Regional System Plan

Transmission Projects and Asset Condition

March 2021 Update

Planning Advisory Committee Meeting

Peter Bernard

MANAGER, TRANSMISSION PLANNING

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Highlights of the RSP Project List Update

- **Major cost estimate changes that occurred between the October 2020 and March 2021 Project List**
  - (MA) Southeast Massachusetts/Rhode Island Reliability Project (SEMA/RI) – cost increase of $10.6M due to COVID-19 impacts, scope updates after withdrawal of QP 489
- **Three new projects**
  - Boston Area Optimized Solution (BAOS) – total cost of $48.6M
    - Details of the three new projects are listed on the next slide
- **Fifteen upgrades have been placed in-service since the October 2020 update**
  - (MA) Total of 8 project
    - SEMA/RI – 4 projects
    - Greater Boston – 3 projects
    - Rebuild the Somerset Substation to resolve asset condition issues – 1 project
  - (CT) Total of 3 projects
    - GHCC – 1 project
    - SWCT – 2 projects
  - (RI) Total of 4 project
    - Aquidneck Island Reliability Project – 3 projects
    - SEMARI – 1 project

March 2021 RSP Project List Update

- **Three New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1874	Install two 11.9 ohm series reactors at North Cambridge Station on Lines 346 and 365 (Massachusetts) BAOS	14.4	Resolve thermal overloads
1875	Install a direct transfer trip (DTT) scheme at Ward Hill Substation on Line 394 (Massachusetts) BAOS	0.8	Resolve thermal overloads
1876	Install one +/- 167 MVAR STATCOM at Tewksbury 345 kV substation (Massachusetts) BAOS	33.4	System restoration in the Boston area

March 2021 RSP Project List Update, cont.

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

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1354	Add Mystic-Chelsea 115 kV cable (Massachusetts) Greater Boston - Central	56.7	Resolve thermal overloads
1516	Construct a new 115 KV three breaker switching station in Sharon MA to segment the three 115 kV circuits that extend from West Walpole to Holbrook (Massachusetts) Greater Boston - South	20.3	Addition of new substation to address loss of load
965	Add third 115 kV line from W. Walpole to Holbrook (Massachusetts) Greater Boston - South	29.9	Resolve thermal overloads
1714	New Grand Army 115 kV GIS switching station built to BPS standards, remote terminal station work (Brayton Point and Somerset) & loop E-183E, F-184, X3 and W4 lines (associated with RSP #1742) (Massachusetts) SEMA/RI	52.1	Resolve thermal overloads
1715	Upgrades at Brayton Point (new 115 kV breaker, new 345/115 kV transformer, upgrades to E183E, F184 station equipment) (Massachusetts) SEMA/RI	15.4	Resolve thermal overloads

March 2021 RSP Project List Update, cont.

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

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1742	Remote terminal station work (Wampanoag and Pawtucket 115 kV) for new 115 kV Grand Army GIS switching station to tie the E-183E, F-184, X3 and W4 lines (associated with RSP #1714) (Rhode Island) SEMA/RI	2.4	Resolve thermal overloads
1790	Medway 115 kV Circuit Breaker Replacements (Massachusetts) SEMA/RI	4.9	Upgraded to meet system short circuit levels
1737	Replace disconnect switches 107A, 107B, 108A and 108B on Line 323 at West Medway Substation #446. Replace 8 line structures with taller structures (Massachusetts) SEMA/RI	2.1	Resolve thermal overloads
1669	Conversion of Jepson 69 kV substation to 115 kV substation (Rhode Island) Aquidneck Island Reliability Project	14.9	Increase system reliability in Newport, RI area
1670	Remove 115 kV to 69 kV transformer at Dexter Substation (Rhode Island) Aquidneck Island Reliability Project	2.5	Increase system reliability in Newport, RI area

March 2021 RSP Project List Update, cont.

