Regional System Plan

Transmission Projects and Asset Condition

October 2022 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 2022 Project List**
  - (CT) Eastern CT 2029
    - Cost increase of $23.6M for the L190-4 and L190-5 line sections reconductor project due to increase in material costs and outage limitations impacting construction sequencing
    - Cost increase of $11.3M for the 400-1 line section rebuild due to increase in estimated pricing as a result of larger matting than anticipated, as a result of wetland and other sensitive environmental areas mitigation
- **One new project**
  - (CT) Eastern CT 2029 - convert the 69 kV equipment at Buddington to 115 kV
    - Project added to provide clarity around the Eastern CT 2029 Solutions work at the Buddington Substation
    - The cost of the project is $5.5M
- **Four upgrades have been placed in-service since the June 2022 update**
  - (CT) Total of one project
    - Eastern CT 2029 – one project
  - (MA) Total of two projects
    - Boston 2028 – one project
    - K Street 345 kV 103S Breaker – one project
  - (RI) Total of one project
    - SEMA/RI – one project
- **No cancelled projects since the June 2022 update**

October 2022 RSP Project List Update

- **One New Project**

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1904	Convert the 69 kV equipment at Buddington to 115 kV to facilitate the conversion of the 400-2 line to 115 kV (Connecticut) Eastern CT 2029	5.5	Resolve thermal overloads

October 2022 RSP Project List Update, cont.

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

Project ID #	Transmission System Upgrades	Cost (in millions $)	Improvement/Need
1782	Reconductor the J16S line (Rhode Island) SEMA/RI	2.2	Resolve thermal overloads
1807	Install a 160 MVAR reactor at Golden Hills 345 kV (Massachusetts) Boston 2028	5.5	Resolve high voltage issues
1863	Install a 1% series reactor with bypass switch at Mystic, CT on the 1465 Line (Connecticut) Eastern CT 2029	4.8	Resolve thermal overloads
1898	K Street 345 kV 103S Breaker - Operate as Normally Open (Massachusetts)	0	Operational flexibility in Southeastern New England area and increased transfer limits

October 2022 RSP Project List Update, cont.

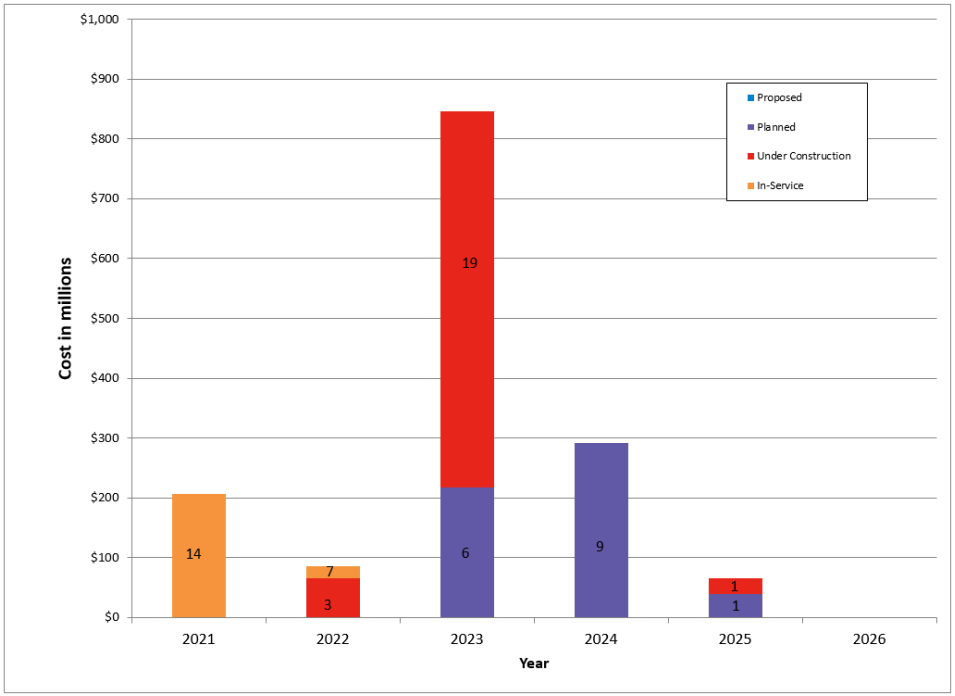
- **Cost Estimate Comparisons of Reliability Projects June vs. October 2022 Update***

