# Regional System Plan

## Transmission Projects and Asset Condition

## June 2017 Update – Rev.1

*Planning Advisory Committee Meeting*

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# Highlights of the Project List Update

- Major cost estimate changes that occurred between the March 2017 and June 2017 Project List:

  (VT) **Connecticut River Valley** - Project cost decreased (cost reduction $15.3M)
  **Projects 1614, 1615, 1617** - Decreased costs reflect competitive bids throughout the projects and a reduction in the amount of contingency, from 50% to 10%, included in the estimates since the projects are better defined

  (NH) **Seacoast New Hampshire** Solution – Project (1318) - New 115 kV overhead/submarine circuit, Madbury-Portsmouth includes a redesign of the underground sections in Durham and Newington NH (cost increase $16.4M)

- 2 New Projects:

  (RI) **(1742) Southeast Massachusetts/Rhode Island Reliability Project** – 1 project added ($2.4M). Project was added to separate RI work from MA work in the Project (1714) (New Grand Army 115 kV switching station). This project is for the RI work and the cost is subtracted from Project (1714)

  (MA) **(1745) New East Eagle 115 kV Substation between Mystic and Chelsea connecting to existing lines** ($42.7M). Project was originally presented to the PAC in October 2014 and was inadvertently omitted from the Project List.

- 2 Cancelled Projects:

  (NH) **Western NH Solution – Project (1269)** cancelled due to concerns with the feasibility of implementing the project. Alternatives to the project will be developed through the appropriate process as long as the needs that drove the project continue to exist. (cost reduction $16.2M)

  (MA) **Southeast Massachusetts/Rhode Island Reliability Project – Project (1735)** – Upgrade was performed as part of a previous project at the Tremont #713 station. There is no longer a need for this upgrade. (cost reduction $0.2M)

- 1 Project Updated – Portion of Project Cancelled

  (NH) **Central NH Solution – Portion of project (1300)** cancelled associated with Eversource load transfer. This was part of the NH 2020 solutions, however it was found in the NH 2023 Needs Assessment that this solution was not adequate. Alternatives to the project will be developed through the appropriate process as long as the needs that drove the project continue to exist. (there is no change in cost associated with cancelling this portion of the project)

# Highlights of the Project List Update

- Central Western MA Upgrades: in-service dates for 4 projects moved forward to 2022. There will be a new Needs Assessment to reevaluate the continued need for these upgrades

- 16 Upgrades on the project list have been placed in-service since the March 2017 update:
  - (CT) SWCT- 2 projects in-service
  - (CT) GHCC- 4 projects in-service
  - (MA)(NH) Greater Boston – 5 projects in-service (MA) 4 projects and (NH) 1 project
  - (MA) Pittsfield/Greenfield – 3 projects in-service
  - (MA) K Street to Dewar/Andrew Square Cable Project
  - (RI) Chase Hill Substation 115/13 kV substation addition

# June 2017 Changes

## 2 New Projects and Corresponding Need

| 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<br>(Rhode Island) Southeast Massachusetts/Rhode Island Reliability Project | 2.4 | Resolve thermal overloads |
| 1745 | New East Eagle 115 kV station between Mystic and Chelsea connecting to existing lines<br>(Massachusetts) | 42.7 | Addition of new substation to address area load growth |

# June 2017 Changes, *cont.*
## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1565 | Relocate the existing 37.8 MVAR capacitor bank from 115 kV B bus to 115 kV A bus at Plumtree Substation<br>(Connecticut) SWCT | 2.8 | Resolve voltage violations |
| 1567 | Reduce 12Y-10K (25.2 MVAR) capacitor at Rocky River to 14.4 MVAR<br>(Connecticut) SWCT | 0.3 | Resolve voltage violations |
| 1599 | Terminal equipment upgrades on the 345 kV line between Haddam and Beseck (362)<br>(Connecticut) GHCC | 0.5 | Resolve thermal violations |
| 1598 | Add a 2nd 345/115 kV autotransformer at Haddam substation and reconfigure the 3-terminal 345 kV 348 line into 2 two-terminal lines<br>(Connecticut) GHCC | 42.0 | Increase load serving capabilities in Middletown area |
| 1600 | Separation of 115 kV double circuit towers corresponding to the Branford – Branford RR line (1537) and the Branford to North Haven (1655) line and adding a series breaker at Branford 115 kV substation<br>(Connecticut) GHCC | 2.0 | Increase load serving capabilities in the Middletown area |

