Regional System Plan

Transmission Projects and Asset Condition

October 2021 Update

Planning Advisory Committee Meeting

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Highlights of the RSP Project List Update

- **Major cost estimate changes greater than $5M that occurred between the June and October 2021 Project List**
  - (MA) Southeast Massachusetts/Rhode Island Reliability Project (SEMA/RI) – cost increase of $7.1M based on Transmission Cost Allocation (TCA) application submitted in August 2021
  - (MA) Greater Boston – cost reduction of $8.0M to reflect the final project costs
- **Twelve new projects**
  - New Hampshire (NH) 2029 Solution – total cost of $134.9M
    - Details of the four projects are listed on the next slide
  - Upper Maine (UME) 2029 Solution – total cost of $158.6M
    - Details of the eight projects are listed on the next two slides
- **Two upgrades have been placed in-service since the June 2021 update**
  - Both projects are in MA
    - Greater Boston – one project
    - SEMA/RI – one project
- **Three projects cancelled since the June 2021 update, as they are no longer needed due to the NH and UME 2029 Solutions**
  - (ME) CMP- LSP Lakes Region, add a second 115/34.5 kV autotransformer at the existing Kimball Road 115 kV Substation and move one of the 115 kV 30 MVAR capacitor banks from bus 4 to bus 3. Cost reduction is $3.3M
  - (ME) Mid-Coast Spur, new 115 kV line section 244 and upgraded line section 80 between Coopers Mills and Highland Substations. Cost reduction is $62.7M
  - (ME) Central New Hampshire Solution, install transfer trip at Kimball Road to disconnect Lovell from 115 kV. Lovell load will continue to be served from CMP subtransmission. Cost reduction is $0.5M

October 2021 RSP Project List Update

- **Twelve New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1878	Install a +50/-25 MVAR synchronous condenser at N. Keene 115 kV substation with a 115 kV breaker (New Hampshire) NH 2029 Solution	36.2	Resolve voltage violations
1879	Install a +50/-25 MVAR synchronous condenser at Huckins Hill 115 kV substation with a 115 kV breaker (New Hampshire) NH 2029 Solution	36.2	Resolve voltage violations
1880	Install a +100/-50 MVAR synchronous condenser at Amherst 345 kV substation with two 345 kV breakers (New Hampshire) NH 2029 Solution	53.6	Resolve voltage violations
1881	Install two 50 MVAR capacitors on Line 363 near Seabrook station with three 345 kV breakers (New Hampshire) NH 2029 Solution	8.9	Resolve voltage violations
1882	Rebuild 21.7 miles of the existing 115 kV line Section 80 Highland – Coopers Mills 115 kV line (Maine) UME 2029 Solution	63.6	Resolve thermal overloads and voltage violations
1883	Convert the Highland 115 kV substation to an eight breaker, breaker-and-a-half configuration with a bus connected 115/34.5 kV transformer (Maine) UME 2029 Solution	26.3	Resolve thermal overloads and voltage violations

October 2021 RSP Project List Update

- **Twelve New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1884	Install a 15 MVAR capacitor at Belfast 115 kV substation (Maine) UME 2029 Solution	5.3	Resolve voltage violations
1885	Install a +50/-25 MVAR synchronous condenser at Highland 115 kV substation (Maine) UME 2029 Solution	17.5	Resolve voltage violations
1886	Install a +50/-25 MVAR synchronous condenser at Boggy Brook 115 kV substation, and install a new 115 kV breaker to separate Line 67 from the proposed solution elements (Maine) UME 2029 Solution	35.5	Resolve voltage violations
1887	Install a 25 MVAR reactor at Boggy Brook 115 kV substation (Maine) UME 2029 Solution	3.4	Resolve voltage violations
1888	Install a 10 MVAR reactor at Keene Road 115 kV substation (Maine) UME 2029 Solution	6.0	Resolve voltage violations
1889	Install three remotely monitored and controlled switches to split the existing Orrington reactors between the two Orrington 345/115 kV autotransformers (Maine) UME 2029 Solution	1.0	Resolve voltage violations

October 2021 RSP Project List Update, cont.

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

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1738	Chelsea Station #488 BPS upgrade (Massachusetts) Greater Boston - Stability	11.5	Meet NPCC BPS standards
1789	West Medway 345 kV circuit breaker upgrades (Massachusetts) SEMA/RI	2.9	Resolve short circuit issues

October 2021 RSP Project List Update, cont.