	As of Jun 2022 Plan Update (in millions $)	As of Oct 2022 Plan Update (in millions $)	Change in Plan Estimate (in millions $)
MAJOR PROJECTS ***			
Southeast Massachusetts/Rhode Island Reliability (SEMA/RI)	368	368	0
Greater Boston - North, South, Central, and Western Suburbs	1050	1050	0
Eastern CT 2029	221	259	38
Boston Area Optimized Solution (BAOS)	49	49	0
New Hampshire (NH) 2029	135	128	-7
Upper Maine (UME) 2029	159	164	6
SUBTOTAL**	1981	2018	37
OTHER PROJECTS	11060	11058	-2
NEW PROJECTS	0	0	0
TOTAL**	**13041**	**13076**	**35**
Minus 'in-service'	-11747	-11759	-12
**Aggregate estimate of active projects in the Plan ** **	**1294**	**1317**	**23**

* 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 2022 RSP Project List Update, cont.

- **Investment of New England Transmission Reliability Projects by Status through 2026**

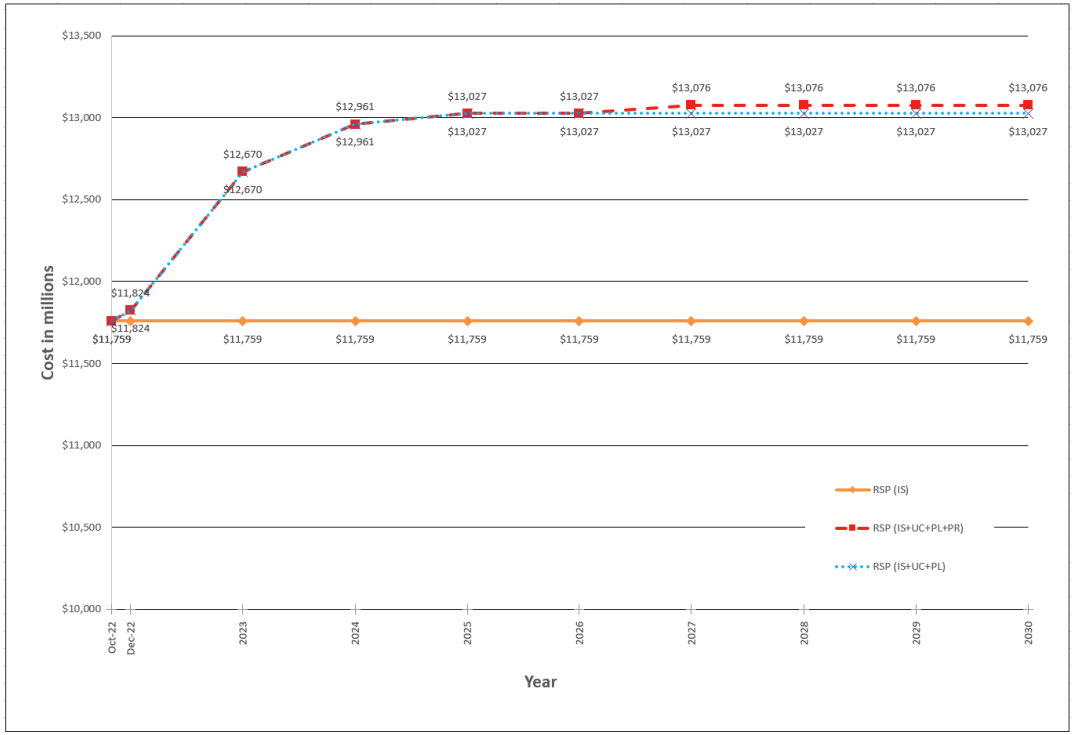


* Numbers shown represent project quantities.