# June 2017 Changes, *cont.*

## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1659 | Increase the size of the existing 115 kV capacitor at Branford substation from 37.8 to 50.4 MVAR<br>(Connecticut) GHCC | 0.7 | Resolves low voltage violations |
| 1253 | Chase Hill Substation 115/13 kV substation addition<br>(Rhode Island) | 3.2 | Addition of new substation to address area load growth |
| 1208 | Separation and reconductoring of Cabot Taps (A-127 and Y-177 115kV lines). This involves 795 ACSS for the Y-177 line and 1590 ACSS for the A-127 tap<br>(Massachusetts) Pittsfield/Greenfield Project | 15.7 | Resolve thermal and voltage violations |
| 1222 | Build a new 115 kV three breaker Switching Station (Erving) ring bus<br>(Massachusetts) Pittsfield/Greenfield Project | Part of project ID# 1221<br>94.0 | Increase load serving capabilities in the Pittsfield/Greenfield area |
| 1525 | Loop the A127W line between Cabot Tap and French King into the new Erving Substation<br>(Massachusetts) Pittsfield/Greenfield Project | 1.3 | Increase load serving capability in Pittsfield/Greenfield area |

# June 2017 Changes, *cont.*
## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1527 | Reconductoring National Grid's portion of the Y-151 between Dracut Junction and Power Street (MA portion of the line) (Massachusetts) Greater Boston – North | Part of project ID# 1213 83.3 | Resolves thermal overloads |
| 1647 | Add a new 115 kV breaker in series with breaker 5 at Framingham (Massachusetts) Greater Boston – Western Suburbs | 1.3 | Eliminate impact of breaker failure contingency |
| 1645 | Add a new 115 kV 36.7 MVAR capacitor bank at Hartwell Station (Massachusetts) Greater Boston – Western Suburbs | 1.3 | Resolve voltage violations |
| 1554 | Add one 115 kV breaker at K Street in series with the 29 breaker (Massachusetts) Greater Boston – Central | 1.3 | Eliminate critical breaker failure contingency |
| 1528 | Reconductoring National Grid's portion of the Y-151 between Dracut Junction and Power Street (NH portion of the line) (New Hampshire) Greater Boston - North | Part of project ID# 1213 83.3 | Resolve thermal overloads |

# June 2017 Changes, *cont.*

## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1612 | Install one 115 kV breaker to separate K Street 345B bus connection from line 483-525 (Massachusetts) K Street to Dewar/Andrew Square Cable Project | 0.7 | Increase load serving capability in the Dewar/Andrew Square area |

# June 2017 Changes, *cont.*

## Cost Estimate Comparisons of Reliability Projects March 2017 vs. June 2017 Update [1]

| | As of Mar 2017 Plan Update (in millions $) | As of Jun 2017 Plan update (in millions $) | Change in Plan Estimate (in millions $) |
|---|---|---|---|
| **MAJOR PROJECTS** | | | |
| Maine Power Reliability Program (MPRP) | 1459 | 1459 | 0 |
| Greater Hartford & Central Connecticut (GHCC) | 337 | 337 | 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 | 306 | 309 | 3 |
| Pittsfield/Greenfield Project | 192 | 191 | -1 |
| Greater Boston - North, South, Central, Western Suburbs | 836 | 827 | -9 |
| New Hampshire Solution - Southern, Central, Seacoast, Northern | 328 | 328 | 0 |
| Vermont Solution - Southeastern, Connecticut River | 111 | 96 | -15 |
| Southwest Connecticut (SWCT) | 415 | 415 | 0 |
| SUBTOTAL [2] | **5565** | **5543** | **-22** |
| **OTHER PROJECTS** | 6814 | 6817 | 3 |
| **NEW PROJECTS** | | 43 | 43 |
| **PROJECTS WHOSE COST ESTIMATES WERE PREVIOUSLY REPORTED AS TO BE DETERMINED (TBD)** | | | |
| TOTAL [2] | **12379** | **12403** | **24** |
| Minus 'in-service' | -8353 | -8426 | |
| **Aggregate estimate of active projects in the Plan [2]** | **4026** | **3977** | |

