

Regional System Plan

Transmission Projects and Asset Condition

March 2020 Update



Planning Advisory Committee Meeting

Jinlin Zhang

PRINCIPAL ENGINEER, TRANSMISSION PLANNING



TABLE OF CONTENTS

	<u>Slide</u>
<i>Highlights of the RSP Project List Update</i>	3
<i>March 2020 RSP Project List Update</i>	4 – 13
<i>Status of Major Transmission Projects</i>	14
<i>March 2020 ACL Update</i>	15 – 24
<i>Appendix</i>	25 – 31



Highlights of the RSP Project List Update

- **Major cost estimate changes that occurred between the October 2019 and March 2020 Project List**
 - (MA) Greater Boston – cost increase of \$52.3M for 3 projects due to Massachusetts Energy Facility Siting Board approved underground solution, siting delays, and construction obstructions
 - (MA) Southeast Massachusetts/Rhode Island Reliability Project (SEMARI) – cost increase of \$61.2M for 6 projects due to higher engineering and siting/permitting costs, increased material and contract costs, and lengthy multi-year system outage schedule and restrictions
- **2 New Projects**
 - (MA) Boston 2028 – Projects #1806 \$3.3M, and #1807 \$5.5M
 - Project #1806: install a 160 MVAR reactor at Golden Hills 345 kV
 - Project #1807: install a 115 kV breaker in series with breaker 4 at Mystic
- **7 Upgrades have been placed in-service since the October 2019 update**
 - (CT) Total of 3 projects
 - Southwest Connecticut (SWCT) – 2 projects
 - Cos Cob Substation 115 kV Breaker Addition project
 - (MA) Total of 4 projects
 - SEMARI – 2 projects
 - Greater Boston – 2 projects



March 2020 RSP Project List Update

- **2 New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need
1806	Install a 115 kV breaker in series with breaker 4 at Mystic (Massachusetts) Boston 2028	3.3	Eliminate impact of breaker failure contingency
1807	Install a 160 MVAR reactor at Golden Hills 345 kV (Massachusetts) Boston 2028	5.5	Resolve high voltage issues



March 2020 RSP Project List Update, cont.

- 7 Projects Placed In-Service and Corresponding Needs

Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need
1573	Reconductor the 1470-1 line from Wilton to Ridgefield Junction (Connecticut) SWCT	8.6	Increase load serving capability
1574	Reconductor the 1470-3 line from Peaceable to Ridgefield Junction (Connecticut) SWCT	0.7	Increase load serving capability
1533	Add two new 115 kV circuit breakers at the Cos Cob Substation and reposition 1750 line termination to accommodate Greenwich area Substation (Connecticut) Cos Cob Breaker Addition	12.0	Increase load serving capability



March 2020 RSP Project List Update, cont.

- **7 Projects Placed In-Service and Corresponding Needs**

Project ID #	Transmission System Upgrades	Cost (in millions \$)	Improvement/Need
1336	Replace the existing 345/115 kV autotransformer with a higher rating transformer and 345 kV and 115 kV switchgear and breakers at Woburn (Massachusetts) Greater Boston - Western Suburbs	57.5	Resolve thermal overloads
1646	Add a new 345 kV 160 MVAR shunt reactor at K Street (Massachusetts) Greater Boston - Western Suburbs	12.0	Resolve high voltage issues
1716	Increase clearances on E-183E & F-184 lines between Brayton Point & Grand Army (Massachusetts) SEMARI	4.2	Increase thermal capability
1717	Separate X3/W4 DCT and reconductor X3, W4 lines between Somerset and Grand Army. Reconfigure Y2 and Z1 (Massachusetts) SEMARI	15.2	Increase thermal capability



March 2020 RSP Project List Update, cont.

