National Grid

The Narragansett Electric Company

2020 System Reliability Procurement Plan Year-End Report

June 1, 2021

Submitted to:
Rhode Island Public Utilities Commission

RIPUC Docket No. 5080

Submitted by:
nationalgrid

Filing Letter & Motion

nationalgrid

Andrew S. Marcaccio
Senior Counsel

June 1, 2021

VIA ELECTRONIC MAIL

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

RE: Docket No. 5080 – 2020 System Reliability Procurement Year-End Report

Dear Ms. Massaro:

On behalf of The Narragansett Electric Company d/b/a National Grid ("National Grid" or the "Company"), enclosed[1], please find the Company's 2020 System Reliability Procurement ("SRP") Year-End Report (the "Report"). The Report is being filed in accordance with R.I. Gen. Laws § 39-1-27.7 and Section 4.4.B of the Least Cost Procurement ("LCP") Standards.[2]

On November 20, 2020, the Company filed its 2021-2023 System Reliability Procurement Three-Year Plan (the "SRP Three-Year Plan" or "Plan").[3] Through the SRP Three-Year Plan, the Company requested approval by the Public Utilities Commission ("PUC") of various programmatic proposals all of which did not require any incremental funding. On December 22, 2020, in alignment with the proposed SRP Three-Year Plan, the PUC approved a $0 SRP rate which is a component of the Energy Efficiency ("EE") charge that became effective January 1, 2021. As of the date of this filing, the programmatic proposals contained within the SRP Three-Year Plan are pending PUC review and approval.

As detailed in the Report, the Company respectfully requests that the PUC consider and approve several updates to the programmatic proposals contained within the Three-Year Plan. The following table provides an updated summary of the requested rulings for SRP factoring in both the Three-Year Plan and the Report.

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[1] Per Commission counsel's update on October 2, 2020, concerning the COVID-19 emergency period, the Company is submitting an electronic version of this filing followed by five hard copies filed with the Clerk within 24 hours of the electronic filing.

[2] The LCP Standards were approved by the PUC on July 23, 2020 in Docket No. 5015. The LCP Standards may be viewed at:
http://www.ripuc.ri.gov/eventsactions/docket/5015_LCP_Standards_05_28_2020_8.21.2020%20Clean%20Copy%20FINAL.pdf

[3] The SRP Three-Year Plan may be viewed at: http://www.ripuc.ri.gov/eventsactions/docket/5080-NGrid-SRP%202021-2023%20Three-Year%20Plan(11-20-2020)V1.pdf

Table 1. Updated Summary of Requested Rulings for SRP in 2021-2023

Applicable Section(s)	SRP Initiative/ Proposal	Requested Ruling in the Plan	Requested Ruling in the Report	Notes
Section 5 of SRP Three-Year Plan	SRP Funding Mechanism	The Company requests the PUC approve the Company's proposal that operational expenditure (opex)-type SRP investments be funded through the System Benefit Charge, or Energy Efficiency (EE) Charge, on customers' bills as described in Section 5 of the Plan.		Proposal only made in the Plan.
Section 5 of SRP Three-Year Plan	SRP Funding Mechanism	The Company requests the PUC approve the Company's proposal that capital expenditure (capex)-type SRP investments be filed and proposed in an SRP Investment Proposal as described in Section 5 of the Plan.		Proposal only made in the Plan.
Section 6 of SRP Three-Year Plan	SRP Performance Incentive Mechanism	The Company requests the PUC approve the Company's proposed performance incentive mechanism (PIM) for calendar years 2021 through 2023 as described in Section 6 of the Plan.		Proposal only made in the Plan.

Applicable Section(s)	SRP Initiative/ Proposal	Requested Ruling in the Plan	Requested Ruling in the Report	Notes
Section 7.2 of SRP Three-Year Plan Section 6.1 of SRP Year-End Report	NWA Screening Criteria	The Company requests the PUC approve the proposed NWA screening criteria for Rhode Island as detailed in Table 5 of the Plan for calendar years 2021 through 2023.	The Company requests approval of the two proposed revisions to the NWA screening criteria for Rhode Island as detailed in Table 4 for calendar years 2021 through 2023.	NWA Screening Criteria established with background detail in the Plan. NWA Screening Criteria updated in the Report.
Section 4 of the SRP Year-End Report	RI NWA BCA Model		The Company requests approval of the proposed revisions to the RI NWA Benefit-Cost Analysis (BCA) Model and the proposed corresponding revisions to the RI NWA BCA Model Technical Reference Manual (TRM) for calendar years 2021 through 2023.	Proposal only made in the Report. The Company proposes the PUC need only consider the version (version 1.1) proposed in the Report.

Applicable Section(s)	SRP Initiative/ Proposal	Requested Ruling in the Plan	Requested Ruling in the Report	Notes
Section 7.3 of the SRP Year-End Report	NPA Screening Criteria		The Company requests approval of the proposed NPA Screening Criteria for Rhode Island as detailed in Table 5 for calendar years 2021 through 2023.	Proposal only made in Report.
Section 8 of SRP Three-Year Plan	NPAs in System Planning	The Company requests the PUC approve the development plan for the Non-Pipeline Alternatives program in calendar years 2021 through 2023 as described in Section 8 of the Plan.		Proposal only made in the Plan.
Section 12 of SRP Three-Year Plan	SRP Timeline: SRP Investment Proposals	The Company requests the PUC rule on SRP Investment Proposals within 60 days of filing as described in Section 12 of the Plan.		Proposal only made in the Plan.
Section 12 of SRP Three-Year Plan	SRP Timeline: Year-End Reports	The Company requests the PUC approve the annual reporting plan for SRP Year-End Reports for calendar years 2021 through 2023 as described in Section 12 of the Plan.		Proposal only made in the Plan.

As noted in Table 1 above, this Report contains proposals to update the Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model ("RI NWA BCA Model") and the Non-Wires Alternative ("NWA") screening criteria as well as proposing the new Non-Pipeline Alternatives ("NPA") screening criteria as part of the NPA Program in development. Please note that the proposals as updated do not require any additional, incremental funding. In addition, the Report also contains the budget spend for SRP in calendar year 2020.

Please be advised that the Company considers Appendix 4-RI NWA BCA Model ("Appendix 4") of the Report to be confidential. Pursuant to 810-RICR-00-00-1.3(H)(3) and R.I. Gen. Laws § 38-2-2(4)(B), the Company respectfully requests that the Commission treat Appendix 4 as confidential. In support of this request, the Company has enclosed a Motion for Confidential Treatment. In accordance with 810-RICR-00-00-1.3(H)(2), the Company also respectfully requests that the Commission make a preliminary finding that Appendix 4 is exempt from the mandatory public disclosure requirements of the Rhode Island Access to Public Records Act.

Thank you for your attention to this filing. If you have any questions or concerns, please do not hesitate to contact me at 401-784-4263.

Sincerely,

Andrew S. Marcaccio

Enclosures

cc: Docket 5080 Service List
Jon Hagopian, Esq.
John Bell, Division

STATE OF RHODE ISLAND
PUBLIC UTILITIES COMMISSION

IN RE: THE NARRAGANSETT ELECTRIC COMPANY	:	
d/b/a NATIONAL GRID'S SYSTEM RELIABILITY	:	DOCKET NO. 5080
PROCUREMENT (SRP) YEAR-END REPORT 2020	:	

MOTION OF THE NARRAGANSETT ELECTRIC COMPANY D/B/A NATIONAL GRID FOR PROTECTIVE TREATMENT OF CONFIDENTIAL INFORMATION

The Narragansett Electric Company d/b/a National Grid ("National Grid" or the "Company") hereby respectfully requests that the Public Utilities Commission ("PUC") grant protection from public disclosure certain confidential information submitted by the Company in the above referenced docket. The reasons for the protective treatment are set forth herein. The Company also requests that, pending entry of that finding, the PUC preliminarily grant the Company's request for confidential treatment pursuant to 810-RICR-00-00-1.3(H)(2).

The record that is the subject of this Motion that requires protective treatment from public disclosure is an Excel File labeled as Appendix 4 - RI NWA BCA Model ("Appendix 4"). Appendix 4 is an appendix to the Company's System Reliability Procurement ("SRP") Year-End Report 2020 which was filed by the Company on June 1, 2021 in the above-referenced docket. National Grid requests protective treatment of Appendix 4 in accordance with 810-RICR-00-00-1.3(H) and R.I. Gen. Laws § 38-2-2-(4)(B).

I. LEGAL STANDARD

For matters before the PUC, a claim for protective treatment of information is governed by the policy underlying the Access to Public Records Act (APRA), R.I. Gen. Laws § 38-2-1 et seq. See 810-RICR-00-00-1.3(H)(1). Under APRA, any record received or maintained by a state or local governmental agency in connection with the transaction of official business is considered public unless such record falls into one of the exemptions specifically identified by APRA. See R.I. Gen. Laws §§ 38-2-3(a) and 38-2-2(4). Therefore, if a record provided to the PUC falls within one of the designated APRA exemptions, the PUC is authorized to deem such record confidential and withhold it from public disclosure.

II. BASIS FOR CONFIDENTIALITY

Appendix 4, which is the subject of this Motion, is exempt from public disclosure pursuant to R.I. Gen. Laws § 38-2-2(4)(B) as "[t]rade secrets and commercial or financial information obtained from a person, firm, or corporation that is of a privileged or confidential nature." *The Attorney General's Guide to Open Government in Rhode Island 6th Edition*[1] provides guidance as to the scope of R.I. Gen. Laws § 38-2-2(4)(B)'s applicability. It states that:

> If a request is made for financial or commercial information that a person is obliged to provide to the government, it is exempt from disclosure if the disclosure is likely either: (1) to impair the government's ability to obtain information in the future, or (2) to cause substantial harm to the competitive position of the person from whom the information was obtained. If a request is made for financial or commercial information that is provided to the government on a voluntary basis, it is exempt from disclosure if the information "is a kind that would customarily not be released to the public by the person from whom it was obtained." The Providence Journal Company v. Convention Center Authority, 774 A.2d 40 (R.I. 2001).

Appendix 4 is the Rhode Island non-wires alternative ("NWA") benefit-cost analysis model that the Company developed to more accurately assess the benefits and costs of NWA opportunities. This model is proprietary to the Company and the Company considers this model to be commercial information. National Grid would customarily not release this model to the public and its submission of Appendix 4 stems from a regulatory directive issued by the PUC via Section 1.3.B of the Least Cost Procurement Standards. Accordingly, National Grid is providing

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[1] http://www.riag.ri.gov/Forms/AGguidetoopengovernment.pdf

Appendix 4 to the PUC to fulfil its regulatory responsibilities. Therefore, Appendix 4 is exempt from public disclosure "if the disclosure is likely either: (1) to impair the government's ability to obtain information in the future, or (2) to cause substantial harm to the competitive position of the person from whom the information was obtained." See *The Attorney General's Guide to Open Government in Rhode Island 6th Edition*, p. 22.

The release of Appendix 4 is likely to cause substantial harm to the competitive position of National Grid. Appendix 4 includes sensitive information and other commercial details regarding the Company's analysis of NWA opportunities. Disclosing this information to the public could harm the Company's ability to procure third-party NWA solution bids in the most cost-effective and unbiased manner and, ultimately, harm customers.

III. CONCLUSION

For the foregoing reasons, the Company respectfully requests that the PUC grant this motion for protective treatment of Appendix 4.

Respectfully submitted,

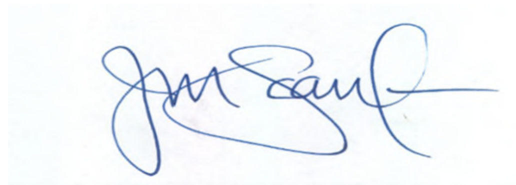
NATIONAL GRID
By its attorney,

Andrew S. Marcaccio (#8168)
National Grid
280 Melrose Street
Providence, RI 02907
(401) 784-4263

Dated: June 1, 2021

CERTIFICATE OF SERVICE

I hereby certify that on June 1, 2021, I delivered a true copy of the foregoing Motion via electronic mail to the parties on the Service List for Docket No. 5080.



Joanne M. Scanlon

Certificate of Service

I hereby certify that a copy of the cover letter and any materials accompanying this certificate was electronically transmitted to the individuals listed below.

The paper copies of this filing are being hand delivered to the Rhode Island Public Utilities Commission and to the Rhode Island Division of Public Utilities and Carriers.

___________________________________ June 1, 2021
Joanne M. Scanlon Date

Docket No. 5080 - National Grid – System Reliability Procurement 2021-2023 Plan
Service list updated 2/26/21

Name/Address	E-mail Distribution List	Phone
National Grid Andrew Marcaccio, Esq. National Grid 280 Melrose St. Providence, RI 02907 Leticia C. Pimentel, Esq. Robinson & Cole LLP One Financial Plaza, 14th Floor Providence, RI 02903	Andrew.Marcaccio@nationalgrid.com; Jennifer.Hutchinson@nationalgrid.com; Raquel.webster@nationalgrid.com; Joanne.scanlon@nationalgrid.com; Celia.obrien@nationalgrid.com; Matthew.Chase@nationalgrid.com; Timothy.Roughan@nationalgrid.com; John.Tortorella@nationalgrid.com; Christopher.Porter@nationalgrid.com; BENJAMIN.RIVERS@nationalgrid.com; John.Richards@nationalgrid.com; Matthew.Ray2@nationalgrid.com; LPimentel@rc.com;	401-784-4263
Division of Public Utilities and Carriers Jon Hagopian, Esq.	Jon.hagopian@dpuc.ri.gov; Margaret.L.Hogan@dpuc.ri.gov; john.bell@dpuc.ri.gov; Joel.munoz@dpuc.ri.gov;	401-784-4775
Tim Woolf Jennifer Kallay Synapse Energy Economics 22 Pearl Street Cambridge, MA 02139	twoolf@synapse-energy.com; jkallay@synapse-energy.com;	

RI EERMC Marisa Desautel, Esq. Office of Marisa Desautel, LLC 55 Pine St. Providence, RI 02903 Mike Guerard, Optimal Energy	marisa@desautelesq.com; guerard@optenergy.com; ross@optenergy.com; kravatz@optenergy.com;	401-477-0023
Acadia Center Hank Webster, Director & Staff Atty.	HWebster@acadiacenter.org;	401-276-0600 x402
Office of Energy Resources (OER) Albert Vitali, Esq. Dept. of Administration Division of Legal Services One Capitol Hill, 4th Floor Providence, RI 02908 Nick Ucci, Commissioner	Albert.Vitali@doa.ri.gov; Nancy.Russolino@doa.ri.gov; Christopher.Kearns@energy.ri.gov; Nicholas.Ucci@energy.ri.gov ; Becca.Trietch@energy.ri.gov; Carrie.Gill@energy.ri.gov ; Nathan.Cleveland@energy.ri.gov;	401-222-8880
Green Energy Consumers Alliance Larry Chretien, Executive Director Kai Salem	Larry@massenergy.org; kai@greenenergyconsumers.org; priscilla@greenenergyconsumers.org;	
Original & 9 copies file w/: Luly E. Massaro, Commission Clerk John Harrington, Commission Counsel Public Utilities Commission 89 Jefferson Blvd. Warwick, RI 02888	Luly.massaro@puc.ri.gov; Cynthia.WilsonFrias@puc.ri.gov; John.Harrington@puc.ri.gov; Alan.nault@puc.ri.gov; Todd.bianco@puc.ri.gov ;	401-780-2107
Frederick Sneesby Dept. of Human Services	Frederick.sneesby@dhs.ri.gov;	
Jordan Garfinkle Bloom Energy	Jordan.Garfinkle@bloomenergy.com;	
Seth Handy, Esq.	seth@handylawllc.com;	

2020 SRP
Year-End Report

SYSTEM RELIABILITY PROCUREMENT

2020 YEAR-END REPORT

Table of Contents

Table of Terms

Term	Definition
3V0	Ground Fault (or Zero Sequence) Overvoltage
AESC	Avoided Energy Supply Components
AMF	Advanced Metering Functionality
Approximate Value	The estimated net present value of deferring the wires investment for the required timeframe.
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
BTM	Behind-the-Meter
Capex	Capital expenditure
CEM	Customer Energy Management
CHP	Combined Heat and Power
CO_2	Carbon Dioxide
CRM	Cost Recovery Mechanism
CSA	Construction Service Agreement
C-Team	(EERMC) Consultant Team
DER	Distributed Energy Resource
DG	Distributed Generation
Division	Division of Public Utilities and Carriers
DPAM	Distribution Planning and Asset Management
DR	Demand Response
DRIPE	Demand Reduction Induced Price Effect(s)
DSP	Distribution System Planning
EE	Energy Efficiency
EE Plan	Energy Efficiency Program Plan
EEP	Energy Efficiency Program
EERMC	Energy Efficiency and Resource Management Council
EPC	Engineering, Procurement, and Construction
EPS	Electric Power System
ESA	Energy Service Agreement
ESS	Energy Storage System
EV	Electric Vehicle
FERC	Federal Energy Regulatory Commission
Framework	Rhode Island Docket 4600 Benefit-Cost Framework
FTE	Full-Time Employee/Equivalent
FTM	Front-of-the-Meter
GHG	Greenhouse gas
GMP	Grid Modernization Plan
ISO	Independent Systems Operator

Term	Definition
ISO-NE	ISO New England Inc.
ISR	Infrastructure, Safety and Reliability Plan
kW	Kilowatt
kWh	Kilowatt-hour
LCP	Least-Cost Procurement
MW	Megawatt
MWh	Megawatt-hour
NECEC	Northeast Clean Energy Council
NERC	North American Energy Reliability Corporation
NOAA	National Oceanic and Atmospheric Administration
NOx	Nitrogen Oxides
NPA	Non-Pipeline Alternatives
NPV	Net Present Value
NWA	Non-Wires Alternative
O&M	Operations and Maintenance
OER	Office of Energy Resources
Opex	Operational expenditure
PIM	Performance Incentive Mechanism
Portal	Rhode Island System Data Portal
PST	Power Sector Transformation
PUC	Public Utilities Commission
PV	Photovoltaic
RD&D	Research, Design, and Development
REC	Renewable Energy Credits
REG	Renewable Energy Growth
RFP	Request for Proposals
RGGI	Regional Greenhouse Gas Initiative
RI NWA BCA Model	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model
RI NWA BCA Model TRM	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Technical Reference Manual
RI Test	Rhode Island Benefit-Cost Test
RNG	Renewable Natural Gas
RPS	Renewable Portfolio Standards
SME	Subject Matter Expert
SO_2	Sulfur Dioxide
SRP	System Reliability Procurement
T&D	Transmission and Distribution
TWG	Technical Working Group
VVO	Volt-VAR Optimization

2020 SYSTEM RELIABILITY PROCUREMENT YEAR-END REPORT

1. Executive Summary

The purpose of System Reliability Procurement (SRP) is to identify targeted alternative solutions, through customer-side and grid-side opportunities, for the electric and gas distribution systems that are cost-effective, reliable, prudent and environmentally responsible and provide the path to lower supply and delivery costs to customers in Rhode Island.

The role of National Grid[1] with respect to SRP is to identify potential Non-Wires Alternative (NWA) and Non-Pipeline Alternative (NPA) opportunities, to source viable alternative solutions that address system needs and defer, reduce, or remove the need for distribution wires and pipes investments, and to support projects and programs that enable such activity.

The Company summarizes the rulings requested of the Rhode Island Public Utilities Commission (PUC) in the table below. Note that no funding requests are associated with these proposals because SRP Year-End Reports are purposed for programmatic proposals only and not financial investment proposals.

Table 1: Summary of Requested Rulings for SRP

SRP Section	SRP Initiative/Proposal	Requested Ruling
4	RI NWA BCA Model	The Company requests approval of the proposed revisions to the RI NWA Benefit-Cost Analysis (BCA) Model and the proposed corresponding revisions to the RI NWA BCA Model Technical Reference Manual (TRM) for calendar years 2021 through 2023.
6.1	NWA Screening Criteria	The Company requests approval of the two proposed revisions to the NWA screening criteria for Rhode Island as detailed in Table 4 for calendar years 2021 through 2023.
7.3	NPA Screening Criteria	The Company requests approval of the proposed NPA Screening Criteria for Rhode Island as detailed in Table 5 for calendar years 2021 through 2023.

[1] The Narragansett Electric Company d/b/a National Grid (National Grid or Company).

The commitments included in the 2020 SRP Report of Docket No. 4980[2] are summarized in the following table with year-over-year progress indicated in the rightmost column. These commitments do not require additional, incremental SRP funding because they are actions covered by the work of full-time employees (FTEs).

Table 2: Summary of 2020 SRP Commitments

SRP Commitment	Status
The Company commits to performing background research on NPAs and exploring how NPAs align with Company policy and the Least Cost Procurement Standards (LCP Standards) for the next update in the Three-Year Plan review. The Company commits to engaging with stakeholders to discuss and understand opportunities and challenges regarding NPAs.	Complete, filed NPA Program plan in 2021-2023 SRP Three-Year Plan[3]
The Company plans to continue analyzing its current NWA screening and development processes to determine how NWAs might be best considered as both complete and partial solutions.	Ongoing, dynamic process
As part of the Company's reevaluation process, it was determined that the Company should pursue third-party solutions for these previously identified NWA opportunities from the East Bay Study. The Company will commit to developing an NWA Request for Proposals (RFP) for the East Bay opportunity.	Complete. Bristol 51 NWA RFP released 6/2/2020.
The Company commits to the following actions with the intent of increasing the viability of the South County East NWA Projects: 1. Analyze whether there are additional benefit streams available that can be combined with NWAs to create more cost-effective solutions. 2. Refine the parameters of the need to capture additional benefits, if applicable. 3. Assess the option of a Company-sourced proposal, where the Company formulates a proposal with specific parameters to be fulfilled by the market, which would be used to compare against third party solutions.	Complete. Company produced the RI NWA BCA Model, which is now in use. Company assessed internally-sourced targeted EE/DR.

[2] "Docket No. 4980." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 15 Oct. 2019, www.ripuc.ri.gov/eventsactions/docket/4980page.html.
[3] "Docket No. 5080." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 20 Nov. 2020, www.ripuc.ri.gov/eventsactions/docket/5080page.html.

SRP Commitment	Status
The Company commits to investigating viable alternate solution pathways for the Bonnet 42F1 (formerly titled “Narragansett 42F1”) and South Kingstown NWA opportunities.	Complete. South Kingstown NWA RFP released 11/23/2020, Bonnet 42F1 NWA RFP released 12/29/2020.
Begin coordination work with the Company’s proposed Grid Modernization Plan (GMP) regarding inclusion of hourly (8,760 hours) data in addition to peak load data once the Grid Modernization Plan with this update is approved for funding.	SRP to align with GMP
The Company recognizes that improved synchronization between SRP and Power Sector Transformation (PST), the Energy Efficiency Program Plan (EE Plan), the Infrastructure, Safety and Reliability Plan, the Grid Modernization Plan (GMP), and the Advanced Metering Functionality (AMF) Business Case is necessary and intends to improve coordination between these filings.	Ongoing, perpetual commitment
Therefore, the Company commits to continued stakeholder engagement and continued participation in enhanced discussions regarding SRP, NWA, and related policy and programs with stakeholders.	Ongoing, perpetual commitment
The Company also commits to continue its efforts to actively avoid double-counting shareholder incentives in SRP programs and projects.	Ongoing, perpetual commitment
The Company intends to implement robust stakeholder engagement and discussion on the electric forecasting process.	Ongoing, perpetual commitment
The Company will commit to development and implementation of a data governance plan in coordination with the work on the AMF and GMP filings and will continue stakeholder engagement and discussion.	SRP to align with GMP

SRP Commitment	Status
The Company commits to stakeholder engagement and discussion regarding locational incentives through in Rhode Island by July 31, 2020 through the SRP Technical Working Group (TWG) meetings and other relevant sessions, and to determine whether the current methodology should be modified.	Complete. Company hosted stakeholder discussion on locational incentives in the SRP TWGs on 4/15/2020, 5/20/2020, and 7/15/2020. The Company filed its findings in the 2021-2023 SRP Three-Year Plan.

Note that the ongoing, perpetual commitments in the table above are ones that the Company has so far aligned and delivered on and intends to continue to achieve.

The proposals and information the Company presents in this SRP Plan advance Power Sector Transformation (PST)[4] goals, align with Docket 4600[5] principles, are coordinated with the Company's other programs and filings, and adhere to Least-Cost Procurement (LCP) law[6].

[4] "Power Sector Transformation Initiative." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, State of Rhode Island Office of the Governor Gina M. Raimondo, 8 Nov. 2017, www.ripuc.ri.gov/utilityinfo/electric/PST_home.html.
[5] "Docket No. 4600 and Docket No. 4600-A." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 2 Nov. 2018, www.ripuc.ri.gov/eventsactions/docket/4600page.html.
[6] "39-1-27.7. System Reliability and Least-Cost Procurement." *TITLE 39 Public Utilities and Carriers* , State of Rhode Island General Assembly, http://webserver.rilin.state.ri.us/Statutes/title39/39-1/39-1-27.7.HTM.

2. Introduction

The Company is pleased to submit this 2020 System Reliability Procurement Year-End Report (Report) to the PUC. This Report has been developed by National Grid through an iterative process with the SRP Technical Working Group (the SRP TWG).[7,8]

This Report summarizes the work the Company has performed in the SRP Program for calendar year 2020.

National Grid respectfully submits this Report and seeks approval of its integral proposals in accordance with the guidelines set forth in Section 4 of the LCP Standards.

[7] Members of the SRP TWG presently include the Company, Acadia Center, the Division, Green Energy Consumers Alliance, OER, NECEC, several EERMC members, and representatives from the EERMC's Consultant Team (EERMC C-Team).

[8] "The Collaborative." *RI Energy Efficiency & Resource Management Council*, RI Energy Efficiency & Resource Management Council, https://rieermc.ri.gov/thecollaborative/.

3. Regulatory Basis for System Reliability Procurement

This Report is submitted in accordance with the regulatory basis detailed in the 2021-2023 SRP Three-Year Plan[9] and Section 4.4.B of the Rhode Island PUC's revised "Least-Cost Procurement Standards," which the PUC approved and adopted pursuant to Order No. 23890 in Docket No. 5015 (LCP Standards).[10]

[9] "Docket No. 5080." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 20 Nov. 2020, www.ripuc.ri.gov/eventsactions/docket/5080page.html.

[10] "Least Cost Procurement Standards." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Energy Efficiency and Resource Management Council, 21 Aug. 2020, http://www.ripuc.ri.gov/eventsactions/docket/5015_LCP_Standards_05_28_2020_8.21.2020%20Clean%20Copy%20FINAL.pdf.

4. SRP Budget Spend

This section details the calendar year spend for the SRP programs.

Table 3. SRP Budget Spend for CY 2020

Initiative/Program	Program Detail	Budget Filed	Budget Spend
NWA	No specific NWA projects have been identified for proposal in CY 2020.	$0	$0
NPA	No specific NPA projects have been identified for proposal in CY 2020.	$0	$0
Rhode Island System Data Portal (Portal)	The Portal is an interactive online mapping tool developed by the Company. The Portal provides specific information for select electric distribution feeders and associated substations within the Company's electric service area in Rhode Island. The SRP Program handles new enhancements to the Portal.	$0	$0
SRP Market Engagement	SRP Market Engagement aims to raise awareness and perform outreach and engagement for the Rhode Island System Data Portal as needed, for NWA-related activities not covered by FTE work, and with third-party solution providers.	$69,370	$20,512
SRP Incentive Mechanism, 2018 Action-Based Earnings	Earnings for actions achieved by the Company during CY 2018 as part of the SRP Incentive Mechanism. Incentive actions are detailed in Section 5 of the 2020 SRP Report in Docket 4980.[11]	$11,865	$11,865
	Total	$81,235	$32,377

Budget spend was lower than anticipated for SRP Market Engagement in CY 2020 mainly due to coordinating program components in response to the COVID-19 pandemic. The corresponding program modifications are detailed in Section 9.

[11] "Docket No. 4980." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 15 Oct. 2019, www.ripuc.ri.gov/eventsactions/docket/4980page.html.

5. RI NWA BCA Model

This section details the RI NWA BCA Model that the Company utilizes to assess cost-effectiveness of NWA projects.

The Company proposes the following major changes to the RI NWA BCA Model, with corresponding text updates in the RI NWA BCA Model Technical Reference Manual (TRM).

