non-Energy Costs	TBD.
Societal	Third Party Developer Costs	TBD.
	(Societal costs included in net societal benefits)	See net benefits below.
Benefits		
Power Sector	Reduced Energy Costs	From AESC, using applicable load profiles.
	Reduced Generation Capacity Costs	From AESC, using applicable load profiles.
	Reduced Transmission Costs	Pooled: From AESC.
		Not pooled: From AESC.
	Reduced Distribution Costs	From AESC.
	Reduced Ancillary Services Costs	TBD.
	Wholesale Market Price Suppression Effect	From AESC, using relevant load profiles.
	Reduced REC Costs	From AESC, using relevant load profiles.
	Reduced GHG Compliance Costs	Embedded costs from AESC, using load profiles.
	Reduced Environmental Compliance Costs	From AESC, using relevant load profiles.
	Reduced Risk	Fuel price hedge value: From LBNL 2002.
		Value of improved reliability: From AESC.
	Utility Non-Energy Benefits	Current EE sources and assumptions, as relevant.
	Innovation and Market Transformation	Proxy multipliers by technology.
Customer	Participant Water and Other Fuels Impact	From AESC.
	Participant Non-Energy Benefits	Proxy multiplier for PV and storage.
	Low-Income Participant Non-Energy Benefits	Apply EE LI benefits where warranted.
	Customer Empowerment	TBD.
Societal	Reduced GHG Emissions	Non-embedded costs from AESC.
	Reduced Environmental Impacts	NO_x: From AESC.
	Economic Development Impacts	TBD.
	Societal Low-Income Benefits	TBD.
	Public Health Benefits	TBD.
	Energy Security Benefits	Same as for EE.

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Table 5. Prioritization of Costs or Benefits to Be Developed (TBD)

	Cost or Benefit	Resource Type	Ease to Develop	Potential Magnitude	Priority
Costs					
Power Sector	Utility Administration Cost	DR, DG, EV, Storage	3	1	high
	Utility Measure Cost	DR, DG, EV, Storage	3	2	high
	Utility Shareholder Incentive	DR, DG, EV, Storage	3	1	high
	Increased Transmission Cost	DG, EV	1	2	low
	Increased Distribution Costs	DG, EV	1	3	high
Customer	Participant Non-Energy Costs	all DERs	2	2	med
Benefits					
Power Sector	Reduced Distribution Costs - Locational	all DERs	1	3	high
	Reduced Distribution Costs - Temporal	all DERs	1	3	high
	Reduced Ancillary Service Costs	all DERs	2	1	low
Customer	Customer Empowerment	all DERs	2	1	low
Societal	Economic Development Impacts	all DERs	2	2	med
	Societal Low-Income Benefits	all DERs	2	2	med
	Public Health Benefits	all DERs	2	2	med

For Ease to Develop: 1=hard, 2=medium; 3=easy.
For Potential Magnitude: 1=low; 2=medium; 3=high.

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5. Costs

5.1. Power Sector

Utility Administration Costs

Description

This includes all costs a utility experiences to administer DER programs that are not in the form of rebates or incentives paid directly to customers. These costs can include program planning and design, marketing, technical assistance, costs to conduct evaluation, measurement and verification (EM&V) studies, costs to produce reports to comply with various regulatory requirements, and costs to pay third-party consultants for technical assistance and quality control.

Energy Efficiency

National Grid estimates the energy efficiency administration costs based on historical experience.

The utility breaks out its energy efficiency administration costs into four categories in its energy efficiency annual plans and reports.[7] These categories include: (1) Program Planning and Administration, (2) Marketing, (3) Sales, Technical Assistance and Training, and (4) Evaluation and Market Research. Program Planning and Administration includes payroll, information technology, contract administration, and overhead expenses. Marketing includes the costs of marketing and advertising to promote a program as well as payroll and expenses to manage marketing. Sales, Technical Assistance and Training includes lead intake, customer service, rebate application, quality assurance, technical assessments, engineering studies, plan reviews, payroll and expenses to manage technical assistance, and training and education of the trade ally community.[8] Evaluation and Marketing Research includes the costs of evaluation or market research studies to support program direction, post-installation studies to study program effectiveness or verification of savings estimates, and payroll and expenses to manage the research.[9]

The utility conducts internal modeling to determine its Program Planning and Administration, Marketing, and Sales, Technical Assistance and Training budgets. The annual plans include a list of specific Evaluation and Market Research efforts that will be conducted during the program year. Each effort has a specific budget that is then allocated to the programs addressed by the evaluation. Costs to

[7] National Grid 2019 EE & SRP Plan, Attachment 5, Tables E-2 and G-2.

[8] Examples of trade allies include but are not limited to: equipment vendors, heating contractors, lead vendors, project expediters, weatherization contractors, and equipment installers.

[9] National Grid 2019 EE & SRP Plan, Attachment 4, pages 18 and 19.

comply with regulatory reporting requirements are a component of Program Planning and Administration costs.

Other DERs

Most DERs will have planning and administration costs. Some DERs may also have marketing, technical assistance, evaluation and regulatory costs. We recommend breaking out the costs by the same categories used for energy efficiency. Additional categories can be included, as needed.

We recommend that National Grid develop the administration costs for other types of DERs using its experience with energy efficiency administration and relevant industry information.

Utility Measure Costs

Description

This includes the utility costs to purchase and install DER measures. This can include rebates or incentives a utility provides for the purchase and installation of energy efficient equipment or to pay customers for reducing demand during peak hours. It can also include capital investments a utility makes to purchase and install renewables or batteries.