- Cost Estimate Comparisons of Reliability Projects October 2019 vs. March 2020 Update ⁽¹⁾

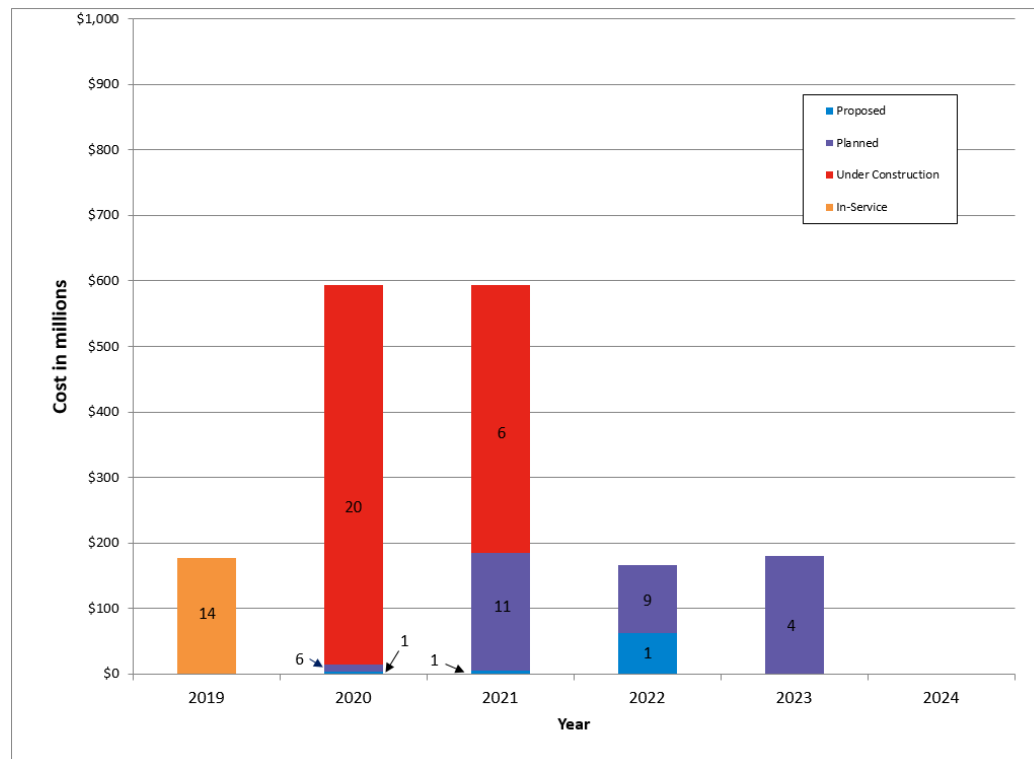
	As of Oct 2019 Plan Update (in millions \$)	As of Mar 2020 Plan Update (in millions \$)	Change in Plan Estimate (in millions \$)
MAJOR PROJECTS			
Greater Hartford & Central Connecticut (GHCC)	307	307	0
Southeast Massachusetts/Rhode Island Reliability (SEMARI)	325	386	61
Pittsfield/Greenfield Project	179	179	0
Greater Boston - North, South, Central, and Western Suburbs	989	1041	52
New Hampshire Solution - Southern, Central, Seacoast, Northern	369	369	0
Southwest Connecticut (SWCT)	399	399	0
SUBTOTAL ⁽²⁾	2568	2682	114
OTHER PROJECTS	9900	9900	0
NEW PROJECTS	0	9	9
TOTAL ⁽²⁾	12468	12590	122
Minus 'in-service'	-10939	-11055	-116
Aggregate estimate of active projects in the Plan ⁽²⁾	1529	1535	6

Notes:

- (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.

March 2020 RSP Project List Update, cont.

- Investment of New England Transmission Reliability Projects by Status through 2024

