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Regional System Plan Transmission Projects and Asset Condition March 2019 Update

Planning Advisory Committee Meeting

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ENGINEER, TRANSMISSION PLANNING

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Highlights of the RSP Project List Update

• Major cost estimate changes that occurred between the October 2018 and March 2019 Project List:

(RI) Aquidneck Island Project – **Project 1671** – Convert lines 61/62 from 69 kV to 115 kV - cost increase (+\$8.5M). Change in costs based on latest estimates.

• Project Updates:

(ME) - MPRP – Project Complete (VT) - Connecticut River Valley – Project Complete

• No New Projects

• 10 Upgrades on the project list have been placed in-service since the October 2018 update:

- (CT) SWCT- 2 projects in-service
- (CT) GHCC 2 projects in-service
- (MA) Central W. MA upgrades 1 project in-service Adams install 2 new breakers and replace 2 in associated line relocations
- (MA) Southeast MA/RI Reliability 1 project in-service Reconductor 108 line from Bourne Substation #917 to Horse Pond Tap
- (VT) Connecticut River Valley Project last project in-service Install one +50/-25 MVAR dynamic voltage support device at Ascutney

- (ME) MPRP 2 projects in-service
- (ME) Greater Boston Stability Install new +/- 200 MVAR STATCOM at Coopers Mills 345 kV Substation

March 2019 Changes 0 New Projects and Corresponding Need

Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need

10 Projects Placed In-Service and Corresponding Needs

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	Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need
	1380	Baird to Congress 8809A - 8909B 115 kV Line Upgrades (Connecticut) SWCT	56.6	Eliminate thermal overloads under contingency conditions
	1620	Ansonia 115 kV Capacitor Bank Additions (Connecticut) SWCT	9.5	Resolve voltage in the SWCT area
	1589	Add a new control house at Southington 115 kV Substation (Connecticut) GHCC	22.6	Improve load serving capability in the GHCC area
	1586	Replace the existing 3% series reactors on the 115 kV lines between Southington and Todd (1910) and between Southington and Canal (1950) with 5% series reactors (Connecticut) GHCC	5.2	Improve load serving capability in the GHCC area
	945	Adams - install two new 115 kV breakers and replace two existing 115 kV breakers and associated line relocations (Massachusetts) Central Western MA Upgrades	16.9	Improve load serving capability in the Western CT/MA area
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10 Projects Placed In-Service and Corresponding Needs

Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need
1736	Reconductor the 108 line from Bourne Substation #917 to Horse Pond Tap (Massachusetts) Southeast MA/RI Reliability Project	2.8	Resolves thermal overloads
1615	Install one +50/-25 MVAR dynamic voltage support device at Ascutney (Vermont) Connecticut River Valley	32.0	Resolve voltage issues in the Connecticut River Valley area
1413	Add a new 115 kV transmission line (256) between Middle Street and Lewiston Lower (Lewiston Loop) (Maine) MPRP	9.1	Increase load serving capability in Maine
1442	Expand Lewiston Lower 115 kV Substation interconnecting lines 256 and 202 between stations Middle Street and Crowleys (Lewiston Loop) (Maine) MPRP	4.7	Increase load serving capability in Maine
1643	Install a new +/- 200 MVAR STATCOM at Coopers Mills 345 kV Substation (Maine) Greater Boston - Stability	53.1	Resolve stability concerns in the greater Boston area

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Cost Estimate Comparisons of Reliability Projects