Energy Efficiency

National Grid develops the utility measure costs based on program designs, the Rhode Island Technical Reference Manual (TRM), and relevant industry information.[10]

The utility represents its energy efficiency measure costs in its energy efficiency annual plans and reports as Rebates and Other Customer Incentives.[11] Energy efficiency measure costs take the form of rebates or incentives. Incentives include, but are not limited to, rebates to customers, copayments to vendors for direct installation of measures, payments to distributors to buy down the cost of their products for sale in retail stores, payments to vendors to create and deliver information, the cost of an education course, or payments to lenders to buy down the interest in a loan.[12]

The utility has a bottom up model of its rebates and incentives for each measure within each program. This model aggregates the incentive costs to the program, sector and portfolio level.

[10] National Grid, *Rhode Island Technical Reference Manual*: For Estimating Savings from Energy Efficiency Programs, 2019 Program Year.

[11] National Grid 2019 EE & SRP Plan, Attachment 5, Tables E-2 and G-2.

[12] National Grid 2019 EE & SRP Plan, Attachment 4, page 19.

Other DERs

Other DERs have measure costs such as capital investments in equipment, installation of equipment and incentives and rebates for equipment or demand reducing efforts. These costs should be included as separate cost category.

We recommend that National Grid develop the utility measure costs for other types of DERs using program designs and relevant industry information.

Utility Shareholder Incentives

Description

This includes any shareholder incentives to utilities for achieving DER goals or for accomplishing specific DER-related actions.

Energy Efficiency

National Grid estimates the utility shareholder incentive based upon the shareholder incentive mechanism and the forecasted efficiency saving. The Company presents the shareholder incentives in its energy efficiency annual plans and reports as Shareholder Incentives.[13]

The utility estimates the shareholder incentive by customer sector using a methodology that is agreed to by stakeholders and documented in its energy efficiency plans.[14] In 2018, the Company can earn a target based-incentive rate equal to 5.0% of the eligible program year spending budget for achieving electric and gas energy savings goals. For electric, the Company's target-based incentive rate is further broken down into energy and demand reduction incentives. The energy portion is 3.5% of the eligible annual spending budget is for achieving MWh savings goals. The demand portion is 1.5% of the annual spending budget for achieving MW savings goals.

Additionally, the incentives are tiered to map to drive actual performance. The incentive mechanism establishes an incentive of 1.25% of the annual spending budget for achieving 75% of the savings goals in a sector. This increases linearly to 5% of the annual spending budget for achieving 100% and increases linearly from that point to 6.25% of the annual spending budget for achieving 125% of the savings goals.[15]

Other DERs

The utility may receive a shareholder incentive for Other DERs and these incentives should be included as separate cost category.

[13] National Grid 2019 EE & SRP Plan, Attachment 5, Tables E-2 and G-2.

[14] National Grid 2019 EE & SRP Plan, Attachment 5, Tables E-9 and G-9.

[15] National Grid 2019 EE & SRP Plan, Section 13, page 42.

We recommend that National Grid estimate the utility shareholder incentives for other types of DERs based upon the DER incentive mechanisms and the forecasted DER savings.

Increased Transmission Costs

Description

This includes any transmission costs that might be increased by DERs.

Energy Efficiency

Energy Efficiency does not increase transmission costs, and this is not currently included in cost-effectiveness models.

Other DERs

We do not expect other DERs to increase transmission costs.

Increased Distribution Costs

Description

This includes any distribution costs that might be increased by DERs.

Energy Efficiency

Energy efficiency does not increase distribution costs, and this is not currently included in cost-effectiveness models.

Other DERs

Some DERs might increase distribution costs, depending upon where they are installed and the ability of the local distribution system to support them. This is especially true for distributed generation and electric vehicles and their charging stations. Estimates for these costs might need to be developed on a case-by-case basis by National Grid.

We recommend that National Grid investigate the potential for all types of DERs to increase distribution system costs, using relevant industry information and its own experience operating and planning for DERs.[16]

[16] Hawaii has conducted many analyses of the increased distribution costs needed to support the high level of distributed generation there. California routinely tracks distribution upgrade costs when customers interconnect EVs to the system, considering factors such as voltage drop and flicker on the service and diversity of load on the local distribution system feeder.

5.2. Participant

Participant Measure Costs

Description

This includes all the costs that a DER program participant might incur for installing and operating a DER. For those programs that provide financial incentives, or rebates, for the upfront costs of installing DERs, the participant costs are the remainder of the total installation cost.[17]

Energy Efficiency

National Grid estimates participant measure cost using the TRM and relevant industry information. The utility represents the costs participating customers pay to implement energy efficiency measures in its annual energy efficiency plans as Customer Contributions.[18]

The utility has a bottom-up model of the estimated customer contribution for each measure within each program. This model aggregates the customer contributions to the program, sector and portfolio level.

Other DERs

Other DERs can have participant costs such as capital investments in equipment and installation of equipment. These costs should be included as separate cost category.

We recommend that National Grid estimate participant measure costs for other types of DERs using relevant industry information.

Participant Non-Energy Costs

Description

This can include increased disposal costs, costs associated with reduced productivity or comfort, transaction costs, and costs associated with the need hire more employees or utilize more costly employees with more specialized or technical skills to maintain or operate equipment.

Energy Efficiency

National Grid assumes that the current energy efficient measures do not increase non-energy costs for participants, therefore these costs are not currently estimated.

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[17] Low-income energy efficiency programs are designed to cover all the installation costs, thus there are no participant costs for these programs.

[18] National Grid 2019 EE & SRP Plan, Attachment 5, Tables E-5 and G-5.

Other DERs

Participants in other DERs may experience non-energy costs. For example, demand response participants may experience lost productivity and comfort during a demand response event.

We recommend that National Grid estimate these costs using relevant industry information.