1. Input source data, as found in the blue tabs, has been updated to reflect the Avoided Energy Supply Components (AESC) 2021 Report[12] and the 2019 ISO New England Electric Generator Air Emissions Report[13] published datasets.
2. Natural Gas Genset and Diesel Genset technology options added to the "System Type" selector dropdown of the "Inputs-Proposals" tab. Associated technology source data and formulas added.
3. Utility Cost Test (UCT) BCA and net benefits calculations and output cells added to the "Proposals Comparison" tab.

These changes were made to allow for enhanced functionality in the RI NWA BCA Model. With regard to the genset change, National Grid has historically received NWA bid proposals that include genset assets. In order to accurately evaluate the bids submitted by third-parties, the Company added genset-relevant benefit-cost data and inputs.

Please see Appendix 4 for the updated RI NWA BCA Model.

Please see Appendix 5 for the updated clean TRM and Appendix 6 for the updated redline TRM. The TRM describes the components of and changes to the RI NWA BCA Model in detail.

The Company requests approval of the proposed revisions to the RI NWA BCA Model and the proposed corresponding revisions to the RI NWA BCA Model TRM for calendar years 2021 through 2023.

[12] "AESC 2021 Materials." *Synapse Energy Economics, Inc.*, Synapse Energy Economics, Inc., Resource Insight, Les Deman Consulting, North Side Energy, Sustainable Energy Advantage, 15 Mar. 2021, www.synapse-energy.com/project/aesc-2021-materials.
[13] "2019 ISO New England Electric Generator Air Emissions Report." *ISO New England*, ISO New England Inc., Mar. 2021, www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf.

6. NWAs in System Planning

This section details the NWA Screening Criteria and the summary of the annual screening results analysis for the Company's Non-Wires Alternative program in Rhode Island.

6.1 Screening Criteria for NWA

The screening criteria for potential NWA opportunities are as follows:

Table 4: Screening Criteria for NWA Opportunities

Criteria Type	Criteria Requirement
Project Type Suitability	Project types include Load Relief and Reliability.[14] The need is not based on Asset Condition. Other types have minimal suitability and will be reviewed as suitability changes due to State or Federal policy or technological changes.
Timeline Suitability	Start date of solution implementation is at least 24 months in the future.
Cost Suitability	Cost of wires option is greater than $1M.
Load Level Suitability	If load reduction is necessary, then it will be less than 20% of the total load in the area of the defined need.

Additionally, by the Company's discretion, National Grid may pursue a project that does not pass one or more of these criteria if there is reason to believe that a viable NWA solution exists, assuming the benefits of doing so justify the costs.

The only changes to the NWA Screening Criteria from the 2021-2023 SRP Three-Year Plan are reflected in the table above and include:

1. The revision of the timeline suitability criterion language from "start date of system need" to "start date of solution implementation" to accurately align with how the Company assesses potential NWA opportunities, and
2. The separation of the load reduction content into its own criterion for clearer presentation of screening logic. Note that the language for the Load Level Suitability criterion has not been changed, only that it has been separated from the Project Type Suitability criterion.

The "start date of solution implementation" indicates the date the wires solution would otherwise need to be installed and operating. This historically has been how distribution planning screens

[14] For definition of reliability, see "Docket 3628: Proposed Service Quality Plan." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 2004, www.ripuc.ri.gov/eventsactions/docket/3628page.html.

potential opportunities, so this language change indeed more accurately reflects the actual process. “Start date of solution implementation” also allows the NWA option to be directly compared, time-wise, with the wires option as both the non-wires and wires options would reference the same need date.

These screening criteria are applied by the electric distribution planning team to all electric system needs that arise through planning analysis and system assessment. Such screening criteria is utilized during initial system assessment.

The Company requests approval of the two proposed revisions to the NWA screening criteria for Rhode Island as detailed in Table 4 for calendar years 2021 through 2023.

6.2 Analysis of System Needs

Detail on system needs that meet the screening criteria and that the Company has determined may produce a potentially viable NWA opportunity are summarized in the table in Appendix 3 and detailed in the sections below as follows:

6.2.1 Bonnet 42F1

The Bonnet 42F1 NWA opportunity, formerly called Narragansett 42F1 NWA, intends to provide load relief in the Town of Narragansett by deferring or removing the need for feeder line work and reconfiguration on the Bonnet 42F1 feeder. The Bonnet 42F1 system need was identified as part of the South County East Area Study.

The Town of Narragansett is mostly supplied by (4) 12.47 kV distribution feeders. Feeder 42F1 is projected to be loaded above summer normal ratings by 2023 and lacks useful feeder ties to reduce loading below their ratings. Either more capacity must be added or load must be reduced in the town. The distribution system need can be addressed through SRP by implementation of an NWA solution that provides load reduction capability.

The Company expects that the Bonnet 42F1 NWA timeframe will span twelve years from 2023 to 2034, which is the maximum amount of time based on the current peak load forecast that the substation and feeder upgrade can be deferred with this solution. There is the potential for a partial or continued NWA solution following 2034 with the Bonnet 42F1 NWA; however, this option has not been assessed at this time.

The Company issued an RFP for the Bonnet 42F1 NWA opportunity on December 29, 2020 and received third-party bid proposals on April 6, 2021. The Company commenced bid evaluation on April 6, 2021 which is ongoing.

If an NWA solution option is identified that passes all Company NWA evaluation criteria and meets all LCP criteria, then the Company may proceed to propose the NWA investment in an SRP Investment Proposal filing.

6.2.2 Bristol 51

The Bristol 51 NWA opportunity intends to provide load relief and address MWh violations in the Town of Bristol by deferring or removing the need for feeder line work and reconfiguration on the Bristol 51F1, 51F2, and 51F3 feeders. The Bristol 51 system need was identified as part of the East Bay Area Study.

The Town of Bristol is mostly supplied by (3) 12.47 kV distribution feeders. Loading on the 51F1, 51F2, and 51F3 feeders is predicted to be over 100% of their summer normal ratings and will be overloaded in the next ten years. Either more capacity must be added or load must be reduced in the town. The distribution system need can be addressed through SRP by implementation of an NWA solution that provides load reduction capability.

The Company issued an RFP for the Bristol 51 NWA opportunity on June 2, 2020 and received third-party bid proposals on August 11, 2020. The Company received one bid proposal. Through extensive evaluation, the Company determined that the submitted bid did not pass the NWA evaluation criteria.

The Company will proceed with the wires option for the Bristol 51 system need.

6.2.3 South Kingstown

The South Kingstown NWA opportunity intends to provide load relief in the Town of South Kingstown by deferring or removing the need for feeder line work and reconfiguration on the Peacedale 59F3 and Kenyon 68F2 feeders. The South Kingstown system need was identified as part of the South County East Area Study.

The western section of the Town of South Kingstown is supplied mostly by (3) 12.47 kV distribution feeders. Feeders 59F3 and 68F2 are projected to be loaded above summer normal ratings and lack useful feeder ties to reduce loading below their ratings. Either new feeder ties must be constructed or load must be reduced in the western half of the town. The distribution system need can be addressed through SRP by implementation of an NWA solution that provides load reduction capability.

The Company expects that the South Kingstown NWA timeframe will span thirteen years from 2022 to 2034, which is the maximum amount of time based on the current peak load forecast that the substation and feeder upgrade can be deferred with this solution. There is the potential for a partial or continued NWA solution following 2034 with the South Kingstown NWA; however, this option has not been assessed at this time.

The Company issued an RFP for the South Kingstown NWA opportunity on November 23, 2020 and received third-party bid proposals on February 22, 2021. The Company commenced bid evaluation on April 6, 2021 which is currently in progress.

If an NWA solution option is identified that passes all Company NWA evaluation criteria and meets all LCP criteria, then the Company may proceed to propose the NWA investment in an SRP Investment Proposal filing.

7. NPAs in System Planning

This section details the Company's Non-Pipeline Alternatives program in Rhode Island.

The Company proposed to develop the NPA program, process, and its integration with gas system planning over calendar years 2021 through 2023 in its 2021-2023 SRP Three-Year Plan. Status and progress updates on NPA program development are provided as detailed below.

Particularly with respect to progress to date from 2020, and Q1 2021, the Company has developed the NPA definition, the NPA screening criteria, and the NPA evaluation process.

7.1 Program Development Approach

In developing the NPA Program, the Company is leveraging the NWA Program as a baseline. The NWA Program has been developed and improved upon over the past twelve years. The Company strives for continuous improvement through internal and external feedback and has streamlined processes using supporting documentation.

Prior to development of the NPA Program, knowledge-sharing discussions were held with the NWA team. These conversations will continue throughout the development of the NPA Program.

The Company recognizes that while there is opportunity for transferrable components of the program, there are fundamental differences between the gas and electric business units that would prompt divergent, unique, and tailored approaches. At this stage, internal working groups have been established to assess what changes would be needed to reflect and align with gas business requirements and standards. Within these discussions, peer utility reviews have been conducted to incorporate best practices from proposed NPA Programs.

This close internal coordination between the NWA and NPA teams and the external stakeholder input through the SRP TWG has been critical to delivering robust and effective NPA Screening Criteria and NPA Evaluation Process.

7.2 Definition of NPA

The Company proposes the following definition for NPAs.

NPA Definition:	Non-Pipeline Alternatives is the inclusive term for any targeted investment or activity that is intended to defer, reduce, or remove the need to construct or upgrade components of a natural gas system, or "pipeline investment."
NPA Requirements:	These NPA investments are required to be cost-effective and are required to meet the specified gas system need.

An NPA can include any action, strategy, program, or technology that meets this definition and these requirements. The Company is currently engaged in ongoing discussions with stakeholders about potential solution types in consideration of NPA solutions, proposals, and investment decisions.

Some technologies and methodologies that can be applicable as an NPA investment include demand-side measures, such as demand response, conservation or energy efficiency, and electrification, and supply-side measures, such as renewable natural gas (RNG). This is not intended to be an exhaustive list of possible demand-side and supply-side solutions. NPA projects can include these and other investments individually or in combination to meet the specified need in a cost-effective manner.

7.3 Screening Criteria for NPA

The Company proposes the following screening criteria for NPAs.

Table 5: Screening Criteria for NPA Opportunities

Criteria Type	Small Project	Large Project
Timeline Suitability	The start date of solution implementation is at least 24 months but less than 60 months in the future.	The start date of solution implementation is at least 36 months but less than 60 months in the future.
Cost Suitability	The cost of the pipes option is greater than $0.5M but less or equal to $2M.	The cost of the pipes option is greater than $2M.
Reliability of the Gas System	The pipes investment has negligible or no effect on critical reliability of the local or broader gas system. This will be determined through gas system modeling and will be determined based on engineering judgement.	

The projects that meet the screening criteria will be prioritized in consideration of capacity-constrained locations. Capacity-constrained refers to areas of the gas network where the system is challenged to access natural gas when and where it is needed in sufficient quantities to meet customers' peak demand, as described in the Aquidneck Island Long-Term Gas Capacity Study.[15] These capacity-constrained areas serve to greater benefit from the implementation of an NPA in their potential to reduce usage or increase supply during timeframes of peak demand. The Company will prioritize NPA-eligible proposed projects that are in or affect these regions or sections of the gas network.

[15] *Aquidneck Island Long-Term Gas Capacity Study*, The Narragansett Electric Company d/b/a National Grid, Sept. 2020, www.nationalgridus.com/media/pdfs/other/aquidneckislandlong-termgascapacitystudy.pdf.

Additionally, by the Company's discretion, National Grid may propose to pursue a project that does not pass one or more of these criteria if there is reason to believe that a viable NPA opportunity exists, assuming the benefits of doing so justify the costs.

Timeline suitability considers the timeframe between when a proposed pipes investment is identified and the required in-service date.

Cost suitability is determined by the estimated cost of the proposed pipes investment. The Company set the initial floor price at $0.5M based on the consideration that any system need with a pipes option value less than $0.5M would not produce an economically viable NPA opportunity and that the market does not find such NPA opportunities to be fiscally prudent for their goals and policies. The Company will regularly evaluate whether the initial floor price is appropriate based on market feedback.

The large and small project types are based on the development and implementation timeframe and the projected cost needed for proposed pipes investments and considers the overall NPA Program process to source, construct, and implement an NPA in lieu of the proposed pipes investment.

Reliability of the gas system reflects the importance of continued safe and reliable operation. System modeling is utilized to assess immediate, local, and system-wide reliability impacts to the gas network and will be leveraged to identify the proposed pipes investments that have negligible to no effect on the critical reliability. When referring to the local and broader gas system, the Company is referring to each as follows. The local gas system is the adjacent pipes or infrastructure that directly connect to the segment of pipe or infrastructure that is being considered for an NPA. The broader gas system refers to the Company's holistic gas system beyond the direct connections to the segment that is being considered for an NPA. This broad view considers the effect of eliminating components of the system, such as creation of capacity constraints, etc. Investments identified to have negligible to no effect on reliability would be eligible for NPA consideration.

These screening criteria are applied by the Gas Asset and Design Engineering team to gas system needs that arise through planning analysis and system assessment. Such screening criteria is utilized during initial system assessment.

The Company requests approval of the proposed NPA Screening Criteria for Rhode Island as detailed in Table 5 for calendar years 2021 through 2023.

7.4 Evaluation Process for NPA

Following receipt of all bid proposals from an NPA opportunity, National Grid proceeds directly into the evaluation stage of the NPA process. This evaluation and review of submitted bid proposals is comprised of five rounds of evaluation, with each round based on a high-level screening, detailed technical review, detailed economic review, customer acceptance, and final round selections, as detailed in the table and figure below. All bid proposals are evaluated in parallel through these five rounds.

Figure 1: National Grid NPA Evaluation Rounds

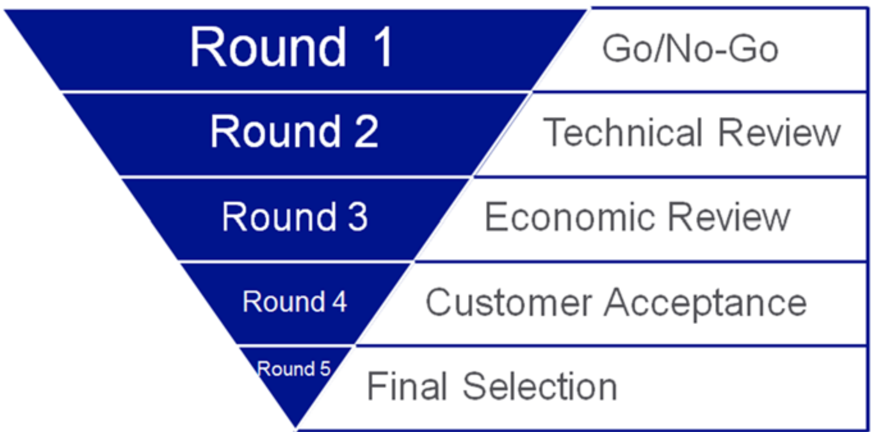


Table 6: National Grid NPA Evaluation Rounds Descriptions

Round	Evaluation Focus
Round 1	Go/No-Go: Preliminary BCA, bidder qualifications, technology type and maturity, schedule, engineering
Round 2	Detailed Technical Review: engineering, controls, communications and operations, permitting, schedule and milestones
Round 3	Detailed Economic Review: full BCA, credit rating assessment, financing structure, payment structure, additional included costs and incentives
Round 4	Customer Acceptance: Customer input from those who would be adopting alternatives dependent upon technology
Round 5	Final Review of Shortlisted Bidders, winning bidder selection as applicable, contract negotiation

The "preliminary BCA", as indicated in Round 1 in the table above, is to determine if the cost-effectiveness of the proposal is feasible. It involves the initial proposed solution cost and applicable benefits based on technology. The "full BCA", as indicated in Round 3 in the table above, include the more complex factors, such as interconnection cost and any contract negotiation changes, and other factors that require deeper research to determine.

Customer Acceptance will play a critical role in the success of implementing an NPA. NPA considers this customer acceptance determination as a separate round. The Company will assess the likelihood of adoption of an NPA solution with learnings from the continued development of the NPA program.

Leveraging the knowledge and lessons learned gained through the Company's NWA Program and NWA evaluation process, the Company has referenced the NWA evaluation categories in order to develop the NPA evaluation process. These evaluation categories will be applied to every NPA bid proposal for any solution approach or technology type that National Grid receives. This includes proposals sourced from third-party solution providers or from an internal National Grid team.

Partial NPA opportunities are also assessed as an option. Partial NPAs are solutions that address part of a specified system need with the rest of the system need addressed by a pipes option. A partial NPA effectively reduces the scope of infrastructure projects.

The factors that will be considered within NPA evaluation include reliability, functionality, existing market conditions for the proposed technologies, societal and environmental impact, cost-effectiveness, safety and risk, flexibility, ability to meet the specific system need, bidder’s experience, and the ability for a solution proposal to pass the BCA. The NPA bid proposal that scores highest in total across all categories and meets the minimum criteria requirements (cost-effective, meets the technical need, and does not detrimentally impact the customer) is selected as the winning bid, as applicable. Additionally, in Rhode Island, the cost and cost-effectiveness are compared between the NPA option and the pipes option, in alignment with LCP 1.3.H. The NPA evaluation categories are detailed and described in Table 7 below.

Table 7: National Grid USA Evaluation Categories for NPA Proposals

Category	Description
Proposal Content & Presentation	Information requested has been provided by the bidder and is sufficiently comprehensive and well presented to allow for evaluation.
Bidder’s Experience	The experience of the Bidder, any Engineering, Procurement and Construction (EPC) contractor, prime subcontractors and, if applicable, O&M operator or other entity responsible for the development, construction, or operation of the proposed solution.
Environmental	The Bidder’s Proposal shall address impacts including but not limited to acoustic, aesthetic, air and greenhouse gas (GHG) emissions, water, and soil impacts, and permitting and zoning considerations. This includes greenhouse gas abatement and considers a proposal’s ability to produce an outcome that reduces the amount of greenhouse gas emissions that would otherwise be produced from the pipes option.
Project Viability	The likelihood that the solution(s) associated with a Proposal can be financed and completed as required by the relevant agreement.

Category	Description
Functionality	The extent to which the proposed solution would meet the defined functional requirements and the ability to provide demand reduction during peak times and within the geographic area of need.
Technical Reliability	The extent to which the proposed type of technology and the equipment would meet the reliability need and can be integrated with utility operations including the ability to monitor and dispatch as applicable.
Safety	National Grid requires that the Bidders recognize safety is of paramount importance. Bidders will be required to provide safety information related to the proposed technology and information regarding safety history. The bid should comply with any jurisdictional compliance and regulatory safety codes.
Customer and Socio-economic Impacts	The Bidder's Proposal shall address how the proposed technology impacts the customer in addition to temporary and permanent jobs to be created, economic development impacts, and property tax payments. National Grid also assesses public health and energy pricing impacts of each solution proposal.
Scheduling	The Bidder's Proposal shall include proposed timelines outlining milestones and provide sufficient detail for each deliverable, including meeting the in-service need date.
Offer Price	The Bidder's Proposal shall be based on project-specific values and financing requirements.
Adherence to Terms	The extent to which the Bidder accepts National Grid's proposed terms will be taken into consideration. The RFP evaluation may impute an additional amount to Bidder's Proposal to reflect any proposed modifications to the non-price terms and conditions by the Bidder that result in National Grid incurring additional costs or risks. Redlines to the terms shall be provided by the Bidder as part of its proposal for review by National Grid during the evaluation period.
Credit	Bidder's capability and willingness to perform all of its financial and other obligations under the relevant agreement will be considered by National Grid in addition to Bidder's financial strength, as determined by National Grid, and any credit assurances acceptable to National Grid that Bidder may submit with its Proposal.
Customer Acceptance	The extent to which the bidder provides compelling evidence for achieving sufficient customer adoption to achieve needed customer adoptions. This may include data, market research, outreach plans on how to promote customer adoptions.
Cost-Effectiveness	This analysis will be performed to determine the cost-effectiveness of a proposal and the RI NPA BCA Model will be used.

8. Rhode Island System Data Portal

This section details the Rhode Island System Data Portal and associated resources.

The Portal is an interactive online mapping tool developed by the Company. The Portal provides specific information for select electric distribution feeders and associated substations within the Company's electric service area in Rhode Island. This information includes feeder characteristics such as geographic locations, voltage, feeder ID, planning area, substation source, approximate loading, and available distribution generation hosting capacity.

The Portal provides this information to stakeholders, customers, and third-party solution providers. The main target audience is third-party solution providers and the main goal of the Portal is to provide information in order to engage the market for cost-effective grid solutions to reduce costs for Rhode Island customers. Therefore, the Portal is considered an SRP resource because it adheres to LCP standards and goals and is a complementary activity to meet electrical energy needs.

Costs related to Portal maintenance and routine operation of existing Portal aspects and work by FTEs are included in the current rate case. Only new enhancements to the Portal are covered in SRP Investment Proposals. New enhancements are expected to originate from collaborative consultation between National Grid and external stakeholders.

A public landing page for the Portal is located on the customer-facing National Grid website.[16]

8.1 Updates to the Portal in the Past Year

The Company has added the following new enhancements to the Portal in CY 2020:

- Addition of the Sea Level Rise map, detailed in Section 8.2 below
- Addition of the ZIP Codes map layer for all maps
- Second update of the "Known Transportation Vehicle Fleet Locations" map layer. Added 19 new locations to detail non-EV fleets that have the potential to be electrified.
- Updated the Rhode Island System Data Portal User Guide to reflect the Sea Level Rise map addition and for better legibility.
- Added the 2019 and 2020 Electric Peak (MW) Forecast Reports to the "Company Reports" tab.
- Added the 2021-2023 System Reliability Procurement Three-Year Plan to the "Company Reports" tab.

These updates were incremental and at no additional cost.

[16] See Rhode Island System Data Portal. *National Grid US*, National Grid USA Service Company, Inc., 2018, www.nationalgridus.com/Business-Partners/RI-System-Portal.

8.2 Portal to Date

To date, the Portal includes tabs that detail select Company reports, a distribution assets overview map, a heat map, a hosting capacity map, sea level rise, and National Grid's NWA program. Each map tab has the date listed in its about dropdown for when the tab data was last updated.

The Company Reports tab lists documents such as the annual SRP reports, annual ISR proposals, the electric peak forecast, and redacted area study reports.

The FAQ tab lists common questions with standard responses to proactively inform and resolve confusion for visitors to the Portal, such as third-party solution providers.

The Distribution Assets Overview tab contains a map that displays specific electric distribution feeder and substation information, summer normal ratings, and up-to-date recorded loading and forecasted loading.

The Heat Map tab contains an interactive color-coded map of distribution feeders based on forecasted load compared to summer normal rating. The heat map provides information on circuits that would benefit from DER interconnection for load relief, and on circuits that have existing capacity for electric vehicle (EV) charging stations, heat pumps, and other beneficial electrification opportunities.

The Hosting Capacity tab contains an interactive map of distribution feeders based on interconnected DG and in-progress DG projects. The hosting capacity map also contains information on substation ground fault overvoltage (3V0) protection status. The Portal details if 3V0 is installed at a substation or if 3V0 is in construction or slated for construction and the proposed in-service date. Installation of 3V0 makes a substation transformer "DG-ready".

The Sea Level Rise tab is an interactive map that overlays National Oceanic and Atmospheric Administration (NOAA) federal sea level rise map data with National Grid's electric distribution network map data in Rhode Island. This map provides information intended to help third-party solution providers and DER developers identify locations on the National Grid electric distribution network in relation to areas that may experience potential coastal flooding impacts in the future. All sea level rise data is sourced and mirrored from the NOAA Sea Level Rise Viewer.[17]

The NWA tab contains a link to National Grid's NWA Website[18], which hosts information on the Company's NWA process and NWA RFP opportunities.

[17] "NOAA Sea Level Rise Viewer." *NOAA Sea Level Rise and Coastal Flooding Impacts*, National Oceanic and Atmospheric Administration of the United States Department of Commerce, https://coast.noaa.gov/slr/.
[18] "Non-Wires Alternatives." *National Grid Business Partners*, National Grid USA, Inc., 13 Nov. 2019, www.nationalgridus.com/Business-Partners/Non-Wires-Alternatives/.

9. SRP Market Engagement

This section provides information regarding the Company's market engagement efforts with respect to SRP.

SRP Market Engagement aims to raise awareness and perform outreach and engagement for the Rhode Island System Data Portal as needed, for NWA-related activities not covered by FTE work, and with third-party solution providers.

Outreach and engagement for activities specific to NWA, such as NWA RFPs, are already included in the work by FTEs dedicated to the development and pursuit of NWA opportunities and solutions. These FTEs are covered by the rate case.

SRP market engagement will enable third-party solution providers and vendors to more easily access available information about National Grid's electric distribution system and SRP opportunities in Rhode Island and therefore further enable these solution providers to create, submit and develop innovative energy solutions for Rhode Island customers. SRP Market Engagement upholds the commitment of National Grid and the State of Rhode Island to advance a more reliable, safe, and cost-effective energy landscape for residents and businesses of Rhode Island.

9.1 Market Engagement Activity of the Past Year

The Company continued market engagement efforts with respect to SRP and NWA during calendar year 2020. The 2020 SRP Outreach and Engagement Plan, as filed in the 2020 SRP Report in PUC Docket No. 4980[19], proposed the following primary business-to-business (B2B) engagement channels that National Grid planned to implement:

- In-Person Demonstrations
- Webinars
- Email
- Paid Search Terms
- Digital Advertisements
- Social Media Engagement
- Feedback Engagement
- Earned Media
- Vendor Contact List
- Contact Channels

[19] "Docket No. 4980." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 15 Oct. 2019, www.ripuc.ri.gov/eventsactions/docket/4980page.html.

The Company struck in-person demonstrations from its market engagement tactics for 2020 due to the rise of the COVID-19 pandemic and with regard to public health and safety.

The Company hosted two (2) Portal webinars in 2020, with email notifications and invites in advance of the webinar dates. The email campaigns had an average open rate of 32.79%, with the average email open rate target set as 15.0%. The Company hosted the first webinar in Q2 on June 18, 2020 with 34 external parties in attendance and the second webinar in Q4 on November 5, 2020 with 11 external parties in attendance. The average webinar attendance target for the Company was 35. The Company assesses that the decreased attendance in Q4 demonstrates market engagement saturation with respect to the Portal, especially considering the higher-than-expected average email open rate.

The Company stopped the paid search terms at the start of 2020 seeing as the four selected terms achieved top web rankings for the Portal landing page links, thereby ensuring that the Portal was now easy to find across all search engines. The terms are: “Rhode Island System Data Portal”, “RI System Data Portal”, “National Grid Rhode Island System Data Portal”, and “National Grid RI System Data Portal”.

The Company maintained digital advertisements for Q1 2020, however stopped the ads after Q1 seeing as web traffic appeared to reach a steady state. The Company resumed digital advertisements during Q3 2020 to drive engagement with the Portal vendor feedback survey.

The Portal vendor feedback survey entailed a pop-up survey form for visitors to complete when they arrived at the Portal landing page. Please see Appendix 7 for the SRP Market Engagement Year-to-Date Results, which is the SRP Marketing and Engagement Plan Quarterly Progress Report for Q4 2020 that shows the cumulative SRP market engagement progress over calendar year 2020 and contains the vendor feedback survey components and results. The Company received minor uptake of the survey by business users that provided National Grid with a perspective on the type of vendor that visits and utilizes the Portal. However, the Company did not receive the quantity of qualitative, targeted feedback that it anticipated; namely that most of the feedback was from residential and not business users. The Company will assess performing a new vendor feedback survey in a more targeted manner in the future with lessons learned applied from the CY 2020 survey. The Company also received residential user feedback that indicated residential user site visits to the Portal were largely incidental and a result of coming across the survey versus actively seeking out the Portal website. The Company did receive a residential user remark on EFI, which is National Grid’s rebate management vendor. The Customer Energy Management (CEM) team was made aware of this comment; however, given that survey submittals were anonymous, response and follow-up with the commenter was not possible.

The Company published four social media updates via National Grid’s LinkedIn page to promote upcoming webinars as well as the survey to the target audience of third-party solution providers.

The Company explored earned media in 2020; however, the Company currently did not find added value for driving market engagement through earned media with the Portal.

The Company further expanded its vendor contact list for SRP and NWA market engagement use. The NWA program has benefitted from this expanded contact list for vendor stakeholder calls and NWA RFP events.

Following calendar year 2020, the Company has entered a maintenance phase with market engagement for the Rhode Island System Data Portal. Therefore, the only planned SRP Market Engagement activities for the Portal are to maintain web traffic analytics to the Portal landing page. These web traffic analytics have no cost to operate or acquire.

Appendices

Appendix 1

Appendix 1 – Rhode Island Company Electric Service Projected Load Growth

Forecasted Load Growth for NWA Opportunities

This appendix provides an overview and update on the Rhode Island electric service projected load growth rates as well as the forecasted load growth for locations in Rhode Island that have the potential for NWA opportunities.

