# Regional System Plan

## Transmission Projects and Asset Condition

## October 2017 Update

*Planning Advisory Committee Meeting*

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# Highlights of the Project List Update

- **Major cost estimate changes that occurred between the June 2017 and October 2017 Project List**:
  (VT) **Connecticut River Valley** - Project cost decreased (cost reduction $9.8M)
  **Project 1614** - Decreased costs reflect competitive bids throughout the project and a reduction in the amount of contingency, from 50% to 10%, included in the estimates since the projects are better defined

- **(ME) MPRP –** project cost increased ($7.0M), $1,357.0 project costs moved to in-service as completed and 3 active projects (1413, 1441 and 1442) have project costs broken out. MPRP is expected to be completed by 8/18.

- **No New Projects**

- **16 Upgrades on the project list have been placed in-service since the June 2017 update**:
  (CT) SWCT- 2 projects in-service
  (CT) GHCC- 2 projects in-service
  (MA) Greater Boston - 4 projects in-service
  (MA) Pittsfield/Greenfield - 2 projects in-service
  (VT) Connecticut River Valley - 1 project in-service
  (ME) MPRP – 2 projects in-service
  (CT) Housatonic River Crossing 115 kV line rebuild
  (MA) Terminal upgrades at Robinson Ave Substation
  (MA) Reconductor Webster St. Tap #1

# October 2017 Changes

## No New Projects and Corresponding Need

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|

# October 2017 Changes, *cont.*

## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1560 | Close the normally open 115 kV 2T circuit breaker at Baldwin Substation<br>(Connecticut) SWCT | 1.6 | Resolves voltage and thermal violations |
| 1572 | Rebuild a portion of 1682 line from Wilton to Norwalk and upgrade Wilton Substation terminal equipment<br>(Connecticut) SWCT | 27.5 | Resolves thermal violations |
| 1588 | Add a breaker in series with breaker 5T at the Southington 345 kV switchyard<br>(Connecticut) GHCC | 1.8 | Eliminate impact of breaker failure contingency |
| 1591 | Loop the 1779 line between South Meadow and Bloomfield into the Rood Avenue substation and reconfigure the Rood Avenue substation<br>(Connecticut) GHCC | 10.7 | Resolves voltage and thermal violations |
| 1555 | Housatonic River Crossing 88006A & 89006B 115 kV line rebuild project - Housatonic River between Milford and Stratford CT<br>(Connecticut) | 19.8 | Address asset condition concerns for line sections in SWCT |

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

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1221 | Modify Northfield Mountain 16R substation and install a 345/115 kV autotransformer<br>(Massachusetts) Pittsfield/Greenfield Project | 94.0 | Resolves voltage and thermal violations |
| 1223 | Build a new 115 kV line from Northfield Mountain to the new Erving Switching Station<br>(Massachusetts) Pittsfield/Greenfield Project | Part of project ID# 1221<br>94.0 | Resolves voltage and thermal violations |
| 1549 | 115 kV Line reconductoring of M-139 between Billerica Tap and Pinehurst and reconductoring of N-140 between Tewksbury and Pinehurst and associated work at Tewksbury<br>(Massachusetts) Greater Boston - North | 20.0 | Increase load serving capability in Greater Boston |
| 1637 | Reconductor the National Grid portion of the M-139/211-503 and N-140/211-504 115 kV lines between Pinehurst – North Woburn tap<br>(Massachusetts) Greater Boston - North | Part of project ID# 1549<br>20.0 | Increase load serving capability in the Greater Boston Area |
| 1553 | Add a breaker in series with breaker 104 at Woburn 345 kV switchyard<br>(Massachusetts) Greater Boston – Western Suburbs | 7.0 | Address reliability concerns in Greater Boston Area |