5.3. Societal

Third Party Developer Costs

Description

This includes any costs incurred by third-parties in developing DERs. It should include all types of costs necessary to develop DERs, such as capital, labor, O&M, administration, marketing, measure costs, and costs of capital.

It is important to ensure that these costs are not double-counted with the power sector utility costs. For example, if a third-party vendor provides energy efficiency services to a utility for a fee, then it should be assumed that that fee covers all the third-party developer costs. As another example, if a third-party developer provides distributed generation services to a utility through a purchased power agreement, then it should be assumed that that agreement covers all the third-party developer's costs.

It is also important to ensure that these costs are not double-counted with participant costs. For example, if a third-party developer leases a distributed generation resource directly to a customer, then it should be assumed that the lease arrangement covers all the third-party developer's costs.

Energy Efficiency

These costs are not relevant to National Grid's energy efficiency programs, because all third-party costs are accounted for as part of the utility costs. However, these costs might be relevant for other types of efficiency programs, such as shared savings programs offered directly to customers by energy service companies.

Other DERs

These costs might be relevant to other types of DERs, depending upon the type of resource and the type of market-based offerings provided by third-party developers. We recommend that National Grid develop estimates for these costs, once it becomes more clear whether and how third-parties will be engaged in other DERs.

Other Societal Costs

We recommend that other societal costs associated with DERs be combined with the societal benefits, to determine net societal impacts. For example, environmental costs created by DERs should be subtracted from the environmental benefits, to provide a net impact. As another example, job and economic development impacts should include the net impacts. See Section 5.3 for methodologies for estimating societal costs and benefits.

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6. Benefits

6.1. Power Sector

Reduced Energy Costs

Description

This includes the energy avoided by the energy saved or generated by the DER. These benefits are represented by the energy prices from the New England wholesale energy market. Ideally, these should reflect the values for time periods (e.g., hourly, monthly, seasonal) when the resource is saving or generating energy.

For those DERs that sometimes cause increases in energy consumption (e.g., load shifting, storage, electric vehicles), the net energy impact should be accounted for. In the short-term, these net energy impacts should be applied to hourly energy market prices. Ideally, over time, they should be applied to sub-hourly prices.

Energy Efficiency

Electric energy savings are valued using the avoided electric energy costs developed in the 2018 AESC Study. The values in the AESC Study represent wholesale electric energy commodity costs that are avoided when generators produce less electricity because of energy efficiency. They include pool transmission losses incurred from the generator to the point of delivery to the distribution companies, the costs of environmental regulations that impose a price on traditional generators, including RGGI and regulations promulgated by Massachusetts Department of Environmental Protection (310 CMR 7.74 and 310 CMR 7.75), and a wholesale risk premium that captures market risk factors typically recovered by generators in their pricing. the avoided energy costs in the 2018 AESC Study are provided in four different costing periods consistent with ISO-NE definitions: winter peak, winter off-peak, summer peak, and summer off-peak as well as hourly.

Energy savings are grossed up using factors that represent transmission and distribution losses.[19]

Other DERs

The AESC Study energy price forecasts for the New England wholesale energy market should be used to reflect the electric energy benefits for all types of DERs. However, DERs can have very different operating profiles, and the avoided energy costs should reflect the hours in which the DER operated as closely as possible.

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[19] AESC 2018. Chapter 6: Avoided Energy Costs, starting on page 109.

Therefore, for each type of DER modeled, a representative hourly operating profile should be developed. That operating profile should be then be applied to the wholesale energy market prices in the corresponding hours, to determine the avoided energy costs for those hours.

Reduced Generation Capacity Costs

Description

This includes the generation capacity avoided by the demand reduction from the DER.

These benefits are represented by the capacity prices from the New England forward capacity market (FCM). In the FCM, capacity benefits accrue because demand reduction reduces ISO-NE's installed capacity requirement. The capacity requirement is based on load's contribution to the system peak, which, for ISO-NE, is the summer peak. Therefore, capacity benefits accrue only from summer peak demand reduction; there is currently no winter generation capacity benefit.

Energy Efficiency

Demand savings created through program efforts are currently valued using the avoided capacity values in the 2018 AESC Study. The values contained in the study reflect the actual and forecasted clearing prices in ISO New England's Forward Capacity Market, accounting for changes in demand, supply (including replacement of retiring major generation by state-mandated procurement of a large amount of clean energy capacity), and market structure and rules (particularly CASPR).

The values also incorporate a reserve margin and losses incurred from the generator to the point of delivery to the distribution companies. ISO-New England reserve margins are incorporated into the capacity values, since energy efficiency avoids the back-up reserves for that generation as well as the generation itself. A loss factor representing losses from the ISO delivery point to the end-use customer is used as a multiplier, since those losses are not included in the avoided costs. Demand savings are calculated to be coincident with the ISO-NE definition of peak.[20]

Other DERs

The AESC Study capacity price forecast for the New England forward capacity market should be used to reflect the electric generation capacity benefits for all types of DERs. This requires identifying the impact of each type of DER on the ISO-NE summer peak. This can be achieved by using the DER hourly operating profile (see Electric Energy Benefits discussion) to determine the extent to which the DER resource is likely to be operational during that time.

[20] AESC 2018. Chapter 5: Avoided Capacity Costs, starting on page 93.