The Company's electric distribution system serves close to 500,000 customers in 38 cities and towns in Rhode Island. The residential class accounts for approximately 41% of the Company's total Rhode Island load, the commercial class accounts for approximately 49%, and the industrial class accounts for approximately 10%.

The forecasted load growth data is derived from the 2021 Electric Peak (MW) Forecast Report[20], which is publicly available in the Company Reports tab on the Rhode Island System Data Portal.

The forecasted load growth rates for counties and towns in Rhode Island are shown in the Rhode Island Projected Load Growth Rates table below. Additionally, as seen in the sections below for Bristol, Kent, and Providence counties, the average annual growth rates are projected to be flat or negative over the next 10 years.

The Bonnet 42F1 and South Kingstown NWA opportunities intend to address the forecasted load growth and system need in Washington County.

The Company has not presently identified other NWA opportunities through the distribution system planning process.

The Company accounts for DR, EE, EV, and PV impacts in the Company's electric peak load forecasting.

Forecasted Load Growth in Bristol County

The Bristol County area annual weather-adjusted summer peak is expected to be flat at an average annual growth rate of 0.0% for the next 10 years. This rate is less than the statewide average annual growth rate of 0.1%.

Forecasted Load Growth in Kent County

The Kent County area annual weather-adjusted summer peak is expected to be flat at an average annual growth rate of 0.0% for the next 10 years. This rate is less than the statewide average annual growth rate of 0.1%.

[20] Gredder, Joseph F., and Jingrui (Rain) Xie. "2021 Electric Peak (MW) Forecast Report." *Rhode Island System Data Portal*, The Narragansett Electric Company d/b/a National Grid, 8 Feb. 2021, http://ngrid-ftp.s3.amazonaws.com/RISysDataPortal/Docs/RI_PEAK_2021_Report_.pdf.

Forecasted Load Growth in Newport County

The Newport County area annual weather-adjusted summer peak is expected to increase at an average annual growth rate of 0.3% for the next 10 years. This rate is greater than the statewide average annual growth rate of 0.1%.

Forecasted Load Growth in Providence County

The Providence County area annual weather-adjusted summer peak is expected to decrease at an average annual growth rate of -0.2% for the next 10 years. This rate is less than the statewide average annual growth rate of 0.1%.

Forecasted Load Growth in Washington County

The Washington County area annual weather-adjusted summer peak is expected to increase at an average annual growth rate of 0.3% for the next 10 years. This rate is greater than the statewide average annual growth rate of 0.1%.

Table A1-1: Rhode Island Projected Load Growth Rates

State	County	Town	Annual Growth Rates (%) 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	5-year Average (%) 2021 to 2025	10-year Average (%) 2021 to 2030
RI			-0.9	-0.8	-0.1	0.5	0.6	0.5	0.4	0.3	0.2	0.2	-0.1	0.1
	BRISTOL		-1.0	-0.9	-0.3	0.3	0.5	0.4	0.3	0.2	0.1	0.1	-0.3	0.0
	KENT		-1.0	-0.9	-0.2	0.4	0.6	0.4	0.3	0.2	0.1	0.1	-0.2	0.0
	NEWPORT		-0.5	-0.4	0.1	0.7	0.9	0.7	0.6	0.5	0.4	0.3	0.2	0.3
	PROVIDENCE		-1.3	-1.1	-0.5	0.2	0.4	0.3	0.2	0.1	0.1	0.0	-0.5	-0.2
	WASHINGTON		-0.6	-0.5	0.1	0.7	0.9	0.7	0.6	0.4	0.3	0.3	0.1	0.3
	WASHINGTON	Kenyon	-3.3	-2.9	-2.1	-1.3	-1.0	-1.0	-0.9	-0.9	-0.9	-0.8	-2.1	-1.5
	WASHINGTON	Narragansett	-2.3	-2.1	-1.3	-0.6	-0.3	-0.4	-0.4	-0.4	-0.4	-0.4	-1.3	-0.9
	WASHINGTON	Peace Dale	-0.4	-0.3	0.2	0.8	0.9	0.7	0.6	0.5	0.4	0.3	0.3	0.4

Appendix 2

Appendix 2 – Screened Wires Projects

Table A2-1: Screened Wires Projects

Count	Project ID	Project Description	NWA Comment	Partial NWA Comment	Capex Spending Rational	Date Initiated
1	C085464	Apponaug 3V0 Distribution Substation	Does not meet NWA screening requirements - Programmatic Ground Fault Overvoltage Protection to address accumulated Distributed Energy Resource interconnections	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	4/6/2020
2	C085540	ELDRED 3V0 Distribution Substation	Does not meet NWA screening requirements - Programmatic Ground Fault Overvoltage Protection to address accumulated Distributed Energy Resource interconnections	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	4/15/2020
3	C085553	RI Repl ACNW Vault Vent Blowers	Does not meet NWA screening requirements - Specific project opened as part of the program to provide manhole ventilation methods to promote natural exchange of air in the duct systems	This project would not be suitable for consideration of a Partial NWA	Asset Condition	4/17/2020
4	C085628	RI Mobile 3V0 Units	Does not meet NWA screening requirements - Programmatic Ground Fault Overvoltage Protection to address accumulated Distributed Energy Resource interconnections	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	4/28/2020
5	C085688	RI- VVO Putnam Pike	Upon further evaluation, the VVO projects are not proposed to address system concerns, the program is used to reduce customer cost and customer energy and therefore there are no comparable NWA projects at this time.	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	5/6/2020
6	C085689	RI VVO Putnam Pike	Upon further evaluation, the VVO projects are not proposed to address system concerns, the program is used to reduce customer cost and customer energy and therefore there are no comparable NWA projects at this time.	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	5/6/2020
7	C085812	Covid Scenario Analysis Work RI	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	5/20/2020
8	C085927	Shippee Ave Voltage Conversion	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	6/11/2020
9	C086391	Verizon Copper to Fiber Conversions	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	Non-Infrastructure	8/28/2020
10	C086486	Admiral Sub Animal Fence	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	9/11/2020
11	C086494	LightHouse URD Cable Replacement	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	9/14/2020

Count	Project ID	Project Description	NWA Comment	Partial NWA Comment	Capex Spending Rational	Date Initiated
12	C086514	RI GE type U bushing Replacement	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	9/16/2020
13	C086518	Columbus Ave Voltage Conversion	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	9/16/2020
14	C086631	RI Repl ACNW Vault Vent Blowers	Does not meet NWA screening requirements - Asset Condition Driven Project	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	10/5/2020
15	C086694	IR-URD Village Point Jud Narra, RI	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	10/15/2020
16	C086862	ACNW Vlt 46 Reconstruction, Prov.	Does not meet NWA screening requirements - Specific project opened as part of the program to provide manhole ventilation methods to promote natural exchange of air in the duct systems	This project would not be suitable for consideration of a Partial NWA	Asset Condition	11/13/2020
17	C086869	ACNW Vlt 72 Reconstruction, Prov.	Does not meet NWA screening requirements - Specific project opened as part of the program to provide manhole ventilation methods to promote natural exchange of air in the duct systems	This project would not be suitable for consideration of a Partial NWA	Asset Condition	11/13/2020
18	C086879	Install PTRs-Highland Corp Ind Park	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	11/16/2020
19	C086993	IRURD Michael Drive Linc Rplc	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	12/16/2020
20	C087120	RI UG Cable Repl Prog Fdr 1103	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	1/13/2021
21	C087124	RI UG Cable Repl Prog Fdr 1171	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	1/13/2021

Count	Project ID	Project Description	NWA Comment	Partial NWA Comment	Capex Spending Rational	Date Initiated
22	C087126	RI UG Cable Repl Prog Fdr 1103A	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	1/13/2021
23	C087128	RI UG Cable Repl Prog Fdr 1103B	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	1/13/2021
24	C087133	RI UG Cable Repl Prog Fdr 1121	Does not meet NWA screening requirements - Asset Condition Driven Project, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA because it is an Asset Condition Driven Program	Asset Condition	1/13/2021
25	C087239	Re-Conductoring 48F1 - COVID	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	1/29/2021
26	C087241	Re-Conductoring 20F2 - COVID	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	1/29/2021
27	C087242	72F3 Reconductor - COVID Analysis	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	1/29/2021
28	C087244	72F5 Reconductoring COVID Analysis	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	1/29/2021
29	C087276	COVID Re-conductoring 59F3	Does not meet NWA screening requirements - Timeline of need was immediate, <$1 Million in cost	This project would not be suitable for consideration of a Partial NWA	System Capacity & Performance	2/2/2021
30	C087362	Natick 3V0 Distribution Substation	Does not meet NWA screening requirements - Programmatic Ground Fault Overvoltage Protection to address accumulated Distributed Energy Resource interconnections	This project would not be suitable for consideration of a Partial NWA	Reliability	2/12/2021
31	C087363	Wampanoag 3V0 Distribution Substation	Does not meet NWA screening requirements - Programmatic Ground Fault Overvoltage Protection to address accumulated Distributed Energy Resource interconnections	This project would not be suitable for consideration of a Partial NWA	Reliability	2/12/2021
32	C087367	Phillipsdale DLine	Does not meet NWA screening requirements - Asset Condition Driven Project	This project would not be suitable for consideration of a Partial NWA	Asset Condition	2/12/2021
33	C087630	Chopmist 34F2 Breaker Rplmt	Does not meet NWA screening requirements - Asset Condition Driven Project	This project would not be suitable for consideration of a Partial NWA	Reliability	3/23/2021

Appendix 3

Appendix 3 – NWA Opportunities Summary

Table A3-1: NWA Opportunities Summary

Project Title	Project Purpose	System Need Detail	NWA Project Details	Affected System Components	Project Origination	Planned Wires Option Work	Planned Start Date	NWA Option Status
Bonnet 42F1 NWA	Load Reduction	The Town of Narragansett is mostly supplied by (4) 12.47 kV distribution feeders. Feeder 42F1 is projected to be loaded above summer normal ratings by 2024 and lacks useful feeder ties to reduce loading below their ratings. Either more capacity must be added or load must be reduced in the town.	Load reduction on Bonnet 42 substation, feeder 42F1 to defer or remove the need for feeder line work and reconfiguration.	Bonnet 42F1 feeder	South County East Area Study	Extend the 59F4 out of Peacedale down to the 17F3 out of Wakefield and create a new feeder tie, as well as move existing load. Make switching steps to further adjust load on the system.	5/1/2023	Bids in evaluation
Bristol 51 NWA	MWh Violation and Load Reduction	The Town of Bristol is mostly supplied by (3) 12.47 kV distribution feeders. Loading on the 51F1, 51F2, and 51F3 feeders is predicted to be over 100% of their summer normal ratings and will be overloaded in the next ten years. Either more capacity must be added or load must be reduced in the town.	Load reduction on Bristol 51 substation feeders 51F1, 51F2, 51F3 to defer or remove the need for feeder line work and reconfiguration.	Bristol 51 substation feeders: 51F1, 51F2, 51F3	East Bay Area Study	To resolve the projected MWh exposure and un-served load in the Bristol area, a new feeder is recommended at Bristol substation along with some feeder mainline upgrades and area feeder reconfigurations. The projected in-service date for this new feeder is calendar year 2028.	5/1/2022	No viable bids received
South Kingstown NWA	Load Reduction	The western section of the Town of South Kingston is supplied mostly by (3) 12.47 kV distribution feeders. Two of those feeders (59F3 and 68F2) are projected to be loaded above summer normal ratings and lack useful feeder ties to reduce loading below their ratings. Either new feeder ties must be created or load must be reduced in the western half of the town.	Load reduction on Peacedale 59F3 and Kenyon 69F2 feeders to defer or remove the need for feeder line work and reconfiguration.	Peace Dale 59F3 feeder Kenyon 69F2 feeder	South County East Area Study	Tap existing 68F5 Kenyon Feeder (at Biscuit City Road with new PTR, and extend 20,000' to P12 Tuckertown Road to create a new Normally Open tie point with the 59F3). With this new line extension, load from 68F2 and 59F3 can be transferred to the 68F5, offloading the two overloaded circuits.	6/1/2022	Bids in evaluation

Appendix 4

Appendix 4 – RI NWA BCA Model - Confidential

Please be advised that the Company is seeking confidential treatment of Appendix 4.

The Company is providing Appendix 4 as an Excel file because it is too large to legibly produce as a PDF file.

Appendix 5

Appendix 5 – RI NWA BCA Model Technical Reference Manual

nationalgrid

National Grid's Technical Reference Manual
for the
Benefit-Cost Analysis
of
Non-Wires Alternatives
in
Rhode Island

For use by and prepared by

The Narragansett Electric Company d/b/a National Grid

May 2021

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Table of Contents

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NATIONAL GRID's RHODE ISLAND NON-WIRES ALTERNATIVES BENEFIT-COST ANALYSIS TECHNICAL REFERENCE MANUAL

1. Introduction

National Grid's[1] Rhode Island Non-Wires Alternatives Benefit-Cost Analysis Technical Reference Manual (RI NWA BCA TRM) details how the Company assesses cost-effectiveness of Non-Wires Alternative (NWA) opportunities planned in Rhode Island through the Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model (RI NWA BCA Model). This cost-effective assessment is in alignment with the Rhode Island Benefit Cost Test (RI Test) as detailed in the Docket 4600 Benefit-Cost Framework[2] and in accordance with Sections 1.3(B) and 1.3(C) of the Least-Cost Procurement Standards (LCP Standards) as detailed in Docket 5015[3], with both dockets respectively approved by the Rhode Island Public Utilities Commission (PUC)[4]. Although the LCP Standards were originally developed for the Company's Energy Efficiency (EE) program, the same principles have been applied to other benefit-cost analyses (BCA) conducted by the Company at the request of the PUC, including the RI NWA BCA Model.

The following RI NWA BCA Model approach was based on the LCP Standards:

I. Assess the cost-effectiveness of the NWA portfolio per a benefit-cost test that builds on the Total Resource Cost Test (TRC Test) approved by the Public Utilities Commission (PUC) in Docket 4443[5], but that more fully reflects the policy objectives of the State with regard to energy, its costs, benefits, and environmental and societal impacts. Based on the Company's EE Program Plans, in consultation with the EERMC, it was determined that these benefits should include resource impacts, non-energy impacts, distribution system impacts, economic development impacts, and the value of greenhouse gas (GHG) reductions, as described below.

II. Apply the following principles when developing the RI Test:

   a. **Efficiency and Conservation as a Resource.** EE improvements and energy conservation are some of the many resources that can be deployed to meet customers' needs. It should, therefore, be compared with both supply-side and demand-side alternative energy resources in a consistent and comprehensive manner.
   b. **Energy Policy Goals.** Rhode Island's cost-effectiveness test should account for its applicable policy goals, as articulated in legislation (e.g., Resilient Rhode Island Act[6]), PUC orders, regulations, guidelines, and other policy directives.

[1] The Narragansett Electric Company d/b/a National Grid (National Grid or Company).
[2] "Docket No. 4600 and Docket No. 4600-A." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 2 Nov. 2018, www.ripuc.ri.gov/eventsactions/docket/4600page.html.
[3] "Least Cost Procurement Standards." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Energy Efficiency and Resource Management Council, 21 Aug. 2020, http://www.ripuc.ri.gov/eventsactions/docket/5015_LCP_Standards_05_28_2020_8.21.2020%20Clean%20Copy%20FINAL.pdf.
[4] "RIPUC." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, State of Rhode Island, www.ripuc.ri.gov/.
[5] "Docket No. 4443." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Energy Efficiency and Resource Management Council, 17 Sept. 2013, www.ripuc.ri.gov/eventsactions/docket/4443page.html.
[6] "Resilient Rhode Island Act of 2014 - Climate Change Coordinating Council." *Chapter 42-6.2*, State of Rhode Island and Providence Plantations, 2014, http://webserver.rilin.state.ri.us/Statutes/TITLE42/42-6.2/INDEX.HTM.

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c. **Hard-to-Quantify Impacts.** BCA practices should account for all relevant, important impacts, even those that are difficult to quantify and monetize.
d. **Symmetry.** BCA practices should be symmetrical, for example, by including both costs and benefits for each relevant type of impact.
e. **Forward Looking**. Analysis of the impacts of the investments should be forward-looking, capturing the difference between costs and benefits that would occur over the life of the NWA investment with those that would occur absent the investments (i.e., "Reference Case"). Sunk costs and benefits are not relevant to a cost-effectiveness analysis.
f. **Transparency.** BCA practices should be completely transparent, and should fully document and reveal all relevant inputs, assumptions, methodologies, and results.

III. With respect to the value of greenhouse gas reductions, the RI Test shall include the costs of carbon dioxide (CO_2) mitigation as they are imposed and are projected to be imposed by the Regional Greenhouse Gas Initiative (RGGI)[7]. The RI Test shall also include any other utility system costs associated with reasonably anticipated future greenhouse gas reduction requirements at the state, regional, or federal level for both electric and gas programs. The RI Test may include the value of greenhouse gas reduction not embedded in any of the above (e.g., non-embedded or societal CO_2 costs). The RI Test may also include the costs and benefits of other emissions and their generation or reduction through LCP (e.g., nitrogen oxides (NOx), sulfur dioxide (SO_2)).

IV. Benefits and costs that are projected to occur over the project life of the individual NWA projects shall be stated in present value terms in the RI Test calculation using a discount rate that appropriately reflects the risks and opportunity cost of the investment.

[7] "State Statutes & Regulations - Rhode Island." *The Regional Greenhouse Gas Initiative*, RGGI, Inc., www.rggi.org/program-overview-and-design/state-regulations.

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2. Overview of the Rhode Island Test

The RI Test compares the present value of a stream of **total benefits** to the **total costs** of the investment, **over the life** of that investment necessary to implement and realize the **net benefits**. The RI Test captures the value produced by the investment installed over the useful life of the investment. The investment life is based on the individual NWA contract timeframe and thus is expected to change on a per project basis.

The benefits calculated in the RI Test are primarily avoided resource (e.g., electric energy) supply and delivery costs, valued at marginal cost for the periods when there is a load reduction; and the monetized value of non-resource savings including avoided costs compared to a Reference Case (e.g., avoided utility capital and operations and maintenance (O&M) costs). The costs calculated in the RI Test are those borne by both the utility and by participants plus the increase in supply costs for any period when load is increased. All capital expenditure (CAPEX) (e.g., equipment, installation) and operational expenditure (OPEX) (e.g., evaluation and administration) are included.

All savings included in the value calculations are net savings. The expected net savings are typically an engineering estimate of savings modified to reflect the actual realization of savings based on evaluation studies, when available. The expected net savings also reflect market effects due to the program (*e.g.*, Demand Reduction Induced Price Effects (DRIPE)).

In accordance with Section 1.3.B of the revised Standards, National Grid adheres to the RI Test for all NWA investment proposals. National Grid has developed the RI NWA BCA Model, which is a derivative of the RI Test and utilizes the same Docket 4600 Benefit-Cost Framework, to more accurately assess NWA opportunities benefits and costs. The benefit categories and formulas in the RI NWA BCA Model are detailed in Section 3.

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3. Description of Program Benefits and Costs

Table 1 summarizes the benefits and costs included in the RI Test and how they are treated in the Company's NWA BCA. Note that an "X" indicates that the category is quantified while an "O" indicates the category is unquantified, as applicable for RI NWAs. The "Docket 4600 Category" column in the table below references the categories and their respective details listed within Appendix A of Docket 4600.[8]

Table 1. Summary of RI Test Benefits and Costs and Treatment

RI Test Category	Docket 4600 Category	NWA	Notes
Electric Energy Benefits	Energy Supply & Transmission Operating Value of Energy Provided or Saved (Power System Level)	X	
	Retail Supplier Risk Premium (Power System Level)	X	
	Criteria Air Pollutant and Other	X	
	Distribution System Performance (Power System Level)	X	
Renewable Portfolio Standards (RPS) and Clean Energy Policies Compliance Benefits	REC Value (Power System Level)	X	
	GHG Compliance Costs (Power System Level)	X	
	Environmental Externality Costs (Power System Level)	X	
Demand Reduction Induced Price Effects	Energy DRIPE (Power System Level)	X	
Electric Generation Capacity Benefits	Forward Commitment Capacity Value (Power System Level)	X	
Electric Transmission Capacity Benefits	Electric Transmission Capacity Value (Power System Level)	X	
	Electric Transmission Infrastructure Costs for Site-Specific Resources	X	
Electric Distribution Capacity Benefits	Distribution Capacity Costs (Power System Level)	X	
Natural Gas Benefits	Participant non-energy benefits: oil, gas, water, wastewater (Customer Level)	O	(1)
Delivered Fuel Benefits		O	
Water and Sewer Benefits		O	
Value of Improved Reliability	Distribution System and Customer Reliability/Resilience Impacts (Power System Level)	X	
Non-Energy Impacts	Distribution Delivery Costs (Power System Level)	O	(2)
	Distribution system safety loss/gain (Power System Level)	O	
	Customer empowerment and choice (Customer Level)	O	

[8] "Docket No. 4600-A." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 3 Aug. 2017, www.ripuc.ri.gov/eventsactions/docket/4600A-PUC-GuidanceDocument-Notice_8-3-17.pdf. Appendix A.

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RI Test Category	Docket 4600 Category	NWA	Notes
	Utility low income (Power System Level)	O	
	Non-participant rate and bill impacts (Customer Level)	O	
Non-Embedded GHG Reduction Benefits	GHG Externality Cost (Societal Level)	X	
Non-Embedded NOx Reduction Benefits	Criteria Air Pollutant and Other Environmental Externality Costs (Societal Level)	X	
Non-Embedded SO_2 Reduction Benefits	Public Health (Societal Level)	X	
Economic Development Benefits	Non-energy benefits: Economic Development (Societal Level)	O	(3)
Utility Costs	Utility / Third Party Developer Renewable Energy, Efficiency, or Distributed Energy Resources costs	X	
Participant Costs	Program participant / prosumer benefits / costs (Customer Level)	X	
Notes (1) These non-electric utility benefits are expected to be negligible for a site-specific targeted need (i.e., NWAs). (2) Currently do not have data to claim benefits for a targeted need case. (3) Sensitivity analysis is currently under development. This benefit is negligible unless sensitivity analysis determines otherwise.			

The following additional Docket 4600 Benefit Categories require further analysis to determine the appropriate methodology and magnitude of quantitative or qualitative impacts:

- Low-income participant benefits (Customer Level)
- Forward commitment avoided ancillary services value (Power System Level)
- Net Risk Benefits to Utility System Operations from Distributed Energy Resource (DER) Flexibility & Diversity (Power System Level)
- Option value of individual resources (Power System Level)
- Investment under uncertainty: real options value (Power System Level)
- Innovation and learning by doing (Power System Level)
- Conservation and community benefits (Societal Level)
- Innovation and knowledge spillover - related to demo projects and other Research, Design, and Development (RD&D) (Societal Level)
- Societal low-income impacts (Societal Level)
- National security and US international influence (Societal Level)

All quantified NWA benefits are directly associated with the development of non-wires compared to a Reference Case with no NWA options. The source for many of the avoided cost value components is the "Avoided Energy Supply Components in New England: 221 Report" (AESC 2021 Study) prepared by Synapse Energy Economics for AESC 2021 Study Group, March, 2021.[9] This report was sponsored by the

[9] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/project/aesc-2021-materials

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electric and gas EE program administrators of National Grid in New England and is designed to be used for cost-effectiveness screening in 2019 through 2021.

The AESC Study determines projections of marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels, as well as avoided environmental compliance costs resulting from EE and other conservation programs. The AESC study is prepared every three years for the AESC Study Group, which is comprised of the Program Administrators as detailed in the AESC Study, as well as utilities throughout New England and other interested non-utility parties.

The AESC Study provides projections of avoided costs of energy in each New England state for a hypothetical future in which a myriad of EE and DER opportunities exist. In the 2021 AESC study four counterfactual cases exist based upon the inclusion of energy efficiency, building electrification, and active demand management. For the purpose of this BCA counterfactual #2 was utilized. This is the most inclusive counterfactual including energy efficiency and active demand management being utilized in 2021 and later years. This counterfactual does not include future building electrification but due to the limitations of the various models it is determined to be the most applicable for NWAs.

The RI NWA BCA methodology is technology agnostic and should be broadly applicable to all anticipated project and portfolio types, with some adjustments as necessary. Specific technology's availability during the specified system need time may differ. This technology coincidence factor is based upon the association between the system, transmission, and distribution peak for the specified NWA need, as detailed in Section 5.2 of National Grid's New York BCA Handbook.[10] These generalized values are subject to change.

3.1 Electric Energy Benefits

Electric energy benefits due to NWA implementation can be a result of reduced energy usage (e.g., targeted EE or DR), a shift of usage from peak to off-peak (e.g., battery storage), or energy generation (e.g., solar). The resulting avoided electric energy costs are appropriate benefits for inclusion in the RI NWA BCA Model. Electric energy benefits are valued using the avoided electric energy costs developed in the AESC 2021 Study, Appendix B.[11]

Avoided costs may be viewed as a proxy for market costs. However, avoided costs may be different from wholesale market spot costs because avoided costs are based on simulation of market conditions, as opposed to real-time conditions. They may be different from standard offer commodity costs because of time lags and differing opinions on certain key assumptions, such as short-term fuel costs.

AESC's wholesale cost of electric energy includes pool transmission losses (PTL) incurred from the generator to the point of delivery to the distribution companies, while AESC's retail cost of electric energy includes the wholesale cost plus the cost of renewable energy credits (RECs) borne by generators (i.e.,

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[10] "National Grid Version 2.0 Benefit-Cost Analysis (BCA) Handbook." *National Grid Non-Wires Alternatives: Additional Information*, Niagara Mohawk Corporation d/b/a National Grid, 31 July 2018, www.nationalgridus.com/media/pdfs/bus-partners/ny_bca_handbook_v2.0.pdf.

[11] "AESC 2021 Materials." *Avoided Energy Supply Components in New England: 2021 Report, Appendix B*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/project/aesc-2021-materials

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embedded GHG costs), wholesale risk premium (WRP) that captures market risk factors typically recovered by generators in their pricing,[12] and distribution losses incurred from the Independent System Operator (ISO) delivery point to the end-use customer. In the RI NWA BCA benefits calculation, energy savings are grossed up using factors that represent transmission and distribution losses, situation dependent, because a reduction in energy use at the end user means that amount of energy does not have to be generated, plus the extra generation that is needed to cover the losses that occur in the delivery.

AESC's avoided energy cost values also internalize the expected cost of complying with current or reasonably anticipated future regional or federal greenhouse gas reduction requirements, which are borne by generators and passed through in wholesale costs.

Both the wholesale and retail costs of electric energy in the AESC 2021 Study are provided in four different costing periods consistent with ISO New England Inc. (ISO-NE) definitions. Net energy savings are apportioned into these periods in the value calculation. The time periods are defined as follows:

- Winter Peak: October – May, 7:00 a.m. – 11:00 p.m., weekdays excluding holidays.
- Winter Off-Peak: October – May; 11:00 p.m. – 7:00 a.m., weekdays. Also, including all weekends and ISO defined holidays.
- Summer Peak: June – September, 7:00 a.m. – 11:00 p.m., weekdays excluding holidays.
- Summer Off-Peak: June – September; 11:00 p.m. – 7:00 a.m., weekdays. Also, including all weekends and ISO defined holidays.

NWA system needs have targeted time of use that fall within the above time periods. Each system need will therefore have a specific ratio of the four time periods. Energy savings for NWAs are allocated to the targeted times and multiplied by the appropriate avoided energy value. Generally, the system need is occurring during summer peak.

In cases where an energy use transfer occurs (e.g., battery storage) energy reductions and increases could occur across time periods. Each time period is calculated separately and then added together resulting in a net monetized energy reduction value. Furthermore, in solutions with energy losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

To account for the value of embedded CO_2 costs (i.e., RECs) separately in the RI NWA BCA Model, AESC's wholesale cost of electric energy values is used as the basis for electric energy savings benefits. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. These benefit values are then grossed up using the appropriate WRP that captures market risk factors typically recovered by generators in their pricing,[13] and distribution loss factors representing losses from the ISO delivery point to the end-use customer.

[12] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.
[13] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.

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The AESC 2021 Study assumes 9% for marginal system losses.[14] Marginal losses are more in line with the peaking nature of NWA use cases. This is similar to the Company's distribution loss estimate of 6.9% for "Secondary Voltage" customers, which are predominantly residential and small commercial customers (e.g., Rates A-16, A-60, C06, G02)[15], plus the Company's non-PTF transmission loss estimates of 0.07%.