October 2018 vs. March 2019 Update ⁽¹⁾

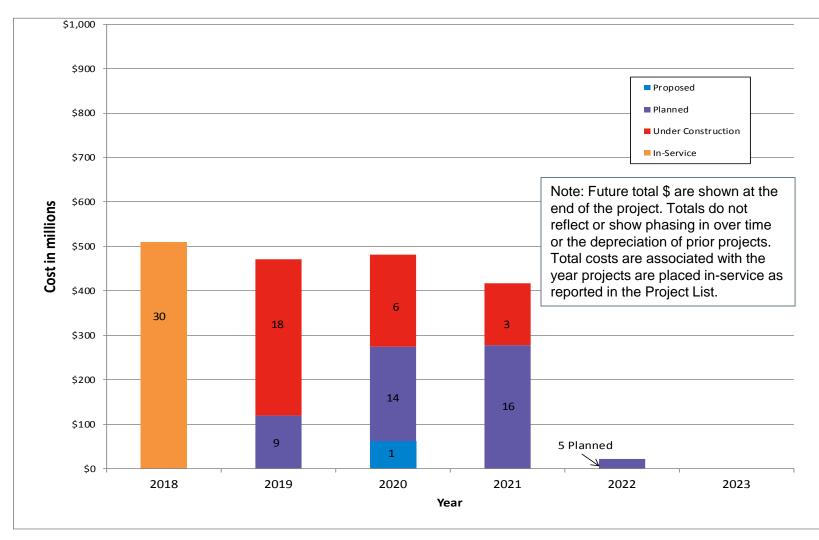
	As of Oct 2018 Plan Update (in millions \$)	As of Mar 2019 Plan Update (in millions \$)	Change in Plan Estimate (in millions \$)
MAJOR PROJECTS			
Maine Power Reliability Program (MPRP)	1466	1466	0
Greater Hartford & Central Connecticut (GHCC)	307	307	0
New England East - West Solution (NEEWS)	1581	1581	0
NEEWS (Greater Springfield Reliability Project) \$676.0			
NEEWS (Rhode Island Reliability Project) \$362.3			
NEEWS (Interstate Reliability Project) \$482.3 NEEWS \$59.6			
Southeast Massachusetts/Rhode Island Reliability Project	324	326	2
Pittsfield/Greenfield Project	179	179	0
Greater Boston - North, South, Central, Western Suburbs	828	838	10
New Hampshire Solution - Southern, Central, Seacoast, Northern	328	328	0
Vermont Solution - Southeastern, Connecticut River	82	82	0
Southwest Connecticut (SWCT)	399	399	0
SUBTOTAL (2)	5494	5506	12
OTHER PROJECTS	6781	6794	12
NEW PROJECTS		0	0
PROJECTS WHOSE COST ESTIMATES WERE PREVIOUSLY REPORTED AS TO BE DETERMINED (TBD)			
TOTAL ⁽²⁾	12275	12300	24
Minus 'in-service'	-10696	-10908	
Aggregate estimate of active projects in the Plan ⁽²⁾	1580	1392	

⁽¹⁾ Transmission Owners provided all estimated costs, which may not meet the guidelines described in Planning Procedure 4, Attachment D

⁽²⁾ May not sum exactly due to rounding

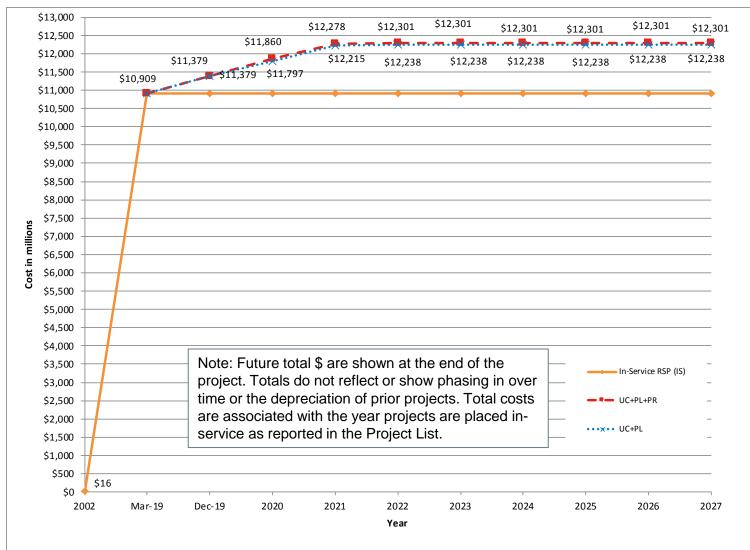
⁽³⁾ The cost estimates for projects in the "Major Projects" category are moved to the "Other Projects" category once they are fully completed.

