

Regional System Plan Transmission Projects March 2015 Update

Planning Advisory Committee Meeting

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Highlights

- Major cost estimate changes that occurred between the October 2014 and March 2015 project list:
 - (ME) MPRP MPRP cost modifications are due to increases in contractor pricing and a better defined scope for the Lewiston Loop. (increased \$16.0M)
 - (NH) New Hampshire Solution Costs modified due changes in scope, construction sequencing, lower unit bid costs for construction and permitting changes. (decreased by \$15.0M)
 - (CT) SWCT Cost modified due to materials and construction cost reductions (for Glenbrook Southend Cable and Milvon Devon Tie). (decreased by \$11.0M)
 - (MA) Greater Boston Cost modified as a part of the refinement of the Greater Boston preferred solution, upgrades were added that were discussed in the November 2014 PAC meeting. These cost updates have now been made to the March 2015 Project listing. (increased \$37.0M)
- Primary equipment owners Northeast Utilities and Northeast Utilities-NSTAR are now reflected as Eversource
 - 10 new projects were added to the Project List since the October 2014 update
 - (MA) Greater Boston Project 6 new projects were added during this period
 - Upgrade Methuen 115 kV station to BPS standards
 - Reconductor the NGRID portion of the M-139/211-503 and N-140/211-504 115 kV lines between Pinehurst-North Woburn tap
 - Reconductor the Eversource portion of the M-139/211-503 and N-140/211-504 115 kV lines between Pinehurst-North Woburn tap
 - Upgrade the Edgar 115 kV station to BPS standards
 - Upgrade the Dover 115 kV station to BPS standards
 - Upgrade the Medway 115 kV station to BPS standards
 - (MA) Reconductor Webster St. Tap #1
 - (MA) Rebuild Somerset Substation
 - (MA) Installation of two, 20 MVAR shunt reactors at Sudbury 115 kV Substation
 - (MA) Reconductor the 345 kV underground cable (372) between Mystic and Kingston substations

MVAR - megavolt-amperes reactive BPS – Bulk Power System

Highlights, cont.

- 34 upgrades on the project list have been placed in-service since the October 2014 update
 - (ME) MPRP 9 projects were placed in-service during this period:
 - Separation of 345 kV Double Circuit Tower of lines 375 and 377 between Surowiec and Maine Yankee at Kennebec River Crossing
 - 6 projects involving re-rating or rebuilding of 115 kV lines
 - Re-rate of the 345 kV line 378 between Maine Yankee substation and Mason substation
 - Modify existing control settings at Mason 115 kV substation to switch out Mason 115 kV capacitors for 115 kV voltage above 1.05pu
 - (CT) SWCT 3 projects were completed:
 - 1.8 mile 115 kV cable between Glenbrook and Southend
 - Peguonnock 115 kV disconnect switch and bus upgrade
 - Mill River 115 kV fault duty and TRV mitigation
 - (CT) NEEWS (Interstate Reliability Project) 2 projects were placed in-service:
 - Substation expansions at Card and Lake Road
 - (NH) New Hampshire Solution 10 projects were completed:
 - Two projects associated with the addition of a 2nd 230/115 kV autotransformer at Littleton
 - Three projects involving the upgrade/rebuild of 115 kV facilities
 - · Four projects involving substation expansion/reconfiguration at Merrimack, Scobie Pond and Three Rivers
 - Oak Hill Substation Loop in 115 kV line V182, Garvins Webster, add (6) 115 kV circuit breakers
 - (MA) Central/Western MA upgrades 3 projects were placed in-service:
 - Addition of a 69 kV breaker at Searsburg
 - Two projects related to the new 115 kV substation in Hampden and the looping in of the 115 kV line from Ludlow to Scitico into the new West Hampden substation
 - (CT) Asset Replacement replace 115 kV 1990 line lattice structures Frost Bridge Stevenson
 - 6 other projects in MA were placed into service:
 - 1 project each that were smaller portions of NEEWS or the Greater Boston solution
 - 1 asset condition based project on the Y177 line
 - Three projects related to substation upgrades