Each technology then has a rating factor that is applied based on its system need coincidence.

The dollar value of annual benefits is therefore calculated as:

- Summer Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings ElectricEnergyCost$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Summer Off-Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Winter Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Winter Off-Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- ElectricEnergyCost ($/kWh) = Projected annual values for each time period (AESC 2021, Appendix B, "Wholesale Cost of Electric Energy")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- WRP = 8% (AESC 2021, Appendix B, "WRP" AESC default value)
- %Losses = 9% (AESC 2021, Appendix B, "Marginal Loss" ISO-NE default value)
- %Inflation = 2% (AESC 2021, Appendix E, page 327)

3.2 RPS and Clean Energy Policy Compliance Benefits

This benefit category captures the value of avoided embedded CO_2 and SO_2 costs separately from the "Environmental and Public Health Benefits" category. These RPS and Clean Energy Policy compliance benefits due to NWAs are the results of the reduced energy usage as described in Section 3.1.

[14] "AESC 2021 Materials." *Avoided Energy Supply Components in New England: 2021 Report, Appendix B*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/project/aesc-2021-materials

[15] "Tariff Provisions." *National Grid: Bills, Meters & Rates*, National Grid US, www.nationalgridus.com/RI-Business/Rates/Tariff-Provisions.

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The resulting avoided RPS and Clean Energy Policy (i.e., RGGI) compliance costs are appropriate benefits for inclusion in the RI NWA BCA Model. When customers do not have to purchase electric energy because of an investment an avoided RPS and Clean Energy Policy compliance benefit is created. These compliance benefits are valued using the avoided wholesale REC costs developed in the AESC 2021 Study, Appendix B.[16] Due to the expanding geographical footprint of the RGGI initiative, and the electricity usage now being dominated by states outside of New England, the AESC treats the effects of RGGI as an exogenous price.

SO_2 emissions pricing is determined by the allowance under the Cross-State Air Pollution Rule (CASPR) and the Acid Rain Program (ARP). The 2020 SO_2 spot auction resulted in a price of $0.02 per short ton. No embedded NOx pricing is assumed.

Nominal annual benefits are calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. These benefit values are then grossed up using the appropriate WRP that captures market risk factors typically recovered by generators in their pricing,[17] and distribution loss factor representing losses from the ISO delivery point to the end-use customer. Each technology then has a rating factor that is applied based on its system need coincidence. Furthermore, in solutions with energy losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

The dollar value of the annual benefits is therefore calculated as:

- RPS and Clean Energy Policy Compliance Benefit ($/yr) = ElectricEnergySavings kWh/yr * (RGGICompliance $/kWh + SOx Embedded) * TechnologyCoincidence * EfficiencyLoss * (1 + %Inflation)^(year-2021) * (1 + WRP) * (1 + %Losses)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- RGGICompliance ($/kWh) = Projected annual values (AESC 2021, Appendix B, "REC Costs")
- SOx Embedded ($/kWh) = Projected annual values (AESC 2021, Page 107)[18]
- %Inflation = 2.00% (AESC 2021, Appendix E, Page 327)
- WRP = 8% (AESC 2021, Appendix B, "WRP" AESC default value)
- %Losses = 9% (AESC 20218, Appendix B, " Marginal Loss" ISO-NE default value)
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution

3.3 Demand Reduction Induced Price Effects

[16] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/project/aesc-2021-materials
[17] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.
[18] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf Page 107

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DRIPE is the reduction in prices in energy and capacity markets resulting from the reduction in need for energy and/or capacity due to reduced demand from electric system investments. These electric system investments can include NWAs. These investments avoid both marginal energy production and capital investments, but also lead to structural changes in the market due to lower demand. Over a period of time, the market adjusts to lower demand, but until that time the reduced demand leads to a reduction in the market price of the energy commodity. This is observed in the New England market when ISO-NE activates its price response programs. When this price effect is a result of NWAs, it is appropriate to include the impact in the RI NWA BCA Model.

DRIPE effects are very small when expressed in terms of an impact on market prices, i.e., reductions of a fraction of a percent. However, the DRIPE impacts are significant when expressed in absolute dollar terms over all the kWh and kW transacted in the market. Very small impacts on market prices, when applied to all energy and capacity being purchased in the market, translate into large absolute dollar amounts. AESC provides values for two types of DRIPE benefits, Intrastate and Rest of Pool (ROP). Intrastate DRIPE takes credit for the reduced clearing price for Rhode Island customers, while ROP DRIPE takes credit for the reduced clearing price for customers across New England. The base case BCA results exclude ROP DRIPE to align with standard industry practice.

Intrastate Energy, Capacity, and Cross DRIPE values developed for the AESC 2021 Study are used in the RI NWA BCA Model. Wholesale Energy DRIPE values in the AESC 2021 Study are provided in four different costing periods consistent with ISO-New England (ISO-NE) definitions. Net energy savings are split up into these periods in the value calculation. See Section 3.1 for time period definitions. Both wholesale and retail Capacity DRIPE values are provided in the AESC 2021 Study on an annual basis. AESC also provides annual wholesale Cross DRIPE values to account for natural gas price effects caused by a change in electricity generation demand. Each technology then has a rating factor that is applied based on its system need coincidence. Furthermore, in solutions with energy losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

Capacity DRIPE is valued differently in the AESC report depending upon whether the benefit results from resources that are bid into the Forward Capacity Market (FCM) (i.e., cleared resources) or reductions in peak demand that are not bid into the FCM (i.e., uncleared resources). For NWA solutions the DRIPE avoided cost forecast for uncleared resource values is used. AESC assumes a lag of 5 years between the appearance of the load reduction and the realization of the Capacity DRIPE benefits for uncleared resources (e.g., load reductions in 2021 results in benefits in 2026). To maintain that lag, DRIPE capacity benefits are shifted based on the commercial operating date of the NWA solution.

Energy and Cross DRIPE benefits are also shifted based on the commercial operating date, but the benefits are realized the year after installation, with the $/kWh avoided costs shifted forward one year and escalated by one year of inflation. Loss factors are applied to the wholesale Energy and Cross DRIPE values to account for local transmission and distribution (T&D) losses from the point of delivery to the distribution company's system to the ultimate customer's facility. Wholesale Capacity DRIPE values are used in the RI NWA BCA Model calculations and then T&D loss factors applied. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. Capacity DRIPE's demand savings are calculated to be coincident with the ISO-NE definition of the peak, which is in the summer.

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The dollar value of annual benefits is therefore calculated as:

- Summer Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings ElectricEnergyCost$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Summer Off-Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Winter Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Winter Off-Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Cross DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * CrossDRIPE $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Generation Capacity DRIPE Benefit ($/yr) = ElectricDemandSavings kW/yr$_{SumPk}$ * WholesaleCapDRIPE $/kW-yr * TechnologyCoincidence * (1 + WRP) * (1 + %Losses$_{Cap}$) * (1 + %Inflation)^(year-2021)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- ElectricDemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- EnergyDRIPE ($/kWh) = Projected annual values (AESC 2021, Appendix B, "Intrastate - Wholesale Energy DRIPE")
- CrossDRIPE ($/kWh) = Projected annual values (AESC 2021, Appendix B, "Intrastate – Wholesale Cross DRIPE")
- RetailCapDRIPE ($/kW-yr) = Projected annual values (AESC 2021, Appendix B, "Intrastate – Capacity DRIPE – Uncleared")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- WRP = 8% (AESC 2021, Appendix B, "WRP" AESC default value)
- %Losses = 9% (AESC 2021, Appendix B, "Marginal Loss" ISO-NE default value)
- %Losses$_{Cap}$ = 16% (AESC 2021, Appendix B, "Marginal Loss Capacity" ISO-NE default value)
- %Inflation = 2% (AESC 2021, Appendix E, Page 327)

3.4 Electric Capacity Benefits

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At the generation and transmission level, electric capacity benefits due to NWAs are a result of load reductions at summer peak. At the distribution and site-specific transmission level, electric capacity benefits are a result of the deferred system upgrade. This value is an avoided cost based on a time-deferred expected project cost of the system upgrade.

3.4.1 Electric Generation Capacity Benefits

When generators do not have to build new generation facilities or when construction can be deferred because of NWAs, an avoided electric energy resource benefit is created. In the New England capacity market, capacity benefits accrue because demand reduction reduces ISO-NE's installed capacity requirement. The capacity requirement is based on avoided load's contribution to the system peak, which, for ISO-NE, is the summer peak. Generation capacity avoided costs are driven by load at the time of the ISO-NE peak, which has by convention associated with an hour ending at 3 PM or 5 PM on a hot summer day.[19] Therefore, capacity benefits accrue only from summer peak demand reduction; there is currently no winter generation capacity benefit for ISO-NE.

Peak demand savings created through NWAs are valued using the avoided wholesale capacity values from the 2021 AESC, Appendix B. The values are then grossed up to account for wholesale risk premium (WRP) and distribution losses. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. Demand savings are calculated to be coincident with the ISO-NE definition of peak, which is in the summer.

The dollar value of annual benefits is therefore calculated as:

- Generation Capacity Benefit ($/yr) = ElectricDemandSavings kW/yr$_{SumPk}$* CapCost $/kW-yr * %Summer Coincidence * TechnologyCoincidence * (1+WRP) * (1+%Losses$_{Cap}$) * (1 + %Inflation)^(year-2021)

Where:

- ElectricDemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- WholesaleCapCost ($/kW-yr) = Projected annual values (AESC 2021, Appendix B, "Wholesale Electric Capacity – Uncleared")
- %Summer Coincidence: % of NWA peak capacity at ISO peak
- TechnologyCoincidence: Coincidence factor applied based on the solution technology type
- WRP = 8% (AESC 2021, Appendix B, "WRP" AESC default value)
- %Losses$_{Cap}$ = 16% (AESC 2021, Appendix B, "Marginal Loss Capacity" ISO-NE default value)
- %Inflation = 2% (AESC 2021, Appendix E, Page 327)

The AESC 2021 Study includes two types of wholesale capacity values: 1) cleared capacity (Forward Capacity Auction (FCA) price), which is the traditional valuation of electric generation capacity, and 2) uncleared capacity, which is a new approach to valuing the capacity of short duration measures that are

[19] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Page 239.

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not actively bid in the ISO-NE Forward Capacity Market (FCM). The AESC study provides these two values for avoided electric generation capacity, which are differentiated based on whether a load reduction is taken into account when bidding into the FCM (cleared capacity) or is not (uncleared capacity), and an overall weighted average avoided capacity value representing a weighted average of the cleared capacity and uncleared capacity values.

Given the three year forward nature of the FCM and the timing of the ISO-NE load forecast, it takes five years from the time of load reduction for uncleared capacity to begin impacting the FCM procurements. As a result, measures with a useful life less than five years (e.g., traditional demand response programs) would not produce any generation capacity benefits in years 1-5 under the traditional capacity modeling methodology.

NWAs will not be considered when bidding into the FCM, so the uncleared capacity values are used.

3.4.2 Electric Transmission Capacity Benefits

When transmission facilities do not have to be built or can be deferred because of NWAs, an avoided electric energy resource benefit is created. Electric transmission capacity benefits are valued in the RI Test based on the costs of Pool Transmission Facilities (PTF). The AESC 2021 Study calculates an avoided cost for PTF of $84/kW-year in 2021 dollars.

Capacity loss factors are applied to the avoided transmission capacity cost to account for local transmission and distribution (T&D) losses from the point of delivery to the distribution company's system to the ultimate customer's facility. Thus, T&D losses are accounted for from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. Demand savings are calculated to be coincident with the ISO-NE definition of peak, which is in the summer.

The dollar value of annual benefits is therefore calculated as:

- Transmission Benefit ($/yr) = DemandSavings kW/yr$_{SumPk}$ * TransCapCost $/kW-yr * %Summer Coincidence * TechnologyCoincidence * (1 + %Losses$_{Avg}$) * (1 + %Inflation)^(year-2021) * TransmissionCoincidence

Where:

- DemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- TransCapCost ($/kW-yr) = $84/kW-year (AESC 2021, Appendix B, "T&D Cost")
- %Summer Coincidence = % of NWA peak capacity at ISO peak
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- %Losses$_{Avg}$ = 8% (AESC 2021, Page 333 "PTF Losses", "Average Loss Peak")
- %Inflation = 2% (AESC 2021, Appendix E, Page 327)
- TransmissionCoincidence (%)= System Need (MW)/RI Capacity (MW)

3.4.3 Electric Distribution Capacity Benefits

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Distribution Capacity benefit is based on the direct deferred distribution infrastructure due to the implementation of the NWA. This value includes such inputs as deferred capital expenditure, deferred O&M, and deferred taxes over the expected contract timeframe of the NWA.

3.4.4 Electric Transmission Infrastructure Site-Specific Benefits

Transmission Infrastructure Site-Specific benefit is based on the direct deferred transmission infrastructure due to the implementation of the NWA. This value includes such inputs as deferred capital expenditure, deferred O&M, and deferred taxes over the expected contract timeframe of the NWA. This value will typically be null for NWAs.

3.5 Natural Gas Benefits

An avoided resource benefit is produced when a project, in which customers have invested, reduces natural gas usage. Natural Gas benefits are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.6 Delivered Fuel Benefits

An avoided resource benefit is produced when a project, in which customers have invested, reduces delivered fuel usage. Avoided delivered fuel costs (natural gas, propane, or fuel oil) are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.7 Water and Sewer Benefits

An avoided resource benefit is produced when a project, in which customers have invested to save electricity or fuel, also reduces water consumption. Examples of reduced water consumption can include a cooling tower project that reduces makeup water usage or need. Water and sewer benefits are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.8 Value of Improved Reliability

Due to the site-specific nature of these solutions, a reliability benefit should also be localized. The reliability benefit is currently difficult to quantify due to the new nature of the technologies that NWAs typically utilize. This benefit will be developed and applied as more projects are implemented and technology-specific reliability values are determined.

3.9 Non-Energy Impacts

Non-Energy Impacts (NEIs) can be produced as a direct result of NWA investments and are therefore appropriate for inclusion in the RI NWA BCA Model. Non-energy impacts may include but are not limited to: labor, material, facility use, health and safety, materials handling, national security, property values, and transportation. For income-eligible measures, NEIs also include the impacts of lower energy bills, such as reduced arrearages or avoided utility shut-off costs. These benefits are currently seen to be negligible for NWAs.

3.10 Environmental and Public Health Impacts

Environmental benefits due to NWAs are a result of reduced energy use from the implemented solution. The resulting avoided environmental costs are appropriate benefits for inclusion in the RI NWA BCA Model. Reduction in the use of electricity generated at central power plants provides environmental

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benefits to Rhode Island and the region, including reduced greenhouse gas emissions and improved air quality.

3.10.1 Non-Embedded Greenhouse Gas Reduction Benefits

Carbon dioxide and other GHG emissions come from a variety sources, including the combustion of fossil fuels like natural gas, coal, gasoline, and diesel. Increase in atmospheric CO_2 concentrations contributes to an increase in global average temperature, which results in market damages, such as changes in net agricultural productivity, energy use, and property damage from increased flood risk, as well as nonmarket damages, such as those to human health and to the services that natural ecosystems provide to society.[20]

According to the AESC 2021 Study, the cost of GHG emissions reductions can be determined based on estimating either carbon damage costs or marginal abatement costs. Damage costs in the AESC are sourced from the December 2020 SCC Guidance published by the State of New York. This guidance recommended a 15 year levelized price of $128 per short ton. Due to the many uncertainties in climate damage cost estimates, the AESC study concluded that the marginal abatement cost method should be used instead. This method asserts that the value of damages avoided, at the margin, must be at least as great as the cost of the most expensive abatement technology used in a comprehensive strategy for emission reduction.[21]

The AESC 2021 Study developed three approaches for calculating the non-embedded cost of carbon based on marginal abatement costs. Note that “non-embedded” costs are not included in AESC’s modeling of energy prices, as opposed to “embedded” costs, which include costs associated with RGGI, SO_2 regulation programs.[22] The first approach is an estimate for the global marginal carbon abatement cost based on carbon capture and sequestration technology, which yields a value of $92 per short ton of CO_2 equivalent and is lower than the prior AESC 2018 Study[23] value used. The second approach is based on a New England specific marginal abatement cost, where it is assumed that the marginal abatement technology is offshore wind. The third approach assumes a New England specific cost derived from multiple sectors, not just electric.

The New England specific marginal abatement costs assume a $125 per short ton of CO2 emissions. This is based on the future cost trajectories of offshore wind facilities along the east coast of the United States. This aligns with New York Department of Environmental Conservation’s 2020 valuation of $125 per ton. This value is used in this BCA model.

The costs of compliance with the RGGI are already included or “embedded” in the projected electric energy market prices. Therefore, the difference between the $125 per short ton societal cost and the RGGI compliance costs already embedded in the projected energy market prices represents the value of

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[20] National Academies of Sciences, Engineering, and Medicine 2017. Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press. https://doi.org/10.17226/24651.

[21] “Avoided Energy Supply Components in New England: 2021 Report.” *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Pages 171 to 182.

[22] “Avoided Energy Supply Components in New England: 2021 Report.” *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. See *Chapter 4. Common Electric Assumptions* for a discussion of how these costs are modeled.

[23] “Avoided Energy Supply Components in New England: 2018 Report.” *AESC 2018 Materials*, Synapse Energy Economics, Inc., 2018, https://www.synapse-energy.com/project/aesc-2018-materials

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carbon emissions not included in the avoided energy costs. The AESC 2021 calculates this value at a $/kwh broken into winter/summer and peak/off-peak aligning with and not double counting the energy benefits calculated in section 3.1.

Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for marginal losses from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

- Non-Embedded GHG Reduction Benefit Summer Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded GHG Reduction Benefit Summer Off-peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded GHG Reduction Benefit Winter Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded GHG Reduction Benefit Winter Off-Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- Non-Embedded GHG Costs: Projected annual values for each time period (AESC 2021, Appendix B, "Non-Embedded GHG Costs")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %Losses = 9% (AESC 2021, Appendix B, "Marginal Loss", ISO-NE default value) %Inflation = 2% (AESC 2021, Appendix E, Page 327)

3.10.2 Non-Embedded NOx Reduction Benefits

Nitrogen oxide (NOx) emissions come from a variety of sources including heavy duty vehicles, industrial processes, and the combustion of natural gas for electricity generation. NOx contributes to the formation of fine particle matter (PM) and ground-level ozone that are associated with adverse health effects including heart and lung diseases, increased airways resistance, which can aggravate asthma and other

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underlying health issues, and respiratory tract infections. In addition to known health impacts, PM pollution and ozone are also likely to contribute to negative climate impacts.[24]

In February, 2018, the US EPA published a Technical Support Document for estimating the benefit of reducing PM2.5 precursors from 17 sectors, including avoided NOx costs from "electricity generating units".[25] The EPA document estimates national average values for mortality and morbidity per ton of directly-emitted NOx reduced for 2016, 2020, 2025, and 2030 based on the results from two other studies.[26,27] Using the average results from the two studies the non-embedded NOx emissions cost to be $10,100 per ton in 2020 (2015 dollars). This translates into a $0.90 per MWh in 2020.
The AESC 2021 Study also estimates avoided NOx emissions costs utilizing a continental U.S. average, non-embedded NOx emission wholesale cost of $14,700 per ton of NOx (2021 dollars).[28] This translates to a $0.77 per MWh in 2021. The RI NWA BCA model utilizes the AESC 2021 value broken down into a winter/summer and peak/off-peak kWh value.

Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021 real dollar values to nominal values. Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for local T&D losses from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2018 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

- Non-Embedded NOx Reduction Benefit Summer Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Summer Off-peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Winter Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Winter Off-Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)

[24] "Our Nation's Air: Status and Trends through 2019." *Our Nation's Air: Trends Report*, United States Environmental Protection Agency, 2020, https://gispub.epa.gov/air/trendsreport/2020.
[25] "Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors (February 2018)." *US EPA Benefits Mapping and Analysis Program (BenMAP)*, United States Environmental Protection Agency, Feb. 2018, www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-17-sectors.
[26] Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Yet al., "Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality", Boston Health Effects Institute, 2009.
[27] Lepeule J, Laden F, Dockery D, and Schwartz J, "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009", EHP Vol 120 No. 7, July 2012.
[28] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Page 183

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Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- Non-Embedded NOx Costs: Projected annual values for each time period (AESC 2021, Appendix B, "Non-Embedded NOx Costs")
- TechnologyCoincidence = Coincidence Factor based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %Losses = 9% (AESC 2021, Appendix B, "Marginal Loss", "ISO default")
- %Inflation = 2% (AESC 2021, Appendix E, Page 327)

3.10.3 Non-Embedded SO_2 Reduction Benefits

Sulfur dioxide (SO_2) emissions come from a variety of sources including industrial processes and the combustion of coal (especially high-sulfur coal) and fuel oil for electricity generation and heating. SO_2 contributes to the formation of fine PM that are associated with adverse health effects including heart and lunch diseases and increased airways resistance, which can aggravate asthma and other underlying health issues. In addition to known health impacts, PM pollution is also likely to contribute to negative climate impacts.[29]

In February, 2018, the US EPA published a Technical Support Document for estimating the benefit of reducing PM2.5 precursors from 17 sectors, including avoided SO_2 costs from "electricity generating units".[30] The EPA document estimates national average values for mortality and morbidity per ton of directly-emitted SO_2 reduced for 2016, 2020, 2025, and 2030 based on the results from two other studies.[31,32] Using the average of the results from the two studies, the RI NWA BCA Model estimates the SO_2 emissions cost to be $69,000 per ton of SO_2 in 2020 (2015 dollars) increasing to $79,500 per ton of SO_2 in 2030 (2015 dollars). These translate into $3.80 per MWh in 2020 and $4.6037 per MWh in 2030 (2015 dollars) using the ISO-NE 2019 marginal SO_2 emissions factor of 0.02 lb SO_2/MWh.[33] Nominal annual benefits are then calculated using an average inflation rate to convert the 2015 real dollar values to nominal values.

Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for local transmission and distribution (T&D) losses from the generator to the end-use customer. Nominal annual

[29] "Our Nation's Air: Status and Trends through 2019." *Our Nation's Air: Trends Report*, United States Environmental Protection Agency, 2020, https://gispub.epa.gov/air/trendsreport/2020.
[30] "Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors (February 2018)." *US EPA Benefits Mapping and Analysis Program (BenMAP)*, United States Environmental Protection Agency, Feb. 2018, www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-17-sectors.
[31] Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Yet al., "Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality", Boston Health Effects Institute, 2009.
[32] Lepeule J, Laden F, Dockery D, and Schwartz J, "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009", EHP Vol 120 No. 7, July 2012.
[33] "2019 ISO New England Electric Generator Air Emissions Report." *ISO New England*, ISO New England Inc., March 2021, https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf. Page 32, Table 5-3.

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benefits are then calculated using an average inflation rate to convert AESC's 2018 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

- Non-Embedded SO_2 Reduction Benefit ($/yr) = ElectricEnergySavings kWh/yr * SO_2EmissionsRate ton/kWh * (NonEmbeddedSO_2Value $/ton - Embedded$SO_2$Value $/ton) * TechnologyCoincidence * EfficiencyLoss (1 + %Losses) * (1 + %Inflation)^(year-2015)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- SO_2EmissionsRate (ton/kWh) = 0.02 lb SO_2/MWh * 1/1,000 MWh/kWh ÷ 2,000 lb/ton (ISO-NE 2021,[34] Table 5-3, 2019 Time-Weighted LMU Marginal Emissions Rates-All LMUs, SO_2 "Annual Average (All Hours)")
- NonEmbeddedSO_2Value ($/ton) = $69,000-$79,500/ton (US EPA 2019, Tables 5-10, average of SO_2 from "Electricity Generation Units", 2015 dollars)
- EmbeddedSO_2Value ($/ton) = $0.02/ton (AESC 2021, Page 107, SO_2 "2021$")[35]
- TechnologyCoincidence = Coincidence Factor based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %Losses = 9% (AESC 2021, Appendix B, "Marginal Loss", "ISO default")
- %Inflation = 2% (AESC 2021, Appendix E, Page 327)

Note that the AESC 2021 Study does not include estimates for avoided SO_2 emissions costs due to the Study's assertion that most of the available emission data is quite old and the impacts are very small.[36]

3.11 Economic Development Benefits

The Docket 4600 Framework includes consideration of societal economic development benefits and notes that such benefits can be reflected via a qualitative assessment or, alternatively, can be quantified through detailed economic modelling. Therefore, economic development impacts (e.g., economic growth, job creation) can be quantified using the Regional Economic Models, Inc. (REMI) model of the Rhode Island economy, which estimates the increased economic activity resulting from investments. The overall societal impact is measured by net Rhode Island gross domestic product (GDP), which encompasses job years, incomes, state tax revenues and the increased competitiveness of Rhode Island business firms.

National Grid agrees with Docket 4600 that economic development benefits are important. However, including these benefits in the base case BCA results can be problematic due to the relatively high uncertainty associated with these benefits, which can discredit other more precise components of the

[34] "2019 ISO New England Electric Generator Air Emissions Report." *ISO New England*, ISO New England Inc., March 2021, https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf. Page32.
[35] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf . Page 107.
[36] "Avoided Energy Supply Components in New England: 2021 Report." *AESC 2021 Materials*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf Page 56.

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BCA. Additionally, because the benefits can be large, they create a “masking” effect. For these reasons, the RI NWA BCA Model did not consider economic development benefits in its BCA.

3.12 Contract/Solution Costs

The contract or solution cost is the direct cost for the NWA. This could be a payment schedule to a third party or for paid customer participation (e.g., targeted energy efficiency or demand response). These cost schedules are typically based on an annual, semi-annual, or monthly cadence. Additionally, these cost schedules may involve an annual escalator. In cases with a known, irregular cost schedule these costs can be entered manually in their respective years.

3.13 Administrative Costs

Administrative costs are related to the ongoing support of the NWA. Administrative costs can include evaluation, measurement and verification (EM&V) costs, ongoing communications and information technology fees, or additional costs related to the post-implementation costs to keep the NWA viable. For each solution an annual expected administrative cost will be applied. In cases with a known, irregular admin cost schedule these costs can be entered manually in their respective years.

3.14 Utility Interconnection Costs

The interconnection cost is the cost for physically and digitally linking the solution to the electric system. This can include upgrading the wires (e.g., with a battery storage or solar solution) or a telecommunications upgrade. Interconnection costs will be determined on a case-by-case basis regarding the specific system need and its respective targeted NWA. This cost will generally be a capital expenditure, initially borne by the utility, prior to the commercially viable date of the NWA solution.

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4. Benefit-Cost Calculations

The RI NWA BCA Model is a comparison tool to be utilized to analyze multiple solutions with respective technologies to assess their cost-effectiveness. Currently four technology types are assessed: Battery Storage, Solar, Demand Response, and Energy Efficiency. The RI NWA BCA Model will be expanded as new technologies or solutions evolve. The RI NWA BCA Model is structured to allow for any given solution to utilize any, all, or a combination of these technologies on a per solution basis.

As prescribed by the Standards, the RI NWA BCA Model uses a "discount rate that appropriately reflects the risks of the investment". The Company maintains that the most reasonable rate at which to discount future year costs and benefits is the Company's after-tax Weighted Average Cost of Capital (WACC) (currently 6.97%)[37] since the NWA investments are utility investments, and after-tax WACC is the Company's effective discount rate.

The total benefits will equal the sum of the net present value (NPV) of each annual benefit component:

- [Electric Energy Benefits + Compliance Benefits + DRIPE Benefits + Electric Generation Capacity Benefits + Electric Transmission Capacity Benefits + Electric Distribution Capacity Benefits + Electric Transmission Infrastructure Site Specific + Natural Gas Benefits + Fuel Benefits + Water & Sewer Benefits + Value of Improved Reliability + Non-Energy Impacts + Non-Embedded GHG Reduction Benefits + Non-Embedded NOx Reduction Benefits + Non-Embedded SO_2 Reduction Benefits + Economic Development Benefits]

The total costs will equal the sum of the NPV of each annual cost component:

- [Contract/Participant Costs + Program Administrative Costs + Utility Interconnection Costs]

The RI Test benefit-cost ratio (BCR) will then equal:

- Total NPV Benefits ÷ Total NPV Costs

The BCA can then financially compare multiple solutions, regardless of technology type.

The NWA investment will be considered cost-effective if the BCR for the resource is greater than 1.0.

[37] "Docket No. 4770." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 29 Nov. 2017, www.ripuc.ri.gov/eventsactions/docket/4770page.html.