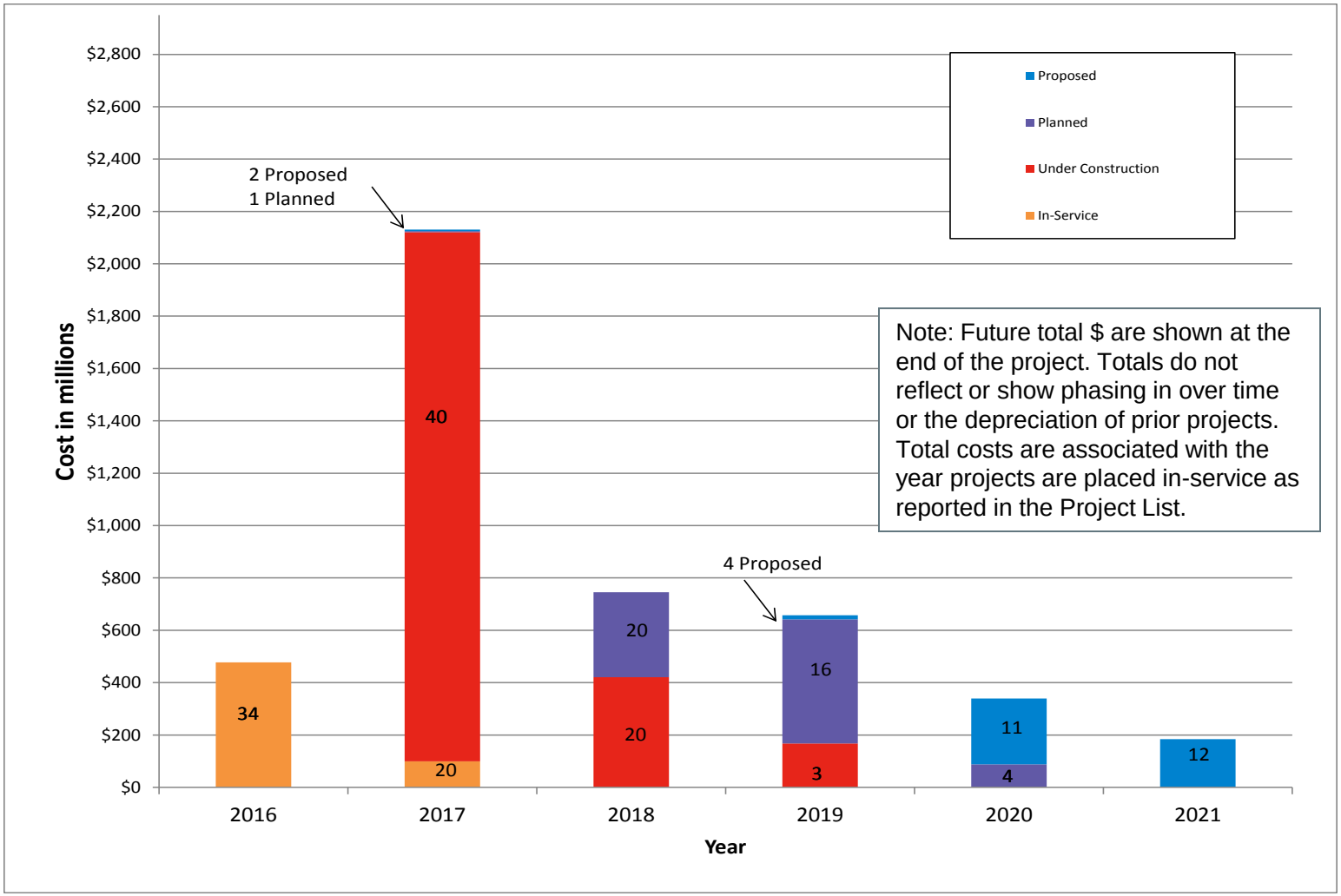
[1] Transmission Owners provided all estimated costs, which may not meet the guidelines described in Planning Procedure 4, Attachment D

[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.