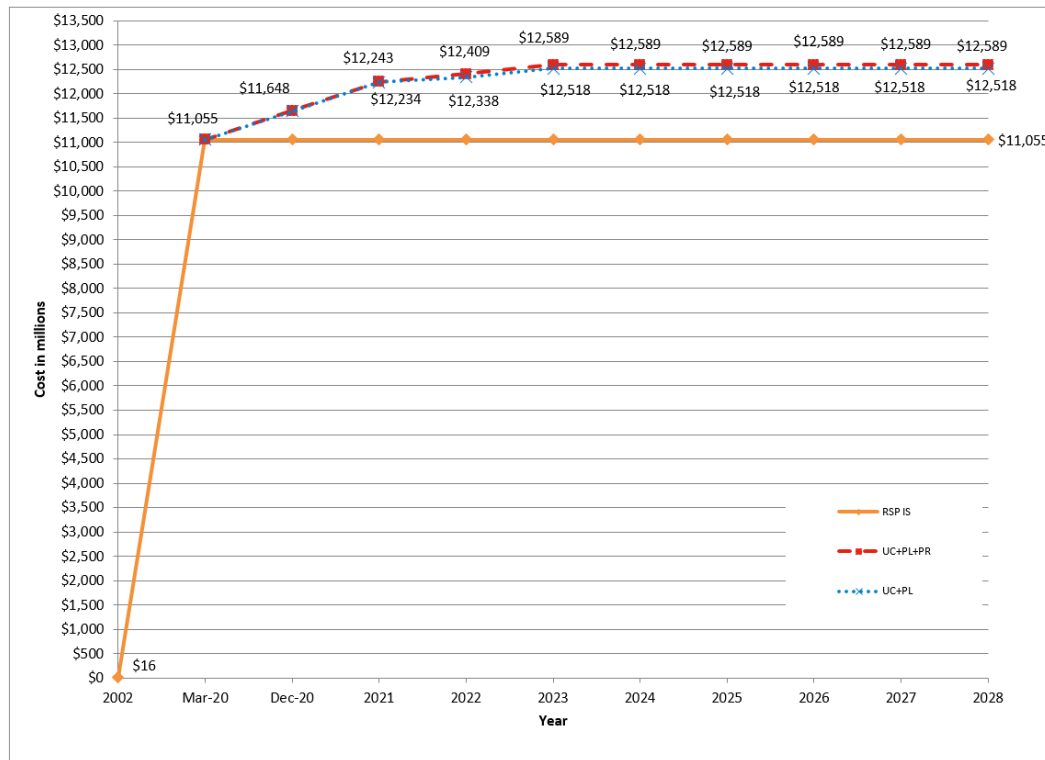


Notes:

- Numbers shown represent project quantities.
- 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.

March 2020 RSP Project List Update, cont.

- Cumulative Investment of New England Transmission Reliability Projects through 2028



Notes:

1. IS – In Service, UC – Under Construction, PL – Planned, PR – Proposed
2. 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.

March 2020 RSP Project List Update, cont.