March 2015 Changes

10 New Projects and Corresponding Need

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1634	Reconductor Webster St Tap #1 the A127 line (Massachusetts)	2.4	Resolves thermal overloads
1635	Rebuild the Somerset Substation to resolve asset condition issues (Massachusetts) Somerset Asset Condition	45.0	Resolves asset condition issues
1636	Upgrade the West Methuen 115 kV station to BPS standards (Massachusetts) Greater Boston - Stability	8.9	Resolve stability concerns in the Greater Boston area
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 (Massachusetts) Greater Boston - North	1.56	Increase load serving capability in the Greater Boston area
1638	Installation of two, 20 MVAR shunt reactors at Sudbury 115 kV Substation (Massachusetts)	4.8	Resolves high voltage violations at light load conditions

Does not include concept projects

10 New Projects and Corresponding Need

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1639	Reconductor the 345 kV underground cable (372) between Mystic and Kingston substations (Massachusetts)	15.1	Resolve asset condition issues
1640	Reconductor the Eversource portion of the M-139/211-503 and N-140/211-504 115 kV lines between Pinehurst – North Woburn tap (Massachusetts) Greater Boston - North	4.7	Increase load serving capability in the Greater Boston area
1641	Upgrade the Edgar 115 kV station to BPS standards (Massachusetts) Greater Boston - Stability	9.6	Resolve stability concerns in the Greater Boston area
1642	Upgrade the Dover 115 kV station to BPS standards (Massachusetts) Greater Boston - Stability	4.8	Resolve stability concerns in the Greater Boston area
1644	Upgrade the Medway 115 kV station to BPS standards (Massachusetts) Greater Boston - Stability	6.9	Resolve stability concerns in the Greater Boston area

Does not include concept projects

34 Projects Placed In-Service and Corresponding Needs

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1085	Card 11F 345 kV Substation expansion (Connecticut) NEEWS (Interstate Reliability Project)	Part of RSP 802 (\$218.0)	Improve East – West, West – East transfer capability
810	Lake Road 27E 345 kV Substation expansion (Connecticut) NEEWS (Interstate Reliability Project)	Part of RSP 802 (\$218.0)	Improve East-West, West-East and Rhode Island import transfer capability
1228	Install new 1.8 mile, 115 kV cable between Glenbrook and Southend Substation and associated substation work at both stations (Connecticut) SWCT	37.0	Improve load serving capability in Glenbrook
1348	Pequonnock 115 kV disconnect switch & bus upgrade (Pequonnock 115 kV Fault Duty Mitigation Phase I) (Connecticut) SWCT	6.046	Eliminate limited short circuit margin concern at Pequonnock
1619	Mill River 115 kV Fault Duty & TRV Mitigation (Connecticut) SWCT	1.741	Eliminate voltage violations under contingency conditions

34 Projects Placed In-Service and Corresponding Needs

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1229	Replace 115 kV 1990 line lattice structures Frost Bridge to Stevenson (Connecticut) Asset Replacement	67.8	Address asset condition issue and increase load serving capability in Naugatuck Valley
1338	Reconductor of the 115 kV line 211-508 from Woburn-Burlington (Massachusetts) Greater Boston - Western Suburbs	4.8	Resolve thermal overloads
929	Searsburg - install in-line 69 kV breaker (Massachusetts) Central/Western Massachusetts Upgrades - Group 6 - Miscellaneous Western MA Projects	3.37	Increase load serving capability in Western MA
948	Hampden - build new 115 kV substation at 1515/O-15S intersection (4 breaker ring) (Massachusetts) Central/Western Massachusetts Upgrades - Group 4 - E. Longmeadow Projects	16.5	Increase load serving capability in Western MA
1217	1515 Line work and substation work at Ludlow (MA) associated with the new Hampden (MA) substation project (NGRID) (Massachusetts) Central/Western Massachusetts Upgrades - Group 4 - E. Longmeadow Projects	3.14	Increase load serving capability in Western MA