Investment of New England Transmission Reliability Projects by Status through 2023



Note: Numbers shown represent project quantities

Cumulative Investment of New England Transmission Reliability Projects through 2027



Note: UC – Under Construction, PL – Planned, PR – Proposed

Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges ⁽¹⁾

	Component /			E	Estimated	Rai	nge
Project Stage	Project / Plan	Estimat	e Range		Costs	Minimum	Maximum
(Status)	Count ⁽²⁾	Minimum	Maximum	(\$	\$millions)	(\$mil	lions)
Proposed	1	-25%	25% ⁽³⁾		63	47	78
Planned	44	-25%	25%		632	474	790
Under Construction	27	-10%	10%		697	625	768
Total Plan (excluding Concept)	72			(5)	1392	1146	1636
Concept	0			(4)	0		
In-Service	10	-10%	10%		213	192	234
Cancelled	0						

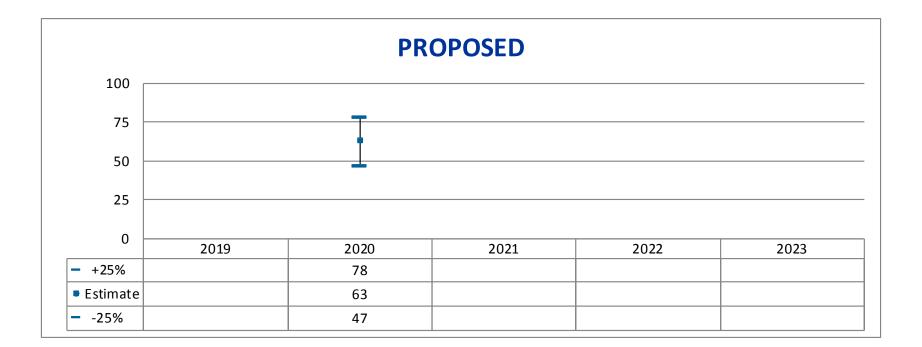
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⁽¹⁾ All costs provided by Transmission Owners. The costs in the table reflect all projected in-service dates

⁽²⁾ Efforts need to be made to describe projects on a more consistent basis

- ⁽³⁾ All estimates may not yet be at this level of accuracy; many estimates may be -25%/+50%
- ⁽⁴⁾ Not included here are the costs of reliability projects for which no estimates have been provided. Estimates for these projects are noted as TBD in the Project Listing and are only Concept Projects.
- ⁽⁵⁾ May not add up due to rounding.

Project Cost Estimate Tolerances by Status and Year in Millions \$

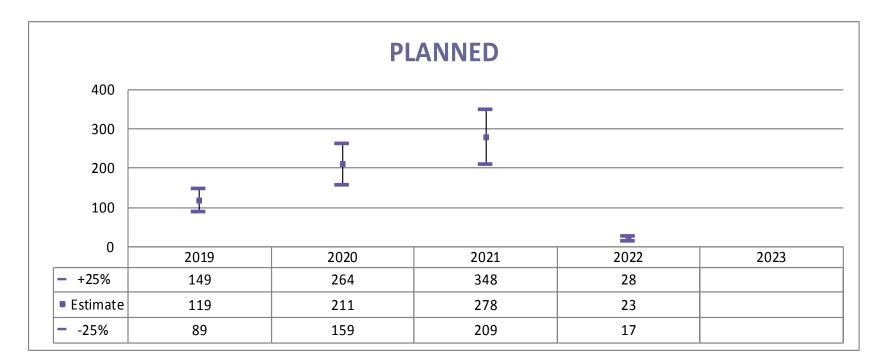


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Note: Future total \$ are shown at the end of the project. Totals do not reflect or show phasing in over time or the depreciation of prior projects. Total costs are associated with the year projects are placed inservice as reported in the Project List.

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Project Cost Estimate Tolerances by Status and Year in Millions \$

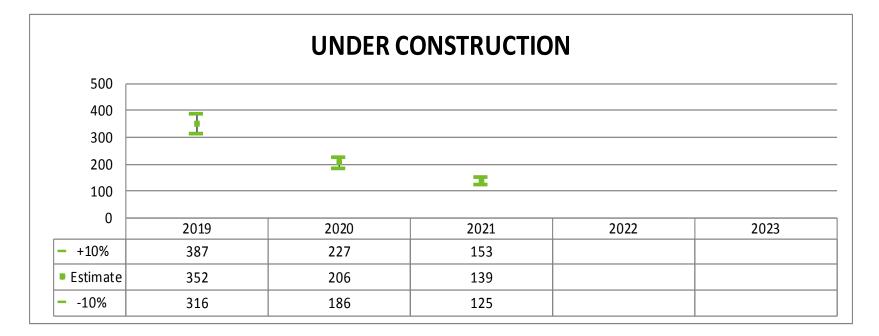


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Note: Future total \$ are shown at the end of the project. Totals do not reflect or show phasing in over time or the depreciation of prior projects. Total costs are associated with the year projects are placed in-service as reported in the Project List.