# October 2017 Changes, *cont.*

## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1522 | Add a new 115 kV 36.7 MVAR capacitor bank at Sudbury Station<br>(Massachusetts) Greater Boston – Central | 1.8 | Address low voltage concerns |
| 1493 | Terminal upgrades at Robinson Ave Substation (V-148S)<br>(Massachusetts) New Highland Park Substation Project | Part of project ID# 1491<br>83.3 | New Substation to increase load serving capability in Rhode Island |
| 1634 | Reconductor Webster St Tap #1<br>(Massachusetts) | 2.8 | Resolves thermal overloads |
| 1614 | Rebuild K31 (Coolidge - Ascutney) 115 kV line<br>(Vermont) Connecticut River Valley | 32.0 | Resolve thermal overload |
| 1411 | Add a new 115 kV transmission line (255) between Larrabee Road and Middle Street (Lewiston Loop)<br>(Maine) Maine Power Reliability Program - (MPRP) | Part of MPRP<br>1,357.0 | Increase load serving capability in Maine |

# October 2017 Changes, *cont.*

## 16 Projects Placed In-Service and Corresponding Needs

| Project ID # | Transmission System Upgrades | Cost (in millions $) | Improvement/Need |
|---|---|---|---|
| 1443 | Add a new Middle Street 115/34/12 kV Substation interconnecting lines 255 and 256 between Lewiston Lower and new Larrabee Road (Lewiston Loop) (Maine) Maine Power Reliability Program - (MPRP) | Part of MPRP 1,357.0 | Increase load serving capability in Maine |

# October 2017 Changes, *cont.*

## Cost Estimate Comparisons of Reliability Projects June 2017 vs. October 2017 Update (1)

| | As of Jun 2017 Plan Update (in millions $) | As of Oct 2017 Plan update (in millions $) | Change in Plan Estimate (in millions $) |
|---|---|---|---|
| **MAJOR PROJECTS** | | | |
| Maine Power Reliability Program (MPRP) | 1459 | 1466 | 7 |
| 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 | 309 | 309 | 0 |
| Pittsfield/Greenfield Project | 191 | 191 | 0 |
| Greater Boston - North, South, Central, Western Suburbs | 827 | 827 | 0 |
| New Hampshire Solution - Southern, Central, Seacoast, Northern | 328 | 328 | 0 |
| Vermont Solution - Southeastern, Connecticut River | 96 | 86 | -10 |
| Southwest Connecticut (SWCT) | 415 | 419 | 4 |
| SUBTOTAL (2) | **5543** | **5544** | **1** |
| **OTHER PROJECTS** | 6777 | 6781 | 4 |
| **NEW PROJECTS** | | 0 | 0 |
| **PROJECTS WHOSE COST ESTIMATES WERE PREVIOUSLY REPORTED AS TO BE DETERMINED (TBD)** | | | |
| TOTAL (2) | **12320** | **12326** | **6** |
| Minus 'in-service' | -8426 | -10002 | |
| **Aggregate estimate of active projects in the Plan (2)** | **3894** | **2324** | |