# June 2017 Changes, *cont.*

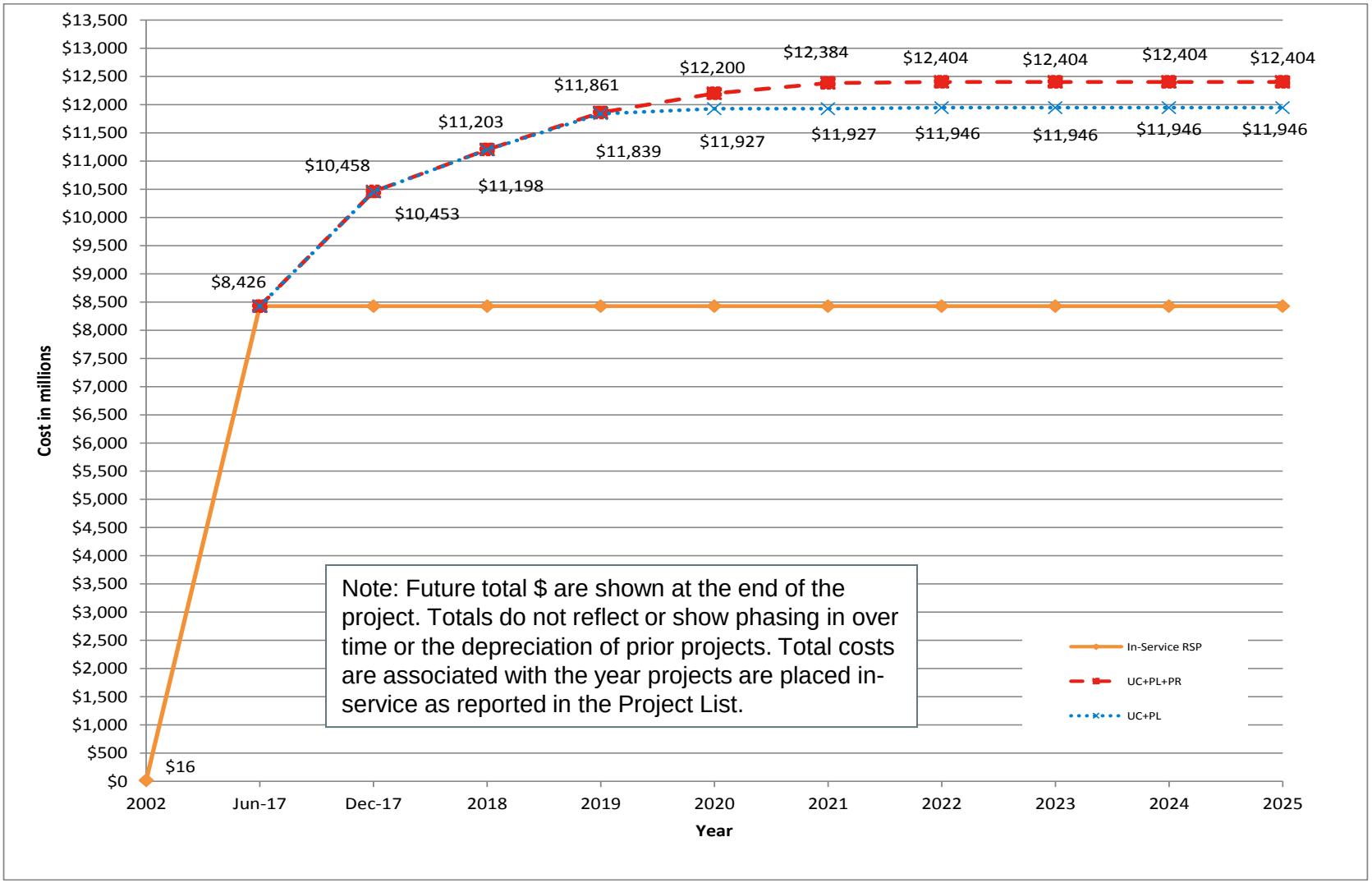
## Investment of New England Transmission Reliability Projects by Status through 2021