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

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1671	Convert lines 61/62 from 69 kV to 115 kV (Rhode Island) Aquidneck Island Reliability Project	33.9	Increase system reliability in Newport, RI area
1635	Rebuild the Somerset Substation to resolve asset condition issues (Massachusetts)	41.9	Resolve asset condition issues
1561	Reconductor the 1887 line between West Brookfield and West Brookfield Junction (1.4 miles) (Connecticut) SWCT	2.6	Increase load serving capability in Housatonic Valley area
1622	Baird to Housatonic River Crossing 88006A - 89006B 115 kV Line Upgrades (Connecticut) SWCT	46.4	Increase load serving capability in SWCT area
1590	Add a 3.7 mile 115 kV hybrid overhead/underground line from Newington to Southwest Hartford and associated terminal equipment including a 1.4% series reactor (Connecticut) GHCC	75.0	Increase load serving capability in the Hartford area and increase Western Connecticut import capability

March 2021 RSP Project List Update, cont.

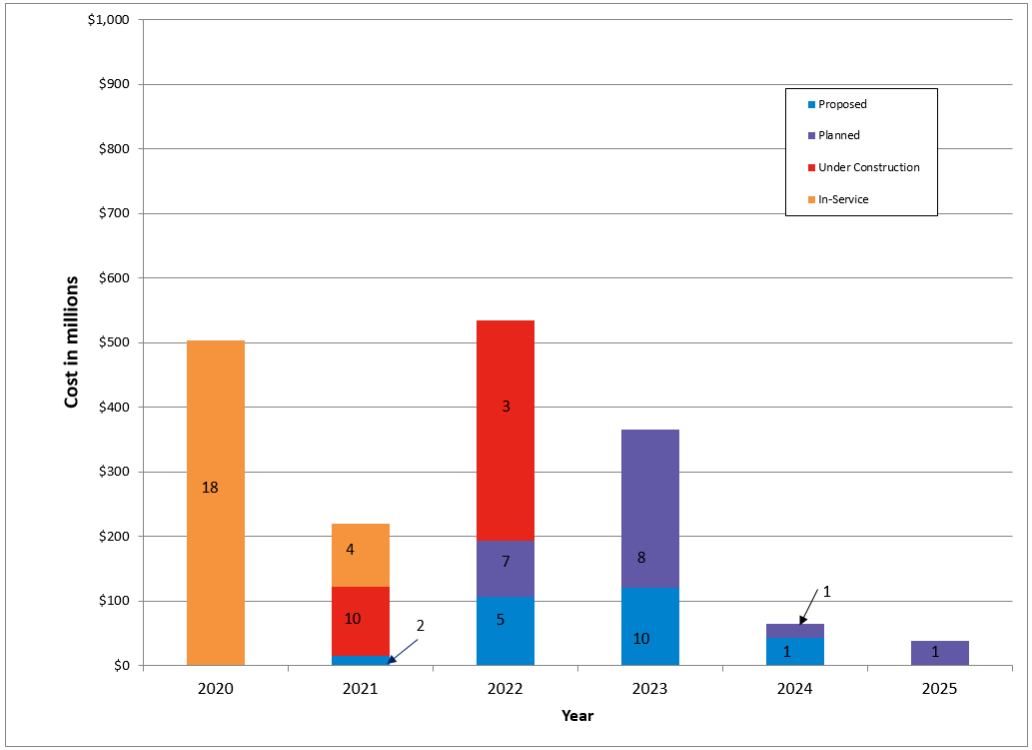
- **Cost Estimate Comparisons of Reliability Projects October 2020 vs. March 2021 Update***

	As of Oct 2020 Plan Update (in millions $)	As of Mar 2021 Plan Update (in millions $)	Change in Plan Estimate (in millions $)
MAJOR PROJECTS			
Southeast Massachusetts/Rhode Island Reliability (SEMA/RI)	349	359	11
Greater Boston - North, South, Central, and Western Suburbs	1043	1043	0
New Hampshire Solution - Southern, Central, Seacoast, Northern	369	369	0
Eastern CT 2029	230	230	0
Boston Area Optimized Solution (BAOS)	0	49	49
SUBTOTAL**	1990	2049	59
OTHER PROJECTS	10772	10772	0
NEW PROJECTS	0	0	0
TOTAL**	**12762**	**12821**	**59**
Minus 'in-service'	-11252	-11653	-401
**Aggregate estimate of active projects in the Plan ** **	**1509**	**1168**	**-342**

* Transmission Owners provided all estimated costs, which may not meet the guidelines described in Planning Procedure 4, Attachment D.
** May not sum exactly due to rounding.
*** The cost estimates for projects in the "Major Projects" category are moved to the "Other Projects" category once they are fully completed.