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Reduced Transmission Costs: Pooled

Description

Reduced load growth and reduced loading of existing equipment can help defer or avoid the addition of load-related transmission and distribution facilities. In New England, some of these avoided transmission costs are socialized across the entire system, or pooled, and some are not. This section includes the pooled transmission capacity avoided by the DER. AESC 2018 developed a standardized approach to estimating pooled avoidable transmission costs. Based on a review of literature from ISO New England and the utilities, AESC 2018 estimates a total cost for pooled transmission facility (PTF) costs, and then allocated these costs to each load serving entity (LSE)[21]

Energy Efficiency

AESC 2018 calculated a single, regional avoided cost for Pool Transmission Facilities (PTF) of $94/kW-year in 2018 dollars.[22] The study performed a traditional avoided-cost analysis for the portion of Pool Transmission Facilities that is load-related (i.e., the portion of the PTF that would be allocated to what ISO New England calls Local Networks, which may cover a single utility or span multiple states).

The transmission benefits for energy efficiency are estimated by applying the energy efficiency summer peak demand reduction to the avoidable transmission costs, because the Company's system is summer peaking.

Other DERs

The 2018 AESC study provided a value for pooled transmission costs avoided by energy efficiency. We recommend applying this value for all types of DERs.

Reduced Transmission Costs: Not Pooled

Description

Some transmission costs in New England are not pooled across the entire system. This section includes the non-pooled transmission capacity avoided by the DER. AESC 2018 developed a standardized approach to estimating non-pooled avoidable transmission costs.[23]

Energy Efficiency

Non-pooled electric transmission capacity benefits for energy efficiency are estimated separately from non-pooled transmission capacity benefits in the 2018 AESC Study. The Company should add in local transmission investments (those not eligible for PTF treatment or "non-PTF facilities") by following the six step process outlined in AESC 2018 including: (1) selecting a time period for the analysis,

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[21] AESC 2018. Chapter 10: Transmission and Distribution, starting on page 195.

[22] AESC 2018. Chapter 10.3: Avoided PTF Costs, starting on page 215.

[23] AESC 2018. Chapter 10: Transmission and Distribution, starting on page 195.

(2) determining the actual or expected relevant load growth in the analysis period, in megawatts, (3) estimating the load-related investments in dollars incurred to meet that load growth, (4) dividing the result of load-related investments by the relevant load growth, to determine the cost of load growth in $/MW or $/kW, (5) multiplying the cost of load growth by a real-levelized carrying charge, to derive an estimate of the avoidable capital cost in $/kW-year and (6) adding an allowance for operation and maintenance of the equipment, to derive the total avoidable cost in $/kW-year.[24]

The transmission benefits for energy efficiency are estimated by applying the energy efficiency summer peak demand reduction to the avoidable transmission costs, because the Company's system is summer peaking.

<u>Other DERs</u>

The 2018 AESC study provided a standardized approach for calculating avoided non-pooled transmission costs for energy efficiency. We recommend the Company use this approach to calculate a value for all types of DERs.

Reduced Distribution Costs

<u>Description</u>

This includes several distribution benefits created by the DER. The original RI Cost-Effectiveness Framework lists a variety of different types of distribution benefits, including: distribution capacity costs, distribution delivery costs, distribution performance, distribution reliability and resiliency, and distribution safety impacts. AESC 2018 developed a standardized approach to estimating avoidable distribution costs.[25]

<u>Energy Efficiency</u>

The 2018 AESC Study provides guidance on how to calculate electric distribution capacity benefits for energy efficiency. The Company should follow the six step process outlined in AESC 2018 including: (1) selecting a time period for the analysis, (2) determining the actual or expected relevant load growth in the analysis period, in megawatts, (3) estimating the load-related investments in dollars incurred to meet that load growth, (4) dividing the result of load-related investments by the relevant load growth, to determine the cost of load growth in $/MW or $/kW, (5) multiplying the cost of load growth by a real-levelized carrying charge, to derive an estimate of the avoidable capital cost in $/kW-year and (6) adding an allowance for operation and maintenance of the equipment, to derive the total avoidable cost in $/kW-year.[26]

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[24] AESC 2018. Chapter 10: Transmission and Distribution, page 195.

[25] AESC 2018. Chapter 10: Transmission and Distribution, starting on page 195.

[26] AESC 2018. Chapter 10: Transmission and Distribution, page 195.

The distribution benefits for energy efficiency are estimated by applying the energy efficiency summer peak demand reduction to the avoidable distribution costs, because the Company's system is summer peaking.

Other DERs

The 2018 AESC study provided a standardized approach for calculating avoided non-pooled transmission costs. We recommend the Company use this approach to calculate two values for all types of DERs, to better account for the locational value of distribution benefits.

One value should represent a distribution benefit for the most constrained portions of the Company's distribution grid, and a separate distribution benefit should be calculated for the remaining portions of the grid. DERs specifically located in the constrained portions of the grid will be given the higher avoided distribution costs, and those located in other areas, or in no specific area in particular, will be given the lower avoided distribution costs.

We also recommend that the Company account for the temporal value of distribution capacity benefits. This also requires identifying the impact of each type of DER on the monthly system peak. This can be achieved by using the DER hourly operating profile (see Electric Energy Benefits discussion) to determine the extent to which the DER resource is likely to be operational during those times.

Reduced Ancillary Services Costs

Description

Ancillary services are those services required to maintain electric grid stability and security. They include frequency regulation, voltage regulation, spinning reserves, and operating reserves. DERs may reduce the need for these services by reducing loads on the electricity system. In general, the total cost of the wholesale ancillary services markets is much smaller than the total cost of either the wholesale energy or generation capacity markets.

Energy Efficiency

The 2018 AESC study does not include ancillary services costs in the wholesale energy and capacity market price forecasts.[27] Consequently, ancillary services benefits are not included in the energy and generation capacity avoided costs in the AESC.

Other DERs

There may be some types of DERs, e.g., distributed batteries or electric vehicles, that can sell power into the ancillary services markets to create a significant revenue stream to help cover the cost of the resource. While that revenue stream might be important for the resource developer, the power sector

[27] Personal communication with the AESC 2018 author.

value of avoided ancillary services is likely to remain a small part of the value of avoided energy and capacity.