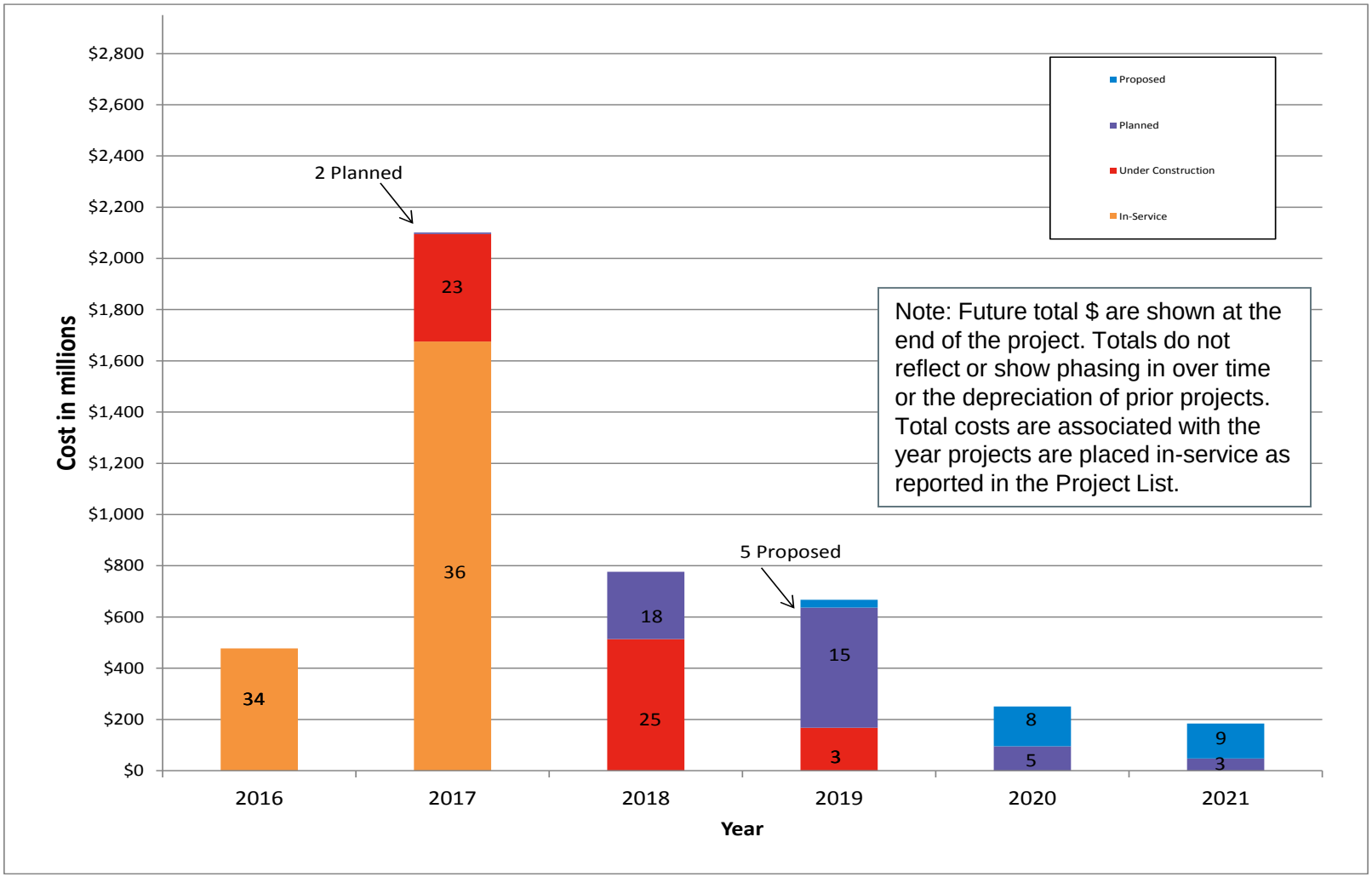
(1) Transmission Owners provided all estimated costs, which may not meet the guidelines described in Planning Procedure 4, Attachment D

(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.