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Project Cost Estimate Tolerances by Status and Year in Millions \$



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Note: Future total \$ are shown at the end of the project. Totals do not reflect or show phasing in over time or the depreciation of prior projects. Total costs are associated with the year projects are placed in-service as reported in the Project List.

Status of Major Transmission Projects

	РРА	TCA	Construction
Pittsfield/Greenfield Project	Approved	Partial 2/11/16,	Project completion
	12/12, 01/16, 05/16	7/17/17, 2/15/19	2014-2020
Maine Power Reliability Program (MPRP)	Approved	Approved	Project completion
	7/08, 2/09, 11/10	1/29/10	2014-2018
Vermont Solution – Connecticut River Valley	Approved	Approved	Project completion
	4/15	12/1/17	2016-2018
Southwest Connecticut (SWCT)	Approved 4/15	Complete 7/16/15, 4/15/16, 5/13/16, 1/3/18, 2/15/19	Project completion 2013-2020
Southeast MA/RI Reliability	Approved 5/17, 4/18	Not Submitted	Project completion 2017-2021

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Status of Major Transmission Projects, cont.

	РРА	ТСА	Construction
Central/Western MA Reinforcements	Approved 12/07, 3/11	Group 1 2/29/2012	Project completion 2009-2019
Greater Boston – North, South, Central and Suburbs	Approved 4/15, 5/15, 6/16	TCA Submitted	Project completion 2013-2021
New Hampshire Solution – Western, Central, Southern and Seacoast	3/13	Seacoast 11/5/15 Southern 1/7/16 Western 12/17/15 Central 11/25/15	Project completion 2013-2020
Greater Hartford & Central Connecticut (GHCC)	4/15	Partial 10/4/2016	Project completion 2015-2019

Project ID #	Transmission System Upgrades	Cost (in millions \$)
100	Eversource 115 kV Structure Replacement Project - Line A126 (New Hampshire)	8.3
101	Eversource 115 kV Structure Replacement Project - Line H123 (New Hampshire)	6.0
102	Eversource 115 kV Structure Replacement Project - Line H141 (New Hampshire)	7.7
103	Eversource 115 kV Structure Replacement Project - Line K174 (New Hampshire)	8.7
104	Eversource 115 kV Structure Replacement Project - Line L163 (New Hampshire)	14.0



Project ID #	Transmission System Upgrades	Cost (in millions \$)
105	Eversource 115 kV Structure Replacement Project - Line A152 (New Hampshire)	6.1
106	Eversource 115 kV Structure Replacement Project - Line X178 (New Hampshire)	11.2
107	349X/Y 345 kV Cable Replacement (Massachusetts)	72.4
108	Eversource 115 kV Structure Replacement Project - Line 65-508 (Massachusetts)	19.5
109	Eversource 115 kV Structure Replacement Project - Line 1327 (Massachusetts)	7.8



Project ID #	Transmission System Upgrades	Cost (in millions \$)
110	Oil Circuit Breaker Replacement Project at the Agawam Substation (Massachusetts)	12.1
111	Eversource 115 kV Structure Replacement Project - Line 1447 (Massachusetts)	6.6
112	Eversource 115 kV Structure Replacement Project - Line 1962 (Massachusetts)	20.3
113	Eversource 115 kV Structure Replacement Project - Line 1768-MA (Massachusetts)	3.0
114	Eversource 115 kV Structure Replacement Project - Line F132 (Massachusetts)	11.0

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Project ID #	Transmission System Upgrades	Cost (in millions \$)
115	1608 115 kV Line Cable Replacement (Connecticut)	11.3
116	1880 115 kV Line Cable Replacement (Connecticut)	7.2
117	Eversource 115 kV Structure Replacement Project - Line 1050 (Connecticut)	7.3
118	Eversource 115 kV Structure Replacement Project - Line 1191 (Connecticut)	8.3
119	Eversource 115 kV Structure Replacement Project - Line 1256 (Connecticut)	12.2