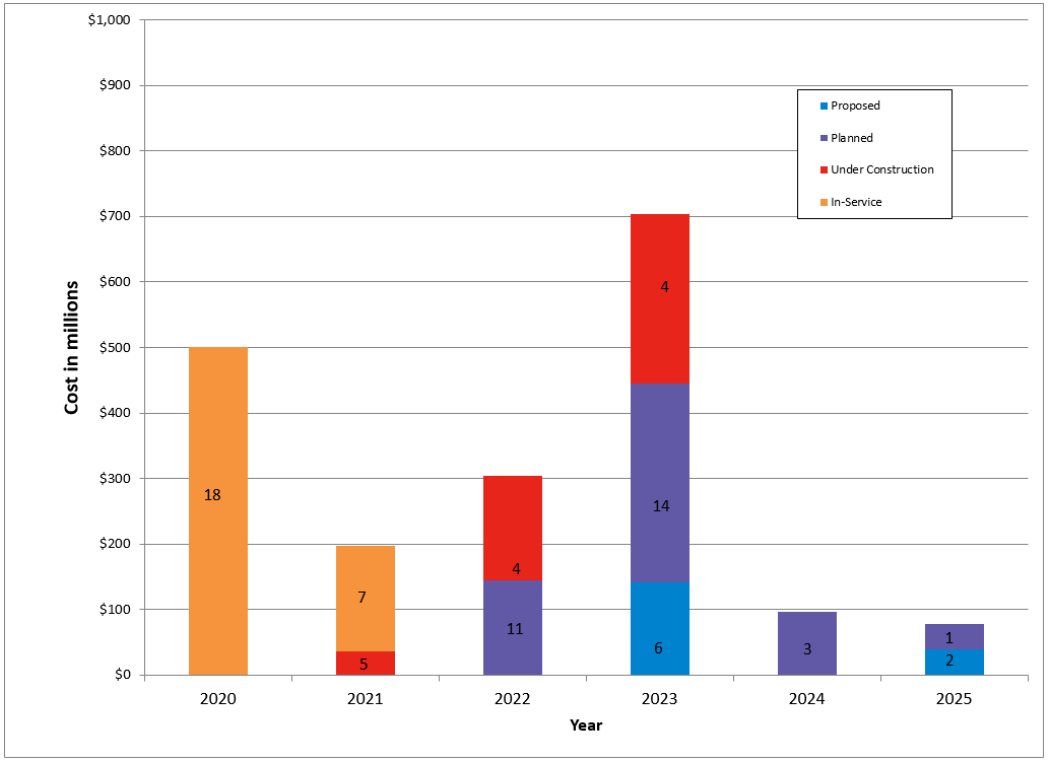
- **Cost Estimate Comparisons of Reliability Projects June vs. October 2021 Update***

	As of Jun 2021 Plan Update (in millions $)	As of Oct 2021 Plan Update (in millions $)	Change in Plan Estimate (in millions $)
MAJOR PROJECTS			
Southeast Massachusetts/Rhode Island Reliability (SEMA/RI)	359	367	7
Greater Boston - North, South, Central, and Western Suburbs	1043	1035	-8
Eastern CT 2029	221	221	0
Boston Area Optimized Solution (BAOS)	47	49	2
New Hampshire (NH) 2029	0	135	135
Upper Maine (UME) 2029	0	159	159
SUBTOTAL**	1670	1965	295
OTHER PROJECTS	11111	11044	-67
NEW PROJECTS	0	0	0
TOTAL**	**12780**	**13008**	**228**
Minus 'in-service'	-11672	-11677	-5
**Aggregate estimate of active projects in the Plan ** **	**1108**	**1331**	**223**

* 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.

October 2021 RSP Project List Update, cont.