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

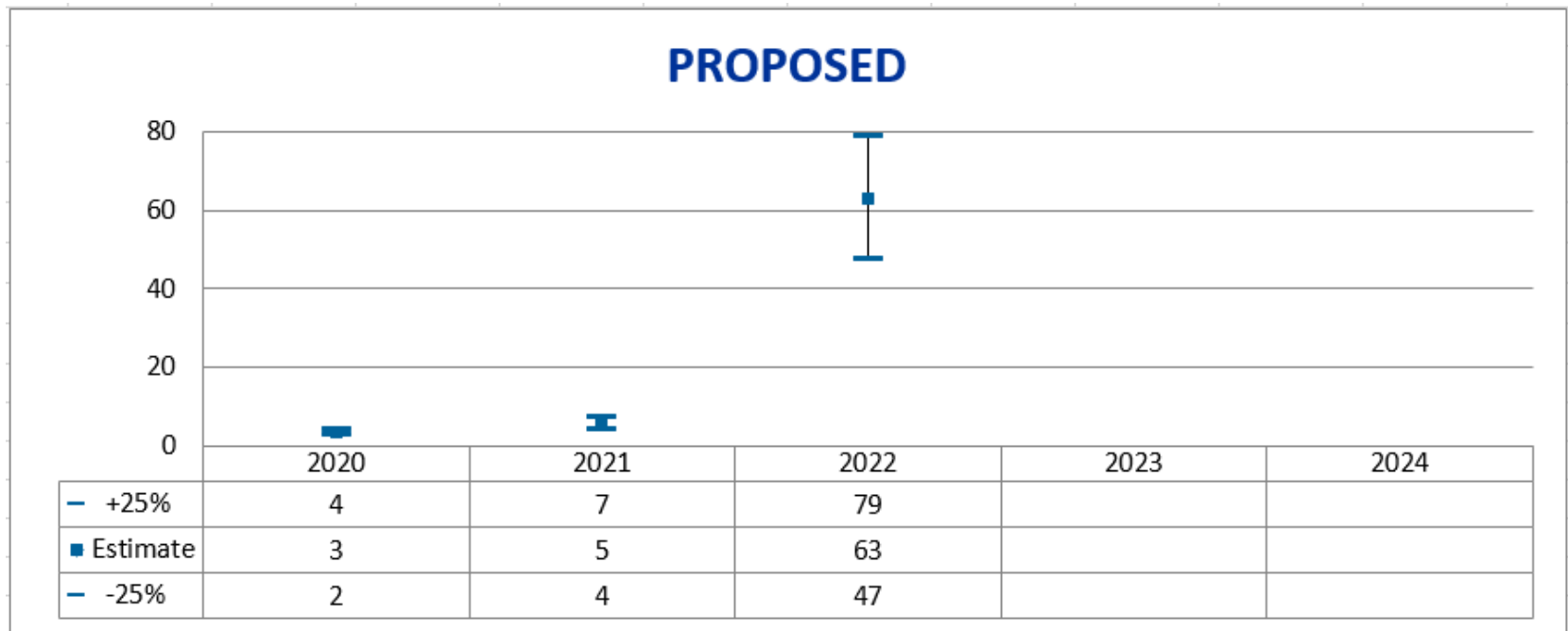
Project Stage (Status)	Component / Project / Plan	Estimate Range		Estimated Costs	Range	
	Count ⁽²⁾	Minimum	Maximum	(\$millions)	Minimum	Maximum
					(\$millions)	
Proposed	3	-25%	25% ⁽³⁾	71	54	89
Planned	30	-25%	25%	474	356	593
Under Construction	26	-10%	10%	988	889	1087
Total Plan	59			⁽⁴⁾ 1534	1299	1769
In-Service	7	-10%	10%	110	99	121
Cancelled						

Notes:

- (1) All costs are 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) May not add up due to rounding.

March 2020 RSP Project List Update, cont.

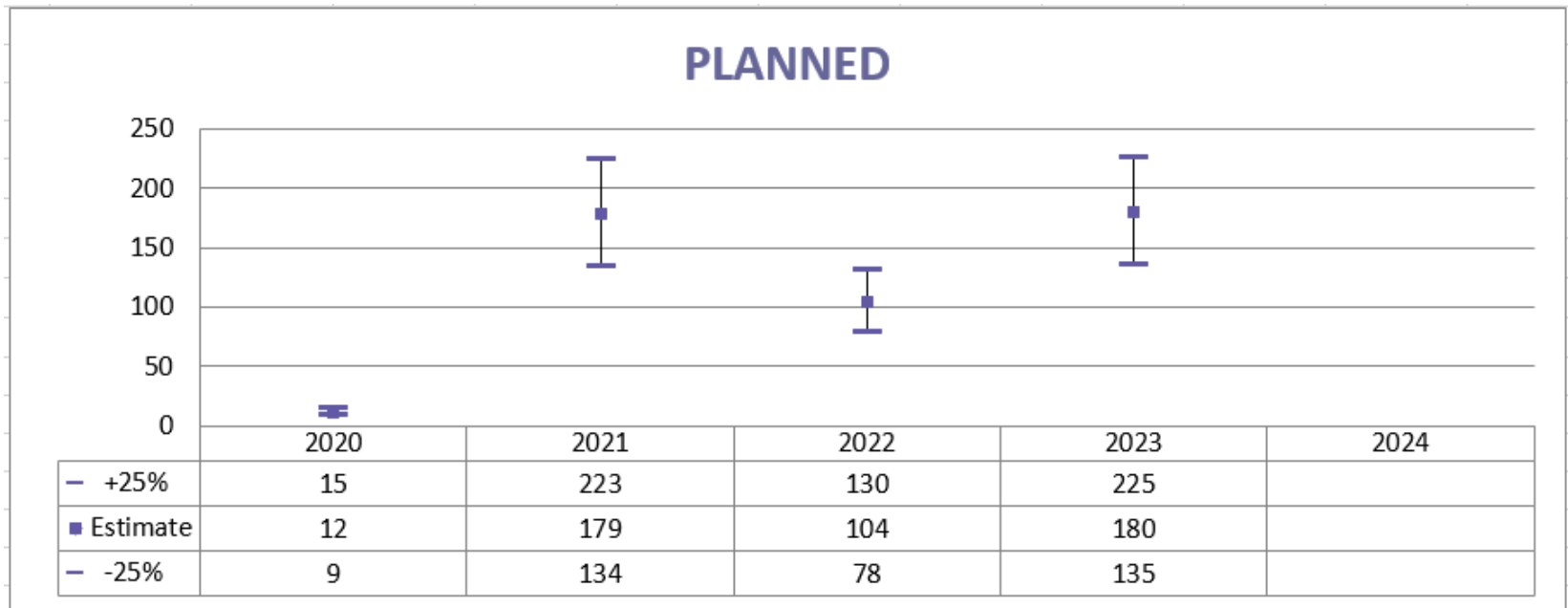
- Project Cost Estimate Tolerances by Status and Year in Millions \$