Project ID #	Transmission System Upgrades	Cost (in millions \$)
120	Eversource 115 kV Structure Replacement Project - Line 1261 (Connecticut)	18.3
121	Eversource 115 kV Structure Replacement Project - Line 1280 (Connecticut)	7.5
122	Eversource 115 kV Structure Replacement Project - Line 1310 (Connecticut)	8.3
123	Eversource 115 kV Structure Replacement Project - Line 1410 (Connecticut)	5.8
124	Eversource 115 kV Structure Replacement Project - Line 1448 (Connecticut)	6.9



Project ID #	Transmission System Upgrades	Cost (in millions \$)
125	Eversource 115 kV Structure Replacement Project - Line 1565 (Connecticut)	11.5
126	Eversource 115 kV Structure Replacement Project - Line 1620 (Connecticut)	10.0
127	Eversource 115 kV Structure Replacement Project - Line 1635 (Connecticut)	5.7
128	Eversource 115 kV Structure Replacement Project - Line 1675 (Connecticut)	7.3
129	Eversource 115 kV Structure Replacement Project - Line 1726 (Connecticut)	16.3

Project ID #	Transmission System Upgrades	Cost (in millions \$)
130	Eversource 115 kV Structure Replacement Project - Line 1465 (Connecticut)	7.0
131	Eversource 115 kV Structure Replacement Project - Line 175 (Connecticut)	12.5
132	Eversource 115 kV Structure Replacement Project - Line 1756 (Connecticut)	7.0
133	Eversource 115 kV Structure Replacement Project - Line 1759 (Connecticut)	7.3
134	Eversource 115 kV Structure Replacement Project - Line 1765 (Connecticut)	12.3



Project ID #	Transmission System Upgrades	Cost (in millions \$)
135	Eversource 115 kV Structure Replacement Project - Line 1766 (Connecticut)	5.8
136	Eversource 115 kV Structure Replacement Project - Line 1767 (Connecticut)	5.4
137	Eversource 115 kV Structure Replacement Project - Line 1769 (Connecticut)	8.2
138	Eversource 115 kV Structure Replacement Project - Line 1770 (Connecticut)	16.3
139	Eversource 115 kV Structure Replacement Project - Line 1772 (Connecticut)	10.0

Project ID #	Transmission System Upgrades	Cost (in millions \$)
140	Eversource 115 kV Structure Replacement Project - Line 1783 (Connecticut)	8.2
141	Eversource 115 kV Structure Replacement Project - Line 1785 (Connecticut)	9.0.
142	Eversource 115 kV Structure Replacement Project - Line 1768-CT (Connecticut)	5.2
143	Eversource 115 kV Structure Replacement Project - Line 1910 (Connecticut)	5.8
144	Millstone Substation 15G High Creep Insulator Replacement (Connecticut)	11.5



Project ID #	Transmission System Upgrades	Cost (in millions \$)
145	Carpenter Hill Control House Rebuild (Massachusetts)	6.9
146	327 Line Asset Condition Refurbishments (Massachusetts)	60.4
147	303 Line Asset Condition Refurbishments (Massachusetts)	24.7
148	3520 Line Asset Condition Refurbishments (Massachusetts)	6.9
149	315 Line Asset Condition Refurbishments - MA Portion (Massachusetts)	53.5



Project ID #	Transmission System Upgrades	Cost (in millions \$)
150	315 Line Asset Condition Refurbishments - RI Portion (Rhode Island)	16.5

32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
11	Replacement of 115 kV, 230 kV and 345 kV structures as part of the VELCO asset maintenance activities addressing the aging and degrading transmission line infrastructure. 100 to 300 structures will be replaced every year based on outage availability (Vermont) Structure Condition Improvement	158.0
52	Replace the Littleton TB-41 autotransformer and bus upgrades to accommodate new transformer specifications (New Hampshire) Autotransformer Replacement Plan	4.3
55	Eversource 345 kV Structure Replacement Project - Line 307 (New Hampshire)	12.9
56	Eversource 345 kV Structure Replacement Project - Line 326 (New Hampshire)	12.3
57	Eversource 345 kV Structure Replacement Project - Line 367 (New Hampshire)	15.8

32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
58	Eversource 345 kV Structure Replacement Project - Line 379 (New Hampshire)	14.8
59	Eversource 345 kV Structure Replacement Project - Line 381 (New Hampshire)	13.6
60	Eversource 345 kV Structure Replacement Project - Line 391 (New Hampshire)	19.6
34	Devon Control House Modifications (Connecticut)	9.4
69	Oil Circuit Breaker Replacement Project at the Frost Bridge Substation (Connecticut)	6.4