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

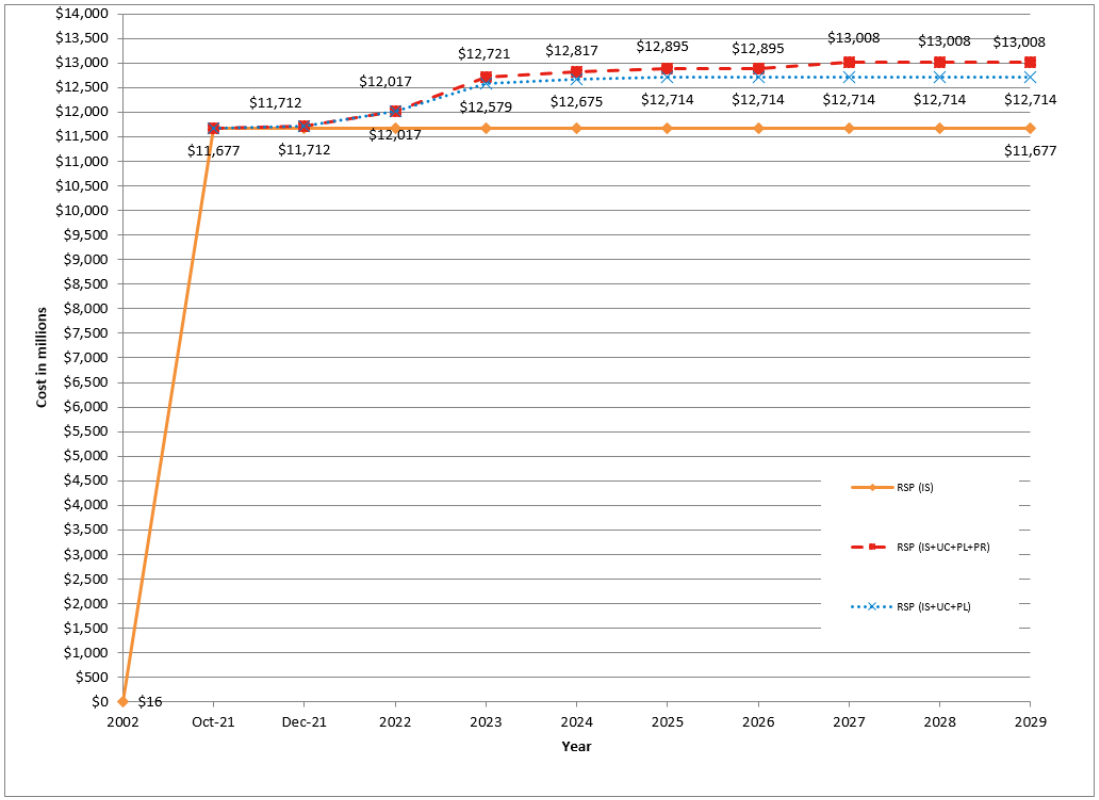


* Numbers shown represent project quantities.

** 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.

October 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.

October 2021 RSP Project List Update, cont.

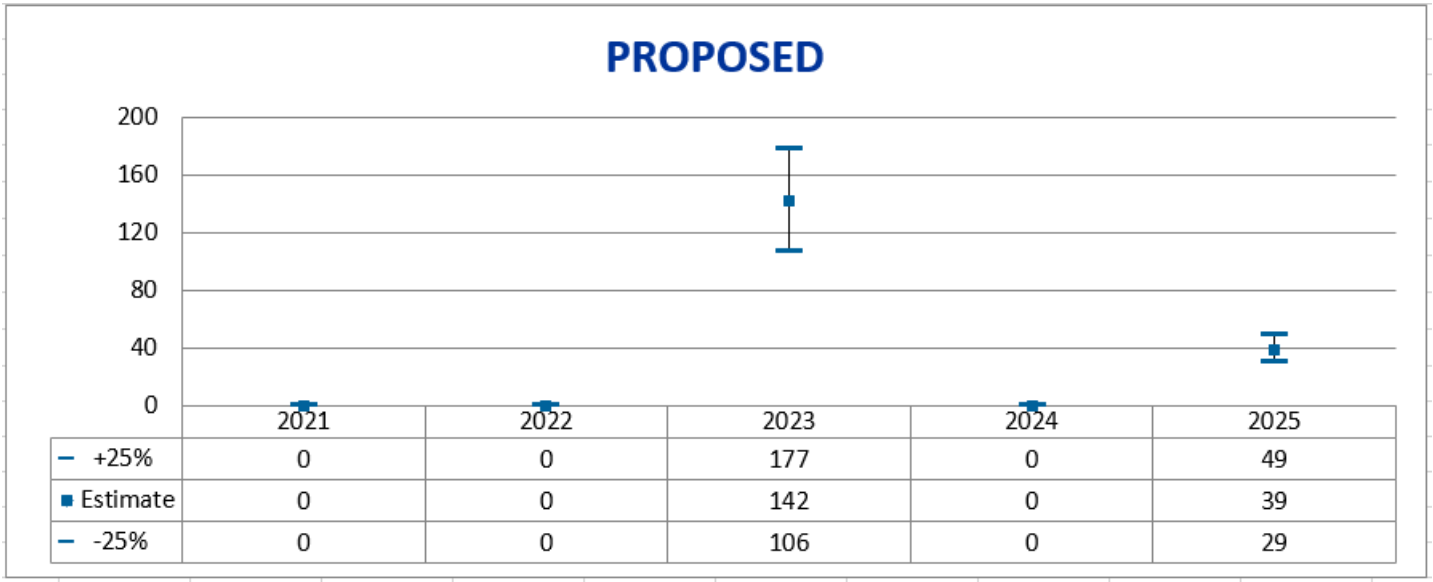
- **Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges***

