COMMONWEALTH OF MASSACHUSETTS
ENERGY FACILITIES SITING BOARD

In the Matter of the Petition of NSTAR Electric Company for Approval to Construct and Operate New Overhead 345 kV Transmission Facilities, and Construct a New 345 kV to 115 kV Substation in the Town of Barnstable and to Modify Various other Ancillary Facilities in the Towns of Carver, Plymouth, Bourne, and Sandwich	)	EFSB 10-2
In the Matter of the Petition of NSTAR Electric Company for Approval to Construct and Operate Transmission Facilities, pursuant to G.L. c. 164, § 72	)	D.P.U. 10-131
In the Matter of the Petition of NSTAR Electric Company for Individual and Comprehensive Zoning Exemptions, pursuant to G.L. c. 40A, § 3	)	D.P.U. 10-132

FINAL DECISION

M. Kathryn Sedor
Presiding Officer
April 27, 2012

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John Young

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ABBREVIATIONS

BECo/Hopkinton	Boston Edison Company, 6 DOMSB 208 (1997)
Berkshire Power	Berkshire Power Development, Inc., D.P.U. 96-104 (1997)
Cape Wind	Cape Wind Associates LLC, 15 DOMSB 1 (2005)
CELCo/Kendall	Cambridge Electric Light Company, 12 DOMSB 305 (2001)
Hydro-Quebec	Massachusetts Electric Company/New England Power Company, 13 DOMSC 119 (1985)
MECo (2002) Decision	Massachusetts Electric Company, D.T.E. 01-77 (2002)
National Grid Worcester	New England Power Company, EFSB 09-1/D.P.U. 09-52/09-53 (2011)
NSTAR/Stoughton	NSTAR Electric Company, 14 DOMSB 233 (2005)
NY Central Railroad	New York Central Railroad v. Department of Public Utilities, 347 Mass. 586 (1964)
Russell	Russell Biomass, EFSB 07-4/D.P.U. 07-35/07-36 (2009)
Save the Bay	Save the Bay v. Department of Public Utilities, 366 Mass. 667 (1975)
Tennessee Decision (2002)	Tennessee Gas Pipeline Company, D.T.E. 01-57, at 3-4 (2002)
Tennessee/Agawam	Tennessee Gas Pipeline Company, D.T.E. 01-57 (2002)
Attorney General	Massachusetts Attorney General
Canal Station	Canal Generating Station
Canal Substation	Substation adjacent to Canal Station
CEII	Critical energy infrastructure information
Commonwealth	Commonwealth Electric Company or Commonwealth of Mass.
Company	NSTAR Electric Company
dBA	A-weighted decibels
Department	Department of Public Utilities
DOMSB	Decisions and Orders of Mass. Energy Facilities Siting Board
DOMSC	Decisions and Orders of Mass. Energy Facilities Siting Council

DSM	demand-side management
EFSB	Energy Facilities Siting Board
EIR	Environmental Impact Report
EMF	electric and magnetic fields (here, 60 hertz magnetic field)
FERC	Federal Energy Regulatory Commission
G.L. c.	Massachusetts General Laws chapter
GenOn	GenOn Canal LLC
GHG	Green house gas(es)
GSRP	Greater Springfield Reliability Project, *often including* the Manchester to Meekville Separation Project in Connecticut
hp	Horsepower
ICAP	installed capacity
ISO-NE	Independent System Operator of New England
kV	Kilovolts
Levitan	Levitan & Associates, Inc.
Load Interruption Guideline	Transmission System Planning Load Interruption Guideline
long-term measures	long-term Settlement Agreement directives to eliminate uplift charges
Lower SEMA	Southern part of SEMA
LSCPR	Local second-contingency protection resource
LTE	Long-time emergency
MACT	Utility Air Toxics' Maximum Achievable Control Technology
MassDEP	Massachusetts Department of Environmental Protection
MEPA	Massachusetts Environmental Protection Act
mG	milligauss
MHC	Massachusetts Historical Commission

MODF	Mineral oil dielectric fuel
Moody's	Moody's Analytics, Inc. and/or "Moody's Economy.com"
MSSF	Myles Standish State Forest
MVA	megavolt-amperes
MVAR	megavolt-amperes, reactive
MW	megawatts
N-1	single contingency loss of a transmission element
N-1-1	contingency loss of one element followed by a second element loss
NAS	National Academy of Sciences
NEPOOL	New England Power Pool
NERC	North American Electric Reliability Corporation
NERC Standards	NERC reliability standards
NHESP	Natural Heritage and Endangered Species Program
NO_X	oxides of nitrogen
NPCC	Northeast Power Coordinating Council
NPDES	National Pollutant Discharge Elimination System
NSTAR	NSTAR Electric Company
NU	Northeast Utilities
PSC	public service corporation
REMVEC	Rhode Island-Eastern Massachusetts-Vermont Energy Control
RFP	request for proposal
RMR	reliability-must-run
ROW	right-of-way
RR	record request
RT DR	real time demand response

Sandwich	Town of Sandwich
SCR	selective catalytic reductor
SEMA	Southeastern Massachusetts load zone
Settlement agreement	Settlement of Dispute Over SEMA Charges
SF_6	sulfur hexafluoride
short-term measures	short-term Settlement Agreement directives to eliminate uplift charges
Siting Board	Energy Facilities Siting Board
Siting Petition	Petition to construct the Project pursuant to G.L. c. 164, § 69J
Solutions Report	Lower Southeastern Massachusetts Area Long Term Solution Study Report
Tremont East	area served by substations east of Tremont Substation
USDOT	U.S. Department of Transportation
USEPA	United States Environmental Protection Agency
VARs	volt-amperes, reactive
WMECo	Western Massachusetts Electric Company

Pursuant to G.L. c. 164, §69J, the Massachusetts Energy Facilities Siting Board ("Siting Board") hereby approves, subject to the conditions set forth below, the petition of NSTAR Electric Company ("NSTAR" or the "Company") to construct a new 345 kV transmission line in the towns of Carver, Plymouth and Bourne, separate an existing double circuit 345 kV transmission line onto separate sets of structures, build a new 345 kV to 115 kV substation in West Barnstable, and modify various other ancillary facilities. Pursuant to G.L. c. 164, § 72, the Siting Board hereby approves, subject to the conditions set forth below, the petition of NSTAR for a determination that the proposed 345 kV transmission line is necessary, serves the public convenience and is consistent with the public interest. Pursuant to G.L. c. 40A, § 3, the Siting Board hereby approves, subject to the conditions set forth below, the petition of NSTAR for individual exemptions from the zoning bylaws of the towns of Carver, Plymouth, Bourne and Barnstable, but denies NSTAR's request for a comprehensive exemption from those zoning bylaws in connection with the proposed transmission facilities and substation, as described herein.

I. INTRODUCTION

A. Summary of the Project

NSTAR proposes to construct improvements to its transmission system in southeastern Massachusetts, including 18 miles of new 345 kilovolt ("kV") overhead transmission line on an existing right-of-way ("ROW") in the towns of Carver, Plymouth and Bourne (Exh. NSTAR-1, at 1-1, 1-9). The Company also proposes to: (1) separate an existing double-circuit 345 kV transmission line crossing of the Cape Cod Canal onto two separate sets of structures; construct a new 345 kV-to-115 kV substation in West Barnstable; and (3) ancillary station changes including the addition of a new 345 kV breaker position at Carver Substation, an expanded 115 kV bus and new switching positions at Bourne Switching Station, as well as additional buswork at the State Forest Transition Station and Plymouth Crossover Station, both in Plymouth (id.). Finally, (4) the Company would increase the voltage from 115 kV to 345 kV without need of construction on existing transmission Line 120, which runs 12.8 miles from the Bourne Switching Station to the proposed new substation in West Barnstable (together, the "Project") (id. at 1-1).

The Company is required under G.L. c. 164, § 69J to present both a preferred route and an alternative route for its project. In this case, the alternative route is 19.4 miles long and

begins at the Carver Substation and travels south and east through Rochester, Wareham and Plymouth and ends in Bourne ("Alternative Route") (id. at 1-10, 1-11).[1] The other portions of the Project, including separating the existing 345 kV circuits crossing the canal, raising the voltage of a section of the existing Line 120, and construction of the proposed substation in West Barnstable, would all occur regardless of whether the Project is located along the Primary or Alternative Route (id. at 1-9, 1-12, 1-13). The Alternative Route would also require ancillary improvements, including the addition of a 345 kV breaker position at Carver Substation, as well as the improvements at Bourne Switching Station mentioned above with respect to the Primary Route (id.).

