

Greater Boston Cost Comparison

NHT Analysis using New England Comparables

January 2015

Executive summary

Key Takeaways from Comp Analysis

- **There is a demonstrated history of transmission project costs exceeding estimates in New England**
 - NHT calculated actuals were 79% higher than estimates *on average* across \$3.9B of projects
- **NHT's analysis of the Greater Boston AC Plan cost estimates shows that they are far below actual costs of comparable projects**
 - In two of three cases, the Greater Boston estimates are below *any* prior project costs for comparable projects
 - NU and Ngrid have not explained why the Greater Boston project would be less costly and easier to permit than average
- **In addition, NHT found that the Greater Boston AC Plan expected in-service dates are also far below averages**
 - The Brattle Group analysis shows a delay to put a project in service could cost customers hundreds of millions of dollars per year

NHT assembled cost and schedule information on NU and Ngrid transmission project comparables

Methodology Summary

- **NHT evaluated \$3.9B of major reliability transmission projects in New England since 2002**
 - 11 Major Projects across 4 states spanning 13 years
 - Most are in-service, but 2 are under construction
- **NHT's analysis includes NU's and Ngrid's complete record of 345 kV overhead and 115/345 kV underground¹**
 - This is their resume in New England and NHT believes highly relevant to the Greater Boston debate
- **NHT reviewed actual cost and schedule information from TCA filings, ISO presentations and state regulatory filings**
 - These numbers are reported from NU or Ngrid themselves and are publicly available²
 - NHT assembled the data in a detailed spreadsheet with links to all sources and full breakdowns of costs

Note: 1 – Based on review of TCA index and RSP project listing. 2 - Some filings were labeled as Critical Energy Infrastructure Information (CEII), but the cost and schedule detail portions of those filings are not CEII.

NHT evaluated \$3.9B of major projects that were constructed over the past decade