# October 2017 Changes, *cont.*

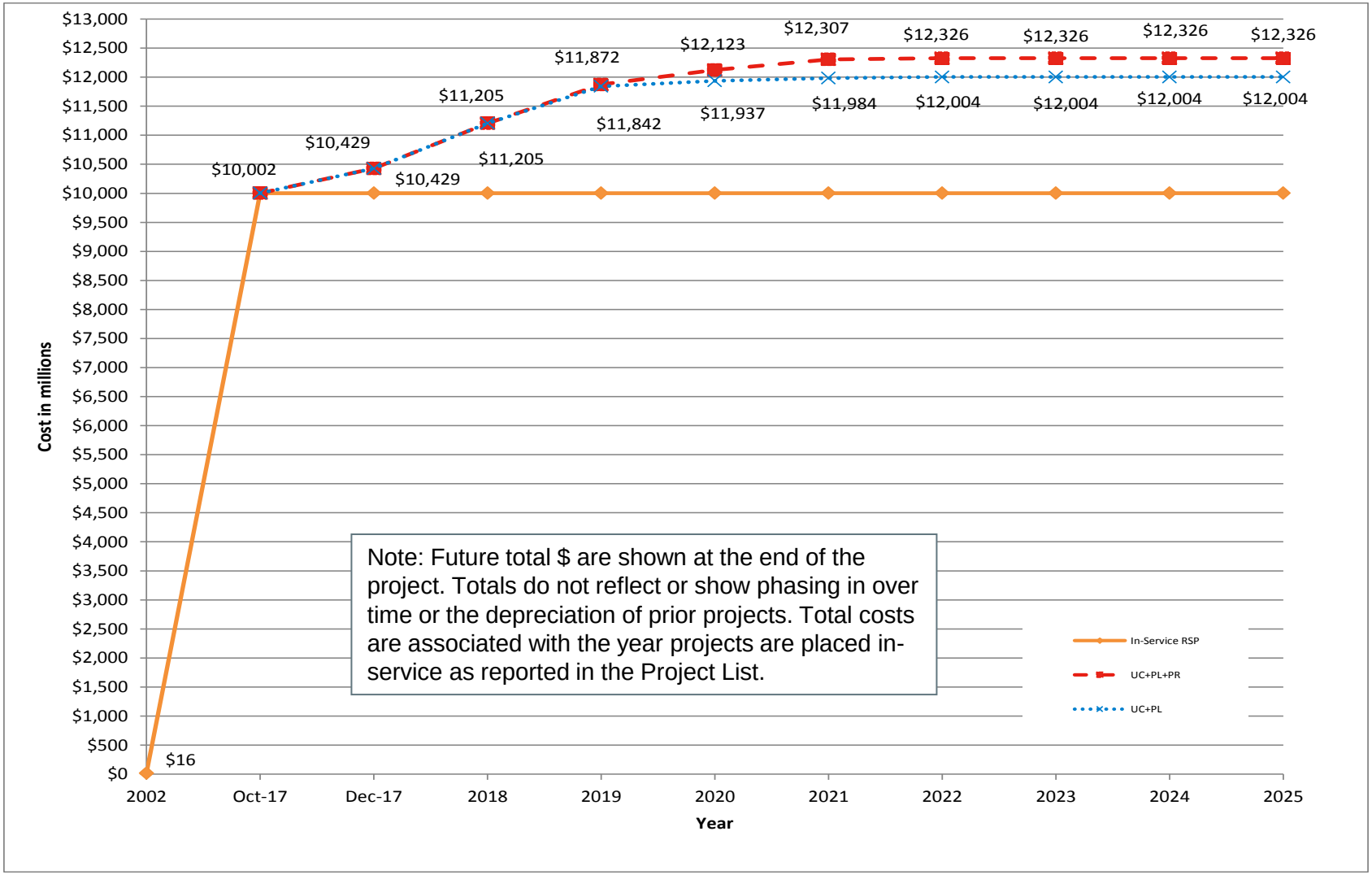
## Investment of New England Transmission Reliability Projects by Status through 2021




Note: Numbers shown represent project quantities

# October 2017 Changes, *cont.*

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