Project Stage (Status)	Component / Project / Plan Count **	Estimate Range Minimum	Estimate Range Maximum	Estimated Costs ($millions)		Range Minimum ($millions)	Range Maximum
Proposed	12	-25%	25%***		294	220	367
Planned	30	-25%	25%		583	437	728
Under Construction	13	-10%	10%		455	409	500
Total Plan	**55**			****	**1331**	**1066**	**1595**
In-Service	2	-10%	10%		14	13	16
Cancelled	3	-25%	25%		67	50	83

* 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.

October 2021 RSP Project List Update, cont.

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

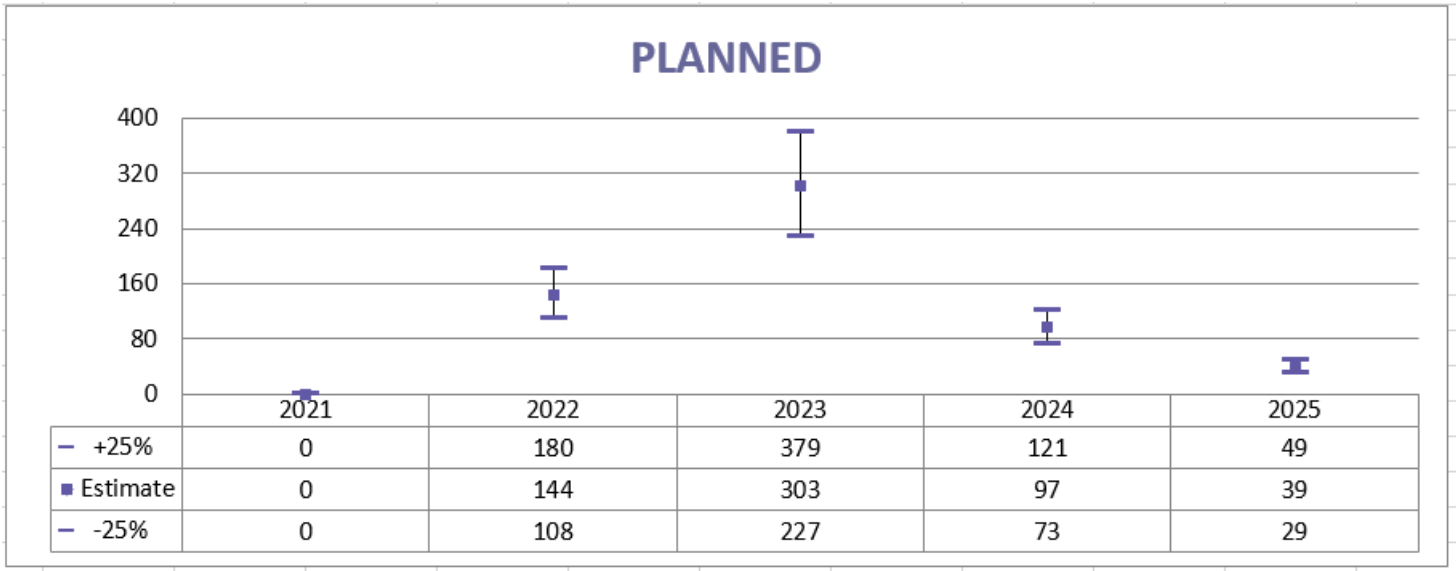


	2021	2022	2023	2024	2025
+25%	0	0	177	0	49
Estimate	0	0	142	0	39
-25%	0	0	106	0	29

* 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.