Note: Numbers shown represent project quantities

# June 2017 Changes, *cont.*

## Cumulative Investment of New England Transmission Reliability Projects through 2025




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

# June 2017 Changes, *cont.*

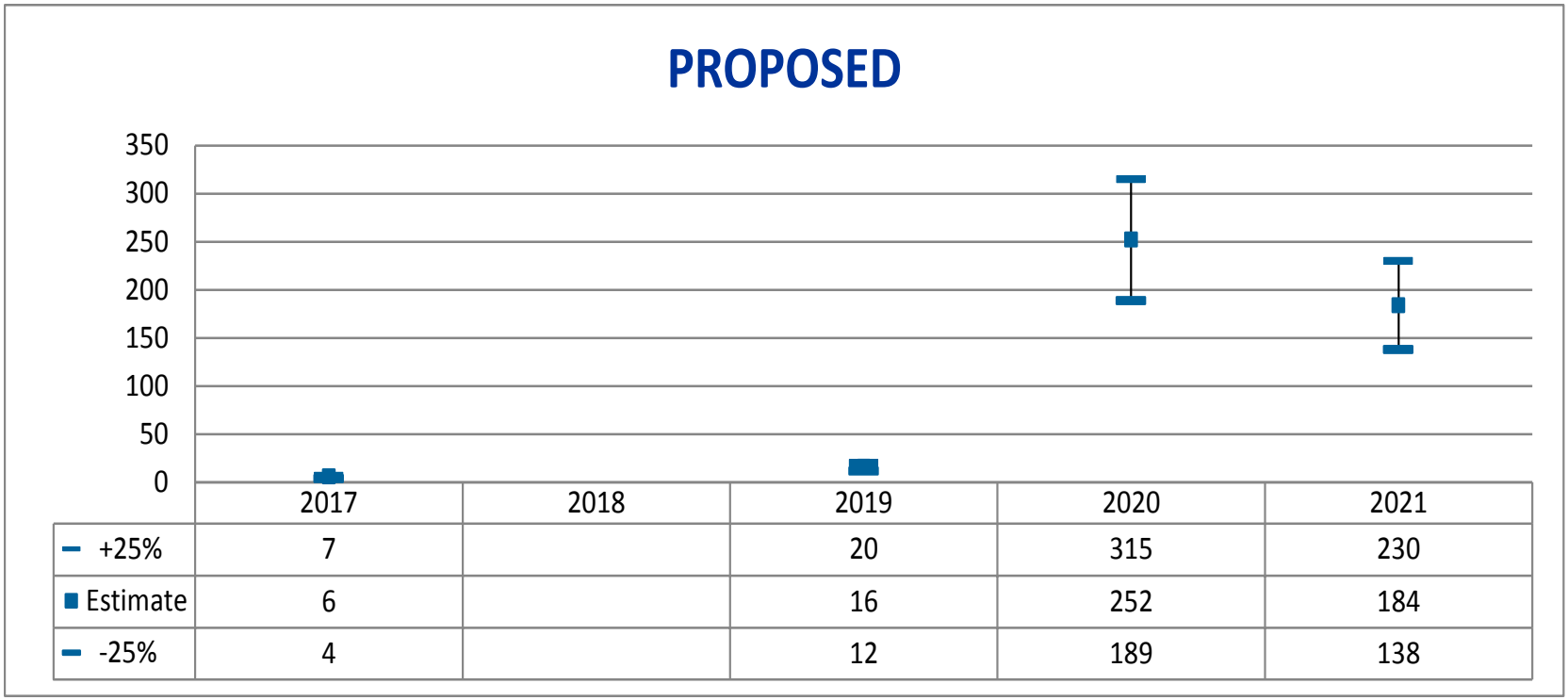
## Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges (1)

| Project Stage (Status) | Component / Project / Plan Count (2) | Estimate Range Minimum | Estimate Range Maximum | Estimated Costs ($millions) | Range Minimum ($millions) | Range Maximum ($millions) |
|---|---|---|---|---|---|---|
| Proposed | 29 | -25% | 25% (3) | 457 | 343 | 572 |
| Planned | 45 | -25% | 25% | 910 | 683 | 1138 |
| Under Construction | 63 | -10% | 10% | 2610 | 2349 | 2871 |
| **Total Plan (excluding Concept)** | **137** | | | (5) **3977** | **3375** | **4580** |
| Concept | 0 | | | (4) 0 | | |
| In-Service | 16 | -10% | 10% | 73 | 66 | 81 |
| Cancelled | 2 | | | 16 | | |

(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.