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1202	Rebuild 1.2 mile length of line 336 with 2-900 ACSS conductor and replace 5, 345 kV 2000 amp disconnect switches with 3000 amp switches at W. Medway station (Massachusetts) NEEWS	2.4	Increase load serving capability in Eastern New England
1394	Add 345 kV breaker at Carver Station to double existing 862 breaker (Massachusetts)	1.5	Eliminate impact of breaker failure contingency
1504	Install 115 kV breaker and tap lines at E. Main St Substation (Massachusetts)	4.3	Addition of new distribution transformer to address load growth
1490	Y-177 Harriman - Montague Asset Condition Replacement (ACR) (Massachusetts)	6.5	Resolves asset condition issues
1638	Installation of two, 20 MVAR shunt reactors at Sudbury 115 kV Substation (Massachusetts)	4.8	Resolves high voltage violations at light load conditions

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1276	Littleton Substation - Add a second 230/115 kV autotransformer and associated 115 kV substation work (New Hampshire) Northern New Hampshire Solution	9.7	Increase load serving capability in Northern New Hampshire
1263	New C-203 230 kV line tap to Littleton NH Substation associated with 2nd 230/115 kV auto project (New Hampshire) Northern New Hampshire Solution	1.99	Increase load serving capability in Northern New Hampshire
1302	Scobie Pond Substation- Add: (1) 115 kV circuit breaker (associated with new circuit, Scobie Pond-Huse Rd - W144) (1) 345 kV circuit breaker in series with circuit breaker 802 (802S) (New Hampshire) Southern New Hampshire Solution	5.6	Increase load serving capability in Southern New Hampshire
1309	Rebuild 115 kV line D118, Deerfield-Pine Hill (New Hampshire) Southern New Hampshire Solution	15.7	Increase load serving capability in Southern New Hampshire
1312	Upgrade Merrimack 230/115 kV substation and relocate existing capacitor banks to Bus 1 and Bus 3 (New Hampshire) Southern New Hampshire Solution	15.5	Increase load serving capability at the Merrimack Station

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1314	Oak Hill Substation - Loop in 115 kV line V182, Garvins- Webster, add (6) 115 kV circuit breakers. (New Hampshire) Southern New Hampshire Solution	20.6	Increase load serving capability in Southern New Hampshire
1321	Scobie Pond Substation-Add: (1) 115 kV circuit breaker (associated with new circuit, Scobie Pond-Chester) (New Hampshire) Southern New Hampshire Solution	2.4	Increase load serving capability in Southern New Hampshire
1322	Three Rivers Substation-Add: (1) 115 kV circuit breaker (New Hampshire) Southern New Hampshire Solution	1.3	Increase load serving capability in Seacoast New Hampshire
1324	Upgrade 115 kV line H141, Chester-Great Bay (New Hampshire) Southern New Hampshire Solution	6.0	Increase load serving capability in Southern New Hampshire
1325	Upgrade 115 kV line R193, Scobie Pond-Kingston Tap (New Hampshire) Southern New Hampshire Solution	2.0	Increase load serving capability in Southern New Hampshire

34 Projects Placed In-Service and Corresponding Needs

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1415	Rebuild a portion of the 115 kV transmission line (257 (formerly 67)) between Coopers Mills and Albion Rd (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1416	Rebuild a portion of the 115 kV transmission line (258 (formerly 84)) between Coopers Mills and Albion Rd (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1417	Rebuild a portion of the 115 kV transmission line (60) between Coopers Mills and Bowman Street (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1418	Rebuild a portion of the 115 kV transmission line (88) between Coopers Mills and Augusta East Side (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1445	Separation of 345 kV Double Circuit Tower of lines 375 and 377 between Surowiec and Maine Yankee at Kennebec River Crossing (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine

Project ID#	Transmission System Upgrades	Cost (in millions)	Improvement/Need
1457	Re-rate of the 115 kV Line 61A between Hotel Road substation and 61A Tap (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1458	Re-rate of the 115 kV Line 88 between Coopers Mills substation and Augusta East Side substation (Maine) Maine Power Reliability Program (MPRP)		Increase load serving capability in Maine
1471	Modify existing control settings at existing Mason 115 kV substation to switch out Mason 115 kV capacitors for 115 kV voltage above 1.05pu (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine
1456	Re-rate of the 345 kV Line 378 between Maine Yankee substation and Mason substation (Maine) Maine Power Reliability Program (MPRP)	Part of RSP 1402 (\$1,378.5)	Increase load serving capability in Maine