October 2021 RSP Project List Update, cont.

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

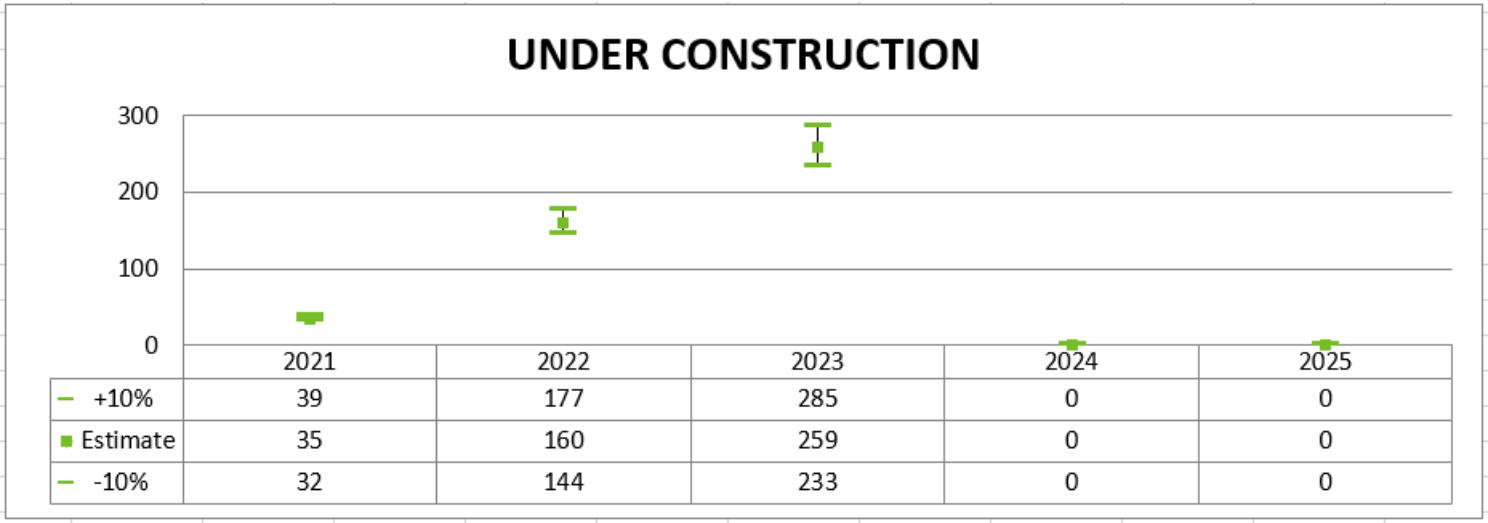


	2021	2022	2023	2024	2025
+25%	0	180	379	121	49
Estimate	0	144	303	97	39
-25%	0	108	227	73	29

* 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.

October 2021 RSP Project List Update, cont.

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



	2021	2022	2023	2024	2025
+10%	39	177	285	0	0
Estimate	35	160	259	0	0
-10%	32	144	233	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 2017-2025
Greater Boston – North, South, Central and Western Suburbs	Approved 4/15, 5/15, 6/16	TCA Submitted	Project completion 2013-2023
Eastern CT 2029	Approved 6/21	Not Submitted	Project completion 2021-2026
Boston Area Optimized Solution (BAOS)	Approved 5/21	TCA Submitted	Project completion 2023
New Hampshire (NH) 2029 Solution	Not Submitted	Not Submitted	Project completion 2023
Upper Maine (UME) 2029 Solution	Not Submitted	Not Submitted	Project completion 2023-2027

October 2021 Asset Condition List Update

- **Eleven New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
294	Millbury #2 Substation Protection Scheme Upgrade and Asset Condition Refurbishments (Massachusetts)	28.0
295	C-129N/D-130 115 kV Line Fiber Installation (Massachusetts)	11.2
296	X-176 115 kV Line Asset Condition Refurbishments (Massachusetts)	18.5
297	282-520 & 282-521 115 kV Lines HPFF Refurbishment (Massachusetts)	69.6
298	115 kV Structure and Shield Wire Replacements - Line D121 (New Hampshire)	13.1
299	115 kV Structure Replacements - Line 456-522 (Massachusetts)	5.7
300	115 kV Structure Replacements - Line 240-510 (Massachusetts)	11.6
301	230 kV Structure Replacements - Line 342-603 (Massachusetts)	5.5

October 2021 Asset Condition List Update, cont.