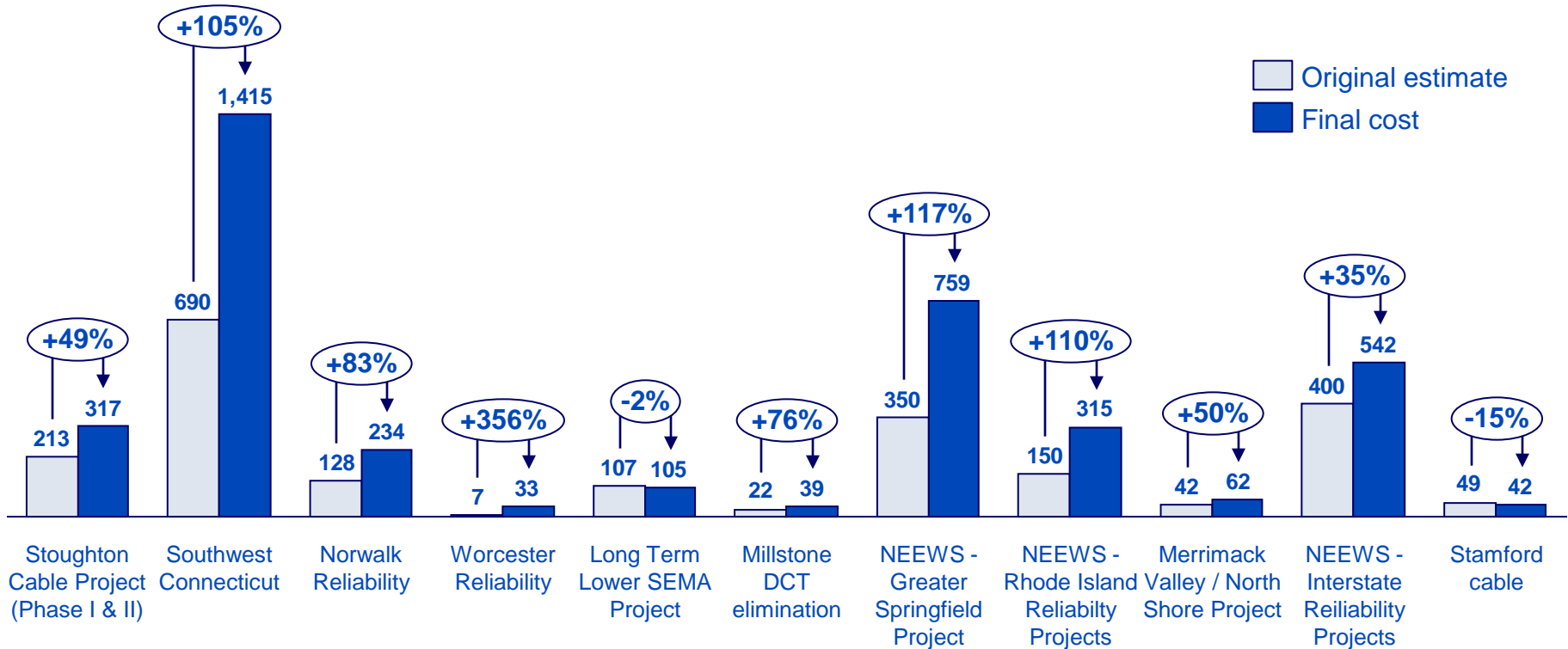
Major Project Summary

Major Project	Comparable Element (s)	Date approved ¹	Cost (\$MM)	Duration (Yrs.) ²
Stoughton	Nstar 345 kV cables	2004	\$316.8	5.0
SW CT	Middletown-Norwalk projects	2002	\$1,414.9	6.9
Norwalk Reliability	Glenbrook cables	2005	\$234.2	3.5
Worcester Reliability	Bloom. – Vernon Hill cable	2006	\$33.4	7.0
Lower SEMA	Carver – Bourne 345 kV line	2008	\$104.6	5.6
Millstone DCT	New 345 kV from DCT lines	2010	\$38.7	2.6
NEEWS – GSRP	345 kV line and substations	2006	\$759.0	6.9
NEEWS – RIRP	Kent – W. Farnum 345 kV	2006	\$314.6	6.3
Salem cables	Salem 115 kV cables	2013	\$62.4	2.5
NEEWS - IRP	New 345 kV lines and subs	2006	\$541.8	9.0
Stamford Reliability	New 115 kV cable	2012	\$41.5	3.6

Note: 1 – Proposed Plan Application (PPA) approval date is date that a project sponsor receives approval from ISO-NE to proceed in accordance with Section I.3.9 of the tariff. 2 - Duration from time ISO-NE selected project as preferred solution to in-service date

The majority of projects analyzed by NHT had actual costs that exceeded their initial estimates

Major Project Cost Overrun Summary (\$ MM)

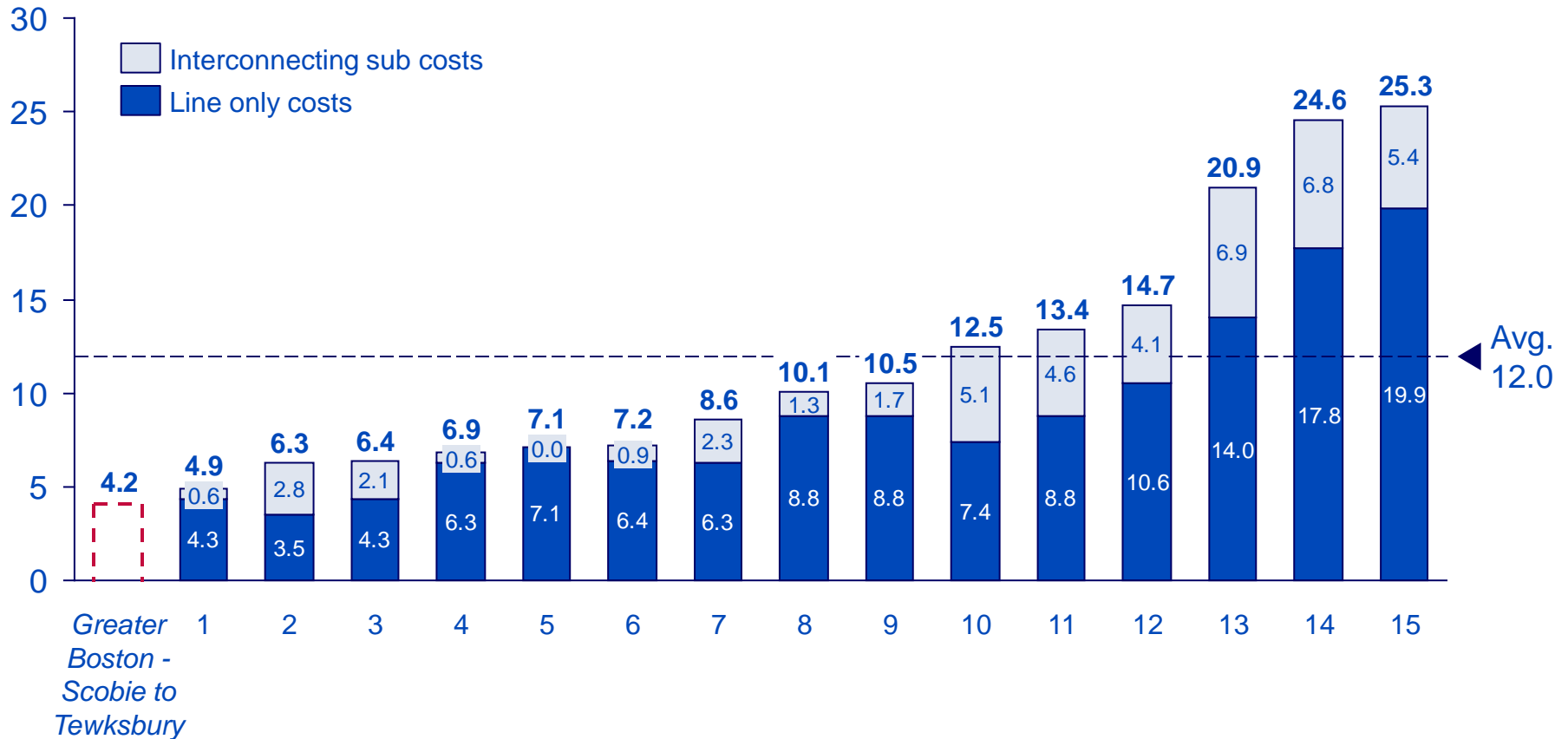


The \$3.9B in Major Projects NHT evaluated were originally estimated to cost \$2.2B – a 79% average increase