# June 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $

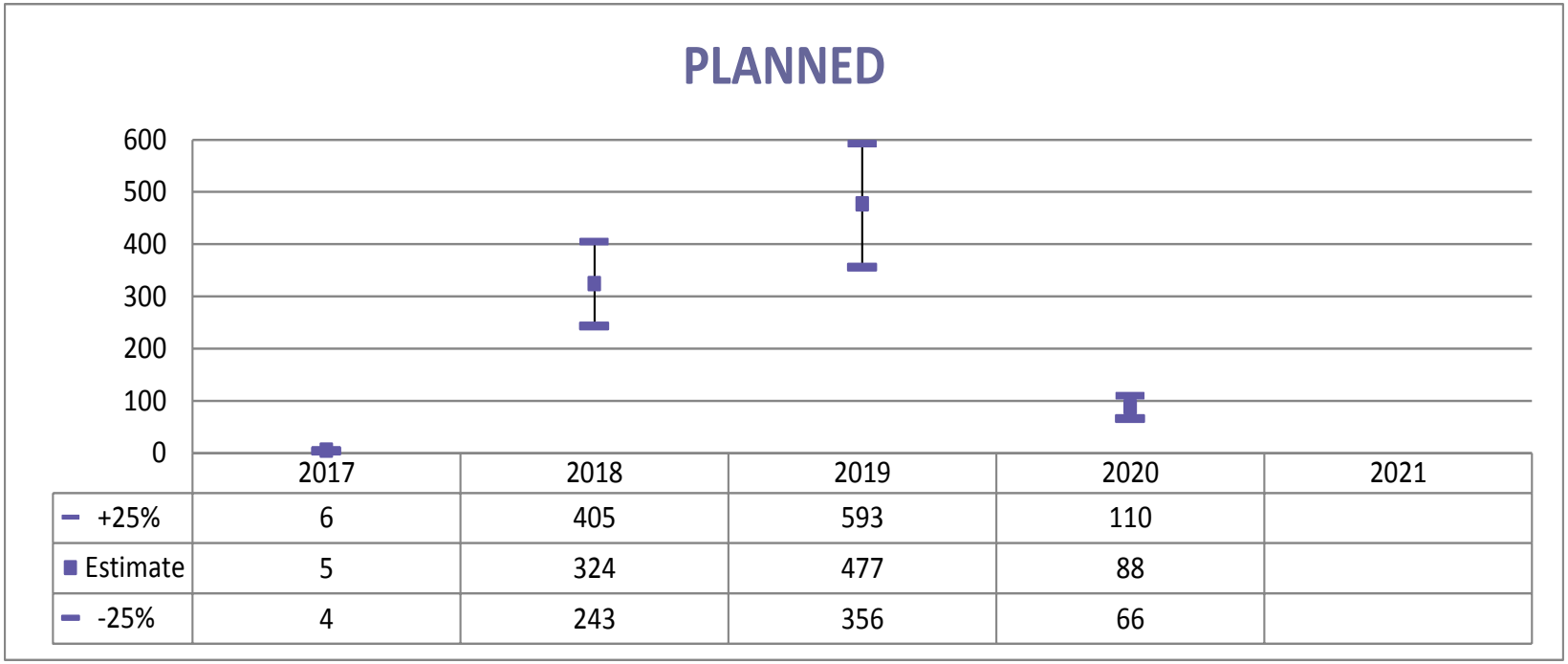



| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +25% | 7 | | 20 | 315 | 230 |
| Estimate | 6 | | 16 | 252 | 184 |
| -25% | 4 | | 12 | 189 | 138 |

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.