** 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 2022 RSP Project List Update, cont.

- **Cumulative Investment of New England Transmission Reliability Projects through 2030**



* 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 2022 RSP Project List Update, cont.

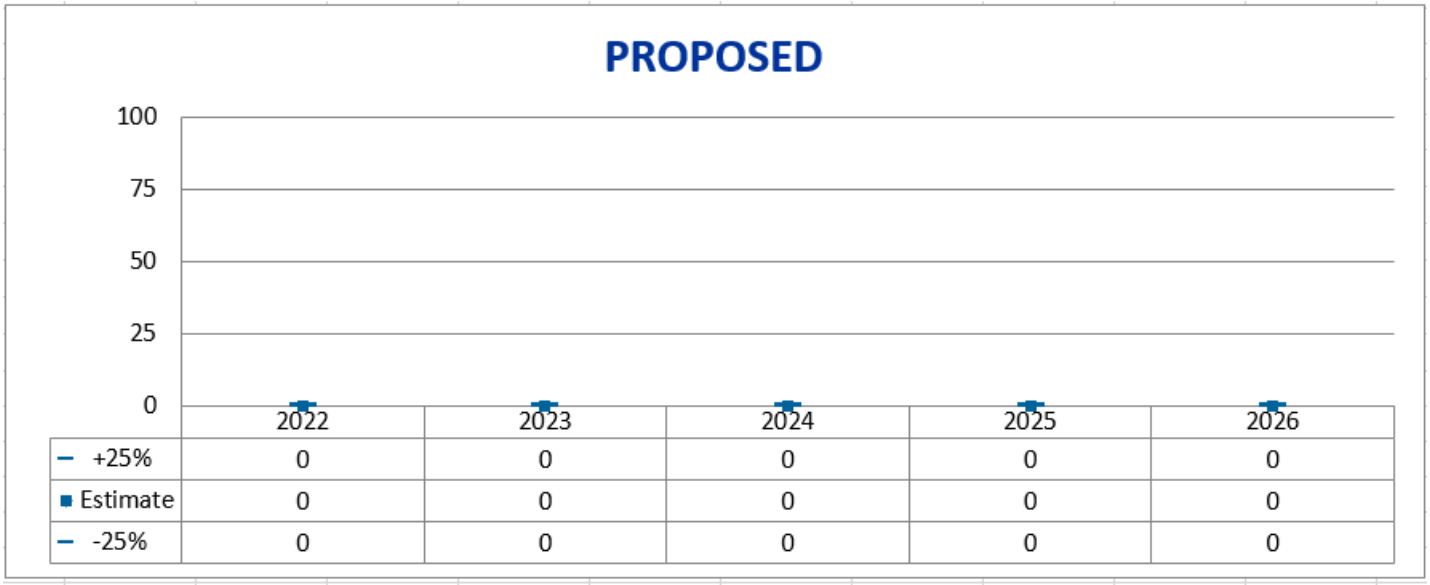
- **Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges***

Project Stage (Status)	Component / Project / Plan Count	Estimate Range Minimum	Estimate Range Maximum	Estimated Costs ($millions)	Range Minimum ($millions)	Range Maximum ($millions)
Proposed	3	-25%	25%**	49	37	61
Planned	16	-25%	25%	548	411	684
Under Construction	23	-10%	10%	721	649	793
Total Plan	**42**			*** **1317**	**1096**	**1539**
In-Service	4	-10%	10%	12	11	14
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.
** 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 2022 RSP Project List Update, cont.

- **Project Cost Estimate Tolerances by Status and Year in Millions $ for the next five years**



	2022	2023	2024	2025	2026
+25%	0	0	0	0	0
Estimate	0	0	0	0	0
-25%	0	0	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.