Cost Estimate Comparisons of Reliability Projects October 2014 vs. March 2015 Update (1)

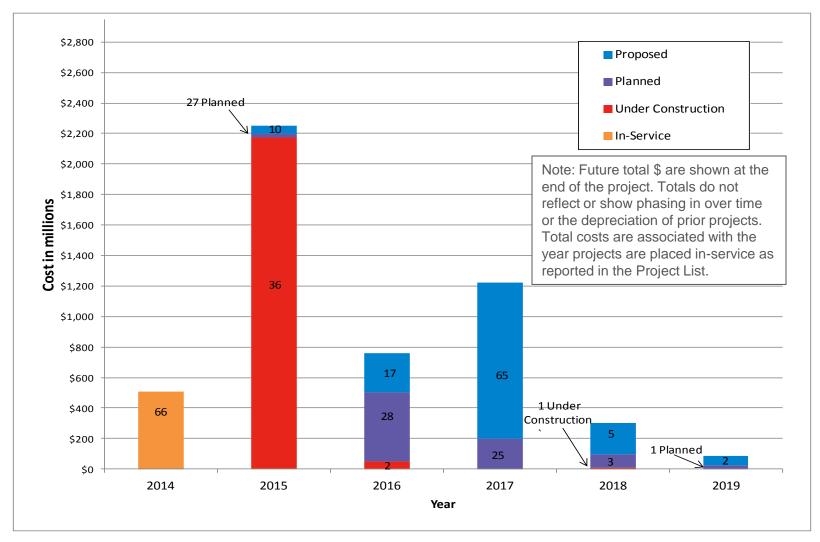
	As of October 2014 Plan Update (in millions \$)	As of March 2015 Plan Update (in millions \$)	Change in Plan Estimate (in millions \$)
MAJOR PROJECTS			
Maine Power Reliability Program (MPRP)	1453	1469	16
Greater Hartford & Central Connecticut (GHCC)	352	352	0
Long Term Lower SEMA Upgrades	114	114	0
New England East - West Solution (NEEWS)	1586	1586	0
NEEWS (Greater Springfield Reliability Project) \$676.0			
NEEWS (Rhode Island Reliability Project) \$314.6			
NEEWS (Interstate Reliability Project) \$535.8 NEEWS \$59.6			
Greater Rhode Island Transmission Reinforcements (including Advanced NEEWS)	151	151	0
Pittsfield/Greenfield Project	147	147	0
Greater Boston - North, South, Central, Western Suburbs	695	732	37
New Hampshire Solution - Southern, Central, Seacoast, Northern	333	318	-15
Vermont Solution - Southeastern, Connecticut River	134	134	0
Southwest Connecticut (SWCT)	442	431	-11
SUBTOTAL ⁽²⁾	5407	5434	27
OTHER PROJECTS	6151	6172	21
NEW PROJECTS		63	63
PROJECTS WHOSE COST ESTIMATES WERE PREVIOUSLY REPORTED AS TO BE DETERMINED (TBD)		0	0
(188)			
TOTAL (2)	11558	11669	111
Minus 'concept'	0	0	
Minus 'in-service'	-6794	-7035	
Aggregate estimate of active projects in the Plan (2)	4764	4634	