# June 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $

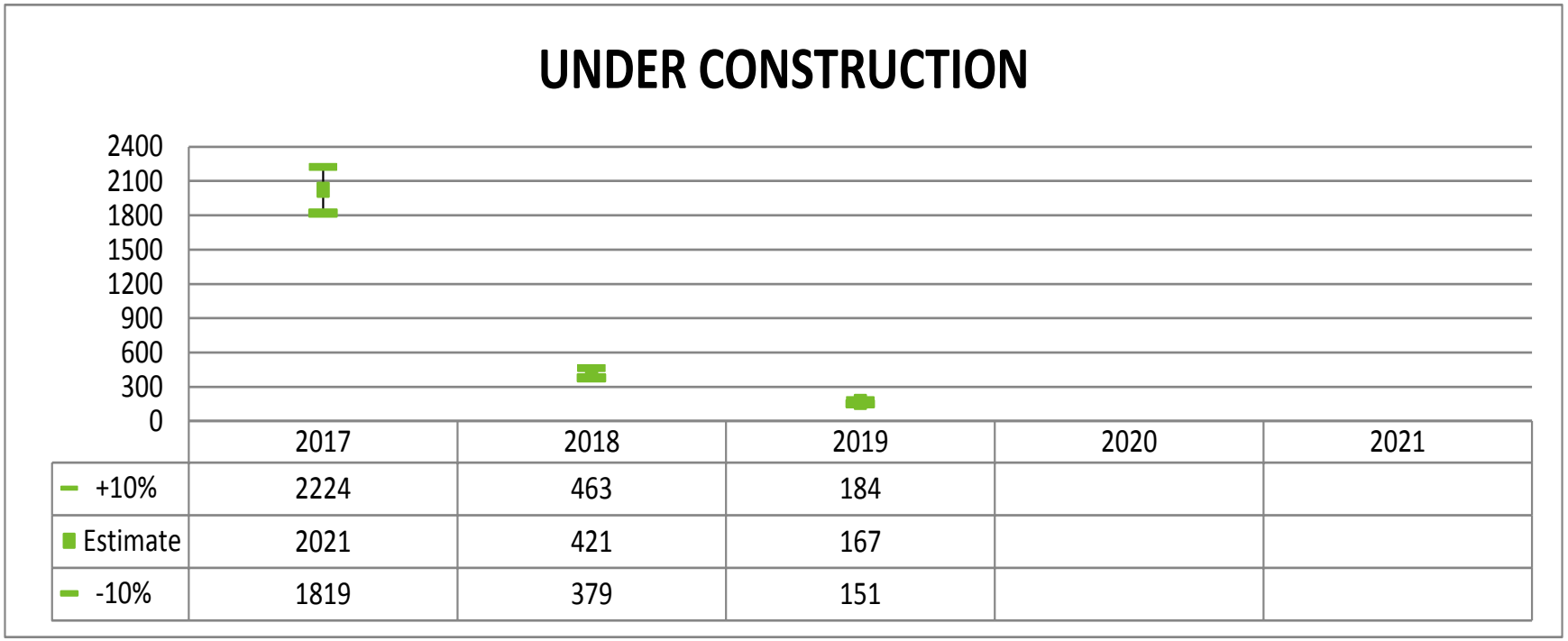



| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +25% | 6 | 405 | 593 | 110 | |
| Estimate | 5 | 324 | 477 | 88 | |
| -25% | 4 | 243 | 356 | 66 | |

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.

# June 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $




| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +10% | 2224 | 463 | 184 | | |
| Estimate | 2021 | 421 | 167 | | |
| -10% | 1819 | 379 | 151 | | |

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 | Partial 2/11/16 | Project completion 2014-2019 |
| Maine Power Reliability Program (MPRP) | Approved 7/08, 2/09, 11/10 | Approved 1/29/10 | Project completion 2014-2018 |
| Vermont Solution – Connecticut River Valley | Approved 4/15 | TCA Submitted | Project completion 2016-2018 |
| Southwest Connecticut (SWCT) | Approved 4/15 | Partial 7/16/15, 4/15/16, 5/13/2016 | Project completion 2013-2020 |
| Southeast MA/RI Reliability | Not Submitted | Not Submitted | Project completion 2019-2021 |

# Status of Major Transmission Projects, *cont.*

| | PPA | TCA | Construction |
|---|---|---|---|
| Central/Western MA Reinforcements | Approved<br>12/07, 3/11 | Group 1<br>2/29/2012 | Project completion<br>2009-2019 |
| Greater Boston – North, South, Central and Suburbs | Approved<br>4/15, 5/15, 6/16 | Not Submitted | Project completion<br>2013-2019 |
| New Hampshire Solution – Western, Central, Southern and Seacoast | 3/13 | Seacoast 11/5/15<br>Southern 1/7/16<br>Western 12/17/15<br>Central 11/25/15 | Project completion<br>2013-2020 |
| Greater Hartford & Central Connecticut (GHCC) | 4/15 | TCA Submitted | Project completion<br>2015-2018 |

# June 2017 Asset Condition
## 9 New Projects

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 32 | West Medway Substation #446 Asset Condition Upgrade (Massachusetts) | 18.9 |
| 33 | 1410 and 100 Line Structure Replacements (Connecticut) | 6.5 |
| 34 | Devon Control House Modifications (Connecticut) | 9.4 |
| 35 | Scobie Pond TB30 345/115 kV transformer replacement project (New Hampshire) | 10.3 |
| 36 | Install two 40 MVAR reactors on the Scobie 115 kV bus, to accommodate the loss of the reactors connected on the 13.8 kV tertiary winding of the TB30 transformer. (New Hampshire) | 5.2 |

# June 2017 Asset Condition
## 9 New Projects

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 37 | New Mt. Tom protection system control house (Massachusetts) | 7.7 |
| 38 | 3419 line (portion in Massachusetts) asset condition and OPGW project (Massachusetts) | 13.7 |
| 39 | 3419 line (portion in Connecticut) asset condition and OPGW project (Connecticut) | Part of Asset Condition #38 |
| 40 | Salem Harbor Substation - Replace circuit breakers, 115kV disconnects, capacitor coupled voltage transformers and various foundation repairs/replacements and reinforcements (Massachusetts) | 6.0 |