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

# October 2017 Changes, *cont.*

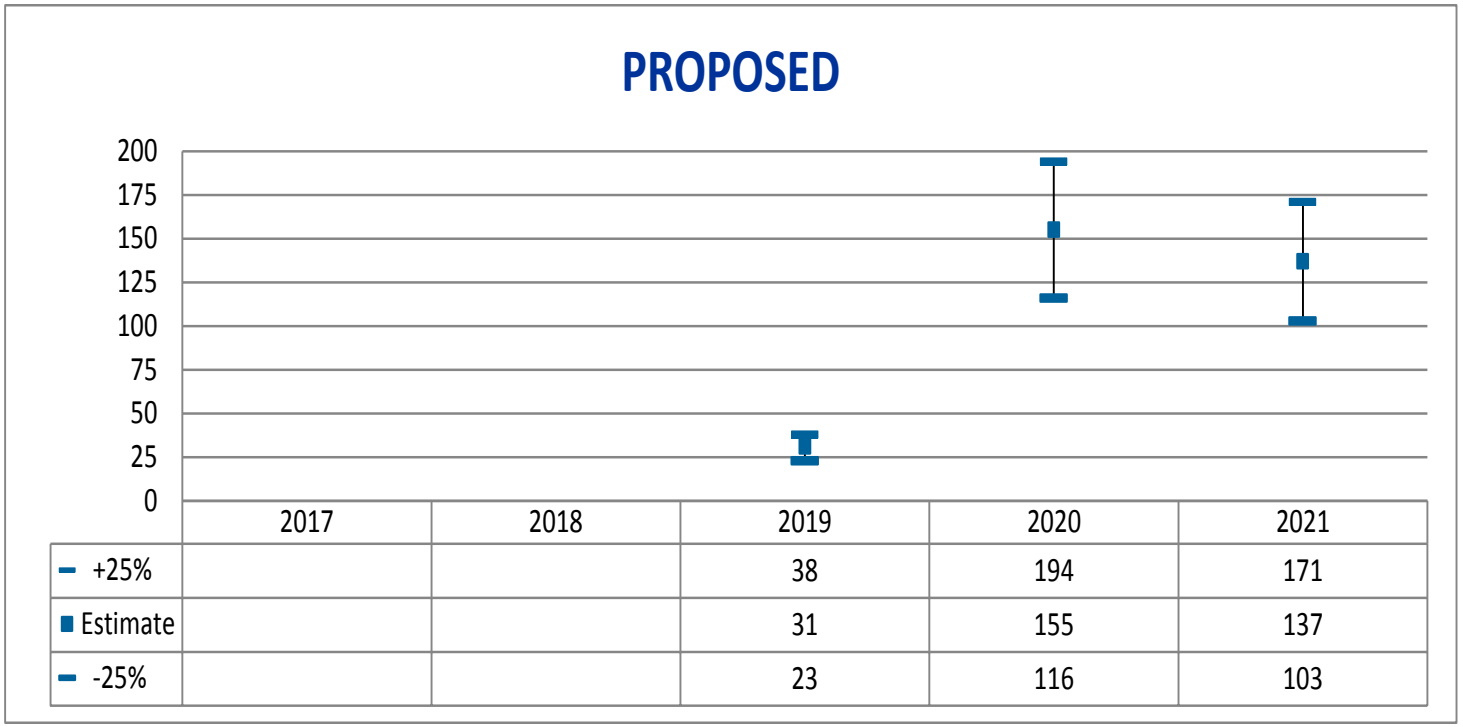
Reliability Project Counts and Aggregated Cost Estimates by Project Stage with Applied Accuracy Ranges (1)