March 2021 RSP Project List Update, cont.

- **Investment of New England Transmission Reliability Projects by Status through 2025**

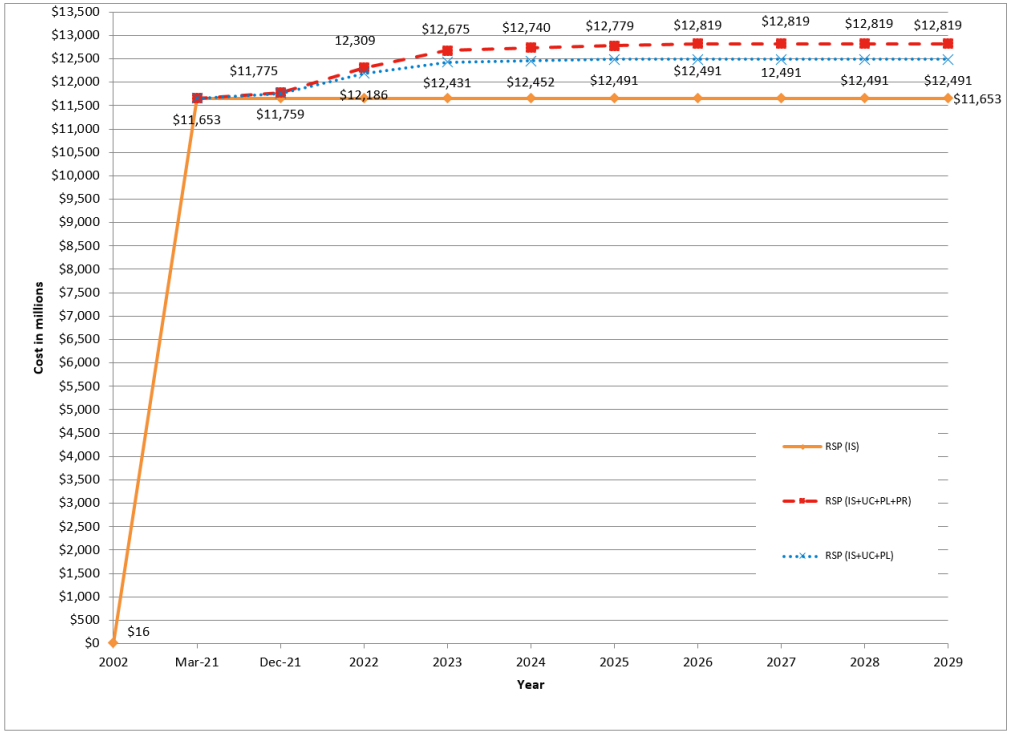


* Numbers shown represent project quantities.

** 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 2021 RSP Project List Update, cont.

- **Cumulative Investment of New England Transmission Reliability Projects through 2029**



* 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.

March 2021 RSP Project List Update, cont.