We recommend that National Grid investigate the extent to which ancillary services benefits are likely to have a significant effect on the total benefits of DERs. Based upon this investigation, the Company should determine what level of priority to give to researching this benefit further.

Wholesale Market Price Suppression Effect

Description

This accounts for reductions in market prices due to (1) reductions in the quantities of capacity and energy that have to be acquired from wholesale energy and capacity markets (capacity DRIPE and energy DRIPE, respectively), (2) reductions in annual retail electricity use that cause a reduction in gas consumption for electric generation (electric own-fuel and cross-fuel DRIPE) (3) reductions in annual retail gas use that reduce gas production and basis prices (gas fuel and cross-fuel DRIPE) and (4) reductions in annual oil use that reduce oil production (oil fuel and cross-fuel DRIPE).

Energy Efficiency

National Grid uses the electric, gas, and oil energy efficiency price suppression impacts from the 2018 AESC Study.[28]

Other DERs

National Grid should calculate DRIPE values for other DERs using hourly load profiles associated with each type of DERs.

Reduced Renewable Energy Credit Costs

Description

This is the savings due to reducing the quantity of renewable energy credits (RECs) that must be purchased to comply with Rhode Island's Renewable Energy Standard (RES).

Energy Efficiency

These savings are included in the electric energy benefits provided by the 2018 AESC study.

Other DERs

The reduced REC costs resulting from by DERs can be determined from the AESC study, in the same way they are determined for energy efficiency.

[28] AESC 2018. Chapter 9: DRIPE, starting on page 146.

In those cases where a DER increases electricity consumption (e.g., electric vehicles), the impact should be represented as increased REC costs, using the same methodology.

Reduced GHG Compliance Costs

Description

This includes the reduced cost of complying with GHG constraints established by laws, regulations, or other directives. Compliance costs are included in the power sector costs, because they affect utility operations and costs and will be passed on to electricity customers. The AESC Studies refer to these as "embedded" environmental impacts, because these costs are embedded in market prices and utility rates.

There are two GHG constraints in effect in Rhode Island: The Regional Greenhouse Gas Initiative (RGGI) and the Resilient Rhode Island Act (RRI Act). The costs of complying with RGGI are included in the AESC wholesale energy market prices used to set the electric energy benefits.

The RRI Act establishes a state-wide GHG emission reduction goal of 80% below 1990 levels by 2050. However, there are no binding requirements associated with this Act, and the role of the electricity industry in complying with it has not yet been defined. Therefore, we recommend that for now the costs of complying with the RRI Act be considered a societal cost, and not a power sector cost. Once the requirements of that Act on the electricity industry become better defined, these compliance costs should be considered a power sector cost.

Energy Efficiency

The costs of complying with the RGGI allowance program are included in the AESC wholesale energy market prices used to set the electric energy benefits.

Other DERs

The costs of complying with the RGGI allowance program are included in the AESC wholesale energy market prices used to set the electric energy benefits. Therefore, the RGGI compliance costs for other DERs will be accounted for by using the AESC values for the DER energy benefits.

Reduced Environmental Compliance Costs

Description

This includes the reduced cost of complying with non-GHG environmental regulations such as SO_2, NO_X, ozone, particulates, and mercury constraints. These compliance costs are included in the power sector costs, because they affect utility operations and costs and will be passed on to electricity customers.

Energy Efficiency

The costs of complying with the existing and expected SO_2 requirements, including the Cross-State Air Pollution Rule (CSAPR) and the Acid Rain Program (ARP), are not included in the AESC wholesale energy market prices used to set the electric energy benefits. Instead, AESC 2018 uses a separate value for SO_2 benefits of $0.50 based on 2015 actual allowance prices, escalated at the rate of inflation through the study period.

The costs of complying with existing and expected NO_X requirements are not included in the 2018 AESC Study. This decision stems from three factors: the New England states being exempt from the CSAPR program; an assumption that currently proposed state-specific regulations in Massachusetts and Connecticut on ozone-season-NO_X are unlikely to be binding; and NO_X prices having been excluded from modeling in the update to the 2015 AESC study. [29]

Other DERs

We recommend that National Grid apply the costs of complying with the existing and expected SO_2 requirements to the SO_2 emissions from all types of DERs.

Reduced Risk

Description

DERs are more modular, adaptable, and flexible resources that provide greater resource diversity. As a result, these resources offer a hedge against volatile gas prices, as well as increased optionality for responding to load growth, improved generation reliability as a result of lower loads and higher reserve margins, increased transmission and distribution reliability and the ability to defer investments in supply-side facilities.

Energy Efficiency

National Grid currently assumes that energy efficiency provides risk benefits in terms of hedging against volatile fuel prices. This is assumed to be a one-time benefit worth 0.5 ¢/kWh saved, or $0.76 per MMBtu saved, based on a study from Lawrence Berkeley National Labs.[30]

The 2018 AESC study provides a value for generation reliability due to increased reserve margins that is not captured in existing energy and capacity markets. AESC 2018 finds that the 15-year levelized benefit of increasing generation reserves through reduced energy usage is $0.65/kW-year for cleared resources and $6.60/kW-year for uncleared load reductions. These estimates of the value of generation reliability

[29] AESC 2018, page 90.

[30] Lawrence Berkeley National Labs, *Quantifying the Value that Wind Power Provides as a Hedge Against Volatile Natural Gas Prices*, June 2002. Available at: http://eaei.lbl.gov/sites/all/files/report-lbnl-50484.pdf

due to lower loads and higher reserve margins are based on a literature review of the value of lost load.[31,32]

The Company now uses these values for generation reliability, as well as the values for fuel price hedging.