B. Procedural History

On September 20, 2010, NSTAR filed a petition to construct the Project pursuant to G.L. c. 164, § 69J ("Siting Petition") with the Siting Board. On October 4, 2010, the Company filed a zoning exemption petition pursuant to G.L. c. 40A, § 3 ("Zoning Petition") and a petition for approval pursuant to G.L. c. 164, § 72 ("Section 72 Petition" and together, "Consolidated Petitions") with the Department of Public Utilities ("Department"). On October 12, 2010, the Chair of the Department consolidated the three petitions for hearing and decision by the Siting Board. Accordingly, the Siting Board conducted a single adjudicatory proceeding and developed a single evidentiary record for the Consolidated Petitions.

Siting Board Staff conducted three public hearings regarding the Project. The hearings were held on December 8, 2010, in Carver; on December 14, 2010, in Bourne; and on December 15, 2010, in Barnstable.[2] A Hearing Officer ruling dated January 14, 2011 granted intervenor status to the Massachusetts Attorney General ("Attorney General"); GenOn Canal, LLC, the owner/operator of Canal Station ("GenOn"); ISO-New England, Inc. ("ISO-NE"); the Town of Sandwich ("Sandwich"); Kathryn Armstrong (a resident of Barnstable); and Kerry LaLiberte

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[1] For both the Primary and Alternative Routes the distances include 1.4 miles from Bournedale Road to Bourne Switching Station via the Cape Cod Canal, a portion that is common to both routes.

[2] Siting Board Staff also conducted site visits on December 8, 2010, and December 15, 2010.

(a resident of Carver).[3] The Hearing Officer also granted limited participant petitions for Mary O'Donnell (a resident of Kingston) and Frederick Weston (a resident of Carver).

Siting Board Staff conducted a technical session on March 25, 2011. Staff held 15 days of evidentiary hearings beginning on May 9, 2011 and ending on July 1, 2011. NSTAR presented the testimony of 16 witnesses in support of the Consolidated Petitions: Henry Oheim, Charles Salamone, Robert Clarke, Michael Rife, John Zicko, Gregory Sullivan, Kevin McCune, Christine Vaughan, Theodore Barten, Michael Howard, Peter Valberg, Richard Levitan, Ellen Cool, Boris Shapiro, John Elder, and Bryant Robinson. GenOn presented four witnesses: Anne Cleary, Shawn Konary, Ira Shavel, and Philip Smith. ISO-NE presented two witnesses: Frank Mezzanotte and Richard Kowalski. Sandwich presented two witnesses: George Dunham and Paul Chernick. Over 1,000 exhibits were entered into the evidentiary record (Company Brief at 8).

II. JURISDICTION AND STANDARD OF REVIEW UNDER G.L. C. 164, § 69J

The Company filed the Siting Petition pursuant to: (1) G.L. c. 164, § 69H, which requires the Siting Board to implement its statute so as to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost; and (2) G.L. c. 164, § 69J, which requires a project applicant to obtain Siting Board approval for the construction of a proposed energy "facility" before a construction permit may be issued by another state agency.

G.L. c. 164, § 69G defines a "facility" to include:

> a new electric transmission line having a design rating of 115 kilovolts or more which is 10 miles or more in length on an existing transmission corridor except reconductoring or rebuilding of transmission lines at the same voltage.

The proposed 345 kV transmission line is a "facility" with respect to Section 69J.

In accordance with G.L. c. 164, §§ 69H and 69J, before approving a petition to construct, the Siting Board requires an applicant to justify its proposal in four phases. First, the Siting Board requires the applicant to show that additional energy resources are needed (see Section III, below). Second, the Siting Board requires the applicant to establish that, on balance, its

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[3] Ms. Armstrong subsequently withdrew as an intervenor in the proceeding. See Armstrong Letter dated October 5, 2011.

proposed project is superior to alternative approaches in terms of reliability, cost, and environmental impact, and in its ability to address the identified need (see Section IV, below). Third, the Siting Board requires the applicant to show that it has considered a reasonable range of practical siting alternatives and that the proposed site for the project is superior to a noticed alternative site in terms of cost, environmental impact, and reliability of supply (see Section V, below). Finally, the applicant must show that its plans for construction of its new facilities are consistent with the current health, environmental protection and resource use and development policies of the Commonwealth (see Section VI, below).

III. NEED

A. Standard of Review

G.L. c. 164, § 69J provides that the Siting Board should approve a petition to construct if the Board determines that the petition meets certain requirements, including that the plans for the construction of the applicant's facilities are consistent with the policies stated in G.L. c. 164, § 69H to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. To accomplish this, the Board must, among other matters, review the need for the facilities to meet reliability, economic efficiency, or environmental objectives. G.L. c. 164, § 69H. Consistent therewith, G.L. c. 164, § 69J requires applicants to include in their petitions an analysis of need for the facility.[4]

To ensure reliability, each transmission and distribution company establishes planning criteria for construction, operation, and maintenance of its transmission and distribution system. Compliance with the applicable planning criteria can demonstrate a "reliable" system. See e.g., New England Power Company, EFSB 09-1/D.P.U. 09-52/09-53, at 4-5 (2011) ("National Grid Worcester"); Western Massachusetts Electric Company, EFSB 08-2/D.P.U. 08-105/08-106, at 8

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[4] The Siting Board's review of proposed transmission facilities is conducted pursuant to G.L. c. 164, § 69J. This section states, in part, that "[n]o applicant shall commence construction of a facility at a site unless . . . in the case of an electric or gas company which is required to file a long-range forecast pursuant to section sixty-nine I, that facility is consistent with the most recently approved long-range forecast for that company." The Siting Board notes that, pursuant to the Department's Order in D.T.E. 98-84A, Massachusetts electric companies, including NSTAR, are now exempt from the requirements of G.L. c. 164, § 69I. Thus, the Siting Board need not consider whether the proposed transmission facilities are consistent with a recently-approved long range forecast.

(2010) ("GSRP"); Boston Edison Company, 6 DOMSB 208, at 243-245 (1997) (BECo/Hopkinton).

To determine whether system improvements are needed, the Siting Board: (1) examines the reasonableness of the Company's system reliability planning criteria; (2) determines whether the Company uses reviewable and appropriate methods for assessing system reliability over time based on system modeling analyses or other valid reliability indicators; and (3) determines whether the relevant transmission and distribution system meets these reliability criteria over time under normal conditions and under certain contingencies, given existing and projected loads.

When a petitioner's assessment of system reliability and facility requirements are, in whole or in part, driven by load projections, the Siting Board reviews the underlying load forecast. The Siting Board requires that forecasts be based on substantially accurate historical information and reasonable statistical projection methods that include an adequate consideration of conservation and load management. G.L. c. 164, § 69J. To ensure that this standard has been met, the Siting Board requires that forecasts be reviewable, appropriate and reliable. GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 9; NSTAR Electric Company, 14 DOMSB 233, at 252-253 (2005) (NSTAR/Stoughton); BECo/Hopkinton, 6 DOMSB 208, at 232 (1997). A forecast is reviewable if it contains enough information to allow a full understanding of the forecast method. A forecast is appropriate if the method used to produce the forecast is technically suitable to the size and nature of the company that produced it. A forecast is reliable if the method provides a measure of confidence that its data, assumptions and judgments produce a forecast of what is most likely to occur. GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 9; NSTAR/Stoughton, 14 DOMSB 233, at 253; BECo/Hopkinton, 6 DOMSB 208, at 232.

B. The Existing Transmission System in Lower SEMA

1. Description

"Southeastern Massachusetts" ("SEMA") is designated by ISO-NE as a load zone. SEMA is served by NSTAR, Massachusetts Electric,[5] and several municipal electric departments, with a number of generation facilities plus transmission connections to other parts

[5] Massachusetts Electric Company is a wholly-owned subsidiary of National Grid USA, as is Nantucket Electric Company.

of New England. NSTAR defines "Lower SEMA" as an area including Greater New Bedford and other South Coast communities, the South Shore from Marshfield to Plymouth (including Carver and Plympton), Cape Cod, and the islands of Martha's Vineyard and Nantucket (Exhs. NSTAR-1, at 2-1; EFSB-N-5). NSTAR provides transmission and distribution service in this area except to Nantucket, which is served by Nantucket Electric via submarine cables from substations on Cape Cod. Lower SEMA is served by local generation and by transmission lines including a 115 kV connection to the Fall River area, two 115 kV connections to the Kingston area, and three 345 kV ties to the rest of the grid (Exh. EFSB-G-1).