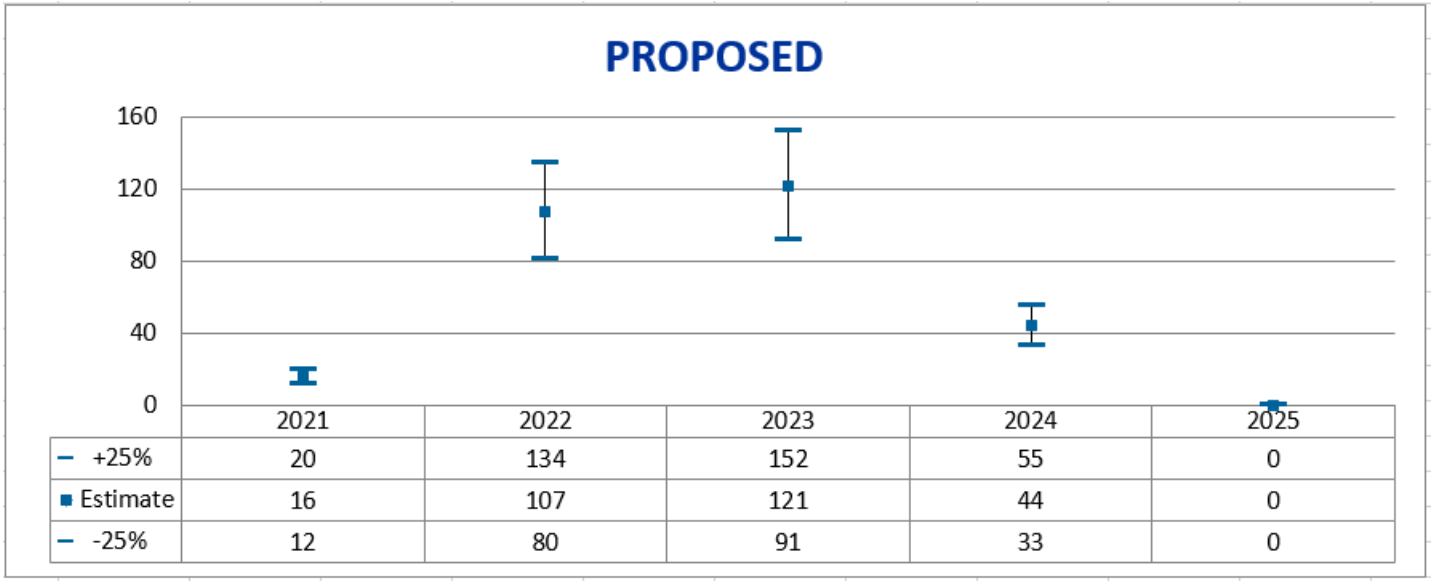
- **Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges***

Project Stage (Status)	Component / Project / Plan Count **	Estimate Range Minimum	Estimate Range Maximum	Estimated Costs ($millions)	Range Minimum ($millions)	Range Maximum
Proposed	19	-25%	25%***	328	246	410
Planned	17	-25%	25%	393	295	491
Under Construction	13	-10%	10%	446	401	491
Total Plan	**49**			**** **1167**	**942**	**1392**
In-Service	15	-10%	10%	401	361	441
Cancelled	0	-25%	25%	0	0	0

* All costs are provided by Transmission Owners. The costs in the table reflect all projected in-service dates.
** Efforts need to be made to describe projects on a more consistent basis.
*** All estimates may not yet be at this level of accuracy; many estimates may be -25%/+50%.
**** May not add up due to rounding.

March 2021 RSP Project List Update, cont.