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5. Appendices

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Appendix 1: AESC 2021 Materials Source Reference

Please refer to the following citation for the Appendix B data tables of the AESC 2021 Study materials.

> "AESC 2021 Materials." *Avoided Energy Supply Components in New England: 2021 Report*, Synapse Energy Economics, Inc., 2021, https://www.synapse-energy.com/project/aesc-2021-materials.

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Appendix 2: Table of Terms

Term	Definition
AESC	Avoided Energy Supply Components
AESC 2021 Study	Avoided Energy Supply Components in New England: 2021 Report
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
Capex	Capital expenditure
CO_2	Carbon dioxide
DER	Distributed Energy Resource
DG	Distributed Generation
DR	Demand Response
DRIPE	Demand Reduction Induced Price Effect(s)
EE	Energy Efficiency
EE Plan	Energy Efficiency Program Plan
EEP	Energy Efficiency Program
EERMC	Energy Efficiency and Resource Management Council
EM&V	Evaluation, Measurement, and Verification
EPA	Environmental Protection Agency
ESS	Energy Storage System
FCA	Forward Capacity Auction
FCM	Forward Capacity Market
FERC	Federal Energy Regulatory Commission
GDP	Gross Domestic Product
GHG	Greenhouse gas
ISO	Independent Systems Operator
ISO-NE	ISO New England Inc.
kW	Kilowatt
kWh	Kilowatt-hour
LCP	Least-Cost Procurement
LCP Standards	Least-Cost Procurement Standards
LMU	Locational Marginal Unit
MW	Megawatt
MWh	Megawatt-hour
NERC	North American Energy Reliability Corporation
NOx	Nitrogen oxides (NO, NO_2)

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Term	Definition
NPV	Net Present Value
NWA	Non-Wires Alternative
O&M	Operations and Maintenance
Opex	Operational expenditure
PM	Particulate Matter
PTF	Pool Transmission Facilities
PTL	Pool Transmission Losses
PUC	Public Utilities Commission
RD&D	Research, Design, and Development
REC	Renewable Energy Credit
REMI	Regional Economic Models, Inc.
RGGI	Regional Greenhouse Gas Initiative
RI	Rhode Island
RI NWA BCA Model	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model
RI NWA BCA TRM	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Technical Reference Manual
RI Test	Rhode Island Benefit-Cost Test
ROP	Rest of Pool
RPS	Renewable Portfolio Standards
SO_2	Sulfur dioxide
T&D	Transmission and Distribution
TRC Test	Total Resource Cost Test
TRM	Technical Reference Manual
US	United States of America
WACC	Weighted Average Cost of Capital
WCMA	West/Central Massachusetts
WRP	Wholesale Risk Premium

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Appendix 6

Appendix 6 – RI NWA BCA Model Technical Reference Manual

Redline Version

nationalgridnationalgrid

National Grid's Technical Reference Manual

for the

Benefit-Cost Analysis

of

Non-Wires Alternatives

in

Rhode Island

For use by and prepared by

The Narragansett Electric Company d/b/a National Grid

~~September~~ May 2021~~0~~

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Table of Contents

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NATIONAL GRID's RHODE ISLAND NON-WIRES ALTERNATIVES BENEFIT-COST ANALYSIS TECHNICAL REFERENCE MANUAL

1. Introduction

National Grid's[1] Rhode Island Non-Wires Alternatives Benefit-Cost Analysis Technical Reference Manual (RI NWA BCA TRM) details how the Company assesses cost-effectiveness of Non-Wires Alternative (NWA) opportunities planned in Rhode Island through the Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model (RI NWA BCA Model). This cost-effective assessment is in alignment with the Rhode Island Benefit Cost Test (RI Test) as detailed in the Docket 4600 Benefit-Cost Framework[2] and in accordance with Sections 1.3(B) and 1.3(C) of the Least-Cost Procurement Standards (LCP Standards) as detailed in Docket 5015[3], with both dockets respectively approved by the Rhode Island Public Utilities Commission (PUC)[4]. Although the LCP Standards were originally developed for the Company's Energy Efficiency (EE) program, the same principles have been applied to other benefit-cost analyses (BCA) conducted by the Company at the request of the PUC, including the RI NWA BCA Model.

The following RI NWA BCA Model approach was based on the LCP Standards:

I. Assess the cost-effectiveness of the NWA portfolio per a benefit-cost test that builds on the Total Resource Cost Test (TRC Test) approved by the Public Utilities Commission (PUC) in Docket 4443[5], but that more fully reflects the policy objectives of the State with regard to energy, its costs, benefits, and environmental and societal impacts. Based on the Company's EE Program Plans, in consultation with the EERMC, it was determined that these benefits should include resource impacts, non-energy impacts, distribution system impacts, economic development impacts, and the value of greenhouse gas (GHG) reductions, as described below.

II. Apply the following principles when developing the RI Test:

   a. **Efficiency and Conservation as a Resource.** EE improvements and energy conservation are some of the many resources that can be deployed to meet customers' needs. It should, therefore, be compared with both supply-side and demand-side alternative energy resources in a consistent and comprehensive manner.
   b. **Energy Policy Goals.** Rhode Island's cost-effectiveness test should account for its applicable policy goals, as articulated in legislation (e.g., Resilient Rhode Island Act[6]), PUC orders, regulations, guidelines, and other policy directives.

[1] The Narragansett Electric Company d/b/a National Grid (National Grid or Company).
[2] "Docket No. 4600 and Docket No. 4600-A." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 2 Nov. 2018, www.ripuc.ri.gov/eventsactions/docket/4600page.html.
[3] "Least Cost Procurement Standards." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Energy Efficiency and Resource Management Council, 21 Aug. 2020, http://www.ripuc.ri.gov/eventsactions/docket/5015_LCP_Standards_05_28_2020_8.21.2020%20Clean%20Copy%20FINAL.pdf.
[4] "RIPUC." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, State of Rhode Island, www.ripuc.ri.gov/.
[5] "Docket No. 4443." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Energy Efficiency and Resource Management Council, 17 Sept. 2013, www.ripuc.ri.gov/eventsactions/docket/4443page.html.
[6] "Resilient Rhode Island Act of 2014 - Climate Change Coordinating Council." *Chapter 42-6.2*, State of Rhode Island and Providence Plantations, 2014, http://webserver.rilin.state.ri.us/Statutes/TITLE42/42-6.2/INDEX.HTM.

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c. **Hard-to-Quantify Impacts.** BCA practices should account for all relevant, important impacts, even those that are difficult to quantify and monetize.
d. **Symmetry.** BCA practices should be symmetrical, for example, by including both costs and benefits for each relevant type of impact.
e. **Forward Looking**. Analysis of the impacts of the investments should be forward-looking, capturing the difference between costs and benefits that would occur over the life of the NWA investment with those that would occur absent the investments (i.e., "Reference Case"). Sunk costs and benefits are not relevant to a cost-effectiveness analysis.
f. **Transparency.** BCA practices should be completely transparent, and should fully document and reveal all relevant inputs, assumptions, methodologies, and results.

III. With respect to the value of greenhouse gas reductions, the RI Test shall include the costs of carbon dioxide (CO_2) mitigation as they are imposed and are projected to be imposed by the Regional Greenhouse Gas Initiative (RGGI)[7]. The RI Test shall also include any other utility system costs associated with reasonably anticipated future greenhouse gas reduction requirements at the state, regional, or federal level for both electric and gas programs. The RI Test may include the value of greenhouse gas reduction not embedded in any of the above (e.g., non-embedded or societal CO_2 costs). The RI Test may also include the costs and benefits of other emissions and their generation or reduction through LCP (e.g., nitrogen oxides (NOx), sulfur dioxide (SO_2)).

IV. Benefits and costs that are projected to occur over the project life of the individual NWA projects shall be stated in present value terms in the RI Test calculation using a discount rate that appropriately reflects the risks and opportunity cost of the investment.

[7] "State Statutes & Regulations - Rhode Island." *The Regional Greenhouse Gas Initiative*, RGGI, Inc., www.rggi.org/program-overview-and-design/state-regulations.

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2. Overview of the Rhode Island Test

The RI Test compares the present value of a stream of **total benefits** to the **total costs** of the investment, **over the life** of that investment necessary to implement and realize the **net benefits**. The RI Test captures the value produced by the investment installed over the useful life of the investment. The investment life is based on the individual NWA contract timeframe and thus is expected to change on a per project basis.

The benefits calculated in the RI Test are primarily avoided resource (e.g., electric energy) supply and delivery costs, valued at marginal cost for the periods when there is a load reduction; and the monetized value of non-resource savings including avoided costs compared to a Reference Case (e.g., avoided utility capital and operations and maintenance (O&M) costs). The costs calculated in the RI Test are those borne by both the utility and by participants plus the increase in supply costs for any period when load is increased. All capital expenditure (CAPEX) (e.g., equipment, installation) and operational expenditure (OPEX) (e.g., evaluation and administration) are included.

All savings included in the value calculations are net savings. The expected net savings are typically an engineering estimate of savings modified to reflect the actual realization of savings based on evaluation studies, when available. The expected net savings also reflect market effects due to the program (*e.g.*, Demand Reduction Induced Price Effects (DRIPE)).

In accordance with Section 1.3.B of the revised Standards, National Grid adheres to the RI Test for all NWA investment proposals. National Grid has developed the RI NWA BCA Model, which is a derivative of the RI Test and utilizes the same Docket 4600 Benefit-Cost Framework, to more accurately assess NWA opportunities benefits and costs. The benefit categories and formulas in the RI NWA BCA Model are detailed in Section 3.

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3. Description of Program Benefits and Costs

Table 1 summarizes the benefits and costs included in the RI Test and how they are treated in the Company's NWA BCA. Note that an "X" indicates that the category is quantified while an "O" indicates the category is unquantified, as applicable for RI NWAs. The "Docket 4600 Category" column in the table below references the categories and their respective details listed within Appendix A of Docket 4600.[8]

Table 1. Summary of RI Test Benefits and Costs and Treatment

RI Test Category	Docket 4600 Category	NWA	Notes
Electric Energy Benefits	Energy Supply & Transmission Operating Value of Energy Provided or Saved (Power System Level)	X	
	Retail Supplier Risk Premium (Power System Level)	X	
	Criteria Air Pollutant and Other	X	
	Distribution System Performance (Power System Level)	X	
Renewable Portfolio Standards (RPS) and Clean Energy Policies Compliance Benefits	REC Value (Power System Level)	X	
	GHG Compliance Costs (Power System Level)	X	
	Environmental Externality Costs (Power System Level)	X	
Demand Reduction Induced Price Effects	Energy DRIPE (Power System Level)	X	
Electric Generation Capacity Benefits	Forward Commitment Capacity Value (Power System Level)	X	
Electric Transmission Capacity Benefits	Electric Transmission Capacity Value (Power System Level)	X	
	Electric Transmission Infrastructure Costs for Site-Specific Resources	X	
Electric Distribution Capacity Benefits	Distribution Capacity Costs (Power System Level)	X	
Natural Gas Benefits	Participant non-energy benefits: oil, gas, water, wastewater (Customer Level)	O	(1)
Delivered Fuel Benefits		O	
Water and Sewer Benefits		O	
Value of Improved Reliability	Distribution System and Customer Reliability/Resilience Impacts (Power System Level)	X	
Non-Energy Impacts	Distribution Delivery Costs (Power System Level)	O	(2)
	Distribution system safety loss/gain (Power System Level)	O	
	Customer empowerment and choice (Customer Level)	O	

[8] "Docket No. 4600-A." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, Rhode Island Public Utilities Commission, 3 Aug. 2017, www.ripuc.ri.gov/eventsactions/docket/4600A-PUC-GuidanceDocument-Notice_8-3-17.pdf. Appendix A.

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RI Test Category	Docket 4600 Category	NWA	Notes
	Utility low income (Power System Level)	O	
	Non-participant rate and bill impacts (Customer Level)	O	
Non-Embedded GHG Reduction Benefits	GHG Externality Cost (Societal Level)	X	
Non-Embedded NOx Reduction Benefits	Criteria Air Pollutant and Other Environmental Externality Costs (Societal Level)	X	
Non-Embedded SO_2 Reduction Benefits	Public Health (Societal Level)	X	
Economic Development Benefits	Non-energy benefits: Economic Development (Societal Level)	O	(3)
Utility Costs	Utility / Third Party Developer Renewable Energy, Efficiency, or Distributed Energy Resources costs	X	
Participant Costs	Program participant / prosumer benefits / costs (Customer Level)	X	

Notes
(1) These non-electric utility benefits are expected to be negligible for a site-specific targeted need (i.e., NWAs).
(2) Currently do not have data to claim benefits for a targeted need case.
(3) Sensitivity analysis is currently under development. This benefit is negligible unless sensitivity analysis determines otherwise.

The following additional Docket 4600 Benefit Categories require further analysis to determine the appropriate methodology and magnitude of quantitative or qualitative impacts.:

- ~~Low income~~Low-income participant benefits (Customer Level)
- Forward commitment avoided ancillary services value (Power System Level)
- Net Risk Benefits to Utility System Operations from Distributed Energy Resource (DER) Flexibility & Diversity (Power System Level)
- Option value of individual resources (Power System Level)
- Investment under uncertainty: real options value (Power System Level)
- Innovation and learning by doing (Power System Level)
- Conservation and community benefits (Societal Level)
- Innovation and knowledge spillover - related to demo projects and other Research, Design, and Development (RD&D) (Societal Level)
- Societal low-income impacts (Societal Level)
- National security and US international influence (Societal Level)

All quantified NWA benefits are directly associated with the development of non-wires compared to a Reference Case with no NWA options. The source for many of the avoided cost value components is the "Avoided Energy Supply Components in New England: 2~~01~~~~8~~21 Report" (AESC 20~~18~~21 Study) prepared by Synapse Energy Economics for AESC 20~~18~~21 Study Group, ~~June 1~~March, 20~~18~~21.[9] This report was

[9] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf.~~ https://www.synapse-energy.com/project/aesc-2021-materials

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sponsored by the electric and gas EE program administrators of National Grid in New England and is designed to be used for cost-effectiveness screening in 2019 through 2021.

The AESC Study determines projections of marginal energy supply costs that will be avoided due to reductions in the use of electricity, natural gas, and other fuels, as well as avoided environmental compliance costs resulting from EE and other conservation programs. The AESC study is prepared every three years for the AESC Study Group, which is comprised of the Program Administrators as detailed in the AESC Study, as well as utilities throughout New England and other interested non-utility parties.

The AESC Study provides projections of avoided costs of energy in each New England state for a hypothetical future in which a myriad of EE and DER opportunities exist. In the 2021 AESC study four counterfactual cases exist~~s~~ based upon the inclusion of energy efficiency, building electrification, and active demand management. For the purpose of this BCA counterfactual #~~-~~2 was utilized. This is the most inclusive counterfactual including energy efficiency and active demand management –being utilized in 2021 and later years. ~~in which no new EE programs are implemented in New England (“Main Case”), and one in which EE programs are implemented (“With EE” sensitivity case). Note that the “With EE” sensitivity case values are lower than the “Main Case” values by approximately 4-8% on average (i.e., avoided energy cost is 4-5% lower, capacity costs are 8% lower, DRIPE is 5-8% lower). AESC defines their “With EE” sensitivity case as:~~ This counterfactual does not include future building electrification ~~o~~but due to the limitations of the ~~e~~various models it is determined to be the most applicable for NWAs.~~pportunities~~

> ~~*Future in which energy efficiency measures are installed in 2018 and later years, in direct contrast to the main 2018 AESC case. The purpose of this future is to provide readers of AESC 2018 an avoided cost stream with which to measure avoided costs of measures currently excluded from program administrator energy efficiency plans.*~~

~~AESC’s “With EE” load projection assumes an annual energy demand reduction of about 20% by 2030. NWAs are site specific solutions that will occur beyond the expected EE reductions. Thus, this analysis will use the “With EE” values for estimating benefits.~~

The RI NWA BCA methodology is technology agnostic and should be broadly applicable to all anticipated project and portfolio types, with some adjustments as necessary. Specific technology’s availability during the specified system need time may differ. This technology coincidence factor is based upon the association between the system, transmission, and distribution peak for the specified NWA need, as detailed in Section 5.2 of National Grid’s New York BCA Handbook.[10] These generalized values are subject to change.

3.1 Electric Energy Benefits

[10] “National Grid Version 2.0 Benefit-Cost Analysis (BCA) Handbook.” *National Grid Non-Wires Alternatives: Additional Information*, Niagara Mohawk Corporation d/b/a National Grid, 31 July 2018, www.nationalgridus.com/media/pdfs/bus-partners/ny_bca_handbook_v2.0.pdf.

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Electric energy benefits due to NWA implementation can be a result of reduced energy usage (e.g., targeted EE or DR), a shift of usage from peak to off-peak (e.g., battery storage), or energy generation (e.g., solar). The resulting avoided electric energy costs are appropriate benefits for inclusion in the RI NWA BCA Model. Electric energy benefits are valued using the avoided electric energy costs developed in the AESC ~~2018~~2021 Study, Appendix B.[11] ~~The "With EE" values in the AESC Study represent wholesale electric energy commodity costs that are avoided when generators produce less electricity because of non-EE programs so these values are used to evaluate benefits.~~

Avoided costs may be viewed as a proxy for market costs. However, avoided costs may be different from wholesale market spot costs because avoided costs are based on simulation of market conditions, as opposed to real-time conditions. They may be different from standard offer commodity costs because of time lags and differing opinions on certain key assumptions, such as short-term fuel costs.

AESC's wholesale cost of electric energy includes pool transmission losses (PTL) incurred from the generator to the point of delivery to the distribution companies, while AESC's retail cost of electric energy includes the wholesale cost plus the cost of renewable energy credits (RECs) borne by generators (i.e., embedded GHG costs), wholesale risk premium (WRP) that captures market risk factors typically recovered by generators in their pricing,[12] and distribution losses incurred from the Independent System Operator (ISO) delivery point to the end-use customer. In the RI NWA BCA benefits calculation, energy savings are grossed up using factors that represent transmission and distribution losses, situation dependent, because a reduction in energy use at the end user means that amount of energy does not have to be generated, plus the extra generation that is needed to cover the losses that occur in the delivery.

AESC's avoided energy cost values also internalize the expected cost of complying with current or reasonably anticipated future regional or federal greenhouse gas reduction requirements, which are borne by generators and passed through in wholesale costs.

Both the wholesale and retail costs of electric energy in the AESC 20~~18~~21 Study are provided in four different costing periods consistent with ISO New England Inc. (ISO-NE) definitions. Net energy savings are apportioned into these periods in the value calculation. The time periods are defined as follows:

- Winter Peak: October – May, 7:00 a.m. – 11:00 p.m., weekdays excluding holidays.
- Winter Off-Peak: October – May; 11:00 p.m. – 7:00 a.m., weekdays. Also, including all weekends and ISO defined holidays.
- Summer Peak: June – September, 7:00 a.m. – 11:00 p.m., weekdays excluding holidays.
- Summer Off-Peak: June – September; 11:00 p.m. – 7:00 a.m., weekdays. Also, including all weekends and ISO defined holidays.

[11] "AESC 20~~18~~21 Materials." *Avoided Energy Supply Components in New England: 20~~18~~21 Report, Appendix B*, Synapse Energy Economics, Inc., 20~~18~~21, ~~www.synapse-energy.com/project/aesc-2018-materials.~~ https://www.synapse-energy.com/project/aesc-2021-materials

[12] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.

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NWA system needs have targeted time of use that fall within the above time periods. Each system need will therefore have a specific ratio of the four time periods. Energy savings for NWAs are allocated to the targeted times and multiplied by the appropriate avoided energy value. Generally, the system need is occurring during summer peak.

In cases where an energy use transfer occurs (e.g., battery storage) energy reductions and increases could occur across time periods. Each time period is calculated separately and then added together resulting in a net monetized energy reduction value. Furthermore, in solutions with energy losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

To account for the value of embedded CO_2 costs (i.e., RECs) separately in the RI NWA BCA Model, AESC's wholesale cost of electric energy values is used as the basis for electric energy savings benefits. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 20~~18~~21 real dollar values to nominal values. These benefit values are then grossed up using the appropriate WRP that captures market risk factors typically recovered by generators in their pricing,[13] and distribution loss factors representing losses from the ISO delivery point to the end-use customer.

The AESC 20~~18~~21 Study assumes ~~8~~9% for marginal~~distribution~~ system losses.[14]~~,~~ Marginal losses are more in line with the peaking nature of NWA use cases. This is ~~which is~~ similar to the Company's distribution loss estimate of 6.9% for "Secondary Voltage" customers, which are predominantly residential and small commercial customers (e.g., Rates A-16, A-60, C06, G02)[15], plus the Company's non-PTF transmission loss ~~estimate~~estimates of 0.07%.

Each technology then has a rating factor that is applied based on its system need coincidence.

The dollar value of annual benefits is therefore calculated as:

- Summer Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings $\text{ElectricEnergyCost}_{\text{SumPk}}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Summer Off-Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * $\text{ElectricEnergyCost}_{\text{SumOffPk}}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Winter Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * $\text{ElectricEnergyCost}_{\text{WinPk}}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Winter Off-Peak Energy Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * $\text{ElectricEnergyCost}_{\text{WinOffPk}}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)

[13] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.
[14] "AESC 20~~18~~21 Materials." *Avoided Energy Supply Components in New England: 20~~18~~21 Report, Appendix B*, Synapse Energy Economics, Inc., 20~~18~~21, ~~www.synapse-energy.com/project/aesc-2018-materials. Detail on ISO Default in Appendix B.~~ https://www.synapse-energy.com/project/aesc-2021-materials
[15] "Tariff Provisions." *National Grid: Bills, Meters & Rates*, National Grid US, www.nationalgridus.com/RI-Business/Rates/Tariff-Provisions.

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Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- ElectricEnergyCost ($/kWh) = Projected annual values for each time period (AESC 20~~18~~21, Appendix B, "Wholesale Cost of Electric Energy")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- WRP = 8% (AESC 20~~18~~21, Appendix B, "WRP" AESC default value)
- %~~D-~~Losses = 9~~8~~% (AESC 20~~18~~21, Appendix B, "~~DL~~Marginal Loss" ISO-NE default value)
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~page 327)

3.2 RPS and Clean Energy Policy Compliance Benefits

This benefit category captures the value of avoided embedded CO_2 and SO_2 costs separately from the "Environmental and Public Health Benefits" category. These RPS and Clean Energy Policy compliance benefits due to NWAs are the results of the reduced energy usage as described in Section 3.1.

The resulting avoided RPS and Clean Energy Policy (i.e., RGGI) compliance costs are appropriate benefits for inclusion in the RI NWA BCA Model. When customers do not have to purchase electric energy because of an investment an avoided RPS and Clean Energy Policy compliance benefit is created. These compliance benefits are valued using the avoided wholesale REC costs developed in the AESC 20~~18~~21 Study, Appendix B.[16] ~~-~~Due to the expanding geographical footprint of the RGGI initiative, and the electricity usage now being dominated by ~~non~~states outside of New England~~ states~~, the AESC treats the effects of RGGI as an exogenous price.

SO_2 ~~T~~ emissions pricing is determined by the allowance under the Cross-State Air Pollution Rule (CASPR) and the Acid Rain Program (ARP). The 2020 SO_2 spot ~~aution~~auction resulted in a price of $0.02 per short ton. No embedded NOx pricing is assumed. ~~he "With EE" values in the AESC Study represent wholesale REC costs that are avoided when generators produce less electricity beyond the expected EE energy reductions, so these values are used to evaluate benefits.~~

Nominal annual benefits are calculated using an average inflation rate to convert AESC's 2021~~18~~ real dollar values to nominal values. These benefit values are then grossed up using the appropriate WRP that captures market risk factors typically recovered by generators in their pricing,[17] and distribution loss factor representing losses from the ISO delivery point to the end-use customer. Each technology then has a rating factor that is applied based on its system need coincidence. Furthermore, in solutions with energy

[16] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf.~~ https://www.synapse-energy.com/project/aesc-2021-materials
[17] Wholesale risk premium represents the observed difference between wholesale costs and retail prices.

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losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

The dollar value of the annual benefits is therefore calculated as:

- RPS and Clean Energy Policy Compliance Benefit ($/yr) = ElectricEnergySavings kWh/yr * (RGGICompliance $/kWh + SOx Embedded) * TechnologyCoincidence * EfficiencyLoss * (1 + %Inflation)^(year-20~~18~~21) * (1 + WRP) * (1 + %~~D~~ Losses)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- RGGICompliance ($/kWh) = Projected annual values (AESC 20~~18~~21, Appendix B, "~~Wholesale~~ REC Costs")
- SOx Embedded ($/kWh) = Projected annual values (AESC 20~~18~~21, ~~Table 34,~~ Page ~~92~~107)[18]
- %Inflation = 2.00% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)
- WRP = 8% (AESC 20~~18~~21, Appendix B, "WRP" AESC default value)
- %~~D~~ Losses = 98% (AESC 20~~1~~218, Appendix B, "~~DL~~ Marginal Loss" ISO-NE default value)
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution

3.3 Demand Reduction Induced Price Effects

DRIPE is the reduction in prices in energy and capacity markets resulting from the reduction in need for energy and/or capacity due to reduced demand from electric system investments. These electric system investments can include NWAs. These investments avoid both marginal energy production and capital investments, but also lead to structural changes in the market due to lower demand. Over a period of time, the market adjusts to lower demand, but until that time the reduced demand leads to a reduction in the market price of the energy commodity. This is observed in the New England market when ISO-NE activates its price response programs. When this price effect is a result of NWAs, it is appropriate to include the impact in the RI NWA BCA Model.

DRIPE effects are very small when expressed in terms of an impact on market prices, i.e., reductions of a fraction of a percent. However, the DRIPE impacts are significant when expressed in absolute dollar terms over all the kWh and kW transacted in the market. Very small impacts on market prices, when applied to all energy and capacity being purchased in the market, translate into large absolute dollar amounts. AESC provides values for two types of DRIPE benefits, Intrastate and Rest of Pool (ROP). Intrastate DRIPE takes credit for the reduced clearing price for Rhode Island customers, while ROP DRIPE takes credit for the reduced clearing price for customers across New England. The base case BCA results exclude ROP DRIPE to align with standard industry practice.

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[18] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf.~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf Page ~~92~~107~~, Table 34.~~

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Intrastate Energy, Capacity, and Cross DRIPE values developed for the AESC 20~~18~~21 Study are used in the RI NWA BCA Model. Wholesale Energy DRIPE values in the AESC 20~~18~~21 Study are provided in four different costing periods consistent with ISO-New England (ISO-NE) definitions. Net energy savings are split up into these periods in the value calculation. See Section 3.1 for time period definitions. Both wholesale and retail Capacity DRIPE values are provided in the AESC 20~~18~~21 Study on an annual basis. AESC also provides annual wholesale Cross DRIPE values to account for natural gas price effects caused by a change in electricity generation demand. Each technology then has a rating factor that is applied based on its system need coincidence. Furthermore, in solutions with energy losses as part of the technology solution (e.g., battery storage, solar) a round trip/efficiency loss modifier is utilized.

Capacity DRIPE is valued differently in the AESC report depending upon whether the benefit results from resources that are bid into the Forward Capacity Market (FCM) (i.e., cleared resources) or reductions in peak demand that are not bid into the FCM (i.e., uncleared resources). For NWA solutions the DRIPE avoided cost forecast for uncleared resource values is used. AESC assumes a lag of 5 years between the appearance of the load reduction and the realization of the Capacity DRIPE benefits for uncleared resources (e.g., load reductions in 20~~18~~21 results in benefits in 20~~23~~26). To maintain that lag, DRIPE capacity benefits are shifted based on the commercial operating date of the NWA solution.

Energy and Cross DRIPE benefits are also shifted based on the commercial operating date, but the benefits are realized the year after installation, with the $/kWh avoided costs shifted forward one year and escalated by one year of inflation. Loss factors are applied to the wholesale Energy and Cross DRIPE values to account for local transmission and distribution (T&D) losses from the point of delivery to the distribution company's system to the ultimate customer's facility. Wholesale Capacity DRIPE values are used in the RI NWA BCA Model calculations and then T&D loss factors applied. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 20~~18~~21 real dollar values to nominal values. Capacity DRIPE's demand savings are calculated to be coincident with the ISO-NE definition of the peak, which is in the summer.