The estimates for Scobie-Tewksbury (Greater Boston) are below all New England comps for the last ten years

New England 345 kV Overhead Line Comps (In 2017 million \$ / mile)

\$ MM / mile

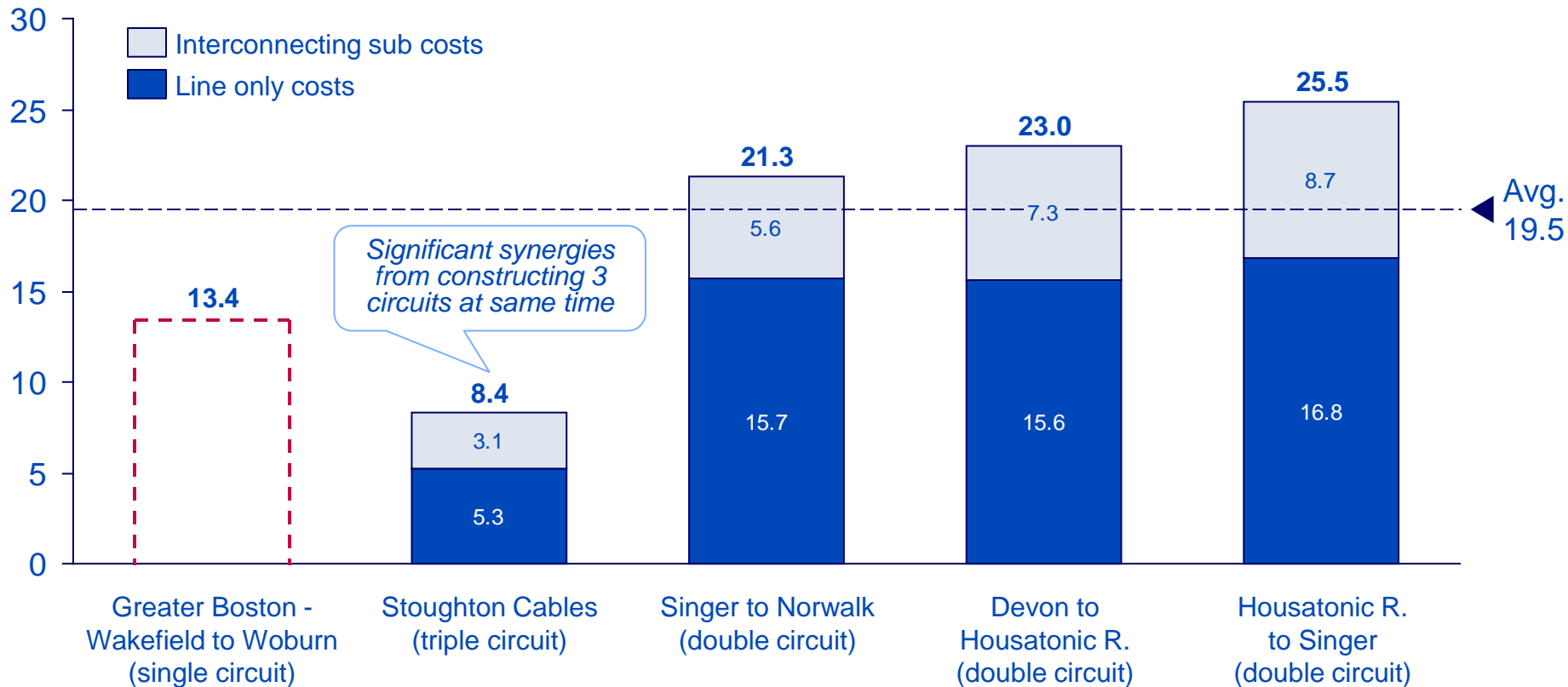


See Appendix for project comparable legend

Likewise, Wakefield-Woburn (Greater Boston) is far below the average cost of construction in New England

New England 345 kV Underground Line Comps (In 2017 million \$ / circuit mile)