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

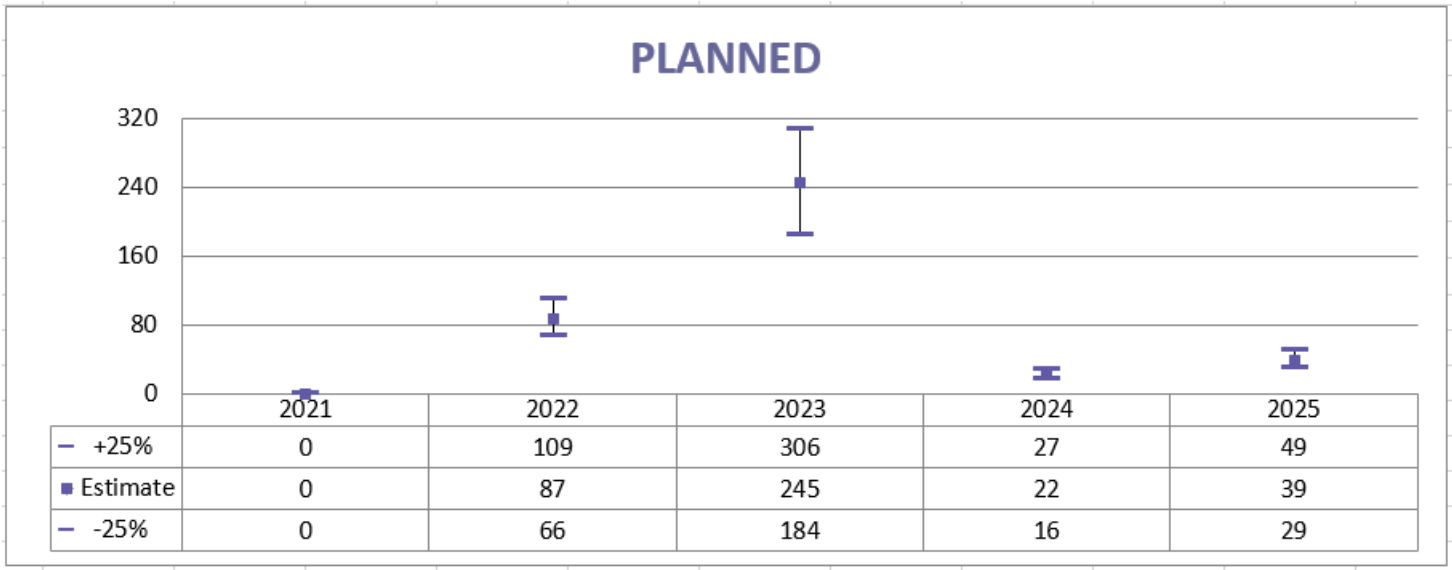


	2021	2022	2023	2024	2025
+25%	20	134	152	55	0
Estimate	16	107	121	44	0
-25%	12	80	91	33	0

* 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 2021 RSP Project List Update, cont.