A smaller area within Lower SEMA, served by substations to the east of Tremont Substation in Wareham, is designated as "Tremont East" and consists of the Cape and Islands plus parts of Wareham and Plymouth (Exh. EFSB-N-6). Two units at the Canal Generating Station ("Canal Station") in Sandwich are the only large generation sources in Tremont East. Tremont East has four transmission level ties to the rest of the grid: two 115 kV lines, Lines 108 and 113, extending east from Tremont Substation and terminating at Bourne Switching Station after crossing the Cape Cod Canal; and two 345 kV lines. One of the 345 kV lines, Line 322, extends from Carver Substation (where it connects to another 345 kV line, Line 331) to a substation adjacent to Canal Station ("Canal Substation") (Exh. EFSB-G-2). The second, Line 342, has termini at Auburn Substation in Whitman, at a substation at the Pilgrim Nuclear Station in the Manomet section of Plymouth, and at Canal Substation (id.). The two 345 kV lines share a right-of-way from a location identified as the State Forest Transition Station to Canal Substation. The two 115 kV lines also share a right-of-way from the Tremont Substation to the Bourne Switching Station, but with the exception of about one-half mile in Bourne, it is a different right-of-way from the 345 kV lines (Exhs. NSTAR-1, at fig. 5-3; EFSB-G-1(1)). All four of these transmission lines cross the Cape Cod Canal on overhead, double-circuit towers, the two 115 kV lines on one set of structures and the two 345 kV lines on the other set.

NSTAR stated that there are nearly 225,000 customers in Tremont East (Exh. NSTAR-1, at 3-6). Most of the load in Tremont East is east of the Cape Cod Canal. The remainder is served by Wareham, Valley, and Manomet Substations (Exh. EFSB-G-2). The only facility on Cape Cod currently operated at 345 kV is the higher voltage side of Canal Substation, along with Lines 322 and 342 which terminate there. Two 115 kV lines connect Canal Substation to the Bourne Switching Station; a third, Line 120, bypasses Bourne Switching Station on its way from

Canal Substation to West Barnstable. Two other 115 kV lines from Bourne Switching Station serve Cape Cod substations, one extending directly to West Barnstable on the same right-of-way as Line 120, and one routed through the Falmouth area. Load on the Cape and Islands is served via these last three 115 kV lines from Canal Substation and Bourne Switching Station. Among the three, the majority of Line 120 was designed with hardware and clearances capable of carrying 345 kV, but it has only operated at 115 kV. The only 345 kV/115 kV transformers operating in Tremont East are at Canal Substation. A schematic transmission system map of Lower SEMA is attached as Figure 1.

Lines 108 and 113 were built in 1960 and 1967, respectively (Exh. NSTAR-1, at 1-2). Each line has a capacity of 227 megavolt-amperes ("MVA")[6] normal and 246 MVA emergency (Exh. EFSB-N-6). The lines have a combined capacity of approximately 460 MW as rated for 12 hours (id.; Exh. SAN-NSTAR-2-32; Tr. 2, at 199-201). NSTAR stated that Lines 322 and 342 were constructed in 1968 and 1971 for the purpose of providing access to the power generated at Canal Station and Pilgrim Nuclear Station (Exh. NSTAR-1, at 1-2). Lines 108, 113, and 322 are owned by NSTAR, while NSTAR and National Grid jointly own Line 342 and also Line 331 (Exh. SAN-NSTAR-2-68(1) at 1, 4). The two 345 kV lines are high capacity lines with a combined total of 2400 MW capacity.

2. History of Transmission Issues in Lower SEMA

Weather and equipment failures are the top causes of transmission line outages exceeding one hour on Cape Cod, according to NSTAR (Tr. 4, at 621-622). Weather-related causes have included lightning, wind, hurricanes, snow and ice (id.). Equipment problems have included failure of a structural tower or tower arm, and a falling static wire (id.). In one instance, in 2002, an aircraft contacted a Cape transmission line, causing an outage (id.). Whether such transmission outages lead to customer outages depends in part on whether other energy resources are available to deliver power.

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[6] MVA is a measure that includes MWs and volt-amperes, reactive ("VARs"). When VARs are in an appropriate range, an MVA measurement is just slightly higher than an MW measurement. Witnesses in the case used the terms almost interchangeably and we do the same here.

a. Canal Station Connections

The Canal Station Unit 1 (550 MW) and Unit 2 (545 MW) began commercial operation in 1968 and 1976, respectively (Exh. NSTAR-1(2-1) at 13; EFSB-N-5; Tr. 6, at 877). Unit 1 was designed as a baseload unit, and operates only on residual oil (Exh. NSTAR-1, at 1-3). Unit 1 is equipped with a selective catalytic reduction ("SCR") unit to control nitrogen oxides ("NO_X") (Exh. NSTAR-1(2-1) at 13). Although Unit 2 was designed as dual-fuel unit capable of running on residual oil or gas, it has little if any history of operating on gas and managers bid and operate Unit 2 on oil even when oil is relatively expensive (id.; Tr. 8, at 996, 1029). Unit 2 does not have SCR and relies on selective non-catalytic reduction, which NSTAR stated is less efficient in reducing NO_X emissions (Exh. NSTAR-1(2-1) at 14).

b. 2003 Cape Cod Blackout

A wide-scale power interruption occurred in Lower SEMA on December 1, 2003. The circumstances were described in a Joint Report prepared by ISO-NE, National Grid, and NSTAR, dated December 19, 2003 (Exh. SAN-NSTAR-2-68(1)). Of the eight investigators, three were witnesses in the present proceeding. At the start of the day, Canal Unit 2 was on line but Canal Unit 1 was not (id.). Early in the morning, one of the 115 kV lines was switched out for scheduled maintenance (id.). Early in the afternoon, brush fires under the 345 kV lines north of Carver triggered momentary faults on Line 331 (id.). Subsequently, at 1:28 p.m., the Rhode Island-Eastern Massachusetts-Vermont Energy Control ("REMVEC"), which is the local transmission operating authority, operated by National Grid, took Line 331 out of service for an inspection, returning the line to service at 6:29 p.m. (id.). Following this action, REMVEC and ISO-NE operators, attempting to follow a written stability procedure for Line 331 being out of service, opened a circuit breaker at the Canal Substation (id.). According to the Joint Report, REMVEC and ISO-NE were then unaware that in this configuration, if Canal Unit 2 shut down, a second 345 kV line would go out of service as well, putting the entire Cape Cod area load onto the one operating 115 kV line (id.).

At about 6:00 p.m., a fire stemming from a fuel oil leak broke out at Canal Station, leading the plant operator to shut down Canal Unit 2 (id.). This automatically caused the second 345 kV line to come out of service (id.). Within minutes, protective controls interrupted the second 115 kV line, which had become overloaded (id.). Power was interrupted to approximately 300,000 customers, including customers on Cape Cod, in the New Bedford area,

and some in the Plymouth area, starting at 6:21 p.m. (id.; Exh. SAN-NSTAR-2-67). The Joint Report does not specify which of the four available transmission lines to Tremont East was returned to service first, but it does state that three-quarters of the load was restored by 7:33 p.m., and power to all customers was restored by 8:15 p.m. (Exh. SAN-NSTAR-2-68(1)).[7] Among the immediate actions in the wake of the incident, ISO-NE modified the operating guidance to avoid opening breakers at Canal Substation without careful consideration (id.). An added response was to re-configure switches at Canal Substation for more robust and flexible service.

c. Uplift Costs, Allocation, and the Settlement Agreement

Until 2006, the Canal units typically were dispatched by ISO-NE based on merit order, usually for baseload requirements (Tr. 1, at 156). The Company stated that a significant price premium for residual oil relative to natural gas on a British Thermal Unit ("BTU") basis emerged in 2006 and has continued to the present time (id.). As a result of this persistent fuel price differential and overall market conditions since 2006, the energy market bids by the Canal units are not competitive with market-clearing bids accepted by ISO-NE (Tr. 8, at 995-996). On economic grounds alone, ISO-NE would rarely require the operation of either Canal unit.