October 2022 RSP Project List Update, cont.

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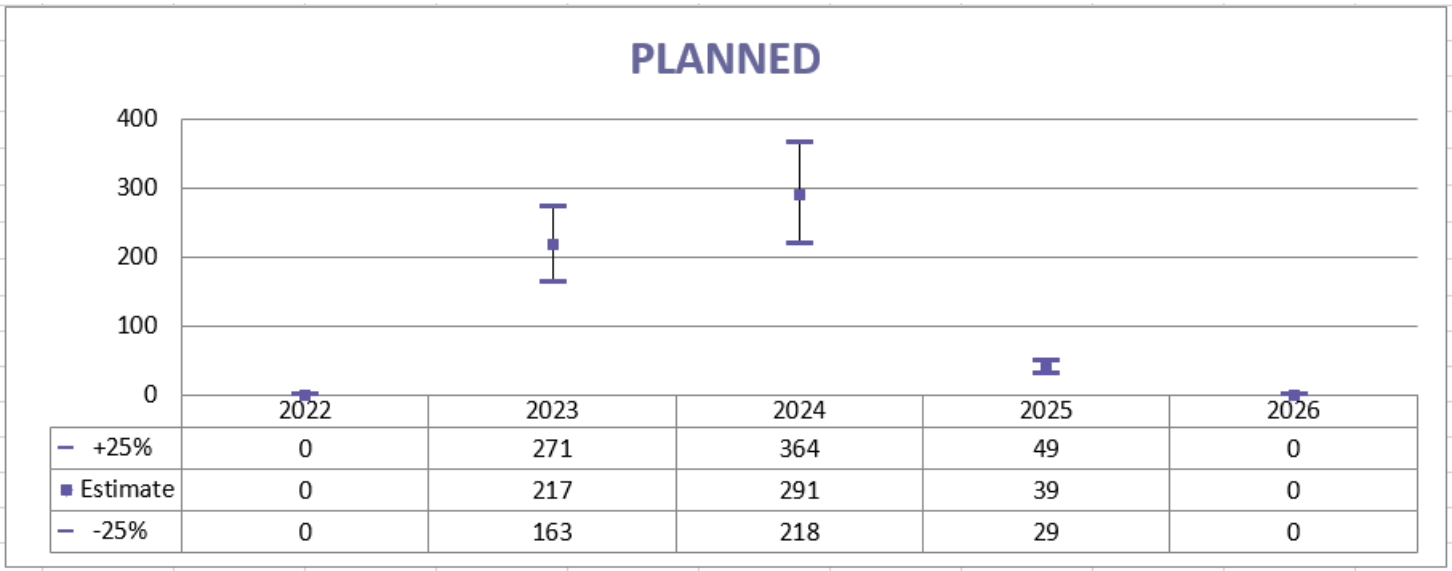
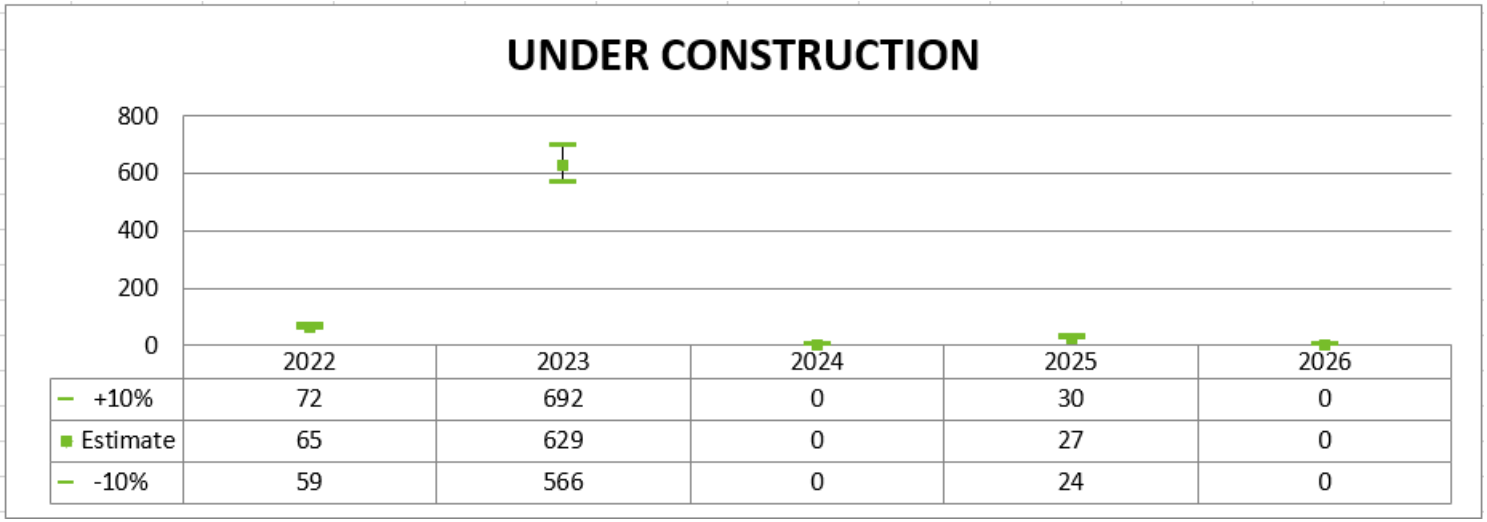