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.

March 2020 RSP Project List Update, cont.

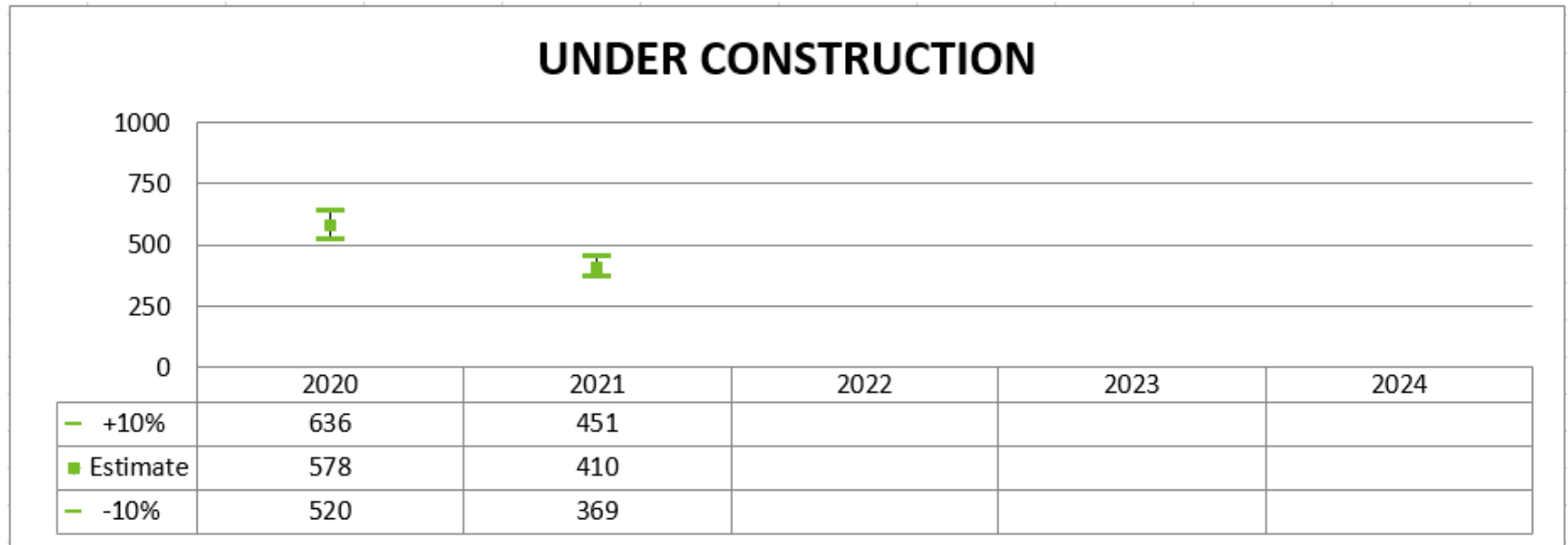
- Project Cost Estimate Tolerances by Status and Year in Millions \$



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.