Beginning in 2006, NSTAR determined that, in order to avoid overloads and voltage issues in the event of loss of the two 345 kV lines, Lines 331 and 342, it needed one Canal unit to operate, regardless of economic merit (see Tr. 2, at 234-236; Tr. 9, at 995-996). At that time, NSTAR found that a combined loss of the Lines 342 and 331 would have caused thermal overloads on a number of 115 kV lines in Lower SEMA, resulting in wide-area outages, when Lower SEMA loads exceeded 76 percent of peak load (Tr. 6, at 808-810). In addition, NSTAR determined that loss of Lines 342 and 322 would have caused overloads on 115 kV lines serving

[7] Characterization of the incident by parties does not match up well with the Joint Report. In the Petition, the Company stated that a 345 kV line (rather than a 115 kV line) was out of service for scheduled maintenance activity. The Petition also does not mention operators' decision to turn off one 345 kV line because of a brush fire nor operators' decision, based on a possibly ambiguous protocol, to open an additional switch that put the second 345 kV line in the vulnerable position of being tied to Canal 2, which then shut down for other reasons (Exh. NSTAR-1, at 1-3). The Attorney General recounted the version of the incident described in NSTAR's Petition (Attorney General Brief at 5). ISO-NE asserted that the 2003 outage "was largely a distribution level problem," whereas the Joint Report refers to events on 115 kV and 345 kV circuitry and at a generator (ISO Initial Brief at 25).

Tremont East when area loads exceeded 70 of peak load, assuming the Canal units were off (Tr. 6, at 808-810). If both Line 342 and Line 322 are lost, Tremont East is served radially by the two 115 kV lines, Lines 108 and 113 (Exh. SAN-NSTAR-2-35). As a result, NSTAR contends that ISO-NE initially felt that operation of the Canal units was only needed for local protection in the event of an N-1-1 contingency, but subsequently concluded that dispatch of the units was necessary to protect against an N-1-1 contingency that posed a threat to the reliability of the bulk power system (Tr. 2, at 235-236).[8]

NSTAR requested dispatch of Canal units to protect local customers against loss of load in the event of an N-1-1 contingency (Tr. 3, at 234). Following this request, ISO-NE dispatched one Canal unit 24 hours a day in order to provide power and voltage support as protection for all of Lower SEMA to avoid potential adverse effects of a contingency loss of both 345 kV lines. This reliability-must-run ("RMR") operation resulted in uplift payments to the operators of Canal Station for the additional cost of operating Canal when the units exceeded the regional clearing price for energy (i.e., when the units were out of economic merit). The incremental cost of operating the Canal units for second contingency system support compared to market price generation units totaled approximately $316 million in 2006, 2007, and 2008 (Exh. NSTAR-1, at 3-2; Tr. 2, at 239).

ISO-NE dispatched the Canal units as Special Constraint Resources, under which the costs were to be allocated solely to NSTAR. NSTAR objected, arguing that the costs should be allocated more broadly throughout SEMA. ISO-NE agreed with NSTAR, and both retroactively and prospectively allocated such costs to the entire SEMA region. ISO-NE's decision meant that NSTAR, Massachusetts Electric, Nantucket Electric, and municipal electric companies in SEMA paid the incremental cost (Tr. 2, at 234). Some of the affected entities disagreed with this decision, brought the dispute to the Federal Energy Regulatory Commission ("FERC"), and settlement proceedings commenced.

Several stakeholders in the process, including NSTAR, National Grid, ISO-NE, Braintree Electric Light Department, Hingham Municipal Lighting Plant, Taunton Municipal Lighting

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[8] An N-1 contingency is the unexpected loss of one element of the transmission system (or of two transmission lines sharing a common tower, or two elements sharing a common circuit breaker). An "N-1-1" contingency consists of an N-1 contingency followed, more than 30 minutes after the first outage but before the repair of the first outage, by a second unexpected loss of a transmission element.

Plant, and a number of generating companies agreed in May 2007 to a Settlement of Dispute Over SEMA Charges ("Settlement Agreement").[9] The Settling Parties agreed to seek FERC approval for some tariff language changes related to the uplift payments. In addition, the Settlement Agreement directed parties to design and proceed with some easily permitted and constructed measures to eliminate the majority of the uplift charges ("short-term measures"), and to identify larger projects that would eliminate the remainder of the uplift charges ("long-term measures"). The Settlement Agreement obligated ISO-NE to evaluate and provide cost estimates for projects that would maintain reliability in Lower SEMA without a need to operate one or both Canal units out of economic merit order (Company Brief at 2-3, citing Exh. EFSB-N-26). FERC accepted the Settlement Agreement for filing on June 21, 2007 (Exh. EFSB-N-2(c)(1) at 1). The Lower SEMA Project was developed by NSTAR as its proposed long-term measure.

d. The Short-Term Measures

NSTAR's short-term measures reinforced the system so that service can be maintained in the event of an N-1-1 loss of the two 345 kV lines supplying Cape Cod when load levels are moderate and there is no generation at the Canal units (Exh. NSTAR-1, at 1-5). By June 2009, NSTAR had installed new 345/115 connections at Carver Substation and a new 115 kV transmission line from Carver Substation to Tremont Substation in Wareham. For local voltage support, NSTAR installed a static VAR compensator at Barnstable Switching Station that automatically delivers VARs to the transmission system as needed (Tr. 2, at 222). Prior to the short-term measures, N-1-1 contingency loss of Lines 342 and 331 would have resulted in service interruption to all of Lower SEMA. These short-term measures solve the modeled N-1-1 overloads from loss of Lines 342 and 331, and Plymouth and New Bedford are no longer vulnerable to an N-1-1 contingency on the 345 kV lines (Exh. NSTAR-1, at 2-27; Tr. 6, at 808). In addition, the short-term measures improved system performance in Tremont East for loss of Lines 342 and 322 under some conditions (NSTAR-1, at 2-19).

In addition to physical improvements to the transmission system, ISO-NE, NSTAR, and National Grid developed a transmission operations guide that incorporated limited load-shedding

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[9] The Department (then the Department of Telecommunications and Energy) and NEPOOL also participated in the FERC proceeding, but are not signatories to the Settlement Agreement (Exhs. EFSB-N-2(a) at 2 of 127; EFSB-N-4).

to maintain overall system reliability in lieu of operating the Canal units (see Exh. EFSB-N-3(1) at 5).[10] Posturing the transmission system after the first contingency so that load is interrupted as a consequence of the second contingency reduces the remaining load in Tremont East to a level that can reliably be served with the two 115 kV lines at the instant when the second 345 kV line goes out, thereby preventing voltage collapse throughout Tremont East.[11]

The Company characterized the short-term measures as effective, performing better than expected (Exh. NSTAR-1, at 1-5). As a result, system operators no longer require operation of the Canal units to prevent second contingency overloads and load shedding.[12] The Canal units operated only sporadically from April 2009 to December 2010, and there were no payments to Canal as an RMR or local second-contingency protection resource ("LSCPR") in 2010 (RR-EFSB-1; RR-EFSB-GEN-1(1)).[13] According to ISO-NE, the limited hours of operation for Canal during this period were primarily to maintain operating reserves at high load levels and to

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10 Specific details on situational load-shedding are considered Critical Energy Infrastructure Information ("CEII") and are therefore confidential.

11 Following loss of one 345 kV line, NSTAR can "posture" the system to drop load in the event of a second contingency by opening switches between an area served by 115 kV lines and another area served by the second 345 kV lines; this posturing is also known as post-first-contingency switching (Exh. NSTAR-CPS-2, at 10; Tr. 14, at 2030). The purpose is to avoid voltage collapse on the second contingency. The effect is for load to be positioned to drop as a direct result of the second contingency. Because there is a limited number of ways to divide Tremont East load, there is also a limited ability to posture for load loss.

12 Establishing that the Canal units are no longer called upon to run for second-contingency protection was hampered by erroneous information initially provided by the Company. The Siting Petition incorrectly states: (1) that "one Canal unit is committed out of economic merit order for approximately 42 - 58 days per year to maintain reserve requirements", and (2) that, were a "do nothing" alternative selected, the Canal units "would continue to run out of merit on heavy load days" (Exh. NSTAR-1, at 2-34, 3-5; also, Company Brief at 29). Several witnesses initially appeared to indicate that the Canal units were still being operated for reliability purposes (Tr. 3, at 337; Tr. 4, at 596; see also RR-EFSB-7). GenOn was later able to clarify that the Canal units have not been dispatched for local second-contingency protection since August 2009, when the short-term measures were completed (Tr. 8, at 1008).

13 In 2008, LSCPR replaced RMR as the payment mechanism for certain reliability services of generators.

control VARs at light load levels (Tr. 10, at 1346, 1471). Annual operating hours in the last six years are presented in Table 1.