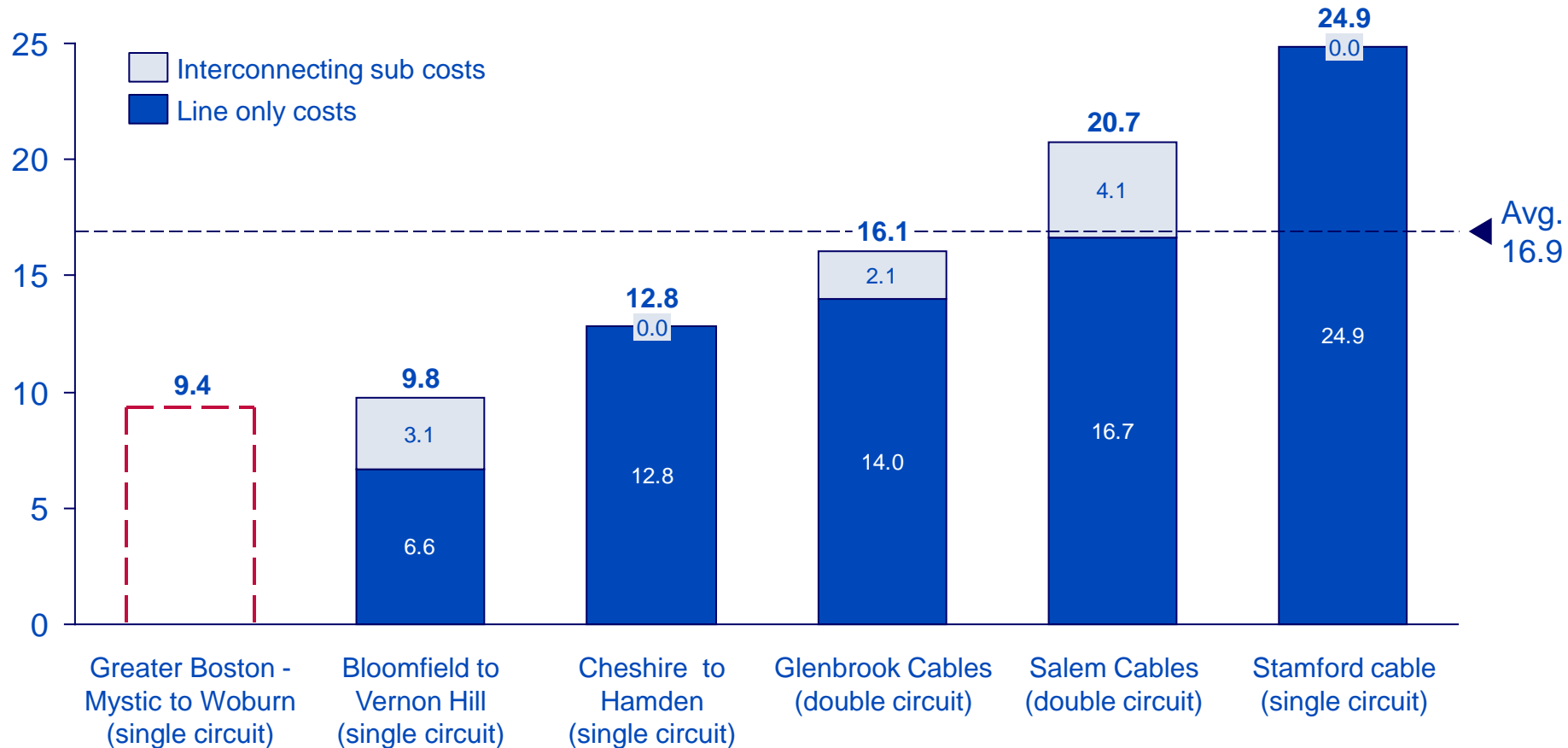
\$ MM / mile



And Mystic-Woburn (Greater Boston) is estimated at a cost below any other comparable in the last ten years

New England 115 kV Underground Line Comps (In 2017 million \$ / circuit mile)

\$ MM / mile



In all cases, NU's and Ngrid's Greater Boston cost estimates are far below the average cost of construction in New England

Greater Boston Comp Comparison

Project	Type	Miles	TO Estimate (\$MM/mile)	NE Comp – Lowest (\$MM/mile)	NE Comp – Average (\$MM/mile)	NE Comp – Highest (\$MM/mile)
Scobie - Tewksbury	Overhead 345 kV	25	\$4.2	\$4.9	\$12.0	\$25.3
Wakefield – Woburn	Underground 345 kV	8	\$13.4	\$8.4	\$19.5	\$25.5
Mystic – Woburn	Underground 115 kV	8	\$9.4	\$9.8	\$16.9	\$24.9

The likelihood that all three Greater Boston projects costs will come in at the low end of recent comps is less than 1%¹

1 – Scobie-Tewksbury (1/15), Wakefield-Woburn (1/4), Mystic-Woburn (1/4). The chance of all happening in the same project at the same time: $(1/15) * (1/4) * (1/5) = 1/300$ or <1%. Or, all three Greater Boston estimates are greater than 1 standard deviation from the average.

Multiplying through by miles, these differences in comps can yield substantial variation in expected total costs