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

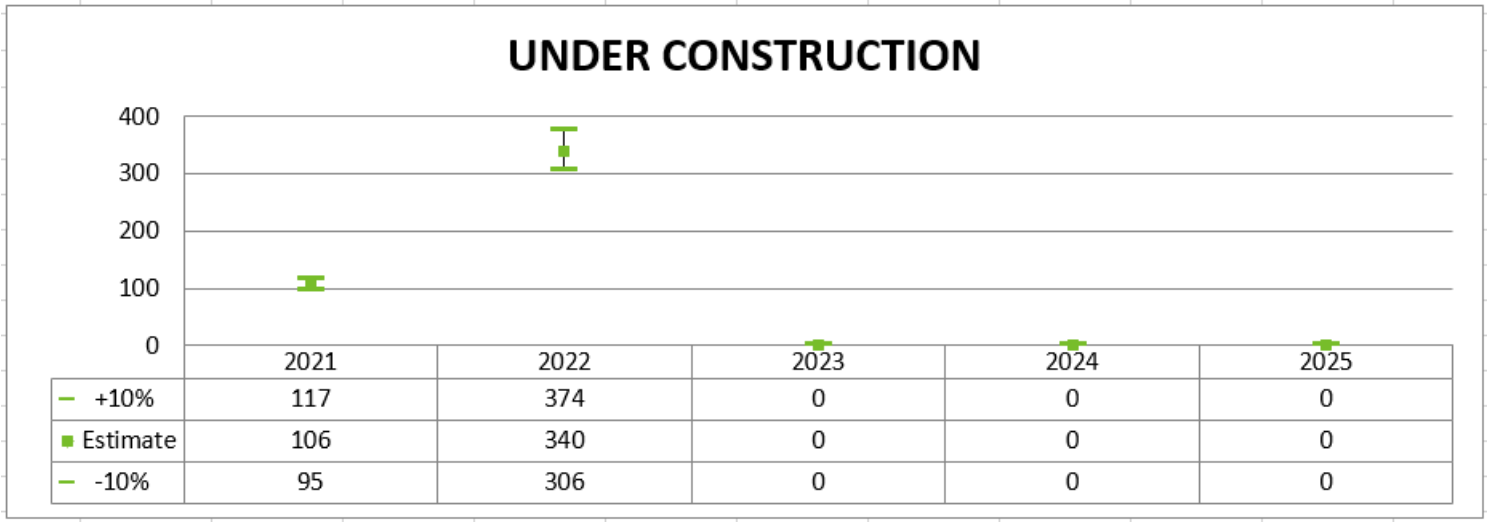


	2021	2022	2023	2024	2025
+25%	0	109	306	27	49
Estimate	0	87	245	22	39
-25%	0	66	184	16	29

* 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 2021 RSP Project List Update, cont.

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



	2021	2022	2023	2024	2025
+10%	117	374	0	0	0
Estimate	106	340	0	0	0
-10%	95	306	0	0	0

* 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
Southeast MA/RI Reliability (SEMA/RI)	Approved 5/17, 4/18	TCA Submitted	Project completion 2017-2023
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 2013-2022
Eastern CT 2029	Not Submitted	Not Submitted	Project completion 2021-2026

March 2021 Asset Condition List Update

- **Forty-one New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
245	Southington Substation Relay Replacement Project (Connecticut)	9.4
246	Prior Year Wood Structure Asset Condition Replacement - Line 329 345 kV (Connecticut)	5.9
247	Prior Year Wood Structure Asset Condition Replacement - Line 352 345 kV (Connecticut)	6.0
248	Prior Year Wood Structure Asset Condition Replacement - Line 338 345 kV (Massachusetts)	5.8
249	Prior Year Wood Structure Asset Condition Replacement - Line 455-507 115 kV (Massachusetts)	10.3
250	Copper Conductor and Shield Wire Replacement - Line 1231/1242 (Massachusetts)	97.0
251	345 kV Line Structure Replacement - Line 312 (Massachusetts)	19.3
252	345 kV Line Structure Replacement - Line 319 (Massachusetts)	7.8

March 2021 Asset Condition List Update, cont.

- **Forty-one New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
253	345 kV Line Structure Replacement - Line 338 (Massachusetts)	8.7
254	115 kV Wood Pole Asset Condition Project - Line 455-507 (Massachusetts)	5.2
255	Copper Conductor and Shield Wire Replacement - Line 1560/1808 (Connecticut)	19.7
256	Copper Conductor and Shield Wire Replacement - Line 1580/1142/1808 (Connecticut)	68.1
257	Copper Conductor and Shield Wire Replacement - Line 1588 (Connecticut)	9.6
258	Copper Conductor and Shield Wire Replacement - Line 1268/1485/1887 (Connecticut)	29.6
259	Copper Conductor and Shield Wire Replacement - Line 1163/1550 (Connecticut)	16.7
260	Copper Conductor and Shield Wire Replacement - Line 1825 (Massachusetts)	7.3

March 2021 Asset Condition List Update, cont.

- **Forty-one New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
261	115 kV Wood Pole and Shield Wire Replacement 2020-2023 - Line 1465 (Connecticut)	8.8
262	345 kV Line Structure and PINCO Insulator Replacement - Line 310 (Connecticut)	59.2
263	345 kV Line Structure Replacement - Line 330 (Connecticut)	6.6
264	345 kV Line Structure and PINCO Insulator Replacement - Line 368 (Connecticut)	8.8
265	345 kV Line Structure and PINCO Insulator Replacement - Line 383 (Connecticut)	16.3
266	345 kV Line Structure and PINCO Insulator Replacement - Line 387 (Connecticut)	10.2
267	345 kV Line Structure and PINCO Insulator Replacement - Line 3041 (Connecticut)	14.4
268	345 kV Line Structure and PINCO Insulator Replacement - Line 3424 (Connecticut)	14.9

March 2021 Asset Condition List Update, cont.