Other DERs

We recommend that the fuel price hedge value plus the value of generation reliability from the 2018 AESC study be applied to the energy saved or generated by all types of DERs.

Utility Non-Energy Benefits

Description

This may include, but is not limited to, cost savings to the Company from reduced payments arrearages, fewer terminations and reconnections, reduced carrying costs, lower debt written off/ lower collection costs, fewer customer calls and notices sent to customers about late payments and terminations, and from a smaller portion of sales sold at the low-income rate.[33]

Energy Efficiency

The utility non-energy benefits currently used by National Grid come from two Massachusetts non-energy benefits studies: (1) Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, NMR Group, Inc., Tetra Tech, 8.15.2011 and (2) Tetra Tech, Inc., Massachusetts Program Administrators Final Report – Commercial & Industrial Non-Energy Impacts Study, 6/29/2012.

Other DERs

We recommend that National Grid use the same non-energy benefits studies to develop estimates of utility non-energy benefits for other types of DERs.

For each type of DER and each type of utility non-energy benefit, National Grid should consider whether the DER energy or bill saving impact will create a similar benefit as energy efficiency. If so, then National Grid should use the same utility non-energy benefit values for the other types of DERs. If not, the Company should consider whether other values can be derived from the energy efficiency values.

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31 AESC 2018, Chapter 11: Value of Improved Reliability, starting on page 217.

32 "Reliability of deliverability through the T&D system is affected by a multitude of factors, including various types of weather (e.g., ice, wind), human error (e.g., vehicle collisions, inadvertent excavation of underground cables), vegetation (contact with standing trees, impacts from falling branches), and equipment failure (from load and/or age). Load-related stresses (e.g., insulation degradation, line sag) may increase the likelihood of equipment failure and some of the other outage causes." AESC 2018, page 217. The study did not quantify the effects of load levels on T&D reliability measures as the available data did not allow quantification of these impacts.

33 Northeast Energy Efficiency Partnership, *Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond*, June 2017, page 10.

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Innovation and Market Transformation

Description

Innovation refers to the benefit of new methods, ideas, and products, leading to faster and broader adoption of DER technologies by customers and public, private, and governmental entities. This benefit can also be described as market transformation, which is widely recognized in the context of energy efficiency as a significant benefit of ratepayer-funded energy efficiency programs.

Innovation and market transformation can be seen as one of the key goals of ratepayer-funded DERs programs and initiatives. Ideally, these programs can lower the cost of new technologies and increase customer awareness and acceptance to the point where little to no ratepayer-funded support will be needed in the future. When this occurs, the benefits of market transformation can be very large. The on-going transformation from incandescent to fluorescent to LED lighting is one example of market transformation that has created significant benefits nationwide.

Market transformation can occur in more subtle ways as well. For example, a customer that purchases an efficient product using a utility-sponsored rebate might decide to replace that product at the end of its life with another efficient product. This is one type of effect that is commonly referred to as "spillover." For this reason, it is important to ensure that there is no double-counting between this market transformation benefit and programmatic assumptions regarding spillover.

Energy Efficiency

Innovation and market transformation are not currently accounted for in the Rhode Island energy efficiency cost-effectiveness screening.

Other DERs

We recommend that proxy multipliers be used to represent DER innovation and market transformation benefits, until better estimates can be determined. These benefits can vary significantly, depending upon the type of DER. We recommend that National Grid use a range of proxy multipliers, ranging from 0% to 25%, depending upon the type of DER, and the type of program supporting the DER. These proxies should be used until better proxies or more quantitative information is available in the future.

Table 6 presents our recommendations for proxy multipliers to be applied until better information is available. The dollar value of these proxies should be obtained by applying the percentage to the total power sector benefits for each DER.

Table 6. Initial Proxy Multipliers for Innovation and Market Transformation

Type of DER	Proxy Multiplier	Reason for Proxy Level
EE: EnergyWise	5%	Little room for technology innovation or cost reduction.
EE: Multi-Family	5%	Little room for technology innovation or cost reduction.
EE: Income-Eligible	5%	Little room for technology innovation or cost reduction.
EE: Res New Construction	15%	New construction programs can influence many trade allies.
EE: Home Energy Report	0%	Customer behavior programs not likely to lead to much MT.
EE: Lighting	5%	Little room for technology innovation or cost reduction.
EE: Consumer Products	5%	Little room for technology innovation or cost reduction.
EE: HVAC	5%	Little room for technology innovation or cost reduction.
EE: C&I New Construction	15%	New construction programs can influence many trade allies.
EE: C&I Large Retrofit	5%	Little room for technology innovation or cost reduction.
EE: C&I Small Business	5%	Little room for technology innovation or cost reduction.
DR: with technologies	25%	Room for innovation, cost reduction, and customer acceptance.
DR: rate design only	0%	Without supportive technologies, DR not likely to lead to much MT.
DG: PV	25%	Lots of room for innovation, cost reduction, and customer acceptance.
DG: CHP	5%	A relatively mature technology.
Distributed Storage	25%	Lots of room for innovation, cost reduction, and customer acceptance.
Electric Vehicles	25%	Lots of room for innovation, cost reduction, and customer acceptance.