Table 1. Recent Historical Annual Hours of Operation, Canal Units One and Two

Year	2005	2006	2007	2008	2009	2010
Canal Unit One	6646 hrs	3850 hrs	7455 hrs	6231 hrs	2030 hrs	424 hrs
Canal Unit Two	5975 hrs	5150 hrs	3084 hrs	3030 hrs	436 hrs	141 hrs

(RR-EFSB-1).

C. Description of Company's Demonstration of Need

1. Regional/National Context for Company Reliability Planning

NSTAR described key aspects of the regional and national reliability-planning regime and the resulting standards and procedures applicable to the Company's transmission system (Exh. NSTAR-1, at 2-1). NSTAR's transmission system is an integral part of the bulk power system delivering power to customers in the northeast region of the United States, and NSTAR is required to ensure that adequate resources are available to meet projected load requirements. As a transmission provider, NSTAR must maintain its system consistent with the reliability standards and criteria developed by the Northeast Power Coordinating Council ("NPCC"), the New England Power Pool ("NEPOOL") and ISO-NE (id.). These criteria are established under the purview of the North American Electric Reliability Council ("NERC"), which sets the standards for electric power transmission for all of North America. The criteria set by NPCC and ISO-NE expressly require transmission operators, such as NSTAR, to design, test and operate their system to withstand representative contingencies as specified in the criteria. NSTAR stated that if the NSTAR transmission system does not have sufficient capability to serve forecasted load under the conditions outlined in the NPCC and ISO-NE criteria, the Company must plan and implement additions and upgrades to address the identified inadequacies (id.).

Based on NERC, NPCC and ISO-NE requirements, the Company's reliability criteria specify that system voltages, line loadings and equipment loadings should be within normal limits for normal conditions and within applicable emergency limits for single and double-contingency situations (id. at 2-13). Specifically, the criteria require the Company to simulate

the performance of the system in the event of N-1 and N-1-1 contingencies. NSTAR notes that all of the relevant planning standards and criteria applicable to the Company's system are deterministic in nature in that the standards are designed to assess the performance of the Company's 115kV and 345kV transmission elements under a series of defined contingency situations (id. at 2-12).

In 2001, FERC assigned ISO-NE primary responsibility for transmission planning in New England (id. at 2-4). In 2004, FERC approved ISO-NE as the Regional Transmission Operator ("RTO") for New England. Beginning in 2007, ISO-NE took steps to adopt a transmission planning process in accordance with FERC Order Nos. 890, 890-A and 890-B, which is referred to as the "Regional System Planning Process" and is set forth in Attachment K of NEPOOL's Open Access Transmission Tariff ("OATT") (id.). In administering the Regional System Planning Process, ISO-NE has a number of responsibilities relating to both generation and transmission resources. For transmission resources, ISO-NE's primary functions are to: (1) conduct periodic needs assessment on a system-wide or specific-area basis, and (2) develop an annual regional transmission plan using a ten-year planning horizon. Needs assessments are designed to identify future system needs with consideration of available market solutions, which could include regulated transmission upgrades or other market responses (id. at 2-6).

Under Attachment K of the OATT, major transmission upgrades include the following steps: (1) system needs are identified though a periodic needs assessment undertaken by ISO-NE subject to stakeholder review and input; (2) regulated transmission solutions are suggested to meet identified system needs; (3) solution studies are prepared to identify the most cost-effective regulated transmission solutions; (4) proposed regulated transmission solutions are reviewed and approved by ISO-NE; and (5) transmission cost allocation is conducted under the OATT (id.). NSTAR's Project is the result of a needs assessment conducted by ISO-NE for the Lower SEMA area as was identified as the most cost-effective regulated transmission solution through a solution study process.

NSTAR's planning process is integrated with and coordinated by ISO-NE as part of its regional planning process and annual Regional System Plan (id. at 2-9). NSTAR conducts an annual review that evaluates the system's performance under projected operating conditions over a ten-year planning period. NSTAR stated that its planning process uses contingency conditions that involve the planned or unplanned loss of one or more major system elements such as

transmission lines, auto-transformers, and major generators in various combinations which would adversely affect the transmission system (id. at 2-13). The Company analyzes each component of the transmission system that serves as a limiting element with respect to capacity of the transmission lines, and models each circuit to simulate operations under the forecast condition. The transmission system is tested for reliability using computer modeling software that runs a series of "what if" scenarios at present and over the planning period, involving one or more contingencies in which one or more elements of the transmission system are assumed to be unexpectedly out of service. The system is studied under projected peak load conditions, to determine whether it remains capable of serving load without violating any thermal or voltage standards (id.). If the modeling process shows that the transmission system will experience overloads then there is a reliability issue that the Company will address with the addition or upgrade of transmission facilities. NSTAR also evaluates the adequacy of the voltages on the transmission and distribution systems.

2. Federal, NERC, and NPCC Requirements

The North American Electric Reliability Corporation's ("NERC") establishes reliability standards ("NERC Standards") for the U.S. transmission system and requires the application of power flow modeling to determine whether a transmission system is able to meet NERC Standards; the Northeast Power Coordinating Council ("NPCC") brings the requirements to our region. Prior to 2005, NERC standards were voluntary on the part of transmission utilities like NSTAR. With the passage of the Energy Policy Act of 2005, Pub. L. No.109-58, 119 Stat. 594 (2005) and subsequent regulatory actions by FERC, the NERC standards became mandatory and enforceable. 16 U.S.C. 824o(e) (2011), North American Electric Reliability Corp., 116 FERC ¶ 61,062, *order on reh'g & compliance*, 117 FERC ¶ 61,126 (2006), *aff'd sub nom.*, Alcoa, Inc. v. FERC, 564 F.3d 1342 (D.C. Cir. 2009).

The required modeling allows planners to understand whether the overall transmission system is capable of withstanding various contingencies without violating either thermal limits or voltage requirements for the individual transmission elements that make up the system. See Mandatory Reliability Standards for the Bulk-Power System, Order No. 693, FERC Stats and Regs. ¶ 31,242, *order on reh'g.* Order No. 693-A, 120 FERC ¶ 61,053 (2007) ("FERC Order 693"). A thermal limit establishes the maximum carrying capacity that a particular line cannot exceed for a particular period of time without causing unsafe sagging of the line or shortening

the expected life of the line. See GSRP, at 15-16. A voltage violation is demonstrated when the transmission study shows that the required voltages cannot be maintained at established levels when the transmission system is modeled at peak load with the loss of modeled transmission elements. Voltage that exceeds or falls below acceptable levels can damage or even destroy utility electrical equipment and customer electrical devices. Extreme voltage variations can lead to voltage collapse, where voltage drops to zero and can potentially cascade across wide areas of the system, leading to further equipment damage and widespread customer outages.

NERC Standards generally require that a transmission system be able to withstand an N-1 contingency without thermal or voltage violations and without solving thermal or voltage violations with an interruption of load. Id. Power flow modeling is also required to determine whether the transmission system is capable of withstanding an N-1-1 contingency. Where a transmission system is found to be unable to withstand an N-1-1 contingency, the transmission system may be upgraded. However, depending on system design and expected system impacts, NERC standards will allow some planned or controlled load interruption as an acceptable approach to solve thermal or voltage violations that occur upon the second contingency of an N-1-1 event. See FERC Order 693, at ¶¶ 1818, 1825. The primary goal in such circumstances is to maintain the integrity and reliability of the overall transmission system. A secondary goal is to minimize the interruption of load.

Although single-element contingencies (N-1) do occur, multiple element contingencies (such as N-1-1) are considerably less likely because two different low-likelihood transmission line or other equipment failures would have to overlap in time. Id. at ¶¶ 1813-1814. However, NERC standards require that the contingencies be applied in a "deterministic" matter, without regard for the probability that the single contingency would actually occur or that the two independent contingencies would occur one after the other. The current power flow modeling methodology does not calculate or incorporate the probability that the various N-1 or N-1-1 contingencies studied would actually occur. U.S. Department of Energy, *National Transmission Grid Study* at B-14 (May 2002).

While NERC permits load interruption to solve transmission needs that arise upon N-1-1 contingencies, it does not establish a limit on the amount of load that can be shed under those circumstances. In 2010, ISO-NE representatives proposed a Transmission System Planning

Load Interruption Guideline ("Load Interruption Guideline").[14] If adopted, the Load Interruption Guideline is intended to provide policy guidance for when it would be acceptable to rely on planned or controlled load interruption to address an N-1-1 contingency. According to the Load Interruption Guideline, the acceptability of interrupting load depends on "the amount of load at risk, the duration of the interruptions, the frequency of interruptions, the customers affected and the impacts of geography" (RR-EFSB-ISO-3(1) at 4).