32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
71	Eversource 345 kV Structure Replacement Project - Line 310 (Connecticut)	15.0
72	Eversource 345 kV Structure Replacement Project - Line 321 (Connecticut)	5.8
75	Eversource 345 kV Structure Replacement Project - Line 364 (Connecticut)	14.2
76	Eversource 345 kV Structure Replacement Project - Line 371 (Connecticut)	11.5
74	Eversource 345 kV Structure Replacement Project - Line 348 (Connecticut)	16.0



32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
77	Eversource 345 kV Structure Replacement Project - Line 383 (Connecticut)	13.5
78	Eversource 345 kV Structure Replacement Project - Line 387 (Connecticut)	13.8
80	Eversource 345 kV Structure Replacement Project - Line 3401 (Connecticut)	8.3
81	Eversource 345 kV Structure Replacement Project - Line 3642 (Connecticut)	10.2
125	Eversource 115 kV Structure Replacement Project - Line 1565 (Connecticut)	11.5

32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
131	Eversource 115 kV Structure Replacement Project - Line 1751 (Connecticut)	12.5
133	Eversource 115 kV Structure Replacement Project - Line 1759 (Connecticut)	7.3
136	Eversource 115 kV Structure Replacement Project - Line 1767 (Connecticut)	5.4
138	Eversource 115 kV Structure Replacement Project - Line 1770 (Connecticut)	16.3
139	Eversource 115 kV Structure Replacement Project - Line 1772 (Connecticut)	10.0



32 Projects Placed In-Service

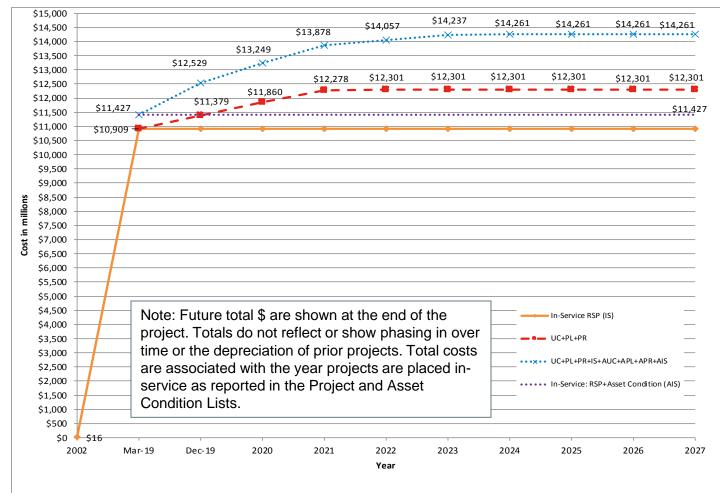
Project ID #	Transmission System Upgrades	Cost (in millions \$)
142	Eversource 115 kV Structure Replacement Project - Line 1768-CT (Connecticut)	5.2
143	Eversource 115 kV Structure Replacement Project - Line 1910 (Connecticut)	5.8
37	New Mt. Tom protection system control house (Massachusetts)	6.7
62	Oil Circuit Breaker Replacement Project at the Agawam Substation (Massachusetts)	4.7
64	Eversource 345 kV Structure Replacement Project - Line 393 (Massachusetts)	10.0



32 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
111	Replace the Deerfield TB-14 autotransformer and bus upgrades to accommodate new transformer specifications (Massachusetts)	6.6
113	Eversource 115 kV Structure Replacement Project - Line 1768-MA (Massachusetts)	3.0

Cumulative Investment of New England Transmission Reliability Projects and Asset Condition through 2027



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Note: RSP - UC – Under Construction, PL – Planned, PR – Proposed, IS – In-service Asset Condition - AUC – Under Construction, APL – Planned, APR – Proposed, AIS – In-service

Appendix

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Summary: Project Listing Definitions