6.2. Participant

Participant Water and Other Fuels Impacts

Description

This includes reductions and increases in the consumption of water resources, including water and wastewater, by making certain end-uses, such as water heaters, dish washers, or clothes washers, more efficient and reducing the need for electricity generation from power plants that consume water.[34]

This also includes reductions and increases in the consumption of "other fuels," which includes fuels beyond those provided by the utility funding the DER. Other fuels can include savings or increased use of gas, electricity, oil, propane, biomass, or other fuels.[35]

Energy Efficiency

Water savings are valued using avoided water and sewer values that are based on average water and sewer rates in Rhode Island. While there are no specific water efficiency measures, when a project in which consumers have invested to save electricity or fuel also affects water consumption—for example, a cooling tower project that reduces makeup water needed—a resource benefit is created. Depending on the project and metering configuration, changes in water consumption may also affect sewerage

[34] National Standard Practice Manual, page 29.

[35] National Standard Practice Manual, page 28.

billings.[36] Water and sewerage rates were determined from an August 2014 internet survey of rates posted by the City of Providence and the Narragansett Bay Commission.

Other DERs

We recommend that the AESC estimates of avoided fuels and water be applied to all types of DERs.

Participant Non-Energy Benefits

Description

Non-energy impacts may include – but are not limited to –reduced operations and maintenance costs, increased comfort, reduced noise, increased home durability, increased health and safety, increased productivity, improved aesthetics, property value increases, improved rental unit marketability, and reduced tenant complaints.[37,38]

Energy Efficiency

The non-energy benefits values for C&I New Construction lighting operations and maintenance savings come from an Optimal Energy Inc. memo titled Non-Electric Benefits Analysis Update from 11/7/2008.

All other participant non-energy benefits come from two Massachusetts non-energy benefits studies: (1) Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, NMR Group, Inc., Tetra Tech, 8.15.2011 and (2) Tetra Tech, Inc., Massachusetts Program Administrators Final Report – Commercial & Industrial Non-Energy Impacts Study, 6/29/2012.

Other DERs

Other types of DERs are not likely to result in many of the non-energy benefits created by energy efficiency resources. However, there are two exceptions.

- Distributed generation, especially distributed solar resources, might result in increased property values, improved rental unit marketability, and customer satisfaction from reducing environmental impacts.
- Distributed storage resources might result in increased property values, improved rental unit marketability, and customer satisfaction from increased reliability.

We recommend that National Grid use a proxy multiplier to reflect the participant benefits of distributed solar and storage technologies, until a better estimate can be deterimined. A proxy multiplier of 15% represents a reasonable approximation of these benefits, and should be used until a better proxy or more quantitative information is available. The 15% proxy multiplier should be applied

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[36] National Grid 2019 EE & SRP Plan, Attachment 4, page 10.

[37] National Grid 2019 EE & SRP Plan, Attachment 4, pages 10 and 11.

[38] National Standard Practice Manual, page 25.

to the monetary value of all of the power sector benefits for the relevant technology. The power sector benefits are a better indicator of the likely participant benefits than all societal benefits.

Low-Income Participant Non-Energy Benefits

Description

In addition to other participant non-energy benefits, low-income non-energy impacts can also include the impacts of having lower energy bills to pay, reduced arrearages or reduced utility shut off costs.[39,40]

Energy Efficiency

All low-income participant non-energy benefits come from two Massachusetts non-energy benefits studies: (1) Residential and Low-Income Non-Energy Impacts (NEI) Evaluation, NMR Group, Inc., Tetra Tech, 8.15.2011 and (2) Tetra Tech, Inc., Massachusetts Program Administrators Final Report – Commercial & Industrial Non-Energy Impacts Study, 6/29/2012.

Other DERs

We recommend that National Grid investigate the likely magnitudes of non-energy benefits associated with DERs installed by low-income customers. This investigation should begin with the low-income participant benefits currently being used for energy efficiency. Many of those benefits are likely to be not relevant to other types of DERs. For example, weatherization benefits such as improved comfort, increased safety, and improved health are probably not relevant for demand response, distributed generation, or storage technologies. However, a subset of the energy efficiency low-income participant benefits, such as reduced energy burden, reduced terminations, increased property value, and reduced property foreclosures, are likely to be relevant to the other types of DERs as well as energy efficiency.

Customer Empowerment

Description

This refers to the benefits of greater customer choice from improved retail competition, flexible demand, integration of commodity and energy services, and development of a market with third-party DER participants.

Energy Efficiency

This impact is not currently accounted for in the Rhode Island energy efficiency cost-effectiveness screening.

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[39] National Grid 2019 EE & SRP Plan, Attachment 4, pages 10 and 11.

[40] National Standard Practice Manual, page 27.

Other DERs

National Grid should investigate the likely magnitudes of customer empowerment benefits.

6.3. Societal

Reduced GHG Emissions

Description

This refers to reduced GHG emissions that are not subject to regulations or constraints, but nonetheless are expected to create environmental costs. The AESC Studies refer to these as "non-embedded" environmental impacts, because these costs are not embedded in market prices or utility rates.

Energy Efficiency

The Company uses the $100 per short ton value from AESC to reflect the long-term cost of GHG emissions.[41] This value represents the total benefit of reducing GHGs, including both embedded and non-embedded costs. The non-embedded costs are derived by subtracting the embedded costs from this $100 per short ton value.

Other DERs

We recommend that the Company use the non-embedded CO_2 values from the AESC study for all types of distributed energy resources.

Reduced Environmental Impacts

Description

This can include reduced emissions of criteria and other air pollutants that are not subject to regulations, reduced liquid and solid waste (nuclear, coal ash, etc.), reduced water for cooling electric generating stations, extracting natural gas (e.g., "fracking"), and other purposes, reduced adverse impacts on the land that must be developed for new generating facilities and reduced adverse impacts on land, air, and water from fuel mining or extraction.[42]

The AESC Studies refer to these as "non-embedded" environmental impacts, because these costs are not embedded in market prices or utility rates.

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[41] National Grid 2019 EE & SRP Plan, Attachment 4, pages 12 and 13.

[42] National Standard Practice Manual, page 29.