	2022	2023	2024	2025	2026
+25%	0	271	364	49	0
Estimate	0	217	291	39	0
-25%	0	163	218	29	0

* 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.

October 2022 RSP Project List Update, cont.

- **Project Cost Estimate Tolerances by Status and Year in Millions $ for the next five years**



	2022	2023	2024	2025	2026
+10%	72	692	0	30	0
Estimate	65	629	0	27	0
-10%	59	566	0	24	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 5/2017, 4/2018	Submitted	Project completion 2018-2025
Greater Boston – North, South, Central and Western Suburbs	Approved 4/2015, 5/2015, 6/2016	Submitted	Project completion 2010-2023
Eastern CT 2029	Approved 6/2021	Not Submitted	Project completion 2021-2024
Boston Area Optimized Solution (BAOS)	Approved 5/2021	Submitted	Project completion 2021 - 2023
New Hampshire (NH) 2029 Solution	Approved 1/2022 (New Hampshire Transmission) Not Submitted (Eversource)	Not Submitted	Project completion 2023
Upper Maine (UME) 2029 Solution	Approved 2/2022 (Versant Power) Partially approved 5/2022 and remainder not submitted (Avangrid)	Not Submitted	Project completion 2023-2027

October 2022 Asset Condition List Update

- **20 New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
330	Line K21 Asset Condition Line Refurbishment (Vermont)	20.6
331	Line K32 Asset Condition Line Refurbishment (Vermont)	14.3
332	Line K50 Asset Condition Line Refurbishment (Vermont)	31.3
333	Construct new Stafford Street Substation (Massachusetts)	56.8
334	K-137/L-138W 115 kV Lines Pilot Protection Scheme (Massachusetts)	19.9
335	G-185S/L-190 115 kV OPGW Installation (Rhode Island)	8.5
336	Tewksbury #22 Substation Asset Condition Replacements (Massachusetts)	35.5
337	E-5/F-6 69 kV Line Asset Condition Refurbishments (Massachusetts)	To be determined

October 2022 Asset Condition List Update, cont.