March 2020 RSP Project List Update, cont.

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



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

	PPA	TCA	Construction
Pittsfield/Greenfield Project	Approved 12/12, 01/16, 05/16	2/11/16, 7/17/17, 2/15/19	Project completion 2014-2020
Southwest Connecticut (SWCT)	Approved 4/15	Complete 7/16/15, 4/15/16, 5/13/16, 1/3/18, 2/15/19	Project completion 2013-2021
Southeast MA/RI Reliability (SEMARI)	Approved 5/17, 4/18	TCA Submitted	Project completion 2017-2023
Central/Western MA Reinforcements	Approved 12/07, 3/11	Group 1 2/29/2012	Project completion 2009-2022
Greater Boston – North, South, Central and Western Suburbs	Approved 4/15, 5/15, 6/16	TCA Submitted	Project completion 2013-2023
New Hampshire – Western, Central, Southern and Seacoast	Approved 3/13	Seacoast 11/5/15 Southern 1/7/16 Western 12/17/15 Central 11/25/15	Project completion 2013-2023
Greater Hartford & Central Connecticut (GHCC)	Approved 4/15	TCA Submitted	Project completion 2015-2020

March 2020 Asset Condition List Update

- 34 New Projects

Project ID #	Transmission System Upgrades	Cost (in millions \$)
213	115 kV Wood Pole Replacement – 1000 (Connecticut)	12.4
214	115 kV Wood Pole Replacement – 1042 (Connecticut)	6.1
215	115 kV Wood Pole and Shield Wire Replacement - 1043 (Connecticut)	5.4
216	115 kV Wood Pole Replacement - 1080 (Connecticut)	24.2
217	115 kV Wood Pole Replacement - 1208 (Connecticut)	9.0
218	115 kV Wood Pole and Shield Wire Replacement – 1232 (Connecticut)	6.7
219	115 kV Wood Pole and Shield Wire Replacement – 1256 (Connecticut)	10.6
220	115 kV Wood Pole and Shield Wire Replacement – 1280 (Connecticut)	12.0



March 2020 Asset Condition List Update, cont.

- 34 New Projects

Project ID #	Transmission System Upgrades	Cost (in millions \$)
221	115 kV Wood Pole and Shield Wire Replacement – 1410 (Connecticut)	13.0
222	115 kV Wood Pole Replacement – 1505 (Connecticut)	7.1
223	115 kV Wood Pole Replacement – 1607 (Connecticut)	7.6
224	115 kV Wood Pole and Shield Wire Replacement - 1618 (Connecticut)	9.8
225	115 kV Wood Pole and Shield Wire Replacement - 1732 (Connecticut)	7.9
226	115 kV Wood Pole Replacement - 1751 (Connecticut)	10.8
227	115 kV Wood Pole Replacement – 1756 (Connecticut)	15.0
228	115 kV Wood Pole and Shield Wire Replacement – 1765 (Connecticut)	14.7



March 2020 Asset Condition List Update, cont.

- 34 New Projects

Project ID #	Transmission System Upgrades	Cost (in millions \$)
229	115 kV Wood Pole and Shield Wire Replacement – 1766 (Connecticut)	16.6
230	115 kV Wood Pole Replacement – 1910 (Connecticut)	10.3
231	115 kV Wood Pole and Shield Wire Replacement – 1355 (Connecticut)	7.5
207	115 kV Wood Pole Replacement - 1161 (Massachusetts)	17.1
208	115 kV Wood Pole Replacement - 1421 (Massachusetts)	15.8
209	115 kV Wood Pole Replacement – 1512 (Massachusetts)	10.8
210	115 kV Wood Pole and Shield Wire Replacement – 1394 (Massachusetts)	7.1
211	115 kV Wood Pole and Shield Wire Replacement – 1858 (Massachusetts)	11.3



March 2020 Asset Condition List Update, cont.