Energy Efficiency

The Company includes the value for NO_x emission reductions not already embedded in the avoided cost of energy. The values are derived from the 2018 AESC Study[43], which utilizes published averages for the continental United States to develop a non-location specific, non-embedded NO_x emission cost. The cost is $31,000 per ton of nitrogen, which translates into an avoided wholesale cost for NO_x of $1.65 per MWh.[44]

Other DERs

We recommend that the Company apply these values from the 2018 AESC Study to other DERs.

Economic Development Impacts

Description

This represents the impact on the local Rhode Island economy from investments and activities related to implementing DERs. This is typically represented in terms of impacts on gross state product (GSP) or number of jobs (or job-years) created. These benefits should include the net impacts, after accounting for any reduction in economic development or jobs associated with the resources or investments that are avoided by the DERs.

Energy Efficiency

The macroeconomic multipliers for the economic growth and job creation benefits of investing in cost-effective energy efficiency are derived from a recent study "Macroeconomic Impacts of Rhode Island Energy Efficiency Investments: REMI Analysis of National Grid's Energy Efficiency Programs", National Grid Customer Department, November, 2014. In order to avoid double-counting of the impacts of bill savings, only the multipliers associated with construction impacts are included as benefits. It is our understanding that the Company will conduct an updated economic impact study soon for future energy efficiency plans.

Other DERs

The economic development and job impacts will be different for different types of DERs. The construction impacts associated with demand response, distributed generation, storage, or electric vehicles can be very different, and it would not be appropriate to use the same multiplier that is used for energy efficiency.

We recommend that National Grid's forthcoming economic impact study address other types of DERs, in addition to energy efficiency.

[43] AESC 2018, Table 157 for electricity and Table 158 for non-electric fuels.

[44] National Grid 2019 EE & SRP Plan, Attachment 4, page 14.

Societal Low-Income Benefits

Description

This may include, but is not limited to, poverty alleviation, reduced energy burden, and reductions in the cost of other low-income assistance and social services.

Energy Efficiency

These impacts are not currently accounted for in energy efficiency cost-effectiveness screening models.

Other DERs

We recommend that National Grid conduct a study of the likely magnitudes of societal low-income benefits for all types of DERs.

Public Health Benefits

Description

This includes the reduction in the frequency and/or severity of health problems of people affected by air or water quality from power plant fuel extraction, combustion, and waste disposal.[45,46]

This benefit can be particularly important regarding power plants, fuel extraction, or waste disposal sites that are located near population centers. Also, if they are located near low-income, elderly, or minority population areas, this benefit might have important implications for environmental justice.

It is important to ensure that there is no double-counting of these benefits and reduced environmental impacts.

Energy Efficiency

These impacts are not currently accounted for in energy efficiency cost-effectiveness screening models.

Other DERs

We recommend that National Grid investigate the likely magnitudes of the public health benefits of all types of DERs.

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[45] National Standard Practice Manual, page 30.

[46] *Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond*, Northeast Energy Efficiency Partnership, June 2017, page 10.

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Energy Security Benefits

Description

This occurs because of reductions in the consumption of fuels and resources that are imported from outside the relevant jurisdiction. This can include fossil fuels that are imported from other regions, electricity that is imported by transmission lines, and natural gas that is imported through pipelines. It can also include fossil fuels that are imported from other parts of the world, including countries that are politically or economically unstable.[47]

Energy Efficiency

National Grid does not currently assume any value for energy security benefits from energy efficiency resources.

In the past, Massachusetts efficiency program administrators assumed that the energy security benefits of reduced oil consumption are equal to $1.83 MMBtu of oil saved.[48]

We recommend that National Grid assume that the energy security benefits of energy efficiency resources equals $1.83 MMBtu of oil saved, based upon the Massachusetts experience.

Other DERs

We recommend that the energy security benefit assumptions that are used for energy efficiency be used for other types of DERs that are expected to reduce oil consumption.

[47] National Standard Practice Manual, page 31.

[48] Northeast Energy Efficiency Partnership, *Non-Energy Impacts Approaches and Values: An Examination of the Northeast, Mid-Atlantic, and Beyond*, June 2017, page 56.

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7. General Modeling Parameters

Study Period

Description

This refers to the number of years over which all the costs and benefits may be experienced. For some DERs, the benefits last well into future years while the costs are incurred in the first year. An appropriate study period will include all the benefits experienced as a result of the costs.

Energy Efficiency

The study period is 25 years which is equal to maximum lifetime of energy efficiency measures.

Other DERs

The economic study period for any type of utility resource should be at least as long as the operating life of the resource. We recommend that a 25-year study period be used for all types of DERs, unless the DER in question has a longer operating life; in which case the study period should cover the entire life.

Discount Rates

Description

This refers to the rate that allows future cash flows to be discounted to their present value, enabling comparison of a stream costs to a stream of benefits that continues well into the future. The choice of discount rate for a cost-effectiveness analysis should be consistent with the regulatory goals of the analysis.[49]

Energy Efficiency

The Company uses a low-risk discount rate when assessing the cost-effectiveness of energy efficiency resources. The real discount rate is equal to the twelve-month average of the historic yields from a ten-year United States Treasury note, using the previous calendar year to determine the twelve-month average.[50]

Other DERs

We recommend that the discount rate that is used for energy efficiency be used for all types of DERs. It is best to use the same discount rate across all types of DERs, to ensure that the different types of resources are analyzed and treated comparably. In addition, the low-risk discount rate, which places greater emphasis on future impacts relative to higher discount rates, is consistent with the regulatory

[49] National Standard Practice Manual, Chapter 9.

[50] National Grid 2019 EE & SRP Plan, Attachment 4, page 20.