The dollar value of annual benefits is therefore calculated as:

- Summer Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings ElectricEnergyCost$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Summer Off-Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Winter Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Winter Off-Peak Energy DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * ElectricEnergyCost$_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %~~D-~~Losses) * (1 + %Inflation)^(year-20~~18~~21)

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- Cross DRIPE Benefit ($/yr) = ElectricEnergySavings kWh/yr * CrossDRIPE $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + WRP) * (1 + %~~T&D~~ Losses) * (1 + %Inflation)^(year-20~~18~~21)
- Generation Capacity DRIPE Benefit ($/yr) = ElectricDemandSavings kW/yr$_{SumPk}$ * WholesaleCapDRIPE $/kW-yr * TechnologyCoincidence * (1 + WRP) * (1 + ~~%D~~ %Losses$_{Cap}$) * (1 + %Inflation)^(year-20~~18~~21)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- ElectricDemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- EnergyDRIPE ($/kWh) = Projected annual values (AESC 20~~18~~21, Appendix B, "Intrastate - Wholesale Energy DRIPE")
- CrossDRIPE ($/kWh) = Projected annual values (AESC 20~~18~~21, Appendix B, "Intrastate – Wholesale Cross DRIPE")
- RetailCapDRIPE ($/kW-yr) = Projected annual values (AESC 20~~18~~21, Appendix B, "Intrastate – ~~Retail~~ Capacity DRIPE – Uncleared")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- WRP = 8% (AESC 20~~18~~21, Appendix B, "WRP" AESC default value)
- %~~T&D~~Losses = ~~1.6~~9% (AESC 20~~18~~21, Appendix B, "~~PTF Loss~~Marginal Loss" ~~AESC default value~~ ISO-NE default value)~~ + 8% (AESC 2018, Appendix B, "DL" ISO-NE default value)~~
-
- %Losses$_{Cap}$ = 16% (AESC 2021, Appendix B, "Marginal Loss Capacity" ISO-NE default value)
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, Page 327~~"GDP Price Index and Inflation Rate"~~)

3.4 Electric Capacity Benefits

At the generation and transmission level, electric capacity benefits due to NWAs are a result of load reductions at summer peak. At the distribution and site-specific transmission level, electric capacity benefits are a result of the deferred system upgrade. This value is an avoided cost based on a time-deferred expected project cost of the system upgrade.

3.4.1 Electric Generation Capacity Benefits

When generators do not have to build new generation facilities or when construction can be deferred because of NWAs, an avoided electric energy resource benefit is created. In the New England capacity market, capacity benefits accrue because demand reduction reduces ISO-NE's installed capacity requirement. The capacity requirement is based on avoided load's contribution to the system peak, which, for ISO-NE, is the summer peak. Generation capacity avoided costs are driven by load at the time of the ISO-NE peak, which has by convention associated with an hour ending at 3 PM or 5 PM on a hot

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summer day.[19] Therefore, capacity benefits accrue only from summer peak demand reduction; there is currently no winter generation capacity benefit for ISO-NE.

Peak demand savings created through NWAs are valued using the avoided wholesale capacity values from the 20~~18~~21 AESC, Appendix B. The values are then grossed up to account for wholesale risk premium (WRP) and distribution losses. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 20~~18~~21 real dollar values to nominal values. Demand savings are calculated to be coincident with the ISO-NE definition of peak, which is in the summer.

The dollar value of annual benefits is therefore calculated as:

- Generation Capacity Benefit (\$/yr) = ElectricDemandSavings kW/yr$_{SumPk}$* CapCost \$/kW-yr * %Summer Coincidence * TechnologyCoincidence * (1+WRP) * (1+%~~D-~~Losses$_{Cap}$) * (1 + %Inflation)^(year-20~~18~~21)

Where:

- ElectricDemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- WholesaleCapCost (\$/kW-yr) = Projected annual values (AESC 20~~18~~21, Appendix B, "Wholesale ~~Cost of~~ Electric Capacity – Uncleared")
- %Summer Coincidence: % of NWA peak capacity at ISO peak
- TechnologyCoincidence: Coincidence factor applied based on the solution technology type
- WRP = 8% (AESC 20~~18~~21, Appendix B, "WRP" AESC default value)
- %~~D-~~Losses$_{Cap}$ = 16~~8~~% (AESC 20~~18~~21, Appendix B, "~~DL~~Marginal Loss Capacity" ISO-NE default value)
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)

The AESC 20~~18~~21 Study includes two types of wholesale capacity values: 1) cleared capacity (Forward Capacity Auction (FCA) price), which is the traditional valuation of electric generation capacity, and 2) uncleared capacity, which is a new approach to valuing the capacity of short duration measures that are not actively bid in the ISO-NE Forward Capacity Market (FCM). The AESC study provides these two values for avoided electric generation capacity, which are differentiated based on whether a load reduction is taken into account when bidding into the FCM (cleared capacity) or is not (uncleared capacity), and an overall weighted average avoided capacity value representing a weighted average of the cleared capacity and uncleared capacity values.

Given the three year forward nature of the FCM and the timing of the ISO-NE load forecast, it takes five years from the time of load reduction for uncleared capacity to begin impacting the FCM procurements. As a result, measures with a useful life less than five years (e.g., traditional demand response programs) would not produce any generation capacity benefits in years 1-5 under the traditional capacity modeling methodology.

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[19] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Page 2~~03~~39.

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NWAs will not be ~~taken into account~~considered when bidding into the FCM, so the uncleared capacity values are used.

3.4.2 Electric Transmission Capacity Benefits

When transmission facilities do not have to be built or can be deferred because of NWAs, an avoided electric energy resource benefit is created. Electric transmission capacity benefits are valued in the RI Test based on the costs of Pool Transmission Facilities (PTF). The AESC 20~~18~~21 Study calculates an avoided cost for PTF of $8~~9~~4/kW-year in 20~~18~~21 dollars.

Capacity loss factors are applied to the avoided transmission capacity cost to account for local transmission and distribution (T&D) losses from the point of delivery to the distribution company's system to the ultimate customer's facility. Thus, T&D losses are accounted for from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2021~~18~~ real dollar values to nominal values. Demand savings are calculated to be coincident with the ISO-NE definition of peak, which is in the summer.

The dollar value of annual benefits is therefore calculated as:

- Transmission Benefit ($/yr) = DemandSavings kW/yr$_{SumPk}$ * TransCapCost $/kW-yr * %Summer Coincidence * TechnologyCoincidence * (1 + %~~T&D~~Losses$_{Avg}$) * (1 + %Inflation)^(year-20~~18~~21) * TransmissionsCoincidence

Where:

- DemandSavings (kW/yr) = Estimated peak electric demand savings based on Engineering models
- TransCapCost ($/kW-yr) = $8~~9~~4/kW-year (AESC 20~~18~~21, Appendix B, "T&D Cost")
- %Summer Coincidence = % of NWA peak capacity at ISO peak
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- %~~T&D~~Losses$_{Avg}$ = ~~1.6~~8% (AESC 2021~~18~~, Page 333 "PTF Losses"~~Appendix B~~, "Average Loss Peak"~~,~~ ~~ISO-NE default value~~) ~~+ 8% (AESC 2018, Appendix B, "ISO default")~~
-
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)
- TransmissionCoincidence (%)= System Need (MW)/RI Capacity (MW)

3.4.3 Electric Distribution Capacity Benefits

Distribution Capacity benefit is based on the direct deferred distribution infrastructure due to the implementation of the NWA. This value includes such inputs as deferred capital expenditure, deferred O&M, and deferred taxes over the expected contract timeframe of the NWA.

3.4.4 Electric Transmission Infrastructure Site-Specific Benefits

Transmission Infrastructure Site-Specific benefit is based on the direct deferred transmission infrastructure due to the implementation of the NWA. This value includes such inputs as deferred capital

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expenditure, deferred O&M, and deferred taxes over the expected contract timeframe of the NWA. This value will typically be null for NWAs.

3.5 Natural Gas Benefits

An avoided resource benefit is produced when a project, in which customers have invested, reduces natural gas usage. Natural Gas benefits are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.6 Delivered Fuel Benefits

An avoided resource benefit is produced when a project, in which customers have invested, reduces delivered fuel usage. Avoided delivered fuel costs (natural gas, propane, or fuel oil) are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.7 Water and Sewer Benefits

An avoided resource benefit is produced when a project, in which customers have invested to save electricity or fuel, also reduces water consumption. Examples of reduced water consumption can include a cooling tower project that reduces makeup water usage or need. Water and sewer benefits are negligible for NWAs, so they are not included in the RI NWA BCA Model calculations.

3.8 Value of Improved Reliability

Due to the site-specific nature of these solutions, a reliability benefit should also be localized. The reliability benefit is currently difficult to quantify due to the new nature of the technologies that NWAs typically utilize. This benefit will be developed and applied as more projects are implemented and technology-specific reliability values are determined.

3.9 Non-Energy Impacts

Non-Energy Impacts (NEIs) can be produced as a direct result of NWA investments and are therefore appropriate for inclusion in the RI NWA BCA Model. Non-energy impacts may include but are not limited to: labor, material, facility use, health and safety, materials handling, national security, property values, and transportation. For income-eligible measures, NEIs also include the impacts of lower energy bills, such as reduced arrearages or avoided utility shut-off costs. These benefits are currently seen to be negligible for NWAs.

3.10 Environmental and Public Health Impacts

Environmental benefits due to NWAs are a result of reduced energy use from the implemented solution. The resulting avoided environmental costs are appropriate benefits for inclusion in the RI NWA BCA Model. Reduction in the use of electricity generated at central power plants provides environmental benefits to Rhode Island and the region, including reduced greenhouse gas emissions and improved air quality.

3.10.1 Non-Embedded Greenhouse Gas Reduction Benefits

Carbon dioxide and other GHG emissions come from a variety sources, including the combustion of fossil fuels like natural gas, coal, gasoline, and diesel. Increase in atmospheric CO_2 concentrations contributes to an increase in global average temperature, which results in market damages, such as changes in net

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agricultural productivity, energy use, and property damage from increased flood risk, as well as nonmarket damages, such as those to human health and to the services that natural ecosystems provide to society.[20]

According to the AESC 20~~18~~21 Study, the cost of GHG emissions reductions can be determined based on estimating either carbon damage costs or marginal abatement costs. Damage costs in the AESC are sourced from the December 2020 SCC Guidance published by the State of New York. This guidance recommended a 15 year levelized price of $128 per short ton. ~~A 2014 meta-analysis of the social cost of carbon based on damage costs found that the social cost of carbon should be~~ at least ~~$125 per metric ton ($113 per short ton) of CO_2, but d~~Due to the many uncertainties in climate damage cost estimates, the AESC study concluded that the marginal abatement cost method should be used instead. This method asserts that the value of damages avoided, at the margin, must be at least as great as the cost of the most expensive abatement technology used in a comprehensive strategy for emission reduction.[21]

The AESC 20~~18~~21 Study developed ~~two~~three approaches for calculating the non-embedded cost of carbon based on marginal abatement costs. Note that "non-embedded" costs are not included in AESC's modeling of energy prices, as opposed to "embedded" costs, which include costs associated with RGGI, SO_2 regulation programs.[22] The first approach is an estimate for the global marginal carbon abatement cost based on carbon capture and sequestration technology, which yields a value of $~~100~~92 per short ton of CO_2 equivalent and is ~~identical~~lower than ~~to~~ the prior AESC 20~~15~~18 Study[23] value used. ~~in the 2018 and 2019 study years.~~ The second approach is based on a New England specific marginal abatement cost, where it is assumed that the marginal abatement technology is offshore wind. The third approach assumes a New England specific cost derived from multiple sectors, not just electric.

~~On October 24, 2018 an amendment to the AESC 2018 Study was issued that corrected assumptions related to the calculation of offshore wind costs. Based on this corrected projection of the future incremental cost of offshore wind energy at $31/MWh and a natural gas generator emissions rate of 0.46 short tons CO_2 per MWh, the AESC 2018 Study amendment estimates a New England specific abatement cost of $68 per short ton of CO_2 equivalent. Note that the AESC 2018 Study estimates the 15-year levelized cost of offshore wind prices will be approximately $80/MWh. After subtracting the cost of energy within the 2018 AESC construct (estimated to be $49/MWh, based on an annual 15-year levelized cost for the West/Central Massachusetts (WCMA) region), the future incremental cost of offshore wind energy would be $31/MWh.~~

[20] National Academies of Sciences, Engineering, and Medicine 2017. Valuing Climate Damages: Updating Estimation of the Social Cost of Carbon Dioxide. Washington, DC: The National Academies Press. https://doi.org/10.17226/24651.

[21] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Pages 17~~1~~~~40~~ to 1~~82~~~~42~~.

[22] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. See *Chapter 4. Common Electric Assumptions* for a discussion of how these costs are modeled.

[23] "Avoided Energy Supply Components in New England: 201~~5~~8 Report." ~~*Massachusetts Energy Efficiency Advisory Council: Special & Cross-Sector Studies*~~ *AESC 2018 Materials*, Synapse Energy Economics, Inc., 2018, ~~Synapse Energy Economics, Inc., 3 Apr. 2015, http://ma-eeac.org/wordpress/wp-content/uploads/2015-Regional-Avoided-Cost-Study-Report.pdf.~~ https://www.synapse-energy.com/project/aesc-2018-materials

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The New England specific marginal abatement costs assume a $125 per short ton of CO2 emissions. This is based on the future cost trajectories of offshore wind facilities along the east coast of the United States. This aligns with New York Department of Environmental Conservation's 2020 valuation of $125 per ton. This value is used in this BCA model.

~~However, the emissions rate used by AESC appears to be based on the U.S. average "uncontrolled emissions factor" for natural gas generators (i.e., 0.46 short tons of CO_2 per MWh), while the most recent electric generator air emissions report from ISO-NE states that the marginal emissions factor for ISO-NE generators is 0.33 short tons of CO_2 per MWh (655 lbs CO_2/MWh). The Company believes this lower ISO-NE emission factor is more appropriate to use, and notes that the emissions factor could be even lower in the future. Therefore, the New England specific abatement cost is $92 per short ton of CO_2 equivalent based on the 2018 ISO-NE emissions factor of 0.33 short tons of CO_2 per MWh.~~

~~Given the uncertainties in both the higher damage cost estimate ($113 per short ton of CO_2) and the lower New England specific abatement cost estimate ($92 per short ton of CO_2) based on future incremental costs of offshore wind energy and future marginal emissions factors, the Company proposes to apply the global marginal carbon abatement cost of $100 per short ton in the RI NWA BCA Model, which is in between the other two estimates.~~

The costs of compliance with the RGGI are already included or "embedded" in the projected electric energy market prices. Therefore, the difference between the $1~~00~~25 per short ton societal cost and the RGGI compliance costs already embedded in the projected energy market prices represents the value of carbon emissions not included in the avoided energy costs. The AESC 2021 calculates this value at a $/kwh broken into winter/summer and peak/off-peak aligning with and not double counting the energy benefits calculated in section 3.1.

Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for ~~local transmission and distribution (T&D)~~marginal losses from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 20~~18~~21 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

- ~~Non-Embedded GHG Reduction Benefit ($/yr) = ElectricEnergySavings kWh/yr * GHGEmissionsRate ton/kWh *(NonEmbeddedGHGValue - EmbeddedGHGValue) * TechnologyCoincidence * EfficiencyLoss * (1 + T&DLosses$_{Ave}$) * (1 + %Inflation)^(year-2018)~~
- Non-Embedded GHG Reduction Benefit Summer Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded GHG Reduction Benefit Summer Off-peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded GHG Reduction Benefit Winter Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)

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- Non-Embedded GHG Reduction Benefit Winter Off-Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded GHG Costs $_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- ~~GHGEmissionsRate (ton/kWh) = 0.33 ton CO_2/MWh * 1/1000 MWh/kWh (ISO-NE 2020, Table 5-3, 2018 Time-Weighted Locational Marginal Unit (LMU) Marginal Emissions Rates-All LMUs, "Annual Average (All Hours)")~~
- ~~NonEmbeddedGHGValue ($/ton) = $100/ton (AESC 2018, Table 151, "AESC 2018 Non-Embedded CO_2 Cost")~~
- ~~EmbeddedGHGValue ($/ton) = Projected annual values (AESC 2018, Table 151, "Embedded Cost of RGGI")~~
- Non-Embedded GHG Costs: Projected annual values for each time period (AESC 2021, Appendix B, "Non-Embedded GHG Costs")
- TechnologyCoincidence = Coincidence factor applied based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %~~T&D~~Losses = ~~1.6~~9% (AESC 20~~18~~21, Appendix B, "~~PTF Losses~~Marginal Loss", ISO-NE default value) ~~+ 8% (AESC 2018, Appendix B, "ISO default")~~
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)

3.10.2 Non-Embedded NOx Reduction Benefits

Nitrogen oxide (NOx) emissions come from a variety of sources including heavy duty vehicles, industrial processes, and the combustion of natural gas for electricity generation. NOx contributes to the formation of fine particle matter (PM) and ground-level ozone that are associated with adverse health effects including heart and lung diseases, increased airways resistance, which can aggravate asthma and other underlying health issues, and respiratory tract infections. In addition to known health impacts, PM pollution and ozone are also likely to contribute to negative climate impacts.[24]

In February, 2018, the US EPA published a Technical Support Document for estimating the benefit of reducing PM2.5 precursors from 17 sectors, including avoided NOx costs from "electricity generating units".[25] The EPA document estimates national average values for mortality and morbidity per ton of directly-emitted NOx reduced for 2016, 2020, 2025, and 2030 based on the results from two other

[24] "Our Nation's Air: Status and Trends through 2019." *Our Nation's Air: Trends Report*, United States Environmental Protection Agency, 2020, https://gispub.epa.gov/air/trendsreport/2020.
[25] "Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors (February 2018)." *US EPA Benefits Mapping and Analysis Program (BenMAP)*, United States Environmental Protection Agency, Feb. 2018, www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-17-sectors.

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studies.[26,27] ~~Using the average of the results from the two studies, the RI NWA BCA Model estimates the non-embedded NOx emissions cost to be $10,100 per ton of NOx in 2020 (2015 dollars) increasing to $11,600 per ton of NOx in 2030 (2015 dollars). These translate into $0.90 per MWh in 2020 and $1.04 per MWh in 2030 (2018 dollars) using the ISO-NE 2018 marginal NOx emissions factor of 0.17 lb NOx/MWh.~~ Using the average results from the two studies the non-embedded NOx emissions cost to be $10,100 per ton in 2020 (2015 dollars). This translates into a $0.90 per MWh in 2020.
The AESC 2021 Study also estimates avoided NOx emissions costs utilizing a continental U.S. average, non-embedded NOx emission wholesale cost of $14,700 per ton of NOx (2021 dollars).[28] This translates to a $0.77 per MWh in 2021. The RI NWA BCA model utilizes the AESC 2021 value broken down into a winter/summer and peak/off-peak kWh value.

Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 20~~18~~21 real dollar values to nominal values.

Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for local T&D losses from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2018 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

~~Non-Embedded NOx Reduction Benefit ($/yr) = ElectricEnergySavings kWh/yr * NOxEmissionsRate ton/kWh * NonEmeddedNOxValue $/ton * TechnologyCoincidence * EfficiencyLoss * (1 + T&DLosses$_{Ave}$) * (1 + %Inflation)^(year-2018)~~

- Non-Embedded NOx Reduction Benefit Summer Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{SumPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Summer Off-peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{SumOffPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Winter Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs$_{WinPk}$ $/kWh * TechnologyCoincidence* EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
- Non-Embedded NOx Reduction Benefit Winter Off-Peak ($/yr) = ElectricEnergySavings kWh/yr * %ElectricEnergySavings * Non-Embedded NOx Costs $_{WinOffPk}$ $/kWh * TechnologyCoincidence * EfficiencyLoss * (1 + %Losses) * (1 + %Inflation)^(year-2021)
-

Where:

[26] Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Yet al., "Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality", Boston Health Effects Institute, 2009.
[27] Lepeule J, Laden F, Dockery D, and Schwartz J, "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009", EHP Vol 120 No. 7, July 2012.
[28] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf. Page 1~~44~~83 ~~reports a cost of $31,000 per ton of nitrogen (2018 dollars), which translates into a cost of $11,935 per ton of NOx based on the other assumptions provided.~~

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- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- %ElectricEnergySavings = Estimated annual electric energy savings fraction for each time period based on Engineering models
- Non-Embedded NOx Costs: Projected annual values for each time period (AESC 2021, Appendix B, "Non-Embedded NOx Costs")
- ~~NOxEmissionsRate (ton/kWh) = 0.17 lb NOx/MWh * 1/1,000 MWh/kWh ÷ 2,000 lb/ton (ISO-NE 2020, Table 5-3, 2018 Time-Weighted LMU Marginal Emissions Rates-All LMUs, NOx "Annual Average (All Hours)")~~
- ~~NonEmbeddedNOxValue ($/ton) = $10,100 $11,60012,211/ton (US EPA 2019, Tables 5-10, average of NOx from "Electricity Generation Units", inflated to 2018 dollars)~~
- TechnologyCoincidence = Coincidence Factor based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %~~T&D~~Losses = ~~1.6~~9% (AESC 20~~18~~21, Appendix B, "~~PTF Losses~~Marginal Loss", ~~) + 8% (AESC 2018, Appendix B,~~ "ISO default")
- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)

~~Note that the AESC 2018 Study also estimates avoided NOx emissions costs utilizing a continental U.S. average, non-location specific, non-embedded NOx emission wholesale cost of $11,935 per ton of NOx or $1.65 per MWh assuming a NOx emissions factor of 0.03 lb NOx/MMBtu and Heat Rate of 9,220 Btu/kWh (0.28 lb NOx/MWh) based on a generic unit addition of a natural gas-fired combustion turbine in New England. While the wholesale cost of NOx is similar to the cost used in the RI NWA BCA Model, the NOx emission factor used in the RI NWA BCA Model is lower than the AESC Study, because the RI NWA BCA Model uses the most recent ISO-NE published marginal emissions factors.~~

3.10.3 Non-Embedded SO_2 Reduction Benefits

Sulfur dioxide (SO_2) emissions come from a variety of sources including industrial processes and the combustion of coal (especially high-sulfur coal) and fuel oil for electricity generation and heating. SO_2 contributes to the formation of fine PM that are associated with adverse health effects including heart and lunch diseases and increased airways resistance, which can aggravate asthma and other underlying health issues. In addition to known health impacts, PM pollution is also likely to contribute to negative climate impacts.[29]

In February, 2018, the US EPA published a Technical Support Document for estimating the benefit of reducing PM2.5 precursors from 17 sectors, including avoided SO_2 costs from "electricity generating units".[30] The EPA document estimates national average values for mortality and morbidity per ton of directly-emitted SO_2 reduced for 2016, 2020, 2025, and 2030 based on the results from two other

[29] "Our Nation's Air: Status and Trends through 2019." *Our Nation's Air: Trends Report*, United States Environmental Protection Agency, 2020, https://gispub.epa.gov/air/trendsreport/2020.

[30] "Estimating the Benefit per Ton of Reducing PM2.5 Precursors from 17 Sectors (February 2018)." *US EPA Benefits Mapping and Analysis Program (BenMAP)*, United States Environmental Protection Agency, Feb. 2018, www.epa.gov/benmap/estimating-benefit-ton-reducing-pm25-precursors-17-sectors.

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studies.[31,32] Using the average of the results from the two studies, the RI NWA BCA Model estimates the SO_2 emissions cost to be $69,000 per ton of SO_2 in 2020 (2015 dollars) increasing to $79,500 per ton of SO_2 in 2030 (2015 dollars). These translate into $3.80 per MWh in 2020 and $4.6037 per MWh in 2030 (2015 dollars) using the ISO-NE 20~~18~~19 marginal SO_2 emissions factor of 0.~~11~~02 lb SO_2/MWh.[33] Nominal annual benefits are then calculated using an average inflation rate to convert the 2015 real dollar values to nominal values.

Loss factors are applied to the marginal emissions factor for ISO-NE generators to account for local transmission and distribution (T&D) losses from the generator to the end-use customer. Nominal annual benefits are then calculated using an average inflation rate to convert AESC's 2018 real dollar values to nominal values.

The dollar value of annual benefits is therefore calculated as:

- Non-Embedded SO_2 Reduction Benefit ($/yr) = ElectricEnergySavings kWh/yr * SO_2EmissionsRate ton/kWh * (NonEmbeddedSO_2Value $/ton - Embedded$SO_2$Value $/ton) * TechnologyCoincidence * EfficiencyLoss (1 + ~~T&D~~%Losses~~Ave~~) * (1 + %Inflation)^(year-20~~18~~15)

Where:

- ElectricEnergySavings (kWh/yr) = Estimated annual electric energy savings based on Engineering models
- SO_2EmissionsRate (ton/kWh) = 0.~~11~~02 lb SO_2/MWh * 1/1,000 MWh/kWh ÷ 2,000 lb/ton (ISO-NE 2021~~0~~,[34] Table 5-3, 201~~8~~9 Time-Weighted LMU Marginal Emissions Rates-All LMUs, SO_2 "Annual Average (All Hours)")
- NonEmbeddedSO_2Value ($/ton) = $69,000-$79,500/ton (US EPA 2019, Tables 5-10, average of SO_2 from "Electricity Generation Units", 2015 dollars)
- EmbeddedSO_2Value ($/ton) = $0.~~5~~02/ton (AESC 20~~18~~21, ~~Table 34~~Page 107, SO_2 "20~~18~~21$")[35]
- TechnologyCoincidence = Coincidence Factor based on the solution technology type
- EfficiencyLoss = modifier applied for energy inefficiencies based on the proposed solution
- %~~T&D~~Losses = ~~1.6~~9% (AESC 20~~18~~21, Appendix B, "~~PTF Losses~~Marginal Loss"~~) + 8% (AESC 2018, Appendix B~~, "ISO default")

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[31] Krewski D, Jerrett M, Burnett RT, Ma R, Hughes E, Shi Yet al., "Extended Follow-up and Spatial Analysis of the American Cancer Society Study Linking Particulate Air Pollution and Mortality", Boston Health Effects Institute, 2009.

[32] Lepeule J, Laden F, Dockery D, and Schwartz J, "Chronic Exposure to Fine Particles and Mortality: An Extended Follow-up of the Harvard Six Cities Study from 1974 to 2009", EHP Vol 120 No. 7, July 2012.

[33] "2019~~8~~ ISO New England Electric Generator Air Emissions Report." *ISO New England*, ISO New England Inc., ~~May~~ March 202~~0~~1, ~~www.iso-ne.com/static-assets/documents/2020/05/2018_air_emissions_report.pdf~~ https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf. Page 3~~0~~2, Table 5-3.

[34] "201~~8~~9 ISO New England Electric Generator Air Emissions Report." *ISO New England*, ISO New England Inc., ~~May~~ March 202~~0~~1, ~~www.iso-ne.com/static-assets/documents/2020/05/2018_air_emissions_report.pdf~~ https://www.iso-ne.com/static-assets/documents/2021/03/2019_air_emissions_report.pdf. Page~~s 29 and~~ 32~~0~~.

[35] "Avoided Energy Supply Components in New England: 2021~~18~~ Report." *AESC 2021~~18~~ Materials*, Synapse Energy Economics, Inc., 20~~18~~21, https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf~~. Page ~~92~~107.~~, Table 34.~~

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- %Inflation = 2% (AESC 20~~18~~21, ~~Table 134~~Appendix E, ~~"GDP Price Index and Inflation Rate"~~Page 327)

Note that the AESC 20~~18~~21 Study does not include estimates for avoided SO_2 emissions costs due to the Study's assertion that most of the available emission data is quite old and the impacts are very small.[36]

3.11 Economic Development Benefits

The Docket 4600 Framework includes consideration of societal economic development benefits and notes that such benefits can be reflected via a qualitative assessment or, alternatively, can be quantified through detailed economic modelling. Therefore, economic development impacts (e.g., economic growth, job creation) can be quantified using the Regional Economic Models, Inc. (REMI) model of the Rhode Island economy, which estimates the increased economic activity resulting from investments. The overall societal impact is measured by net Rhode Island gross domestic product (GDP), which encompasses job years, incomes, state tax revenues and the increased competitiveness of Rhode Island business firms.

National Grid agrees with Docket 4600 that economic development benefits are important. However, including these benefits in the base case BCA results can be problematic due to the relatively high uncertainty associated with these benefits, which can discredit other more precise components of the BCA. Additionally, because the benefits can be large, they create a "masking" effect. For these reasons, the RI NWA BCA Model did not consider economic development benefits in its BCA.

3.12 Contract/Solution Costs

The contract or solution cost is the direct cost for the NWA. This could be a payment schedule to a third party or for paid customer participation (e.g., targeted energy efficiency or demand response). These cost schedules are typically based on an annual, semi-annual, or monthly cadence. Additionally, these cost schedules may involve an annual escalator. In cases with a known, irregular cost schedule these costs can be entered manually in their respective years.