- ISO New England Inc. Transmission, Markets and Services Tariff Section II Attachment K, Regional System Planning Process Project Listing Subcategories
 - **Concept:** shall include a transmission project that is being considered by its proponent as a potential solution to meet a need identified by the ISO in a Needs Assessment or the RSP, but for which there is little or no analysis available to support the transmission project. (Project not well-defined, costs not well-defined, solution implementation not supportable).
 - **Proposed:** The project will include a regulated transmission solution that has been proposed in response to a specific Needs Assessment or the RSP and has been evaluated or further defined and developed in a Solutions Study or in the competitive solutions process and communicated to PAC. (Project well-defined, cost estimate quality sufficient for comparison of alternatives).
 - **Planned:** The project will include a Transmission upgrade that has been approved by the ISO, pursuant to Section I.3.9 (presumes Needs Assessment and Solutions Study have been completed). (Still subject to Schedule 12C review for Transmission Cost Allocation)

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Project Listing

Project Listing Column Definitions for:

- Reliability Projects
- Interconnection Projects
- Market Efficiency Upgrades

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Elective Projects

Project Listing – Column Definitions

Part Number (Part #)

The Part #'s designate the 'need' category of the project. Original categories are not changed when a project is placed 'In-Service' or 'Cancelled'.

Part 1 – These projects are Reliability Upgrades.

1a: Planned or Under Construction

1b: Concept or Proposed

Part 2 – These projects are Generator Interconnection Upgrades.

2a: Planned (I.3.9 approval with Generator Interconnection Agreement including FCM related transmission upgrades to meet the Capacity Capability Interconnection Standard), or Under Construction

2b: Concept or Proposed (at a minimum, a completed System Impact Study and I.3.9 approval but no Generator Interconnection Agreement)

Part 3 – These projects are Market Efficiency Upgrades.

3a: Planned or Under Construction

3b: Concept or Proposed

Part 4 – These projects may be promoted by any entity electing to support the cost of transmission changes. The entity sponsoring the changes will have their own justification for their actions.

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4a: Planned or Under Construction

4b: Concept or Proposed

Project Listing – Column Definitions, *cont.*

Project ID

This number is generated from ISO-NE System Planning Information Tracking System. It may change in the future as the tracking system evolves.

Primary Equipment Owner

The company listed here is the responsible equipment owner / provider designated to design and implement the project.

Other Equipment Owner

For projects that involve multiple Transmission Owners, the company listed here is also a responsible equipment owner / provider designated to design and implement the project.

Projected Month/Year of In-Service

The month/year entered is the date the project is expected to be placed in service.

Major Project

Name given to a project that consists of smaller subprojects.

Project / Project Component

A brief, high-level description of the project is entered here. It will either include major pieces of substation equipment and/or types of line work to be performed.

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Project Listing – Column Definitions, *cont.*

Status

In Service: The project has been placed in operation.

Under Construction: The project has received necessary approvals and a significant level of engineering or construction is underway.

Planned: The project will include a Transmission upgrade that has been approved by the ISO.

Proposed: The project will include a regulated transmission solution that has been proposed in response to a specific Needs Assessment on the RSP and has been evaluated or further defined and developed in a Solutions Study and communicated to PAC.

Concept: Shall include a transmission project that is being considered by its proponent as a potential solution to meet a need identified by the ISO in a Needs Assessment or the RSP, but for which there is little or no analysis available to support the transmission project.

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Cancelled: Project has been cancelled.

Project Listing – Column Definitions, *cont.*

PPA Approval (Review of Market Participant's Proposed Plans)

A date in this column signifies when the project received approval pursuant to Section I.3.9 of the ISO-New England Tariff. This approval indicates that the project will have no adverse impact on the stability, reliability, or operating characteristics of the system. A 'no' indicates that an approval is required, but has not been received yet. An 'NR' indicates that an I.3.9 approval is not required.

TCA Approval (Transmission Cost Allocation)

A date in this column signifies when the project PTF costs were reviewed and approved. This approval indicates that it has been agreed whether, and by how much, the scope of the project and associated costs exceed regional needs. An 'NR' indicates that a TCA approval is not applicable either because the project has been cancelled or no/very minimal PTF costs are involved.

Estimated Costs

The pool-supported project cost estimate presented here should be the best estimate available. It is understood that the estimate accuracy may vary dependent on the maturity of the project. Accuracy tolerances for these estimates are targeted as follows:

Concept Project

Proposed Project that has been reviewed and approved to proceed by ISO-NE (+50%/-25%),

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I.3.9-Approved Project (+/-25%), and

TCA-Approved Project (+/-10%)