| Project Stage (Status) | Component / Project / Plan Count (2) | Estimate Range Minimum | Estimate Range Maximum | Estimated Costs ($millions) | Range Minimum ($millions) | Range Maximum ($millions) |
|---|---|---|---|---|---|---|
| Proposed | 22 | -25% | 25% (3) | 322 | 242 | 403 |
| Planned | 47 | -25% | 25% | 900 | 675 | 1125 |
| Under Construction | 51 | -10% | 10% | 1101 | 991 | 1212 |
| **Total Plan (excluding Concept)** | **120** | | | (5) **2324** | **1908** | **2739** |
| Concept | 0 | | | (4) 0 | | |
| In-Service | 16 | -10% | 10% | 1576 | 1418 | 1734 |
| Cancelled | 1 | | | 75 | | |

(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.

# October 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $

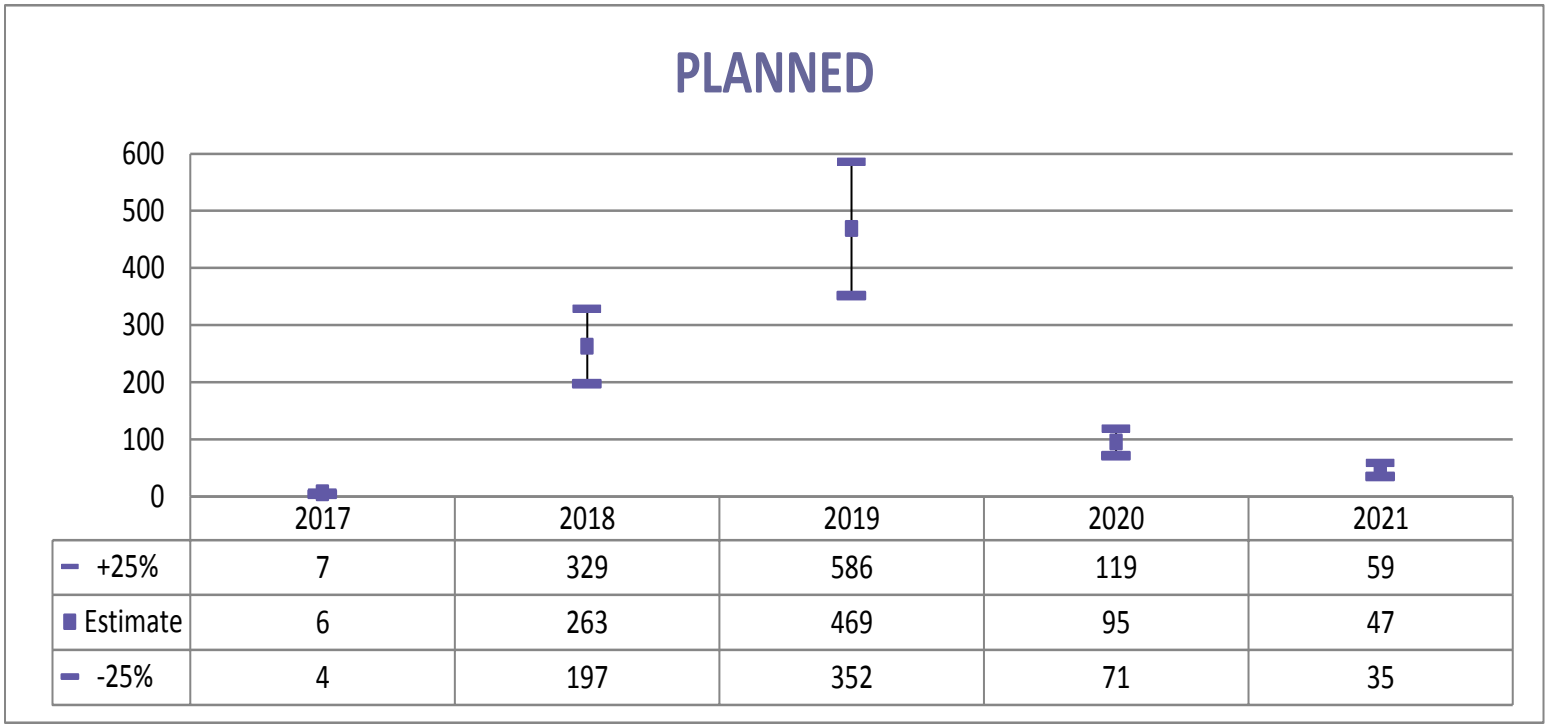



| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +25% | | | 38 | 194 | 171 |
| Estimate | | | 31 | 155 | 137 |
| -25% | | | 23 | 116 | 103 |

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.