- 34 New Projects

Project ID #	Transmission System Upgrades	Cost (in millions \$)
212	115 kV Wood Pole and Shield Wire Replacement – 1976 (Massachusetts)	7.5
198	115 kV Wood Pole Replacement - B143 (New Hampshire)	7.4
199	115 kV Wood Pole Replacement - C129 (New Hampshire)	9.1
200	115 kV Wood Pole Replacement - F139 (New Hampshire)	8.0
201	115 kV Wood Pole Replacement – G128 (New Hampshire)	6.9
202	115 kV Wood Pole Replacement – K105 (New Hampshire)	6.1
203	115 kV Wood Pole and Shield Wire Replacement – K174 (New Hampshire)	14.7
204	115 kV Wood Pole Replacement – L175 (New Hampshire)	5.3

March 2020 Asset Condition List Update, cont.

- **34 New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions \$)
205	115 kV Wood Pole and Shield Wire Replacement – M127 (New Hampshire)	33.4
206	115 kV Wood Pole and Shield Wire Replacement - Y138 (New Hampshire)	8.5



March 2020 Asset Condition List Update, cont.

- 25 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
197	1130 Line Optical Ground Wire (OPGW) Replacement (Connecticut)	8.2
171	345 kV Structure Replacement Project – 368 (Connecticut)	7.1
175	345 kV Structure Replacement Project – 3252 (Connecticut)	7.5
177	345 kV Structure Replacement Project – 3424 (Connecticut)	7.7
193	115 kV Structure Replacement Project – 1470 (Connecticut)	11.1
50	Card 11F-5X autotransformer Replacement Project (Connecticut)	3.7
49	Southern CT Loop Line Structure Replacements - 1655 (Connecticut)	18.6
137	115 kV Structure Replacement Project – 1769 (Connecticut)	8.3



March 2020 Asset Condition List Update, cont.

- 25 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
140	115 kV Structure Replacement Project – 1783 (Connecticut)	8.1
141	115 kV Structure Replacement Project – 1785 (Connecticut)	9.0
165	345 kV Structure Replacement Project – 321 (Connecticut)	6.5
108	115 kV Structure Replacement Project – 65-508 (Massachusetts)	14.0
112	115 kV Structure Replacement Project – 1962 (Massachusetts)	4.4
134	115 kV Structure Replacement Project – F132 (Massachusetts)	14.8
179	345 kV Structure Replacement Project – 336 (Massachusetts)	6.0
182	345 kV Structure Replacement Project – 354 (Massachusetts)	20.9



March 2020 Asset Condition List Update, cont.

- 25 Projects Placed In-Service

Project ID #	Transmission System Upgrades	Cost (in millions \$)
183	345 kV Structure Replacement Project – 381 (Massachusetts)	12.4
88	NPCC Directory #1 Protection Modifications - Phase 1 (Massachusetts)	2.4
100	115 kV Structure Replacement Project - A126 (New Hampshire)	8.3
101	115 kV Structure Replacement Project – H123 (New Hampshire)	6.2
102	115 kV Structure Replacement Project – H141 (New Hampshire)	9.4
103	115 kV Structure Replacement Project – K174 (New Hampshire)	8.7
190	345 kV Structure Replacement Project – 381 (New Hampshire)	6.6
85	Phase 1 of Seabrook 345 kV GIS Switchyard Like-for Like Equipment Replacement (New Hampshire)	87.4

March 2020 Asset Condition List Update, cont.