⁽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

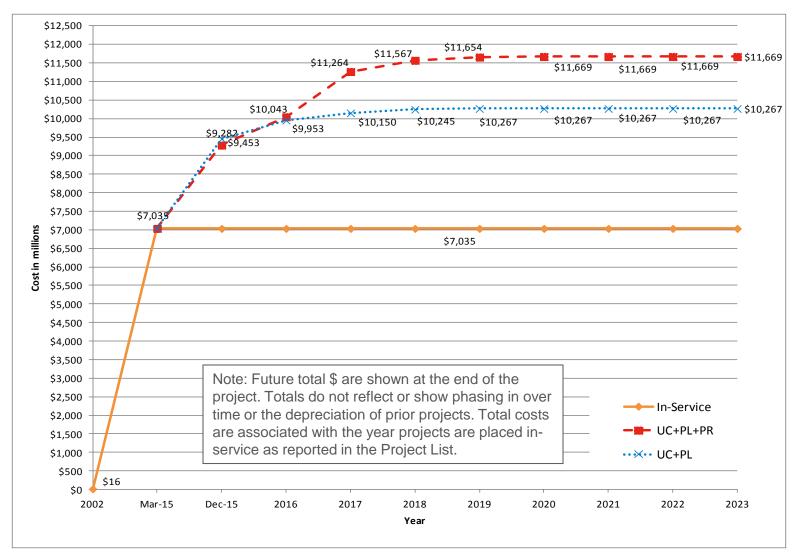
⁽³⁾ The cost estimates for projects in the "Major Projects" category are moved to the "Other Projects" category once they are fully completed.

Investment of New England Transmission Reliability Projects by Status through 2019



Note: Numbers shown represent project quantities

Cumulative Investment of New England Transmission Reliability Projects through 2023



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

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

	Component /			E	Estimated	Rai	nge
Project Stage	Project / Plan	Estimat	e Range		Costs	Minimum	Maximum
(Status)	Count (2)	Minimum	Maximum	(\$millions)	s) (\$millions)	
Proposed	98	-25%	25% ⁽³⁾		1626	1219	2032
Planned	72	-25%	25%		786	590	983
Under Construction	50	-10%	10%		2222	2000	2444
Total Plan (excluding Concept)	220			(5)	4634	3909	5459
Concept	22			(4)	0		
In-Service	34	-10%	10%		241	217	265
Cancelled	0				0		

⁽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

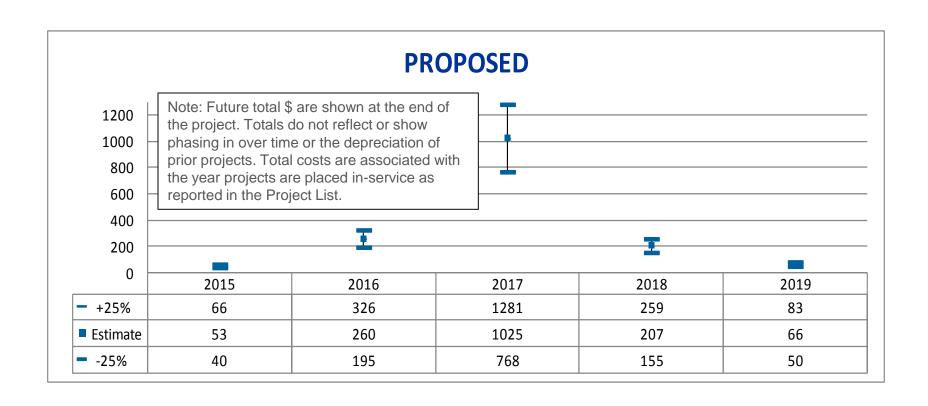
⁽³⁾ All estimates may not yet be at this level of accuracy; many estimates may be -25%/+50%

⁽⁴⁾ Not included here are the costs of 22 reliability projects for which no estimates have been provided.

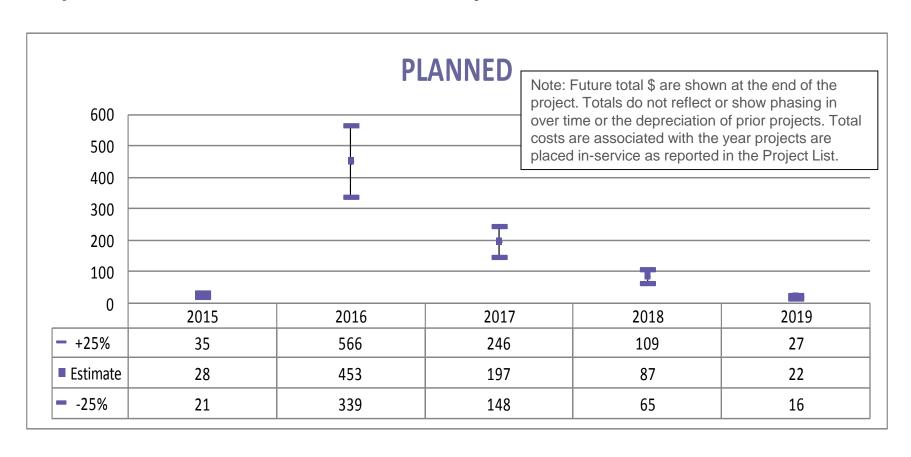
Estimates for these projects are noted as TBD in the Project Listing and are only Concept Projects.