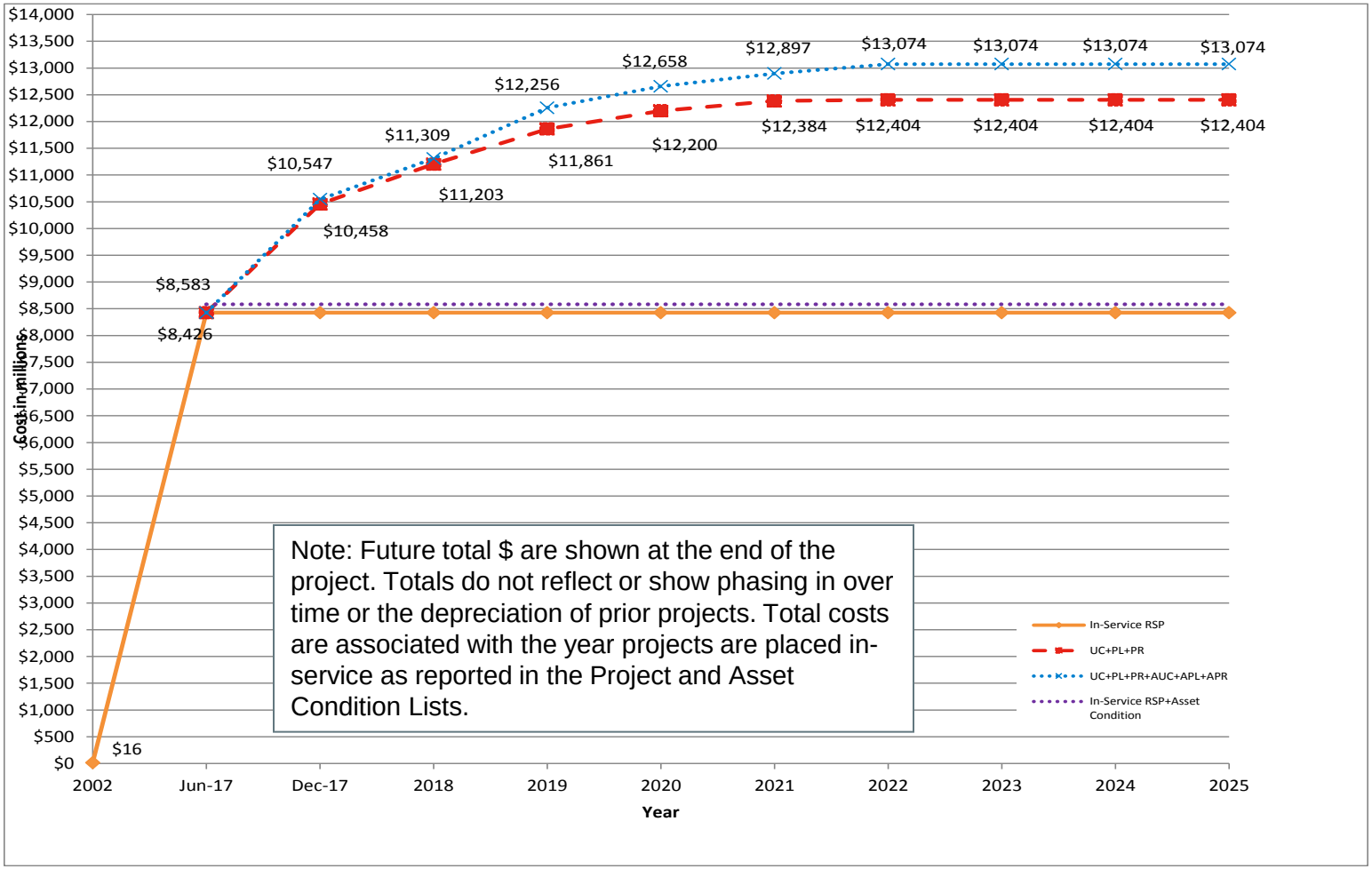
# June 2017 Asset Condition, *cont.*

1 Projects Placed In-Service

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 3 | Replace Essex STATCOM power electronics and controls<br>(Vermont) Essex STATCOM Refurbishment | 27.3 |

# June 2017 Changes, *cont.*

Cumulative Investment of New England Transmission Reliability Projects and Asset Condition through 2025




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

# Appendix

# Summary: Project Listing Definitions

- **ISO New England Inc. Transmission, Markets and Services Tariff Section II**
  - **Attachment K, Regional System Planning Process**
    - Definition of Needs Assessment
    - Definition of Solution Studies
  - **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 on the RSP and has been evaluated or further defined and developed in a Solutions Study 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)

# Project Listing

Project Listing Column Definitions for:

- Reliability Projects
- Interconnection Projects
- Market Efficiency Upgrades
- Elective Projects
- Projects In-Service
- Cancelled 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.

- 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.

# 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.

**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%),

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

TCA-Approved Project (+/-10%)