- **Forty-one New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
269	345 kV Line Structure and PINCO Insulator Replacement - Line 3754 (Connecticut)	5.0
270	S-145/T-146 115 kV Line Reconductoring - North Reading Substation to Wallace Substation (Massachusetts)	16.5
271	V-148S Asset Condition Refurbishment and Switch Replacement - MA Portion (Massachusetts)	10.4
272	V-148S Asset Condition Refurbishment and Switch Replacement - RI Portion (Rhode Island)	14.3
273	Copper Conductor and Shield Wire Replacement Projects - C129 Line (New Hampshire)	18.5
274	Copper Conductor and Shield Wire Replacement Projects - D108 Line (New Hampshire)	6.7
275	Copper Conductor and Shield Wire Replacement Projects - G128 Line (New Hampshire)	7.6
276	Copper Conductor and Shield Wire Replacement Projects - L163 Line (New Hampshire)	23.3

March 2021 Asset Condition List Update, cont.

- **Forty-one New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
277	Copper Conductor and Shield Wire Replacement Projects - X104 (New Hampshire)	7.0
278	Amherst substation Protection & Controls Upgrades (New Hampshire)	6.1
279	Webster-Beebe River 115 kV Corridor Asset Condition and OPGW Project - A111 Line (New Hampshire)	35.9
280	Webster-Beebe River 115 kV Corridor Asset Condition and OPGW Project - E115 Line (New Hampshire)	55.1
281	Webster-Beebe River 115 kV Corridor Asset Condition and OPGW Project - Z180 Line (New Hampshire)	9.7
282	345 kV Line Structure Replacements - Line 373 (New Hampshire)	9.4
283	Line K22 Asset Condition Structure Refurbishment (Vermont)	9.7
284	Line K24 Asset Condition Structure Refurbishment (Vermont)	15.2
285	Line K34 Asset Condition Structure Refurbishment (Vermont)	6.7

March 2021 Asset Condition List Update, cont.

- **Twenty-nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
233	Line K41 Asset Condition Structure Refurbishment (Vermont)	9.3
196	Berlin Substation Mitigate several Asset Condition Concerns (Vermont)	6.6
86	Seabrook 345 kV GIS Switchyard Equipment Replacement Phase 2 (New Hampshire)	Part of Asset Condition #85*
206	115 kV Wood Pole and Shield Wire Replacement - Y138 (New Hampshire)	8.5
198	115 kV Wood Pole Replacement - B143 (New Hampshire)	6.4
199	115 kV Wood Pole Replacement - C129 (New Hampshire)	9.0
201	115 kV Wood Pole Replacement - G128 (New Hampshire)	7.4
205	115 kV Wood Pole and Shield Wire Replacement - M127 (New Hampshire)	29.7

* Cost estimate for Asset Condition #85 (ISD=12/2019) is $87.4M

March 2021 Asset Condition List Update, cont.

- **Twenty-nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
104	115 kV Structure Replacement Project - Line L163 (New Hampshire)	17.0
105	115 kV Structure Replacement Project - Line A152 (New Hampshire)	6.9
188	345 kV Structure Replacement Projects - Line 373 (New Hampshire)	11.0
189	345 kV Structure Replacement Projects - Line 379 (New Hampshire)	11.6
191	345 kV Structure Replacement Projects - Line 385 (New Hampshire)	14.4
192	345 kV Structure Replacement Projects - Line 391 (New Hampshire)	17.3
202	115 kV Wood Pole Replacement - K105 (New Hampshire)	4.1
204	115 kV Wood Pole Replacement - L175 (New Hampshire)	3.8

March 2021 Asset Condition List Update, cont.