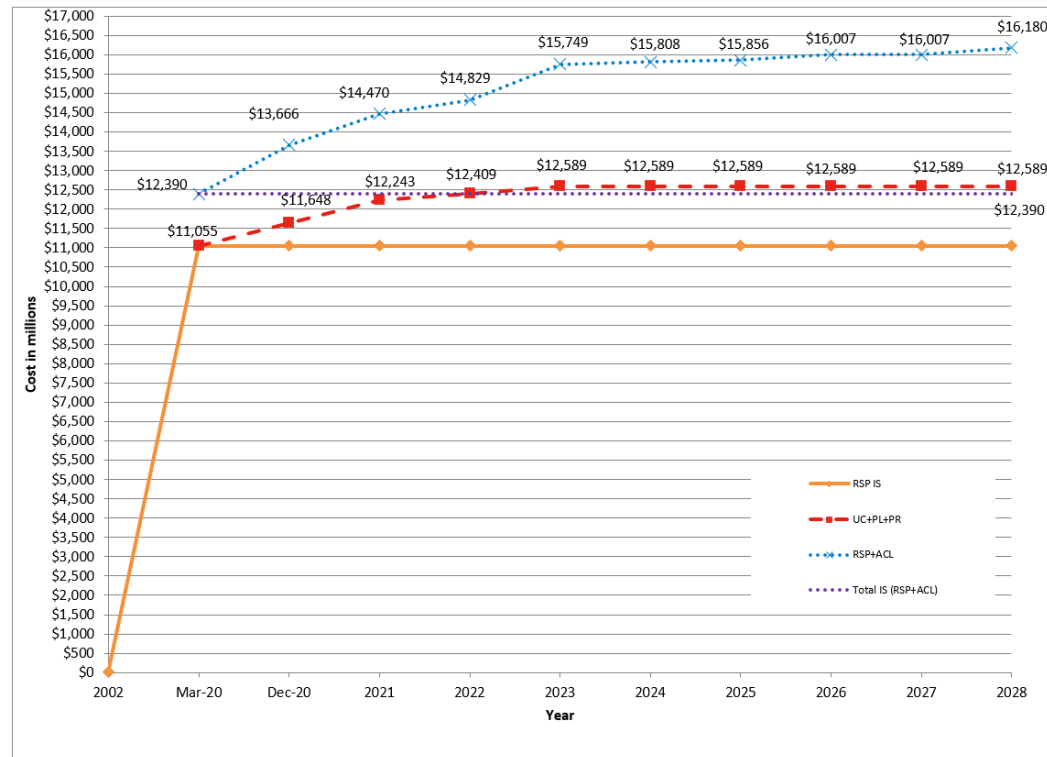
- **25 Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions \$)
54	NPCC Directory #1 Protection Modifications - Phase 1 (Rhode Island)	1.1



March 2020 Asset Condition List Update, cont.

- Cumulative Investment of New England Transmission Reliability Projects and Asset Condition through 2028



Notes:

- IS – In Service, UC – Under Construction, PL – Planned, PR – Proposed
- 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.

APPENDIX



Summary: Project Listing Definitions

- **Major ISO New England Inc. Transmission, Markets and Services Tariff Section II Attachment K, Regional System Planning Process Project Listing Subcategories**
 - **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)

Note: On December 10, 2019, FERC accepted Tariff changes that removed the “Concept” category.



Project Listing

- **Project Listing Column Definitions for**
 - Reliability Projects
 - Interconnection Projects
 - Market Efficiency Upgrades
 - Elective Projects



Project Listing – Column Definitions, cont.

- **Part Number (Part #)**

- The Part #'s designate the 'need' category of the project¹
 - Part 1: these projects are Reliability Upgrades
 - » 1a Planned or Under Construction
 - » 1b 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 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 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
 - » 4a Planned or Under Construction
 - » 4b Proposed

Note:

¹ Original categories are not changed when a project is placed 'In-Service' or 'Cancelled'.



Project Listing – Column Definitions, cont.

- **Project ID**
 - The Project ID is generated by ISO-NE System Planning
- **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 is given to a project that consists of smaller subprojects
- **Project/Project Component**
 - The month/year entered is the date the project is expected to be placed in service
 - A brief, high-level description of the project is entered here
 - Includes major pieces of substation equipment and/or types of line work to be performed

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 pursuant to Section I.3.9 of the Tariff
- Proposed
 - A regulated transmission solution that has been selected by the ISO in response to a Needs Assessment and communicated to PAC
- 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. The project has been placed in operation
- **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 because the project has been cancelled, has no/minimal PTF cost, or is associated with the interconnection of a resource or Elective Transmission Upgrade.
- **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:
 - Proposed Project that has been reviewed and approved to proceed by ISO-NE (+50%/-25%)
 - I.3.9-Approved Project (+/-25%), and
 - TCA-Approved Project (+/-10%)