The proposed Load Interruption Guideline states that load interruption for N-1-1 contingencies is allowed from 0-100 MW, and is "potentially allowable" from 100-300 MW. With interruptions up to 100 MW, the Guideline states that transmission solutions "would generally not be undertaken and the cost of [the] transmission solution would not generally be approved as a regional cost" (id. at 7). By contrast, transmission solutions may be approved as a regional cost for situations involving the interruption of between 100 and 300 MW, depending on the level of the load interruptions, the characteristics of the load being interrupted, restoration time, hours of exposure and the cost of the solution (id.). ISO-NE proposes that loads exceeding 300 MW should not be interrupted as a result of N-1-1 contingencies.

3. Description of the Company's Reliability and Need Analysis

a. Load Forecasting Methodology

The Company developed a peak-load forecast for purposes of testing and evaluating the reliability of the system and resource needs (Exh. NSTAR-1, at 2-20). The Company used ISO-NE's recently approved peak forecast for New England and adapted it to determine peak loads over the planning horizon at the Company's substations serving Lower SEMA in general and Tremont East in particular (id.). The Company's substation peak demand forecasts are derived from econometric models for each substation as a function of each substation's historic peaks relative to the operating region's peak (id. at 2-21). Each operating region's peak is forecasted based on regional econometric variables and the Temperature Humidity Index ("THI") (id.). Substation forecasts are then developed by simulating the estimated historic relationship between forecasts of the operating region's peak trend and the THI under the

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[14] On November 17, 2010, ISO-NE representatives made a PowerPoint presentation of the proposed Load Interruption Guideline at a meeting of the ISO Reliability Committee. ISO-NE indicated that when finalized, the guideline would be effected as an ISO-NE Planning Procedure (RR-EFSB-ISO-3(1) at 2).

extreme weather ("90/10" assumption[15]) which is the same basis on which transmission planning is performed by ISO-NE (id. at 2-22; Exh. SAN-NSTAR-2-1; Tr. 2, at 182).

Each operating region's forecast is initially produced through econometric regression equations without consideration of additional energy efficiency programs (Exh. NSTAR-1, at 2-22). After the peak forecast is produced for each operating region, projected incremental energy efficiency is subtracted from the peak demand forecast (id.). Demand reduction due to energy efficiency is spread across the substations in a region according to the size of each substation's demand (id.). The Company assumed that under the existing three-year efficiency program approved by the Department the amount of yearly incremental energy savings would reach a peak in 2015, and increase, albeit more slowly, between 2016 and 2020. The Company determined that, of NSTAR's total energy efficiency savings over the period, 16 percent would accrue in the former Commonwealth Electric service area (essentially Lower SEMA), and of that amount, 55 percent would occur in Tremont East (Exh. NSTAR-GMR-2, at 4). The Company translated the anticipated efficiency savings (in kWh) into peak demand reduction (in MW) by using a ten-year average load factor, and a 5.2 percent system loss factor (Exh. NSTAR-GMR-2, at 3). For Tremont East, the Company determined that cumulative demand reductions attributable to ongoing efficiency programs would increase from 6 MW in 2011 to 69 MW in 2021 (id. at 9).

In its Petition, the Company initially presented a 2009 peak load forecast that predicted 90/10 peak loads in Tremont East of 602 MW in 2010 rising to 667 MW in 2019. During the course of the proceedings, the Company submitted an updated 2010 forecast acknowledging that the actual 2010 peak for Tremont East reached 664 MW under rather extreme weather conditions described by the Company as 96/4 (Exh. NSTAR-GMR-2, at 20). The 2010 peak load forecast ranged from the actual peak of 664 MW in 2010 to 726 MW by 2019. According to the Company, the increase in the peak load forecast better reflects immediate load growth patterns evident in the Tremont East area (id.). A graph comparing the 2009 and 2010 Company peak forecasts, as well as that of Sandwich witness Paul Chernick (labeled "Tremont East PC

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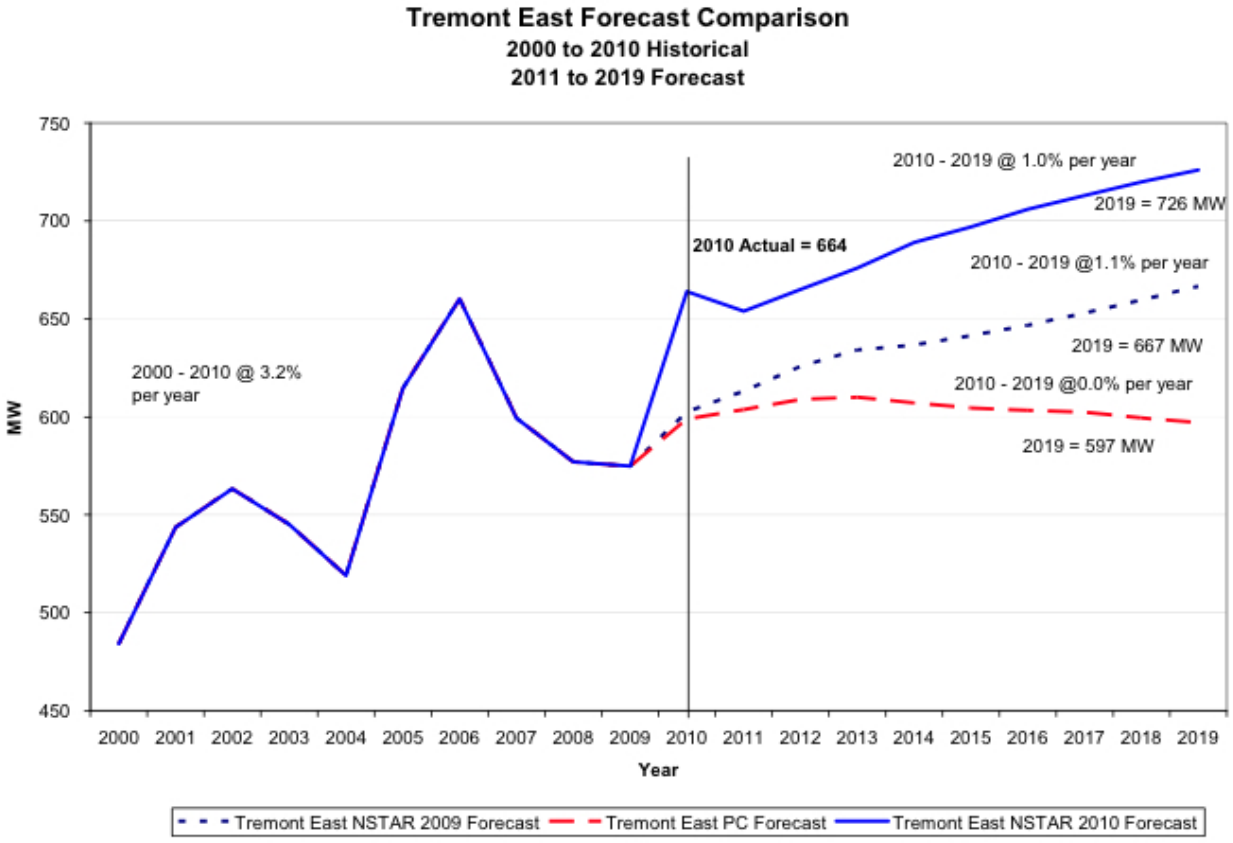
[15] A 90/10 forecast is based on 90% chance that actual peak loads would be less than estimated loads largely as a function of weather conditions such as temperature and humidity

Forecast"), is shown below. The percentage values noted for each forecast are the compound annual growth rates ("CAGR") for the 2010 – 2019 period.