⁽⁵⁾ May not add up due to rounding.

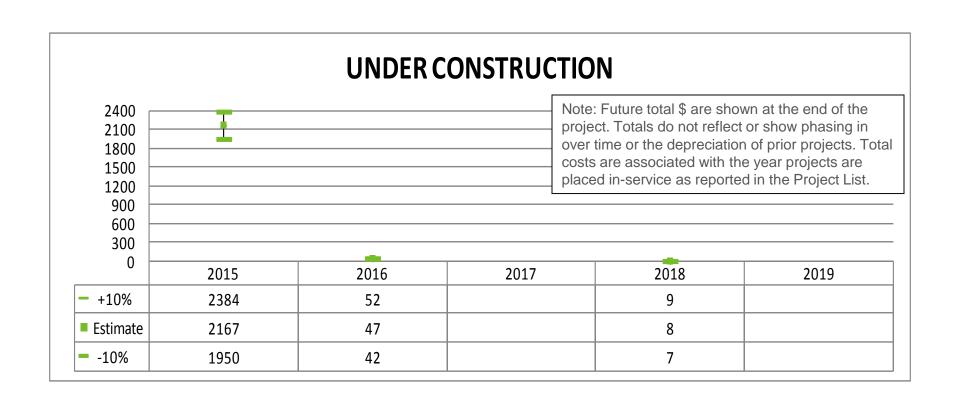
Project Cost Estimate Tolerances by Status and Year in Millions



Project Cost Estimate Tolerances by Status and Year in Millions



Project Cost Estimate Tolerances by Status and Year in Millions



Status of Major Transmission Projects

	PPA	TCA	Construction
Auburn Area Transmission System Upgrades	Approved 1/08, 2/10	Approved 10/13, 2/14	Project completion 2013-2015
Pittsfield/Greenfield Project	Approved 12/12	Not Submitted	Project completion 2014-2016
Maine Power Reliability Program (MPRP)	Approved 7/08, 2/09, 11/10	Approved 1/29/10	Project completion 2014-2017
Vermont Solution – Connecticut River Valley	Approved 2/15	Not Submitted	Project completion 2017
Southwest Connecticut (SWCT)	Submitted	Not Submitted	Project completion 2013-2019

Status of Major Transmission Projects, cont.

	PPA	TCA	Construction
Central/Western MA Reinforcements	Approved 12/07, 3/11	Group 1 2/29/2012	Project completion 2009-2017
New England East-West Solution (NEEWS)	Approved 9/08, 5/12	Greater Springfield Reliability Project (GSRP) Approved 2/24/2014	Rhode Island Reliability Project and GSRP are completed; Projected completion of other components 2013-2015
Greater Boston – North, South, Central and Suburbs	Small portions of the Project have PPA approval	Not Submitted	Project completion 2013-2020
New Hampshire Solution – Western, Northern, Southern and Seacoast	3/13	Not Submitted	Project completion 2013-2016
Greater Hartford & Central Connecticut (GHCC)	Submitted	Not Submitted	Project completion 2017

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
- Merchant 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: Conceptual or Proposed

Part 2 – These projects are Generator Interconnection Upgrades.

2a: Proposed (I.3.9 approval but without Generator Interconnection Agreement), Planned (I.3.9 approval with Generator Interconnection Agreement), or Under Construction

2b: Conceptual or Proposed

Part 3 – These projects are Market Efficiency Upgrades.

3a: Planned or Under Construction

3b: Conceptual or Proposed

Part 4,5 – 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.

4,5a: Planned or Under Construction

4,5b: Conceptual 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 (+/-25%),

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

TCA-Approved Project (+/-10%)