- **20 New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
338	Millstone Substation 345 kV Breaker Replacements (Connecticut)	17.6
339	Northfield Mountain Substation 345 kV Breaker Replacements (Massachusetts)	9.2
340	Holbrook Station 345/115 kV Autotransformer Replacement (Massachusetts)	10.3
341	Deerfield Station 345 kV Breaker Replacements (New Hampshire)	5.2
342	Line 379 Asset Condition Wood Structure Replacements (New Hampshire)	8.0
343	Timber Swamp Station 345 kV Breaker Replacements (New Hampshire)	7.4
344	Line 373 Asset Condition Wood Structure Replacements (New Hampshire)	7.1
345	Line 326 Asset Condition Wood Structure Replacements (New Hampshire)	6.2

October 2022 Asset Condition List Update, cont.

- **20 New Projects**

Project ID #	Transmission System Upgrades	Cost (in millions $)
346	Line 385 Asset Condition Wood Structure Replacements (New Hampshire)	5.0
347	Line 391 Asset Condition Wood Structure Replacements (New Hampshire)	9.0
348	Line C196 Asset Condition Wood Structure Replacements (New Hampshire)	14.8
349	Scobie Pond Station 345 kV Trench Replacement & Control House Expansion Project (New Hampshire)	19.7

October 2022 Asset Condition List Update, cont.

- **18 Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
67	Manchester Control House Expansion (Connecticut)	48.3
87	Seabrook 345 kV GIS Switchyard Equipment Replacement Phase 2 (New Hampshire)	Part of Asset Condition #85*
92	Robinson Avenue Station #102 Asset Condition Upgrades (Massachusetts)	18.0
170	345 kV Structure Replacement Projects - Line 364 (Connecticut)	16.4
181	345 kV Structure Replacement Projects - Line 312 (Massachusetts)	41.3
224	115 kV Wood Pole and Shield Wire Replacement – 1618 (Connecticut)	8.8
230	115 kV Wood Pole Replacement – 1910 (Connecticut)	8.2
245	Southington Substation Relay Replacement Project (Connecticut)	9.4

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

October 2022 Asset Condition List Update, cont.

- **18 Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
270	S-145/T-146 115 kV Line Reconductoring - North Reading Substation to Wallace Substation (Massachusetts)	21.9
282	345 kV Line Structure Replacements - Line 373 (New Hampshire)	9.4
289	NH 115 kV Laminated Wood Structure Replacement Program Phase I - K105 Line (New Hampshire)	16.5
298	115 kV Structure and Shield Wire Replacements - Line D121 (New Hampshire)	13.1
302	690 Line Rebuild and Asset Condition Project (Connecticut)	11.0
307	M-139/N-140 115 kV Lines Pilot Protection Schemes (Massachusetts)	9.4
314	345 kV Structure and Shield Wire Replacements - 352 Line (Connecticut)	5.8
318	115 kV Structure Replacements - 211-508 Line (Massachusetts)	5.8