(Exh. NSTAR-GMR-2, at 22)

NSTAR did not account for small distributed generation facilities (e.g., behind-the-meter generators) separately in the Company's peak load regression analysis. The Company noted that any smaller distributed generation faculties present in the historical data would have already been implicitly included in the Company's analytical approach (Exh. NSTAR-GMR-2, at 23). With respect to larger distributed generation facilities, the Company noted that such resources would be considered like other larger generators in the need analysis – only to the extent that they clear the forward capacity market and provide reliable capacity (id. at 23).

b. Contingency Analysis

Consistent with the reliability criteria established by NERC, NPCC and NEPOOL/ ISO-NE, NSTAR performed a contingency analysis to assess the ability of the local area transmission system to withstand double-contingency outages given projections of peak-load

(described supra), generator availability, and dispatch conditions (Exh. NSTAR-1, at 2-23). The Company's contingency analysis determined that critical transmission lines and other system elements would experience overloads under contingency conditions currently and continuing through 2013 (the five-year horizon) and 2018 (the ten-year horizon), and it calculated the magnitude of such contingency overloads on the specific transmission elements (id.).

i. Transmission Line Ratings

The first step of the contingency analysis involved the Company's evaluation of the thermal capability of each element according to its normal rating, long-term rating, and short-term rating (id. at 2-24). The "normal" rating for a transmission element is the continuous operating limit; the "long-term emergency" ("LTE") rating is the 12-hour capability of the element under peak-load conditions, which assumes that any loading affecting this line will last no more than 12 hours; "short-term emergency" ("STE") rating is the 15-minute capability of the element, although in practice the Company would have only about five minutes or less, depending on the overload, to alleviate the overload, which means that the Company must take immediate action to shed load. The Company performs its N-1-1 contingency analysis based on the LTE ratings, which is presumed to permit the Company sufficient time to dispatch crews and make repairs when problems occur (id.).

ii. Generation Availability

As required by NERC, NPCC and NEPOOL/ISO-NE reliability criteria, the Company performed the contingency analysis by first establishing designated base-case conditions for 2013 with "reasonably stressed" generation unit dispatches in the study area (id.). NPCC, NERC and ISO-NE reliability standards require that the contingency modeling assume conditions that "stress" the system before beginning to test it with contingencies. For example, ISO-NE Planning Procedure No. 3 ("PP-3"), Reliability Standards for the New England Area Bulk Power Supply System, states:

> With due allowance for generator maintenance and forced outages, design studies will assume power flow conditions with applicable transfers, load, and resource conditions that reasonably stress the system.

Section 5.2 of ISO-NE Planning Procedure 5-3, Guidelines for Conducting and Evaluating Proposed Plan Application Analyses ("PP 5-3"), defines "Reasonably Stressed Conditions" as follows:

> Reasonably stressed conditions are those severe load and generation system conditions which have a reasonable probability of actually occurring. Generally both import and export conditions should be addressed. The purpose of testing these conditions is to identify potential weaknesses in the system and not to test the worst imaginable extreme.

The Company developed three generator dispatch scenarios for the Lower SEMA area to assess transmission system loading conditions relating to "generator unavailability" that could occur coincident with transmission-element contingencies:

Base Case - 2013			
Units	Dispatch 1	Dispatch 2	Dispatch 3
2013	**2013_Disp1**	**2013_Disp2**	**2013_Disp3**
Canal 1	559	559	-
Canal 2	-	553	-
Pilgrim	685	685	685
Cape Wind	-	476	-
SEMASS	-	67	67
Dartmouth	-	61	61
Fore River	667	667	667
Somerset 6	105	109	109
Dighton	-	140	140
Taunton	-	131	131
Tiverton	-	245	245

(Exh. NSTAR-1, at 2-26)

iii. Load-Flow Analysis

To determine whether transmission elements would become overloaded under the NEPOOL/ISO-NE reliability criteria, the Company simulated the failure of one or two transmission elements on the system. To perform this analysis, the Company compiled a list of the transmission elements on the system, such as transmission lines, transformers and breakers, and then ran a series of simulations to test the transmission system using the base-case generation scenarios, and the outage of these transmission elements. These simulations allow the Company to model the load flows and voltages on all other transmission elements in the event of each contingency, and to perform technical evaluations of the system's capacity to meet normal and emergency operating requirements (Exh. NSTAR-1, at 2-26).

c. Results of Contingency Analysis

The thermal and voltage results presented by the Company indicate that the two 115 kV transmission lines serving the Tremont East area would experience the most significant overload conditions with the loss of the 345 kV Lines 342 and 322, under the N-1 and N-1-1 contingencies. Specifically, the loss of these two 345 kV lines would result in overloading of 115 kV Lines 108 and 113 to 149 percent and 137 percent, respectively, of the LTE rating under summer peak load conditions in 2013, without either of the Canal units operating, and Cape Wind unavailable for dispatch (id. at fig. 2-2, p. 1). Based on these loading levels, the transmission system operators would have fewer than five minutes to evaluate the system condition and take action to avoid permanent damage to the 115 kV lines and voltage collapse. Use of the 2010 updated peak load forecast would significantly worsen the situation. The Company concluded from the contingency analysis that it is vital that reinforcement of the transmission system in this area be completed as soon as possible (id. at 2-33).

D. Positions of the Parties

Sandwich, and its witness, Paul Chernick, assert that NSTAR has failed to meet its statutory burden to demonstrate a need for the project through a load forecast for electric power demand based on historically accurate information, reasonable statistical projection methods, and adequate consideration of conservation and load management efforts (Sandwich Initial Brief at 1). Sandwich contends that NSTAR's load forecasting methodology is rife with errors, unexplained anomalies, and fails to appropriately reflect established policies of the Commonwealth regarding energy efficiency and renewable and distributed generation resources that can further reduce loads and offset system demands (id. at 2). Sandwich faults NSTAR for providing very little forecast documentation with its Petition and responding slowly and incompletely to repeated discovery requests for such documentation, and introducing a new forecast late in the proceeding. That the peak load forecast shifted upward so significantly from 2009 to 2010 suggests to Sandwich that the methodology is unreliable and not accurately predictive (Sandwich Initial Brief at 31).

With regard to energy efficiency assumptions in the load forecast, Sandwich asserts that NSTAR's approach is flawed because it: (1) uses a loss factor that is too low; (2) is unclear whether NSTAR has fully taken account of Cape Light Compact's energy efficiency efforts; (3) ignores the fact that projected energy efficiency savings MWs would be higher under peak

load conditions than under normal conditions; and (4) inexplicably assumes that incremental energy efficiency savings will begin to diminish by 2015, despite strong policies of the Commonwealth to the contrary (Sandwich Initial Brief at 17). Sandwich also asserts that the load forecast is flawed because smaller distributed generation resources, that often operate behind-the-meter and reduce customer net loads, were not accounted for at all. Sandwich disputes the Company's logic of excluding such generators because of their intermittency. Sandwich notes the Cape has many renewable and distributed generation projects announced or under development, and that such projects are growing rapidly in response to Commonwealth laws, regulations and programs (Sandwich Comments on Issues Memorandum at 8-9).

Sandwich also disputes the need for the Project based on numerous aspects of the contingency analysis performed by the Company including the exclusions of both Canal units and Cape Wind in certain dispatch scenarios, and what the Town views as extremely remote probabilities that both of the 345 kV lines serving Tremont East would be sequentially out of service. Mr. Chernick calculated that, based on data provided by the Company, the loss of both 345kV lines would occur only once in 88.5 years (Sandwich Initial Brief at 11). Sandwich asserts that the high costs of the Project, and extremely low probability of it ever being necessary in actual practice, should compel the Siting Board to reject the Project. Even if the contingencies were to occur despite the long odds, Sandwich contends that limited load shedding is both a permissible and acceptable approach that would avoid the excessive Project costs. Sandwich contends that the Company's assertions of Project need inappropriately rely on "alleged urgency, scare tactics and the resulting parade of horribles" (id. at 9).

ISO-NE asserts that its regional transmission planning process determined a reliability need in the Lower SEMA areas, and identified the Project as the preferred solution to meet that need (ISO-NE Initial Brief at 17). In its Long Term Needs Assessment, ISO-NE's working group looking at Lower SEMA identified a number of weaknesses including thermal and voltage violations, inadequate transfer capability resulting in constrained imports and exports, and stability concerns. ISO-NE contends that these evaluations reflected ISO-NE's "considerable expertise and experience in transmission system planning and operation . . . and relied upon assumptions and parameters that have been reviewed and vetted by various stakeholder and regulatory participants through the open PAC [Project Advisory Committee] process" (ISO-NE Comments on Issues Memorandum at 3). Moreover, ISO-NE asserts that, even without growth

in load, the Lower SEMA transmission system has been shown inadequate to meet reliability criteria – even under existing load conditions (ISO-NE Initial Brief at 18).