3.13 Administrative Costs

Administrative costs are related to the ongoing support of the NWA. Administrative costs can include evaluation, measurement and verification (EM&V) costs, ongoing communications and information technology fees, or additional costs related to the post-implementation costs to keep the NWA viable. For each solution an annual expected administrative cost will be applied. In cases with a known, irregular admin cost schedule these costs can be entered manually in their respective years.

3.14 Utility Interconnection Costs

The interconnection cost is the cost for physically and digitally linking the solution to the electric system. This can include upgrading the wires (e.g., with a battery storage or solar solution) or a telecommunications upgrade. Interconnection costs will be determined on a case-by-case basis regarding the specific system need and its respective targeted NWA. This cost will generally be a capital expenditure, initially borne by the utility, prior to the commercially viable date of the NWA solution.

[36] "Avoided Energy Supply Components in New England: 20~~18~~21 Report." *AESC 20~~18~~21 Materials*, Synapse Energy Economics, Inc., 20~~18~~21, ~~https://www.synapse-energy.com/sites/default/files/AESC-2018-17-080-Oct-ReRelease.pdf.~~ https://www.synapse-energy.com/sites/default/files/AESC_2021_.pdf Page 56.

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4. Benefit-Cost Calculations

The RI NWA BCA Model is a comparison tool to be utilized to analyze multiple solutions with respective technologies to assess their cost-effectiveness. Currently four technology types are assessed: Battery Storage, Solar, Demand Response, and Energy Efficiency. The RI NWA BCA Model will be expanded as new technologies or solutions evolve. The RI NWA BCA Model is structured to allow for any given solution to utilize any, all, or a combination of these technologies on a per solution basis.

As prescribed by the Standards, the RI NWA BCA Model uses a "discount rate that appropriately reflects the risks of the investment". The Company maintains that the most reasonable rate at which to discount future year costs and benefits is the Company's after-tax Weighted Average Cost of Capital (WACC) (currently 6.97%)[37] since the NWA investments are utility investments, and after-tax WACC is the Company's effective discount rate.

The total benefits will equal the sum of the net present value (NPV) of each annual benefit component:

- [Electric Energy Benefits + Compliance Benefits + DRIPE Benefits + Electric Generation Capacity Benefits + Electric Transmission Capacity Benefits + Electric Distribution Capacity Benefits + Electric Transmission Infrastructure Site Specific + Natural Gas Benefits + Fuel Benefits + Water & Sewer Benefits + Value of Improved Reliability + Non-Energy Impacts + Non-Embedded GHG Reduction Benefits + Non-Embedded NOx Reduction Benefits + Non-Embedded SO_2 Reduction Benefits + Economic Development Benefits]

The total costs will equal the sum of the NPV of each annual cost component:

- [Contract/Participant Costs + Program Administrative Costs + Utility Interconnection Costs]

The RI Test benefit-cost ratio (BCR) will then equal:

- Total NPV Benefits ÷ Total NPV Costs

The BCA can then financially compare multiple solutions, regardless of technology type.

The NWA investment will be considered cost-effective if the BCR for the resource is greater than 1.0.

[37] "Docket No. 4770." *State of Rhode Island Public Utilities Commission and Division of Public Utilities and Carriers*, The Narragansett Electric Company d/b/a National Grid, 29 Nov. 2017, www.ripuc.ri.gov/eventsactions/docket/4770page.html.

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5. Appendices

Appendix 1	AESC 20~~18~~21 Materials Source Reference
Appendix 2	Table of Terms

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Appendix 1: AESC 20~~18~~21 Materials Source Reference

Please refer to the following citation for the Appendix B data tables of the AESC 20~~18~~21 Study materials.

> "AESC 20~~18~~21 Materials." *Avoided Energy Supply Components in New England: 20~~18~~21 Report*, Synapse Energy Economics, Inc., 20~~18~~21, ~~www.synapse-energy.com/project/aesc-2018-materials~~ https://www.synapse-energy.com/project/aesc-2021-materials.

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Appendix 2: Table of Terms

Term	Definition
AESC	Avoided Energy Supply Components
AESC 20~~18~~21 Study	Avoided Energy Supply Components in New England: 20~~18~~21 Report
BCA	Benefit-Cost Analysis
BCR	Benefit-Cost Ratio
Capex	Capital expenditure
CO_2	Carbon dioxide
DER	Distributed Energy Resource
DG	Distributed Generation
DR	Demand Response
DRIPE	Demand Reduction Induced Price Effect(s)
EE	Energy Efficiency
EE Plan	Energy Efficiency Program Plan
EEP	Energy Efficiency Program
EERMC	Energy Efficiency and Resource Management Council
EM&V	Evaluation, Measurement, and Verification
EPA	Environmental Protection Agency
ESS	Energy Storage System
FCA	Forward Capacity Auction
FCM	Forward Capacity Market
FERC	Federal Energy Regulatory Commission
GDP	Gross Domestic Product
GHG	Greenhouse gas
ISO	Independent Systems Operator
ISO-NE	ISO New England Inc.
kW	Kilowatt
kWh	Kilowatt-hour
LCP	Least-Cost Procurement
LCP Standards	Least-Cost Procurement Standards
LMU	Locational Marginal Unit
MW	Megawatt
MWh	Megawatt-hour
NERC	North American Energy Reliability Corporation
NOx	Nitrogen oxides (NO, NO_2)

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Term	Definition
NPV	Net Present Value
NWA	Non-Wires Alternative
O&M	Operations and Maintenance
Opex	Operational expenditure
PM	Particulate Matter
PTF	Pool Transmission Facilities
PTL	Pool Transmission Losses
PUC	Public Utilities Commission
RD&D	Research, Design, and Development
REC	Renewable Energy Credit
REMI	Regional Economic Models, Inc.
RGGI	Regional Greenhouse Gas Initiative
RI	Rhode Island
RI NWA BCA Model	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Model
RI NWA BCA TRM	Rhode Island Non-Wires Alternative Benefit-Cost Analysis Technical Reference Manual
RI Test	Rhode Island Benefit-Cost Test
ROP	Rest of Pool
RPS	Renewable Portfolio Standards
SO_2	Sulfur dioxide
T&D	Transmission and Distribution
TRC Test	Total Resource Cost Test
TRM	Technical Reference Manual
US	United States of America
WACC	Weighted Average Cost of Capital
WCMA	West/Central Massachusetts
WRP	Wholesale Risk Premium

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Appendix 7

Appendix 7 – SRP Market Engagement Year-to-Date Results

SYSTEM RELIABILITY PROCUREMENT

2020 Marketing and Engagement Plan

Quarterly Progress Report for Q4

Table of Contents

1. Purpose

The purpose of the Outreach and Engagement Plan Quarterly Report is to illustrate to stakeholders the level of effectiveness achieved with the current Outreach and Engagement Plan efforts and, therefore, to assess the potential level of engagement for third-party solution providers with the Rhode Island System Data Portal (Portal).

2. Executive Summary

This Quarterly Report for Q4 2020 demonstrates that although the company's paid digital ad campaign ended in Q1 the Portal landing page traffic has remained in line with our MA and NY Portals and NWA webpage. Additionally, the web rankings, resulting from the paid search terms channel, remained high through Q1 2020 and National Grid therefore deemed it appropriate to end the paid search term channel. The team launched a developer engagement survey in July 2020 as a new channel to engage developers and solicit feedback on the Portal which will be hosted on our Portal landing page through October 2020. To drive participation and maximize responses on the developer survey, the team restarted paid advertisement (digital banners) from August 2020 to October 2020. This new channel was added as an alternative to an in-person focus group due to a response to COVID-19.

3. Campaign Performance Evaluation

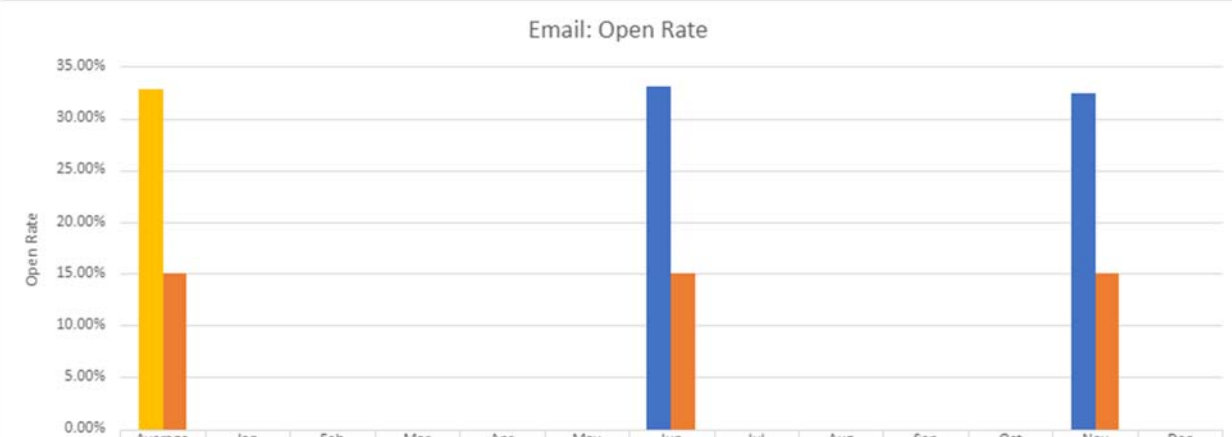
National Grid will continuously monitor, track, and assess the effectiveness of the 2020 SRP Outreach and Engagement Plan.

National Grid will evaluate using the metrics outlined in the 2020 Outreach and Engagement Plan and summarized in the table below.

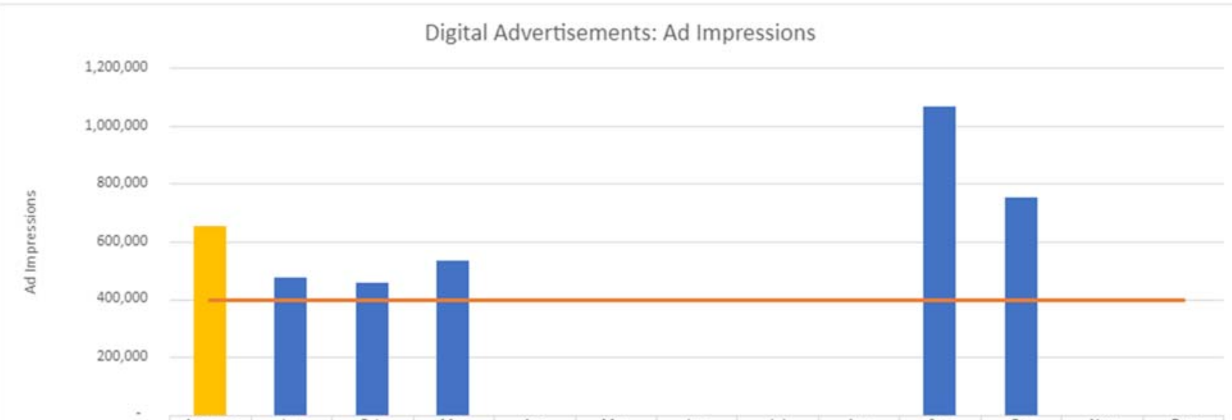
Table 1. Campaign Performance Evaluation Goals

Outreach Channel	Corresponding Metric	Goal
Webinars	Attendance	Average Attendance ≥ 35
Email Outreach	Open Rate	Average Open Rate ≥ 15%
Digital Advertisements	Click-Through Rate (CTR)	Average CTR ≥ 0.60%
Digital Advertisements	Ad Impressions	Average Ad Impressions ≥ 400k
Paid Search Terms	Web Rankings	Web Rankings ≥ 5th
Web Traffic	Total Site Visits	Average Total Site Visits ≥ 1500

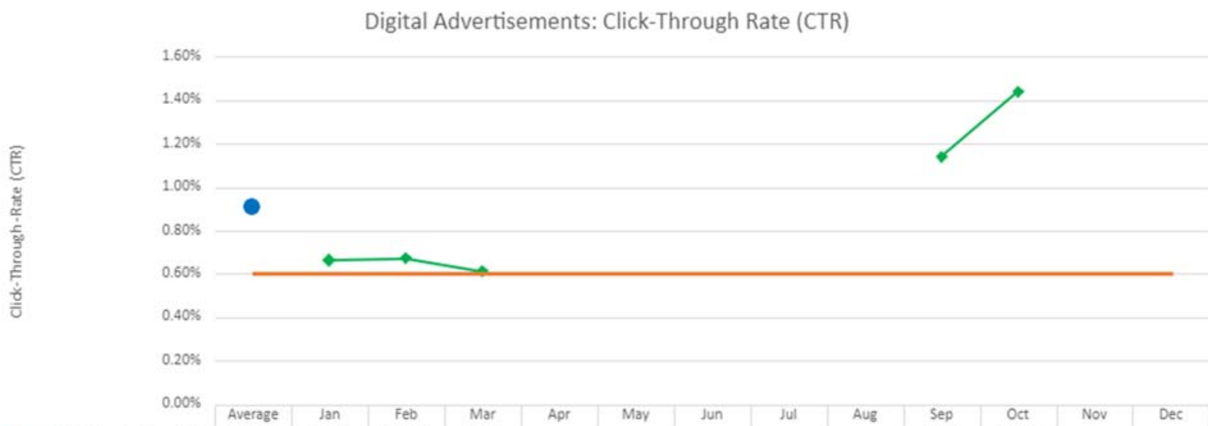
4. Campaign Performance Measurement



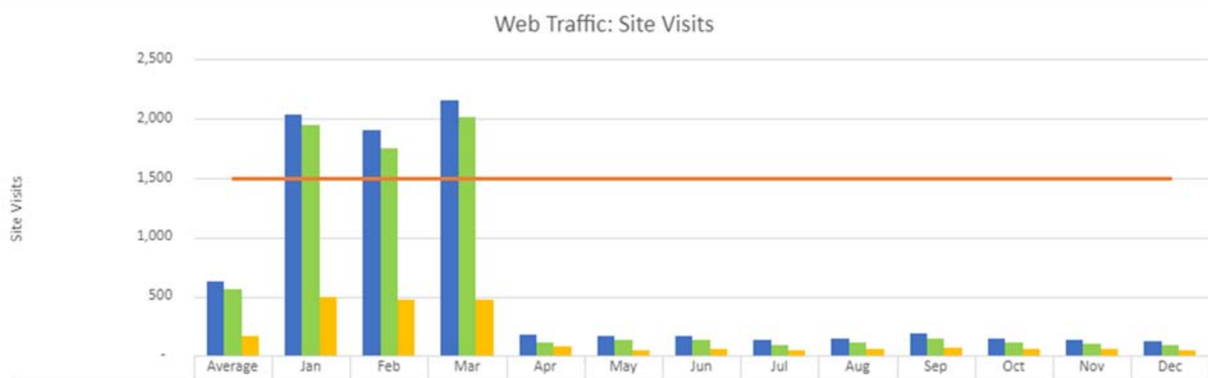
	Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Open Rate	32.79%						33.07%					32.50%	
Target	15.00%						15.00%					15.00%	



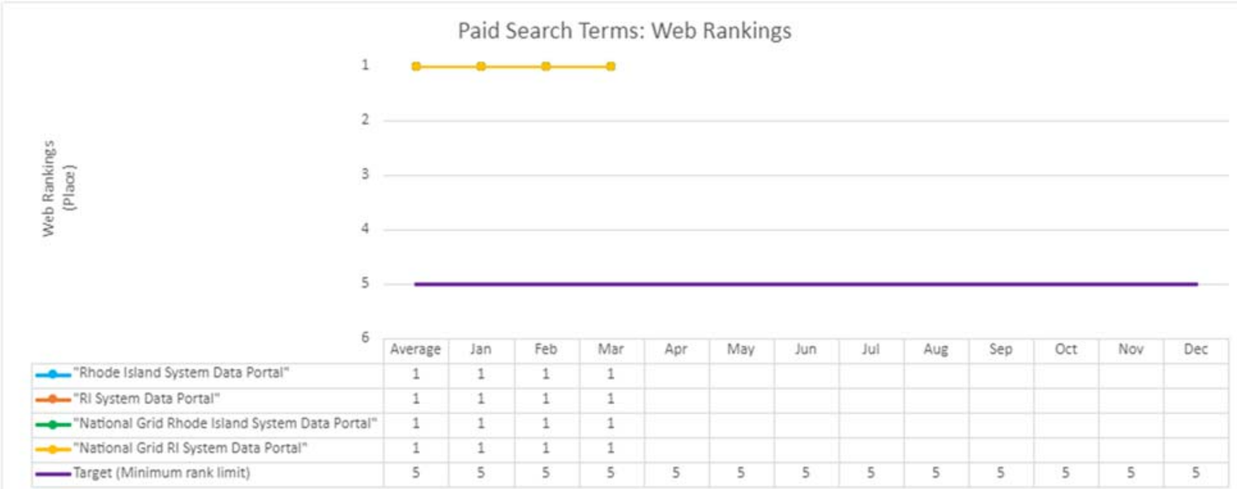
	Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Ad Impressions	656,194	473,843	455,567	531,890						1,066,590	753,079		
Target	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000	400,000



	Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Click-Through Rate (CTR)	0.90%	0.66%	0.67%	0.61%						1.14%	1.44%		
Target	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%	0.60%



	Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Total Site Visits	622	2,040	1,903	2,150	181	167	164	129	144	186	147	135	118
New Visitors	562	1,946	1,755	2,008	116	133	131	95	113	148	108	99	90
Returning Visitors	164	498	470	470	82	51	62	51	53	68	58	61	48
Target for Total Visits	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500	1,500



	Average	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
"Rhode Island System Data Portal"	1	1	1	1									
"RI System Data Portal"	1	1	1	1									
"National Grid Rhode Island System Data Portal"	1	1	1	1									
"National Grid RI System Data Portal"	1	1	1	1									
Target (Minimum rank limit)	5	5	5	5	5	5	5	5	5	5	5	5	5

5. Continuous Improvement: Next Steps

The outreach and engagement results demonstrate that the SRP Marketing team will need to continue to evaluate web traffic as it compares to our other Portal and NWA websites. Going forward the Portal is entering a maintenance phase and no paid marketing is currently planned for 2021 through 2023.

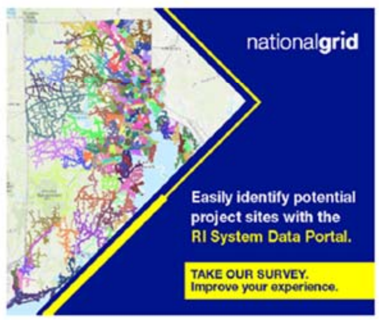
Appendix A: Table of Terms

Below is a table to help provide clarity on the marketing and related terms used in this Quarterly Report.

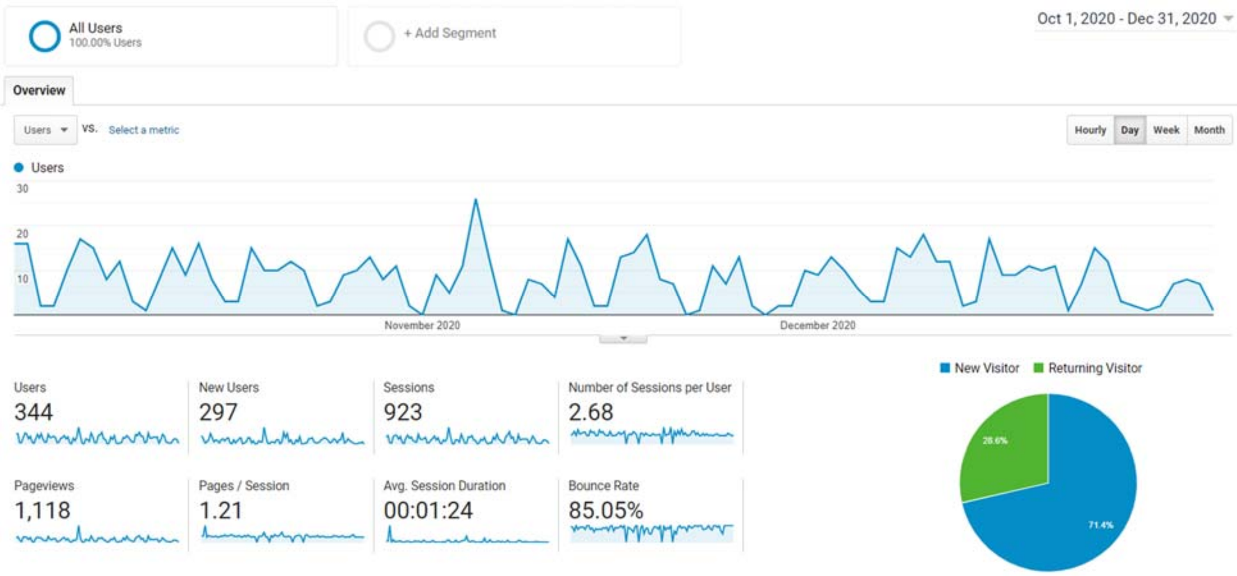
Term	Definition
Clicks	The number of times an individual selects or clicks on an advertisement or its equivalent.
Click-Through Rate (CTR)	The rate of clicks per impression, calculated by clicks divided by impressions. This represents, in part, the percentage of times users have clicked on a banner.
Digital Ad Placements	A specific group of advertisements on which an advertiser can choose to place their ads using placement targeting. A digital placement is one that takes place on digital media, such as the internet.
Impressions	The number of times an advertisement was viewed.
Non-Wires Alternative (NWA)	The inclusive term for any electrical grid investment that is intended to defer or remove the need to construct or upgrade components of a distribution and/or transmission system, or "wires investment".
Open Rate	The percentage of people who opened an email out of the total number of recipients. This number will include people who opened the email more than once. An indicator of subject line success and topic relevance.
Paid Search Term	A phrase or word on which advertisers bid to trigger their website or webpage to be shown to relevant users, dependent on term used.
Rankings	The position of a website or webpage in a search result list, dependent on the term used in the search engine.
Returning Site Visit	The number of times a unique first-time visitor returns to the website.
Search Engine Optimization (SEO)	The process of maximizing the number of visitors to a website by ensuring that the site appears high on the list of results returned by the search engine.
Total Site Visits	The total number of visits of individuals to a website during a given period. Total site visits are the sum of unique site visits and returning site visits.
Unique Site Visit	The number of visits of distinct individuals to a website during a given period. Does not include the number of revisits that an individual makes to the website.
Webinar	A live, web-based video conference that uses the internet to connect the individual hosting the conference to an audience of viewers. A portmanteau of the terms "web seminar".

Appendix B: Survey Display Ads

Google Display Ads
Banner Ads: September 15 – October 15, 2020



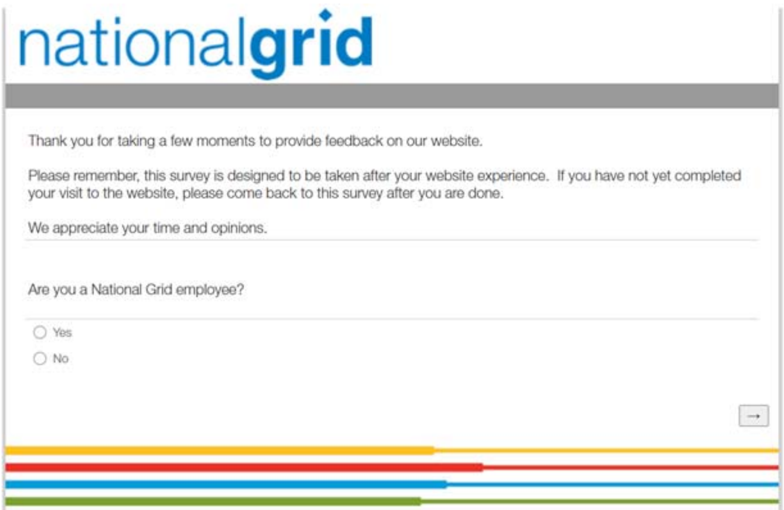
Appendix C: Google Analytics Web Traffic Report

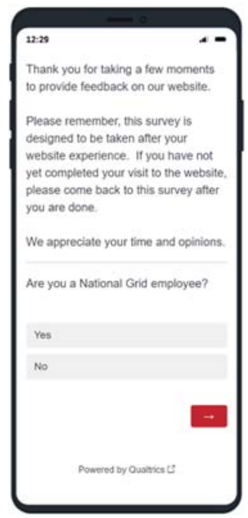


Appendix D: Vendor Feedback Survey

The screen captures below detail the walkthrough of the RI Portal vendor feedback survey, with the desktop browser view as the left image and the mobile web view on the right.