- **Twenty-nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
246	Prior Year Wood Structure Asset Condition Replacement - Line 329 345 kV (Connecticut)	5.9
247	Prior Year Wood Structure Asset Condition Replacement - Line 352 345 kV (Connecticut)	6.0
215	Prior Year Wood Structure Asset Condition Replacement - Line 352 345 kV (Connecticut)	5.4
163	667 69 kV line rebuild and asset condition project (Connecticut)	24.1
120	115 kV Structure Replacement Project - Line 1261/1598 (Connecticut)	20.3
129	115 kV Structure Replacement Project - Line 1726 (Connecticut)	16.3
248	Prior Year Wood Structure Asset Condition Replacement - Line 338 345 kV (Massachusetts)	5.8
249	Prior Year Wood Structure Asset Condition Replacement - Line 455-507 115 kV (Massachusetts)	10.3

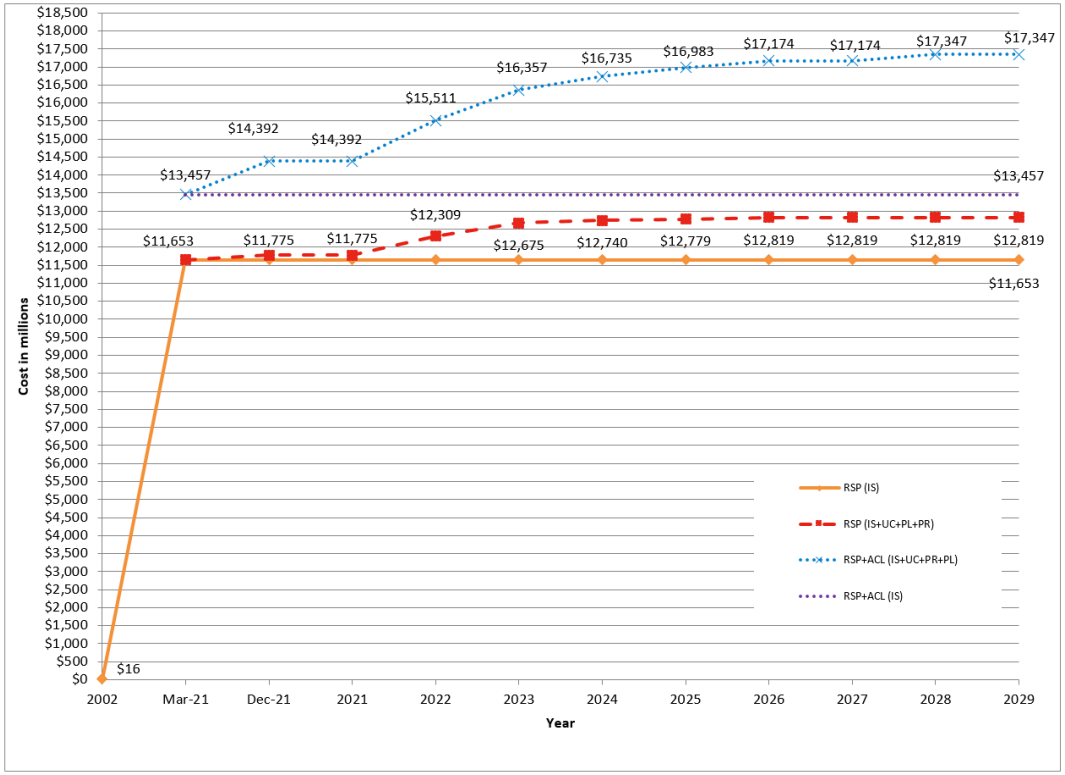
March 2021 Asset Condition List Update, cont.

- **Twenty-nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
32	West Medway Substation #446 Asset Condition Upgrade (Massachusetts)	18.9
42	Brighton #329 115 kV Control House (Massachusetts)	21.0
147	303 Line Asset Condition Refurbishment (Massachusetts)	22.5
148	3520 Line Asset Condition Refurbishment (Massachusetts)	5.6
209	115 kV Wood Pole Replacement - 1512 (Massachusetts)	10.8

March 2021 Asset Condition List Update, cont.

- **Cumulative Investment of New England Transmission Reliability Projects and Asset Condition through 2029**



* 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/competitive solution process have been completed). (Still subject to Schedule 12C review for Transmission Cost Allocation)

* 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 project*
    - 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

* 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
- **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 PTF 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%)