# October 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $

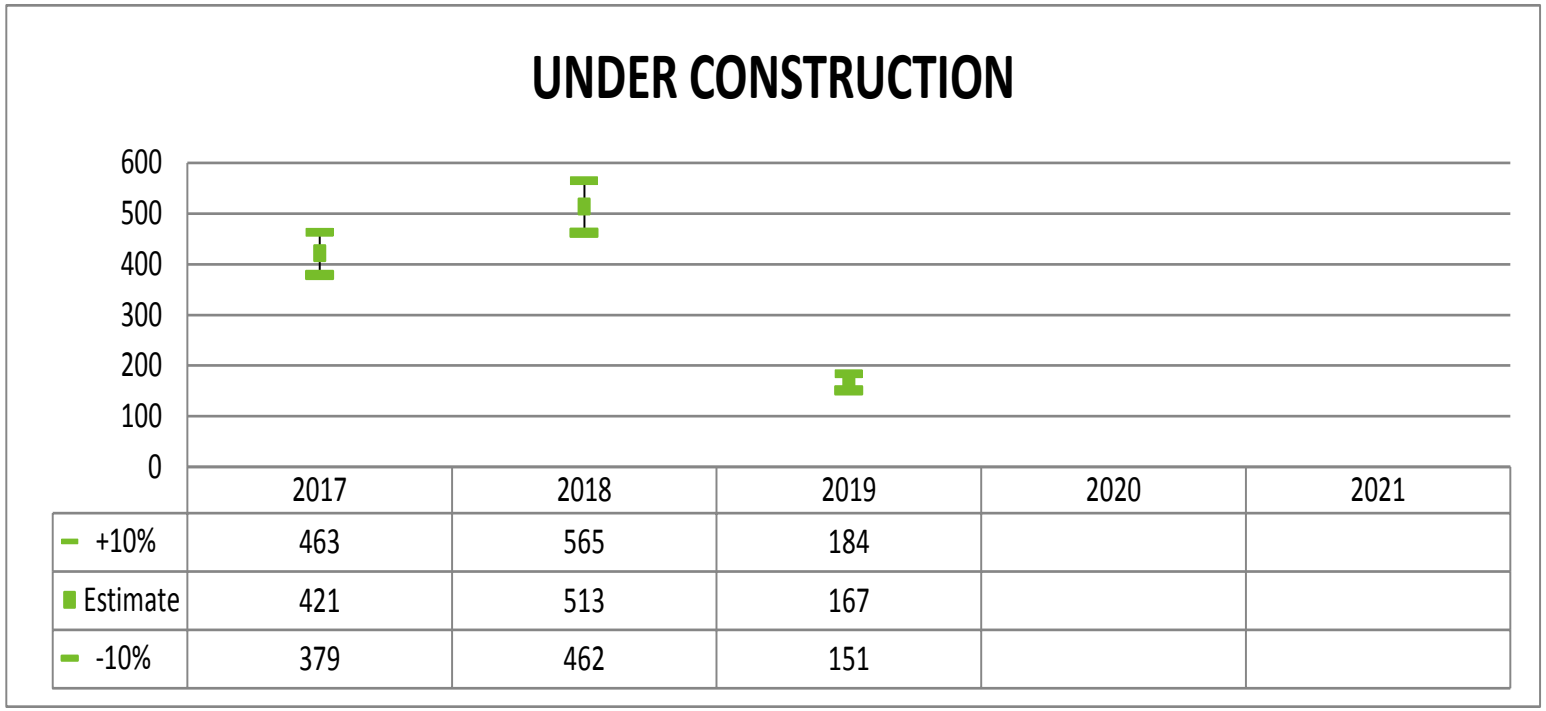



| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +25% | 7 | 329 | 586 | 119 | 59 |
| Estimate | 6 | 263 | 469 | 95 | 47 |
| -25% | 4 | 197 | 352 | 71 | 35 |

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.

# October 2017 Changes, *cont.*

Project Cost Estimate Tolerances by Status and Year in Millions $




| | 2017 | 2018 | 2019 | 2020 | 2021 |
|---|---|---|---|---|---|
| +10% | 463 | 565 | 184 | | |
| Estimate | 421 | 513 | 167 | | |
| -10% | 379 | 462 | 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, 7/17/17 | 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 | Approved 5/17 | Not Submitted | Project completion 2017-2021 |

# 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 | TCA 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 |

# October 2017 Asset Condition
## 12 New Projects

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 41 | Scotia Street Substation Project (Massachusetts) | 21.1 |
| 42 | Brighton #329 115 kV Control House (Massachusetts) | 21.0 |
| 43 | K Street #385 115 kV Control House (Massachusetts) | 18.4 |
| 44 | Mystic #250 115 kV Control House (Massachusetts) | 23.9 |
| 45 | 345 kV 354 Line Structure Replacements (Massachusetts) | 10.2 |

# October 2017 Asset Condition
## 12 New Projects

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 46 | Southern CT Loop Line Structure Replacements - 1261/1598 115 kV (Connecticut) | 7.6 |
| 47 | Southern CT Loop Line Structure Replacements - 1342 115 kV (Connecticut) | 30.3 |
| 48 | Southern CT Loop Line Structure Replacements - 1508 115 kV (Connecticut) | 16.6 |
| 49 | Southern CT Loop Line Structure Replacements - 1655 115 kV (Connecticut) | 14.8 |
| 50 | Replace the Card 11F-5X autotransformer. Foundation and bus upgrades to accommodate new transformer specifications (Connecticut) | 8.6 |

# October 2017 Asset Condition

## 12 New Projects

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 51 | Replace the Deerfield TB-14 autotransformer and bus upgrades to accommodate new transformer specifications (New Hampshire) | 7.7 |
| 52 | Replace the Littleton TB-41 autotransformer and bus upgrades to accommodate new transformer specifications (New Hampshire) | 6.2 |