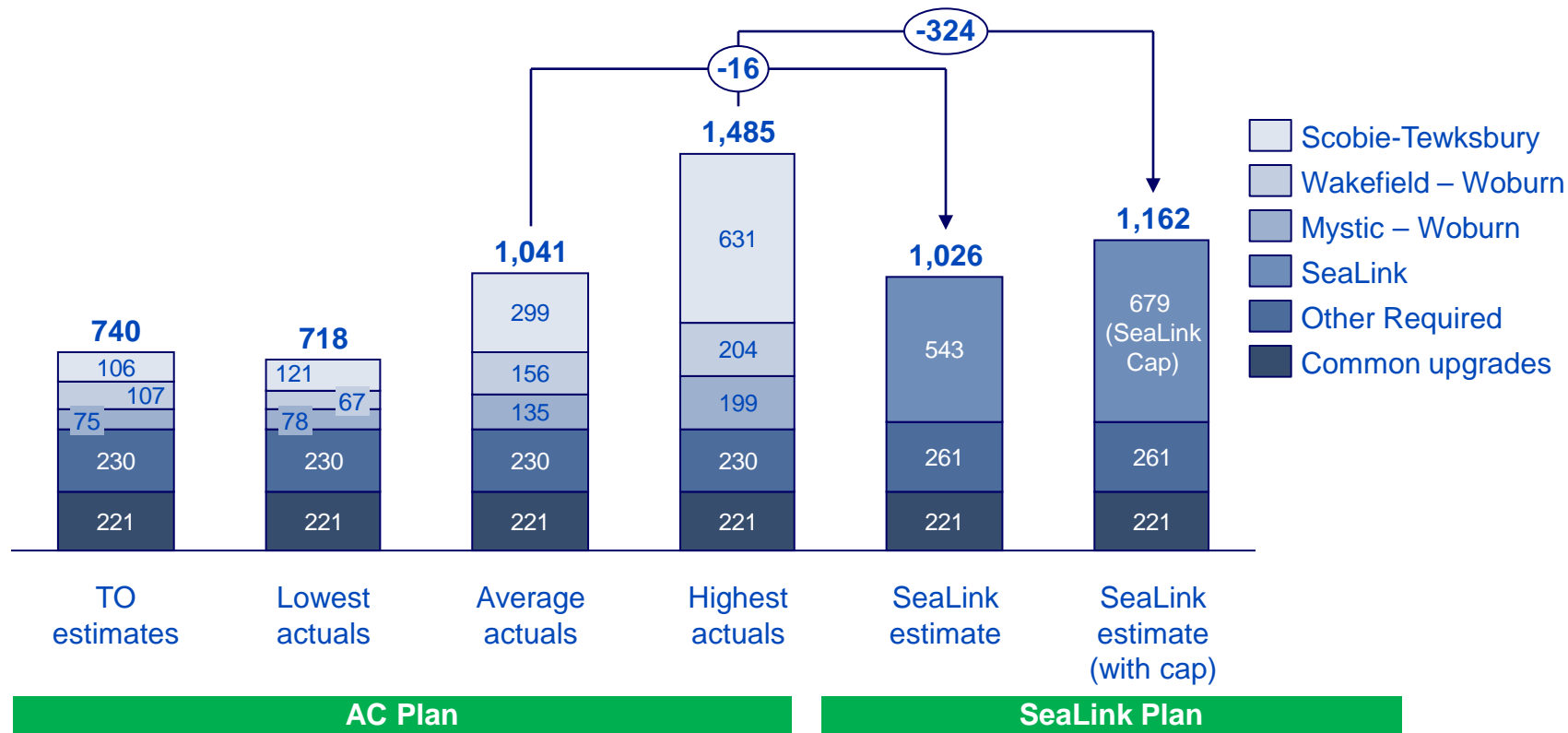
Greater Boston Comp Comparison

Project	Type	TO Estimate (\$MM)	NE Comp – Lowest (\$MM)	NE Comp – Average (\$MM)	NE Comp – Highest (\$MM)
Scobie - Tewksbury	Overhead 345 kV	\$106.3 ¹	\$121.4	\$298.8	\$631.3
Wakefield – Woburn	Underground 345 kV	\$107.3	\$66.9	\$156.2	\$203.7
Mystic – Woburn	Underground 115 kV	\$75.0	\$78.3	\$134.9	\$199.1
Other Required	Various	\$230.1	\$230.1	\$230.1	\$230.1
Common upgrades	Various	\$221.2	\$221.2	\$221.2	\$221.2
TOTAL		740.0	\$717.9	\$1,041.1	\$1,485.3

Notes: 1 – Y-151 reconductoring cost estimate (separate from Scobie-Tewksbury) is removed and added into other required upgrades. The estimate for this upgrade is \$16.6 MM.

SeaLink is more cost-effective than the AC Plan (at New England average prices) by \$16 million

Greater Boston Plan Comparison (\$MM)



The potential high cost case exceeds the SeaLink case (with cap) by more than \$300 million

NHT also captured key milestone dates including the duration of major project ISO-NE selection to in-service

Major Project Durations

Major Project	Comparable Element (s)	Duration (Yrs.) ¹
Stoughton	Nstar 345 kV cables	5.0
SW CT	Middletown-Norwalk projects	6.9
Norwalk Reliability	Glenbrook cables	3.5
Worcester Reliability	Bloom. – Vernon Hill cable	7.0
Lower SEMA	Carver – Bourne 345 kV line	5.6
Millstone DCT	New 345 kV from DCT lines	2.6
NEEWS – GSRP	345 kV line and substations	6.9
NEEWS – RIRP	Kent – W. Farnum 345 kV	6.3
Salem cables	Salem 115 kV cables	2.5
NEEWS - IRP	New 345 kV lines and subs	9.0
Stamford Reliability	New 115 kV cable	3.6