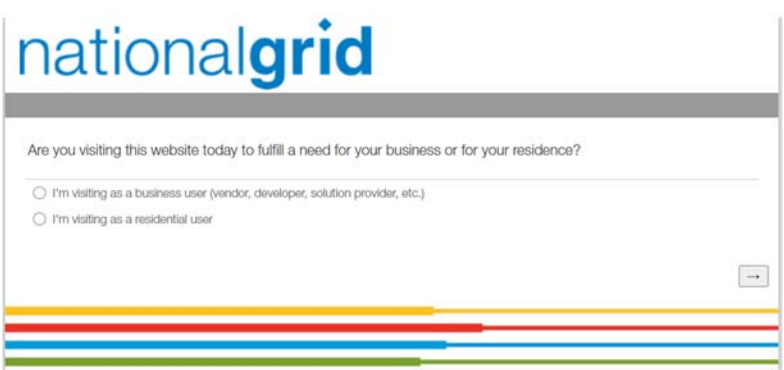
Survey start:

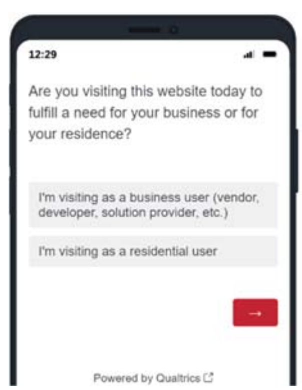




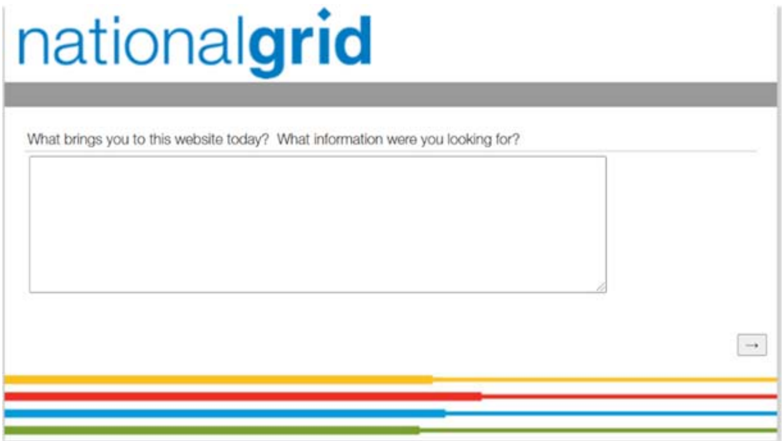
If Yes to first question:

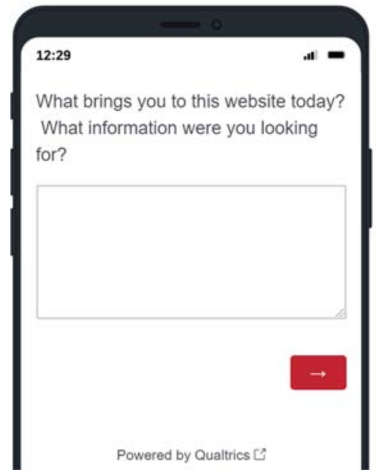
Otherwise, if "No" was selected, the survey proceeds:



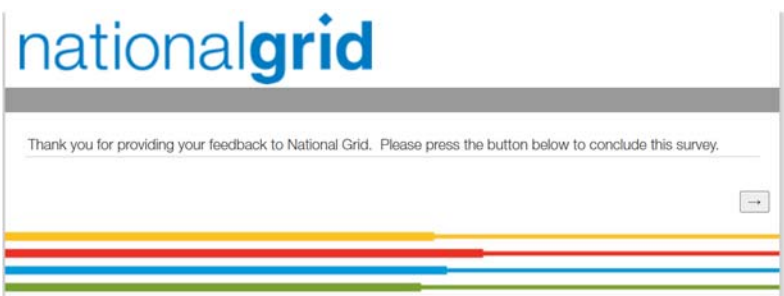


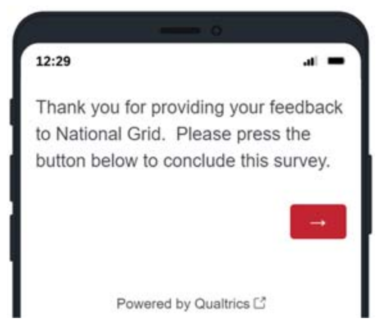
If “residential user” was selected:



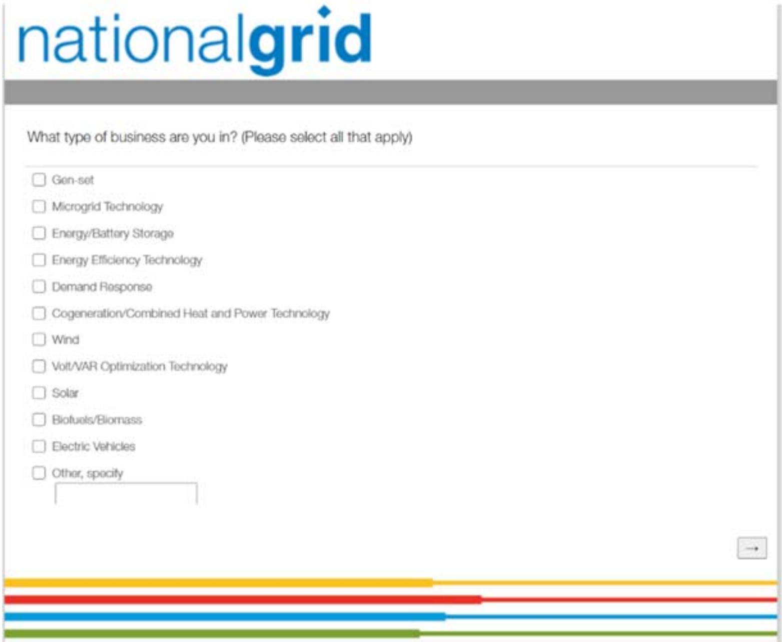


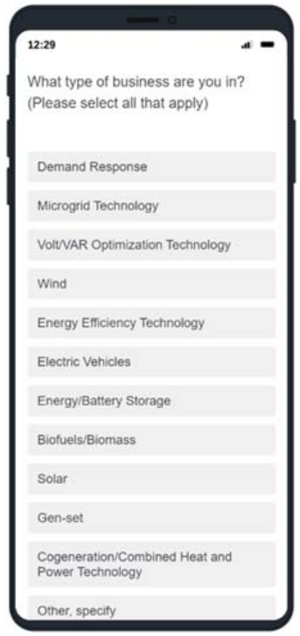
Then:

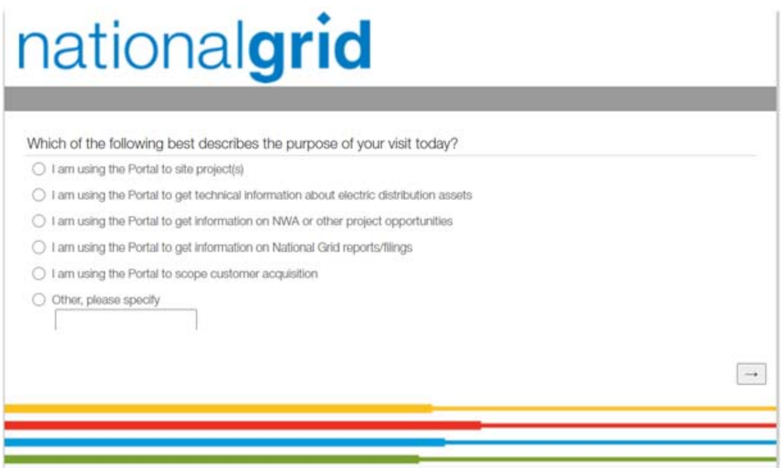


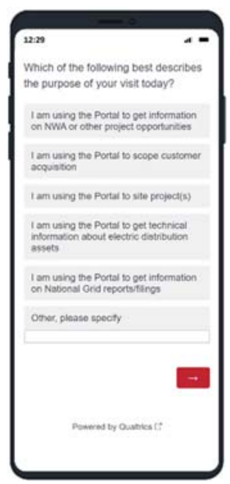


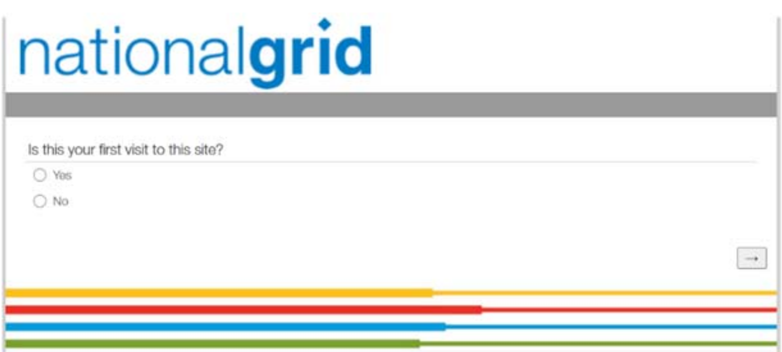
Otherwise, if “business user” was selected, the survey proceeds:

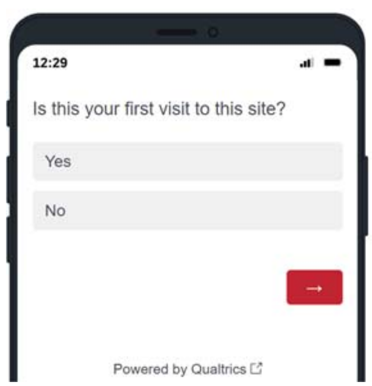

nationalgrid
What type of business are you in? (Please select all that apply)
Gen-set
Microgrid Technology
Energy/Battery Storage
Energy Efficiency Technology
Demand Response
Cogeneration/Combined Heat and Power Technology
Wind
Volt/VAR Optimization Technology
Solar
Biofuels/Biomass
Electric Vehicles
Other, specify

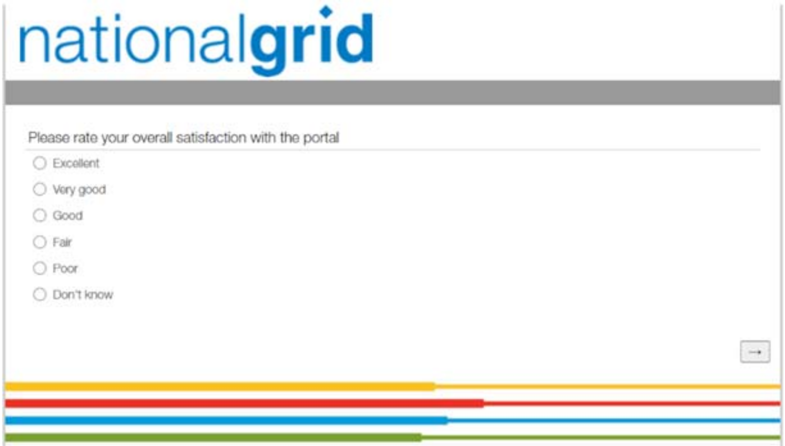

12:29
What type of business are you in? (Please select all that apply)
Demand Response
Microgrid Technology
Volt/VAR Optimization Technology
Wind
Energy Efficiency Technology
Electric Vehicles
Energy/Battery Storage
Biofuels/Biomass
Solar
Gen-set
Cogeneration/Combined Heat and Power Technology
Other, specify

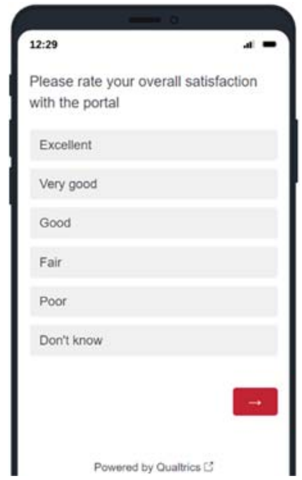

nationalgrid
Which of the following best describes the purpose of your visit today?
I am using the Portal to site project(s)
I am using the Portal to get technical information about electric distribution assets
I am using the Portal to get information on NWA or other project opportunities
I am using the Portal to get information on National Grid reports/filings
I am using the Portal to scope customer acquisition
Other, please specify

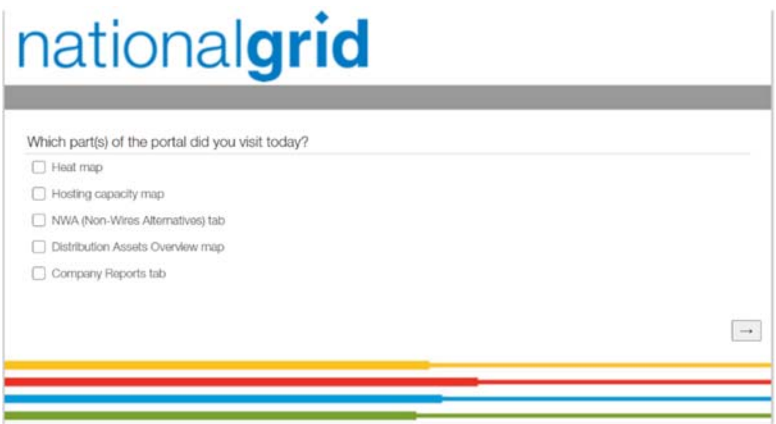

12:29
Which of the following best describes the purpose of your visit today?
I am using the Portal to get information on NWA or other project opportunities
I am using the Portal to scope customer acquisition
I am using the Portal to site project(s)
I am using the Portal to get technical information about electric distribution assets
I am using the Portal to get information on National Grid reports/filings
Other, please specify
Powered by Qualtrics

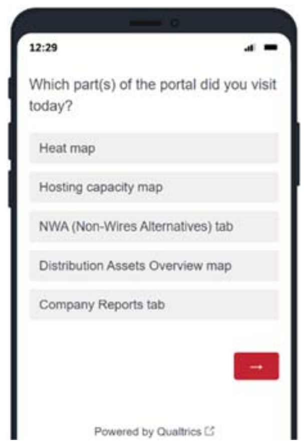

nationalgrid
Is this your first visit to this site?
Yes
No

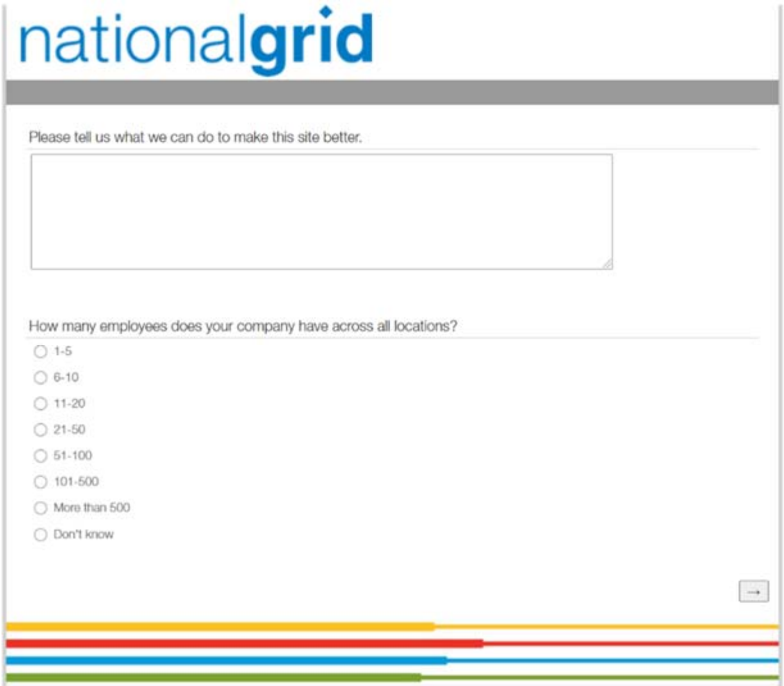

12:29
Is this your first visit to this site?
Yes
No
Powered by Qualtrics

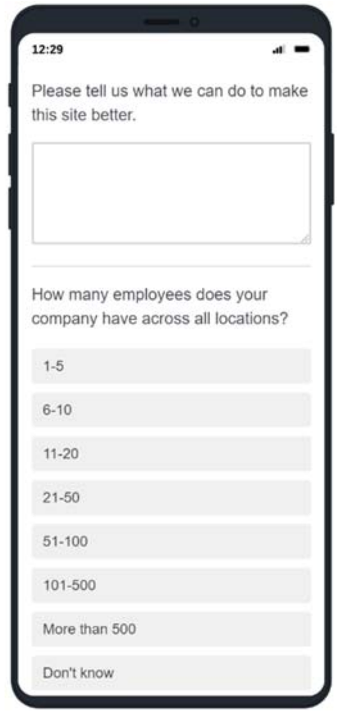

nationalgrid
Please rate your overall satisfaction with the portal
Excellent
Very good
Good
Fair
Poor
Don't know

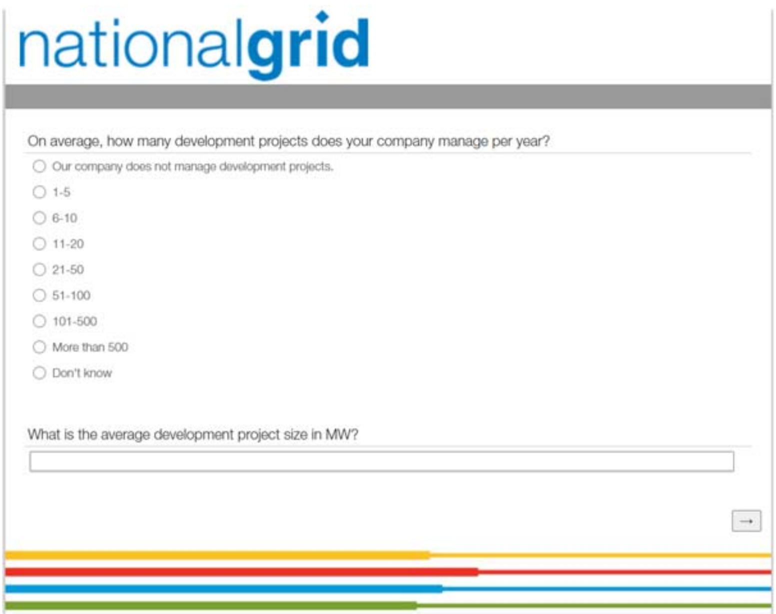

12:29
Please rate your overall satisfaction with the portal
Excellent
Very good
Good
Fair
Poor
Don't know
Powered by Qualtrics


nationalgrid
Which part(s) of the portal did you visit today?
Heat map
Hosting capacity map
NWA (Non-Wires Alternatives) tab
Distribution Assets Overview map
Company Reports tab

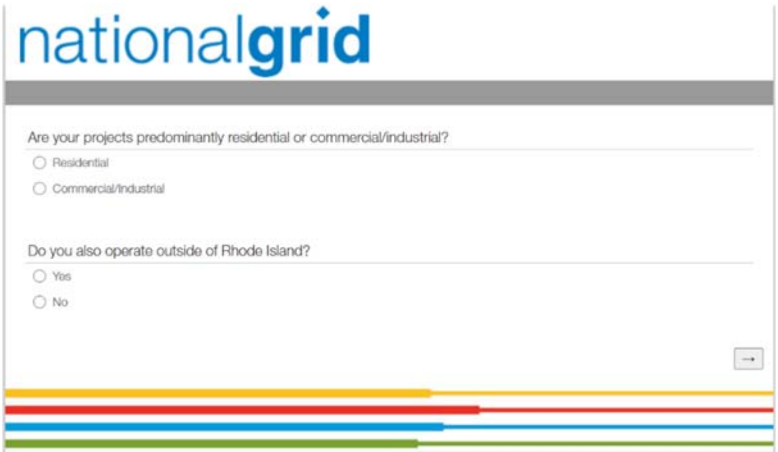

12:29
Which part(s) of the portal did you visit today?
Heat map
Hosting capacity map
NWA (Non-Wires Alternatives) tab
Distribution Assets Overview map
Company Reports tab
Powered by Qualtrics

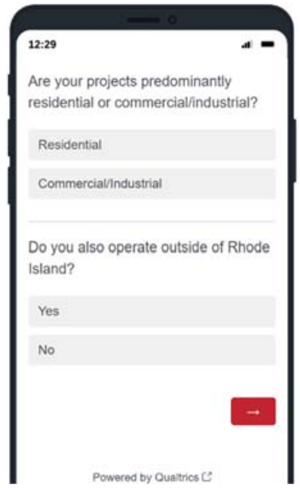

nationalgrid
Please tell us what we can do to make this site better.
How many employees does your company have across all locations?
1-5
6-10
11-20
21-50
51-100
101-500
More than 500
Don't know
→

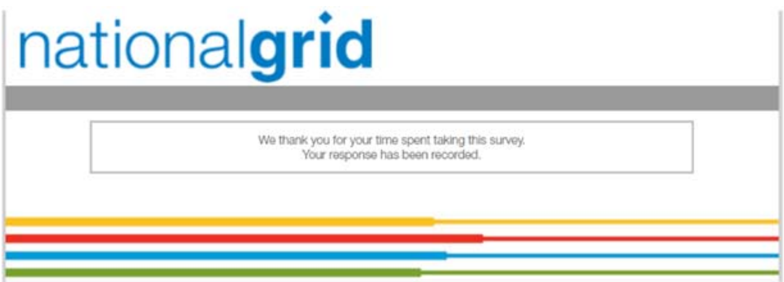

12:29
Please tell us what we can do to make this site better.
How many employees does your company have across all locations?
1-5
6-10
11-20
21-50
51-100
101-500
More than 500
Don't know

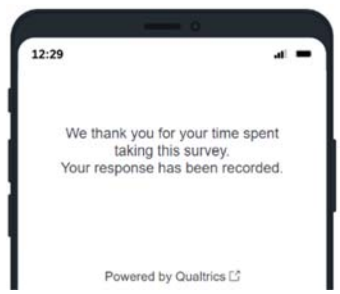

nationalgrid
On average, how many development projects does your company manage per year?
Our company does not manage development projects.
1-5
6-10
11-20
21-50
51-100
101-500
More than 500
Don't know
What is the average development project size in MW?
→


12:29
On average, how many development projects does your company manage per year?
Our company does not manage development projects.
1-5
6-10
11-20
21-50
51-100
101-500
More than 500
Don't know
What is the average development project size in MW?


nationalgrid
Are your projects predominantly residential or commercial/industrial?
Residential
Commercial/Industrial
Do you also operate outside of Rhode Island?
Yes
No

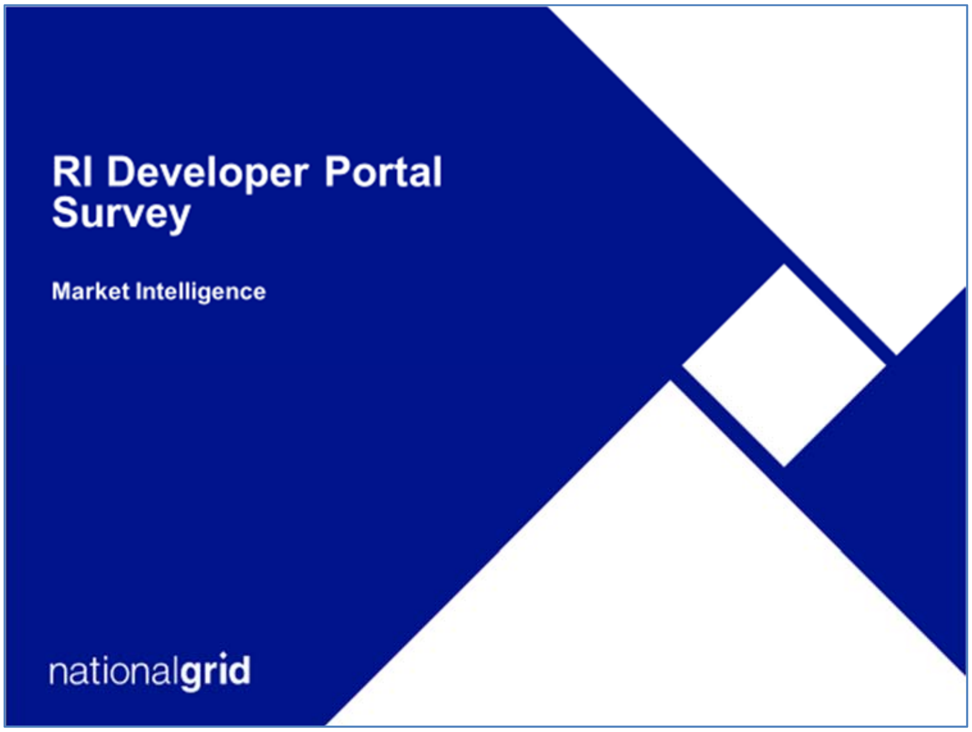

12:29
Are your projects predominantly residential or commercial/industrial?
Residential
Commercial/Industrial
Do you also operate outside of Rhode Island?
Yes
No
Powered by Qualtrics


nationalgrid
We thank you for your time spent taking this survey.
Your response has been recorded.


12:29
We thank you for your time spent taking this survey.
Your response has been recorded.
Powered by Qualtrics

Survey end.

Appendix E: Vendor Feedback Survey Results



Methodology

- **Web Survey**
  - Preview link: https://nationalgrid.co1.qualtrics.com/jfe/preview/SV_3HSk9dktqwCUSyN?Q_SurveyVersionID=current&Q_CHL=preview
- **Invitation offered via pop-over on RI Developer Portal site**
  - https://www.nationalgridus.com/Business-Partners/RI-System-Portal
- **Invitation programmed to appear only once very 30 days for any single visitor**
- **Web Survey active from June 30, 2020 through November 6, 2020**

National Grid | [Insert document title] | [Insert date] 2

Key Findings

Most of the visitors to the portal are Residential Customers (53% of survey respondents)

- Most residential survey respondents indicated that their visit was incidental
- Nearly all of the Residential survey respondents visited after marketing activities commenced in early August

Employees also make a significant portion of the visitors too (29% of survey respondents)

Among business users, no respondent indicated any dissatisfaction with the portal or any part of it

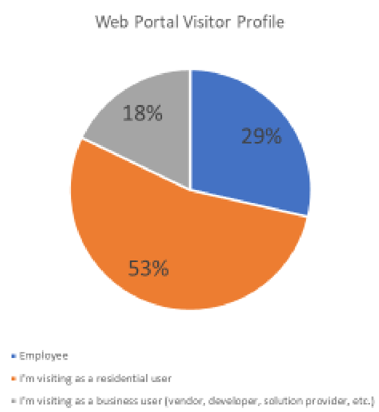
The limited feedback from business users indicates Very Good or Excellent experiences with the website

The lack of complete survey responses among business users limits statistical analysis (n=3)

National Grid 3

Website visitor profile

Most of the visitors to the portal were Residential Customers

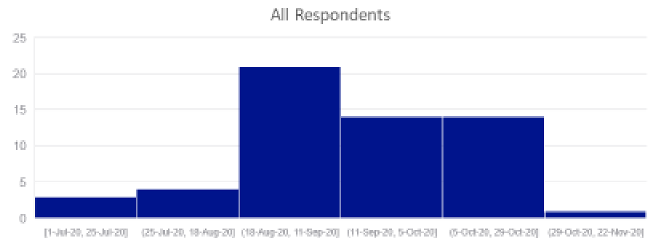


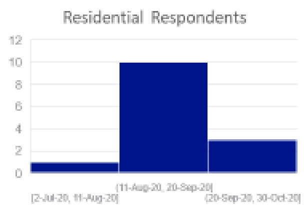
Are you a National Grid employee? Are you visiting this website today to fulfill a need for your business or for your residence? n=28

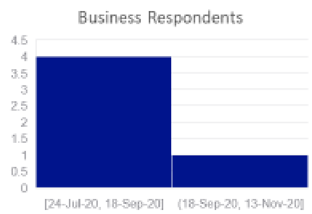
National Grid 4

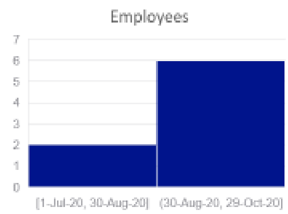
Timing of Responses

Marketing activities seem to drive traffic from all three groups. Nearly all residential responses started after the commencement of marketing activities (August 18, 2020)









National Grid 5

Business User Response

What type of business are you in? (Please select all that apply) - Selected Choice
Demand Response
Which of the following best describes the purpose of your visit today? - Selected Choice
I am using the Portal to get information on National Grid reports/filings
Please tell us a bit more about this project.
-
Is this your first visit to this site?
No
Approximately how often do you visit?
A couple of times a week
Please rate your overall satisfaction with the portal
Excellent
Which part(s) of the portal did you visit today?
Distribution Assets Overview map
Please rate your satisfaction with the Distribution Assets Overview map
Very Good
Please tell us what we can do to make this site better.
-
How many employees does your company have across all locations?
6-10
On average, how many development projects does your company manage per year?
101-500
Are your projects predominantly residential or commercial/industrial?
Commercial/Industrial
Do you also operate outside of Rhode Island?
Yes

National Grid 6

Business User Response

What type of business are you in? (Please select all that apply) - Selected Choice
Energy/Battery Storage,Demand Response,Microgrid Technology
Which of the following best describes the purpose of your visit today? - Selected Choice
I am using the Portal to get technical information about electric distribution assets
Please tell us a bit more about this project.
-
Is this your first visit to this site?
Yes
Approximately how often do you visit?
N/A
Please rate your overall satisfaction with the portal
Very Good
Which part(s) of the portal did you visit today?
Distribution Assets Overview map
Please rate your satisfaction with the Distribution Assets Overview map
Very Good
Please tell us what we can do to make this site better.
-
How many employees does your company have across all locations?
More than 500
On average, how many development projects does your company manage per year?
-
Are your projects predominantly residential or commercial/industrial?
Residential
Do you also operate outside of Rhode Island?
No

National Grid 7

Business User Response

What type of business are you in? (Please select all that apply) - Selected Choice
Solar
Which of the following best describes the purpose of your visit today? - Selected Choice
I am using the Portal to site project(s)
Please tell us a bit more about this project.
We are solar developers.
Is this your first visit to this site?
Yes
Approximately how often do you visit?
N/A
Please rate your overall satisfaction with the portal
Very Good
Which part(s) of the portal did you visit today?
Hosting capacity map
Please rate your satisfaction with the Hosting Capacity map
Very Good
Please tell us what we can do to make this site better.
not much
How many employees does your company have across all locations?
1-5
On average, how many development projects does your company manage per year?
11-20
Are your projects predominantly residential or commercial/industrial?
Commercial/Industrial
Do you also operate outside of Rhode Island?
Yes

National Grid 8

Residential Visitors – Reason for Visiting Website

Most residential survey respondents indicated that their visit was incidental

Prices

Grid map

I love puzzles

National grid asked me to participate in survey.

You asked for my opinion

Milestone Customer-Generator-Installation email

Came up on my iPad

Trying to get information about your rebate provider. EFI is totally non-responsive and reflects poorly on National Grid. EFI is a total fraud and I am reporting to the RI Public Utilities Commission.

What brings you to this website today? What information were you looking for?

National Grid 9

Appendix: Questionnaire

Are you a National Grid employee? [If yes, thank respondent and end survey]
Are you visiting this website today to fulfill a need for your business or for your residence? (Answer options: "I'm visiting as a business user (vendor, developer, solution provider, etc.)" or "I'm visiting as a residential user")
What type of business are you in? (Please select all that apply) - Selected Choice
What type of business are you in? (Please select all that apply) - Other, specify – Text
[Residential Respondents only] What brings you to this website today? What information were you looking for?
[Remainder of survey only for Business Users]
Which of the following best describes the purpose of your visit today? - Selected Choice
Which of the following best describes the purpose of your visit today? - Other, please specify – Text
Please tell us a bit more about this project.
What piqued your interest with the NWA or project opportunity (the area, load level, customer demographic, etc.)?
What initiative are you referencing the technical information for?
What reports or fillings are you interested in?
Please tell us a bit more about this initiative.
Is this your first visit to this site?
Approximately how often do you visit?
Please rate your overall satisfaction with the portal
Which part(s) of the portal did you visit today?
Please rate your satisfaction with the Company Reports Tab
Please rate your satisfaction with the Distribution Assets Overview map
Please rate your satisfaction with the Heat Map
Please rate your satisfaction with the Hosting Capacity Map
Please rate your satisfaction with the NWA (Non-Wires Alternatives) tab
Please tell us what we can do to make this site better.
How many employees does your company have across all locations?
On average, how many development projects does your company manage per year?
What is the average development project size in MW?
Are your projects predominantly residential or commercial/industrial?
Do you also operate outside of Rhode Island?

National Grid 10