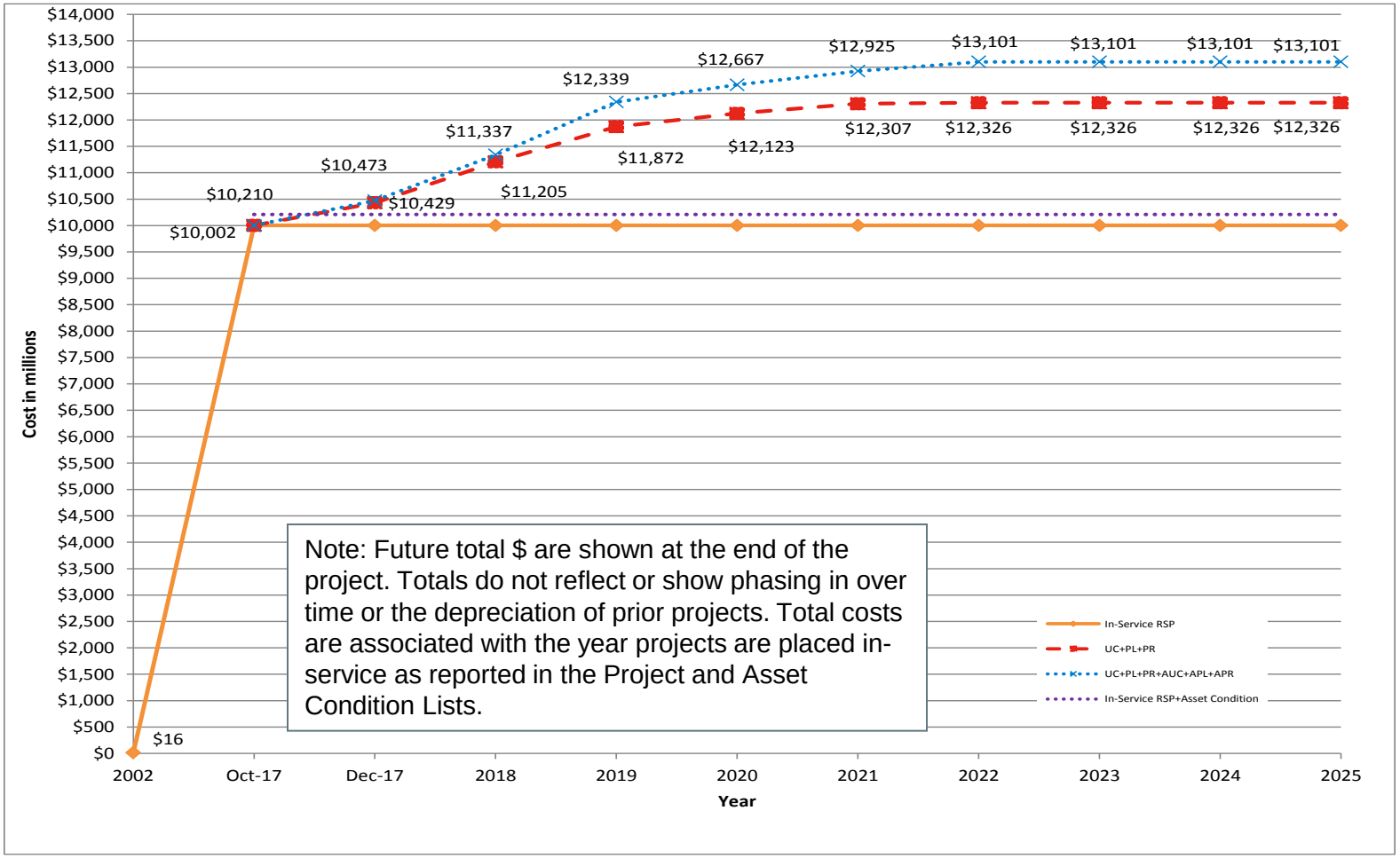
# October 2017 Asset Condition, *cont.*

## 4 Projects Placed In-Service

| Project ID # | Transmission System Upgrades | Cost (in millions $) |
|---|---|---|
| 35 | Scobie Pond TB30 345/115 kV transformer replacement project (New Hampshire) | 7.8 |
| 29 | 1620/1975 line structure replacement (Connecticut) | 11.1 |
| 41 | Scotia Street Substation Project (Massachusetts) | 21.1 |
| 12 | Doreen-Oswald Jct. 1211 115 kV Line Structure Replacement (Massachusetts) | 11.5 |

# October 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%)