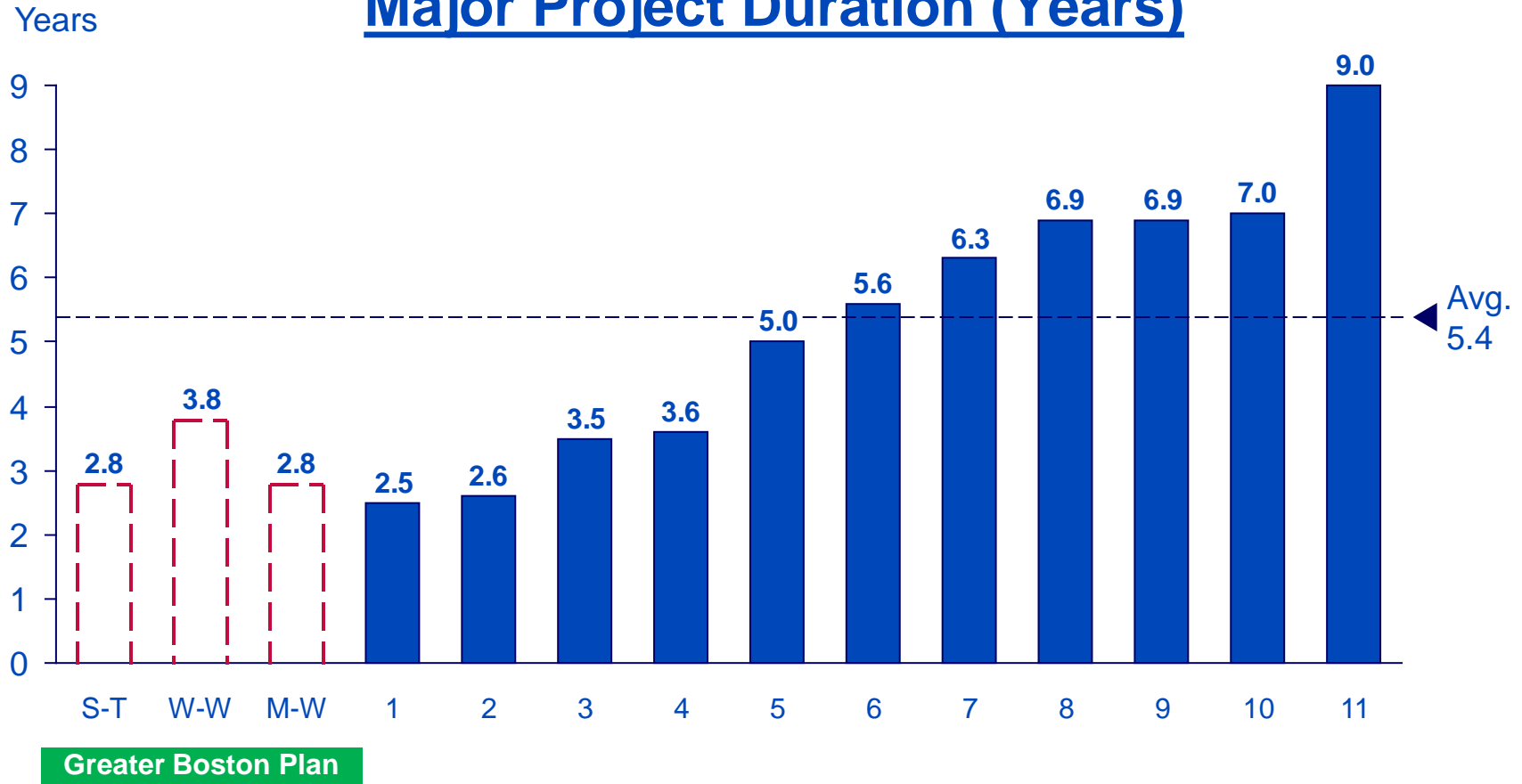
Duration statistics

- Low – 2.5 years
- Avg. – 5.4 years
- Max – 9.0 years
- StDev. – 2.1 years

1 – Duration from time ISO-NE selected project as preferred solution to in-service date

The estimates for in-service dates in Greater Boston are also far below the averages for projects in New England