- **Eleven New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
302	690 Line Rebuild and Asset Condition Project (Connecticut)	11.0
303	115 kV Wood Pole Replacement - Line 1751 (Connecticut)	28.8
304	478-508 & 478-509 115 kV Lines Asset Condition & OPGW (Massachusetts)	5.9

October 2021 Asset Condition List Update, cont.

- **Nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
107	349X/Y 345 kV Cable Replacement (Massachusetts)	72.4
195	Sand Bar Substation - Mitigate several Asset Condition concerns: Control House, P&C, circuit breakers, switches (Vermont)	10.6
200	115 kV Wood Pole Replacement - F139 (New Hampshire)	7.5
217	115 kV Wood Pole Replacement – 1208 (Connecticut)	9.6
229	115 kV Wood Pole and Shield Wire Replacement – 1766 (Connecticut)	16.6
241	Glenbrook STATCOM Replacement (Connecticut)	18.7
243	115 kV Lattice Tower Asset Condition and OPGW Project - Line 1768 (Connecticut)	22.9
252	345 kV Line Structure Replacement - Line 319 (Massachusetts)	7.8

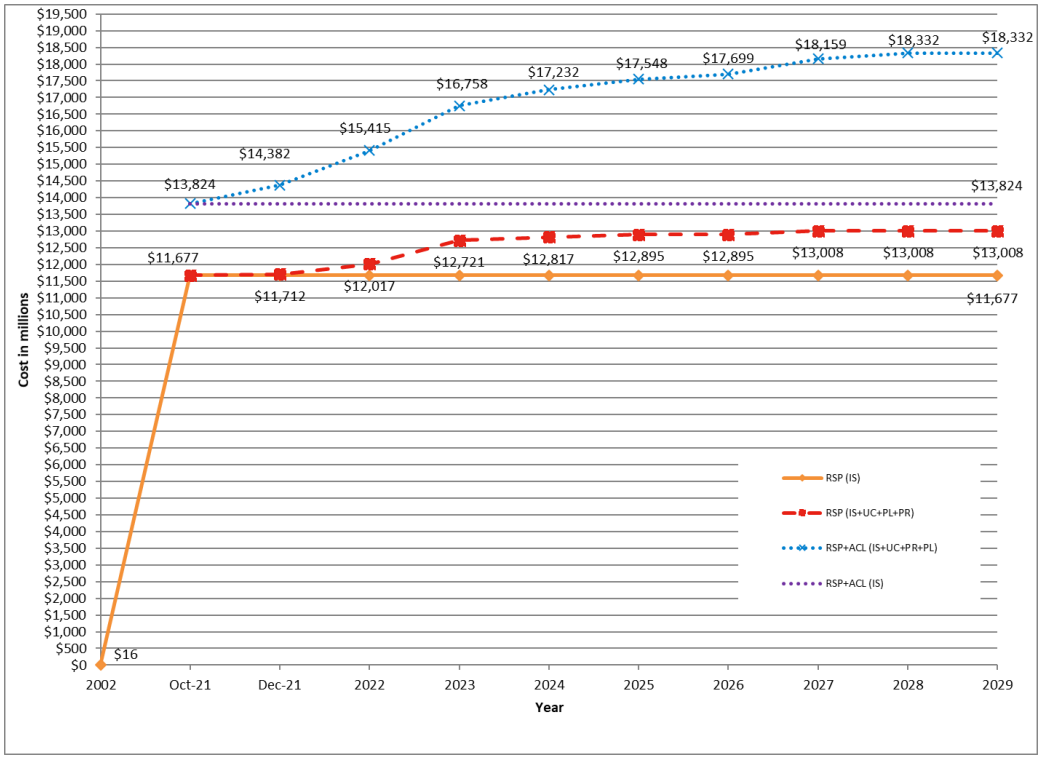
October 2021 Asset Condition List Update, cont.

- **Nine Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
304	478-508 & 478-509 115 kV Lines Asset Condition & OPGW (Massachusetts)	5.9

October 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%)