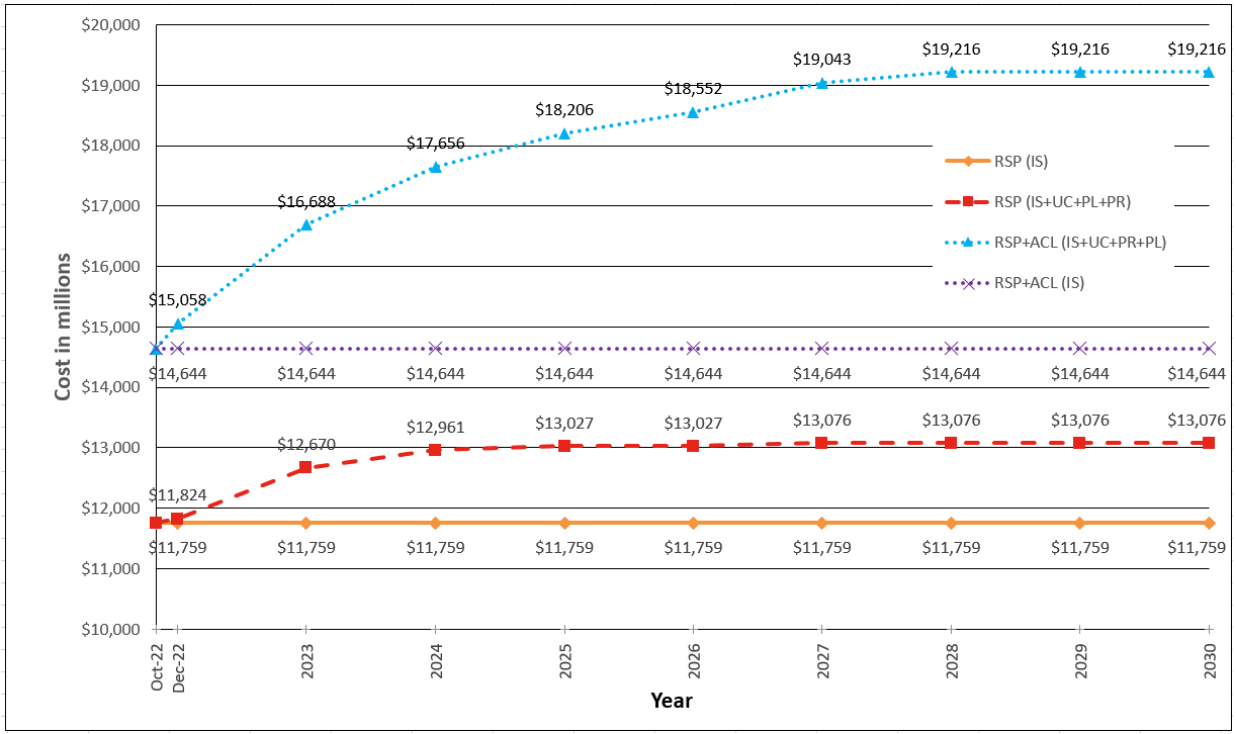
October 2022 Asset Condition List Update, cont.

- **18 Projects Placed In-Service**

Project ID #	Transmission System Upgrades	Cost (in millions $)
319	115 kV Structure Replacements - 391-508 Line (Massachusetts)	5.0
320	115 kV Structure Replacements - 533-508 Line (Massachusetts)	5.0

October 2022 Asset Condition List Update, cont.

- **Cumulative Investment of New England Transmission Reliability Projects and Asset Condition through 2030**



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** 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.

Questions

APPENDIX

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 (must be the preferred solution to solve the needs and have I.3.9 approval) or Under Construction
      - 1b Proposed (is supported by a Solutions Study or a Competitive Solution Process)
    - Part 2: these projects are Generator Interconnection Upgrades
      - 2a Planned (I.3.9 approval with 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 Interconnection Agreement)
    - Part 3: these projects are Market Efficiency Upgrades
      - 3a Planned (must be the preferred solution to solve the needs and have I.3.9 approval) or Under Construction
      - 3b Proposed (is supported by a Competitive Solution Process)
    - 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 (I.3.9 approval with Interconnection Agreement) or Under Construction
      - 4b Proposed (I.3.9 approval but without Interconnection Agreement)

* 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
    - A regulated transmission solution upgrade that has been approved by the ISO pursuant to Section I.3.9 of the Tariff, or
    - An interconnection related transmission upgrade that has been approved by the ISO pursuant to Section I.3.9 of the Tariff with Interconnection Agreement
  - Proposed
    - A regulated transmission solution that has been selected by the ISO in response to a Needs Assessment and communicated to PAC, or
    - An interconnection related transmission upgrade that has been approved by the ISO pursuant to Section I.3.9 of the Tariff, but without Interconnection Agreement
  - Cancelled
    - Project has been cancelled

* On December 10, 2019, FERC accepted Tariff changes that removed the 'Concept' category.

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%)
  - An "NR" indicates that the PTF cost estimate is less than $5M, either for the individual project or for the entire project when the individual project is part of a larger project (typically shown as Major Project), and/or not eligible for regional cost