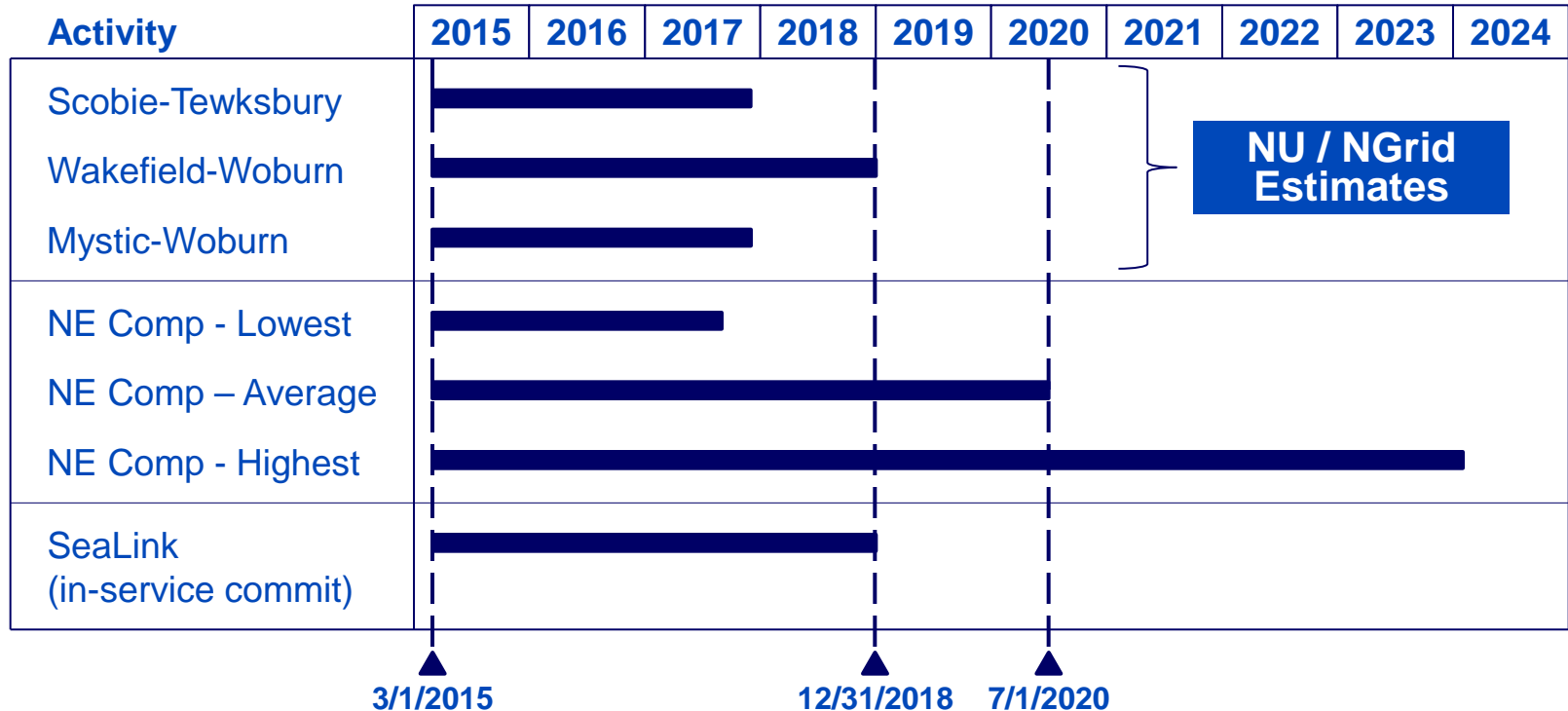
Major Project Duration (Years)



Notes: S-T is Scobie-Tewksbury, W-W is Wakefield-Woburn, M-W is Mystic-Woburn. See Appendix for project comp legend.

SeaLink's in-service commitment date is ~1.5 years *ahead* of the average New England Comp timeline

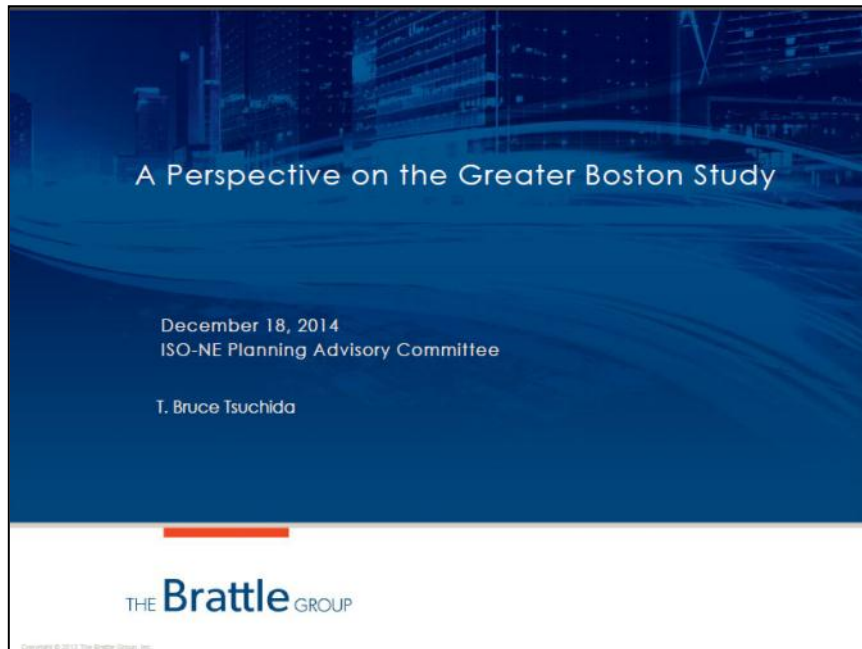
Estimated Years from Selection to In-Service



We have no reason to believe the three major AC Plan projects would be so materially ahead of the average duration

At NHT's request, The Brattle Group conducted an analysis to evaluate the value behind speed for Greater Boston

Brattle Study Results



- The Brattle Group evaluated the value of speed to put projects into service:

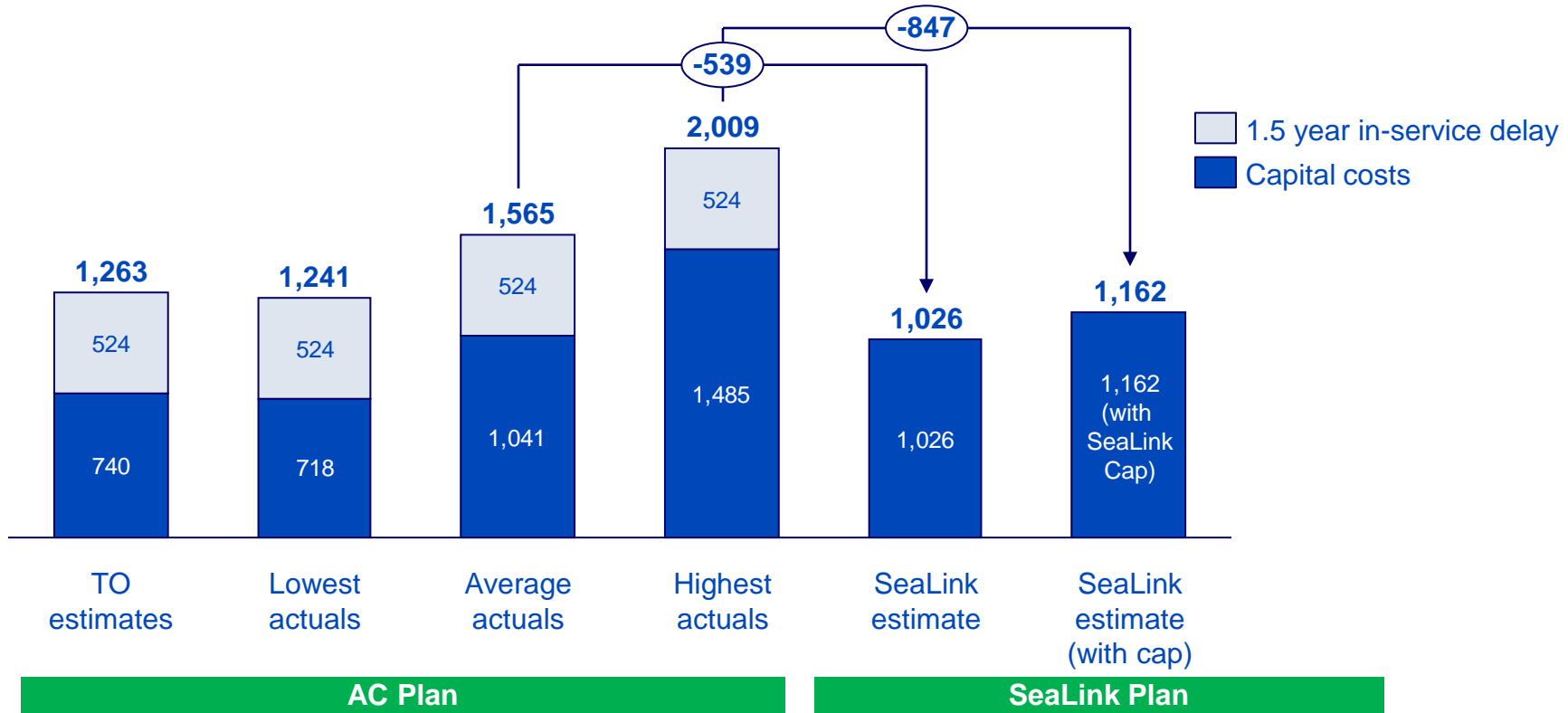
Scenario	Value
1 year delay	\$349 MM
2 year delay	\$698 MM

- These are market impacts to Wholesale Cost to Load
- Average differential:
 - 1.5 years * \$349 MM = \$524 MM

These costs will ultimately be paid for by customers in New England and should be taken into account in this decision

Taking into account the in-service delay, all AC Plan scenarios are more expensive than SeaLink

Greater Boston Plan Comparison (\$MM)



SeaLink's containment proposal protects customers against both the cost and schedule risk of the AC Plan

Appendix

Overhead 345 kV Project Legend

#	Major Project – Component Name	\$ MM / mile
1	NEEWS (IRP) - RI/CT to W. Farnum	\$ 4.9
2	L. SEMA - Carver to Bourne	\$ 6.3
3	NEEWS (IRP) - W. Farnum to MA/RI	\$ 6.4
4	NEEWS (IRP) - Lake to RI/CT	\$ 6.9
5	Millstone DCT Separation	\$ 7.1
6	NEEWS (IRP) - Card to Lake	\$ 7.2
7	SWCT - Black to Beseck	\$ 8.6
8	SWCT - Beseck to Devon	\$ 10.1
9	SWCT - Oxbow to Beseck	\$ 10.5
10	NEEWS (GSRP) - CT/MA - Bloom.	\$ 12.5
11	SWCT - Scovill to Chestnut	\$ 13.4
12	NEEWS (RIRP) - Kent to Farnum	\$ 14.7
13	NEEWS (GSRP) - Agawam to CT/MA	\$ 20.9
14	NEEWS (GSRP) - E. Spring. to Ludlow	\$ 24.6
15	NEEWS (GSRP) - E. Spring. To Fairmont	\$ 25.3

Major Project Duration Legend

#	Major Project Name	Duration
1	Merrimack Valley / North Shore Project	2.5
2	Millstone DCT elimination	2.6
3	Norwalk Reliability	3.5
4	Stamford Reliability Project	3.6
5	Stoughton Cable Project (Phase I & II)	5.0
6	Long Term Lower SEMA Project	5.6
7	NEEWS - Rhode Island Reliability Projects	6.3
8	Southwest Connecticut	6.9
9	NEEWS - Greater Springfield Project	6.9
10	Worcester Reliability	6.9
11	NEEWS - Interstate Reliability Projects	9.0