GenOn asserts that the need identified by NSTAR for the Project is, "at best, premature and overstated" (id. at 7). While its initial concerns in this proceeding centered around the evaluation of Project alternatives, particularly quick-start generation at the Canal site, GenOn stated that it became evident that NSTAR's peak load forecasts are not reliable, as evinced by the 2010 actual peak loads for Tremont East arriving six to eight years early relative to the 2009 forecast. GenOn contends that these forecast inaccuracies are "rather stunning" and that "the urgency of need cannot be justified by NSTAR's unreliable peak forecasting methodology" (GenOn Reply Brief at 24).

GenOn contends that many of NSTAR's assumptions in its need analysis are contrary to the Commonwealth's public policy goals. Among the shortcomings cited by GenOn is a failure of NSTAR to consider any combined heat and power, community wind projects, or photovoltaic projects generating on Cape Cod that have not already cleared the FCM. Similarly, GenOn notes that NSTAR seems to use an outdated view of the role of efficiency in the supply mix going forward, with yearly incremental savings peaking in 2015 and then tailing off. GenOn argues that these extreme assumptions cannot be reconciled with the multitude of legislative mandates in Massachusetts to increase the contribution of those types of resources in the Massachusetts supply mix (GenOn Initial Brief at 16). This result is even more troublesome, GenOn asserts, because ratepayers bear the cost of regulations and programs to bring such resources to market, and would also have to pay the cost of "redundant resources for contingency protection" such as the Project (id.).

The Attorney General asserts that NSTAR has shown that its load forecast is based on substantially accurate historical information and reasonable statistical projection methods and is reviewable, appropriate and reliable (Attorney General Initial Brief, at 9-10). She further contends that NSTAR has shown through its analyses that the existing system does not meet applicable reliability criteria under normal operating conditions and under N-1 and N-1-1 contingencies for projected load (id. at 20). Given the potential for Canal units to be run out-of-merit to address the reliability requirements in Tremont East, the Attorney General sees the Project supported by economic efficiency grounds as well as reliability considerations.

Accordingly, the Attorney General asserts that the Company has demonstrated that there is a need for the Project (id. at 21).

NSTAR asserts that the load flow modeling evidence demonstrates that its proposed project or at least some additional energy resources are needed because its transmission system in Lower SEMA does not comply with reliability standards established by NERC. The Company argues that need is established as long as net peak load in Tremont East is over 460 MW, and peak loads have been over 600 MW for years. Given these actual loads, NSTAR states that distributed generation and load reductions from demand-response programs will be insufficient to reduce net peak load in Tremont East to any level even close to the 460 MW limit. In addition, it argues that electrical load in the area will grow over the next decade making the reliability need greater.

E. Analysis and Findings on Need

In sorting through the many issues that the parties have raised concerning the Company's demonstration of need, some appear to be fundamental methodological questions while others are more narrowly focused technical disagreements, or even judgment calls among the hundreds of such choices that go into collecting data, structuring models, and assessing the results for a need demonstration. Before addressing these issues, however, we note the fundamental importance of one key fact that is not in dispute in this case: in 2010 the Tremont East area experienced an all-time-high peak load level of 664 MW on an extraordinarily hot and humid summer day that was a statistical rarity – a one-in-25-year occurrence (or 96/4). This, level of peak demand was not anticipated in the Company's initial Petition to occur until after 2018.

The significance of this real-world extreme occurrence to the Siting Board's review of need cannot be overstated. It shows that the forecasting results initially presented by the Company, whatever their flaws, clearly did not reflect the most challenging peak load conditions that could arguably have been used in the contingency analysis of its system in Lower SEMA and Tremont East. It should also be noted that, while the deterministic scenarios and methodologies that underlie contingency analyses inherently tend towards the improbable, as asserted by Mr. Chernick, in this instance, actual weather conditions were far more challenging than the 90/10 weather assumptions specified for use by reliability planning standards and industry protocols. In fulfilling its statutory responsibilities to ensure reliable electric service, the Board views as entirely appropriate placing significant weight on actual loads that

demonstrate a credible, material and potentially recurring threat to system reliability and not necessarily relying solely on projections and modeling for purposes of making a need determination. See National Grid Worcester, EFSB 09-1/D.P.U. 09-52/09-53, at 6, n.7.

As noted by GenOn, the "rather stunning" disparity between the initial projections of peak loads in Tremont East, and the actual experience in 2010 clearly exemplifies why the reliability of the load forecast has proven to be a major issue in this case, with a number of criticisms presented primarily by Sandwich and GenOn. Sandwich takes exception to the Company's treatment of energy efficiency-related peak demand reductions, and smaller distributed generation resources that are typically "behind-the-meter" (Sandwich Brief at 17-21). The essence of these criticisms regarding energy efficiency is that the Company has taken a "known and measureable" approach by assuming that such savings will accrue primarily from existing and approved program budgets rather than any expectation of future program investments.

The Siting Board notes that these highly cost-effective energy efficiency programs are now well-established policies of the Commonwealth, as reflected in the Green Communities Act, the Global Warming Solution Act and longstanding Department case precedent and programs as well as those of other Commonwealth agencies. There is no substantiation for the Company's assumption that incremental energy savings and related peak-load reductions from these ground-breaking programs will plateau around 2015 and decrease thereafter. Nevertheless, the Company's caution is not entirely misplaced, but a preferable approach would have been to submit sensitivity cases that offered a more robust outlook on the continuing effectiveness of these programs, given not just the investment of public funds, but the likelihood of future regulatory changes affecting energy use and technological progress in this area. Arguably, yearly incremental energy savings could just as easily have continued accelerating over the forecast period as peaking and then decelerating.

With regard to net-metered distributed generation sources that serve as an offset to net customer loads, the Company contends that it did not separately identify this growing resource in its forecast, although it argues that distributed generation is embedded in the regressed relationships of historical data. Here again, the Company's methodology falls short of faithfully reflecting established laws and regulations of the Commonwealth, such as the Solar Carve Out, that are now beginning to deliver megawatts of new resources in Tremont East (Sandwich

Comments on Issue Memorandum at 9). Given the uncertainties associated with siting and building any generation resources, distributed or otherwise, this area also lends itself to the use of sensitivity cases to explore reasonable parameters of future program effectiveness.

Larger renewable resources – such as Cape Wind, that must bid into ISO-NE energy markets to supply the grid – were treated by the Company like other central station generators, that is, on the supply side in load flow modeling, rather than as an offset to end-use customer loads typified by smaller, net-metered resources. For Cape Wind, in particular, the Siting Board notes that the Company's approach used different base-case generation scenarios, including one dispatch with the full anticipated capability of Cape Wind and two dispatches with zero generation, reflecting the intermittence of the resource. The Board finds that a third scenario based on partial-load operation, would have added additional value to the simulation.

The Board agrees with the Company's decision to include some dispatch scenarios that had both Canal units off-line. Since 2006, the Canal units seldom operated in economic merit, because of the price disparity between natural gas and residual oil. Witnesses debated whether the price disparity would continue at recent levels, but not one witness predicted that the price disparity would disappear entirely. As a result, in accordance with current practices, the Canal units are both likely to be off-line at the time of an N-1-1 contingency on the 345 kV lines, even at most times when loads are above 460 MW – which is the transfer limit of the two 115 kV lines that feed Tremont East.

Another area of considerable debate regarding Project need is the relevance of probabilistic assessments and whether they can be properly ascertained during Siting Board reviews, given the complexities of power grids and the resources that feed them, coupled with the dictates of reliability planning that are largely grounded in deterministic approaches.[16] The Siting Board understands the well-established use of deterministic methods in the evaluation of system reliability needs and views their use as appropriate for such purposes. In reviewing this issue, the Board finds that the probabilities associated with relevant system contingencies, or the resulting likelihood of load-shedding outages, are not really questions of whether need for a

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[16] As noted above, the use of 90/10 peak load forecasts in reliability planning is a clear illustration of a probabilistic concept that is, in fact, an accepted part of established planning procedures. In 2010, this parameter was eclipsed by actual events that involved 96/4 extreme weather conditions.

resource exists – but rather, of how that need is dealt with. Accordingly, we address this issue in Section IV, below.

ISO-NE has asserted that as the regional transmission planning reliability authority, its planning procedures, studies, and findings on reliability should be accorded considerable weight, if not outright acceptance by the Siting Board. While the Siting Board welcomes and appreciates ISO-NE's active involvement in this proceeding, we cannot ignore that this is an adjudicatory proceeding and facts in Siting Board cases must be presented to substantiate arguments; the Board then evaluates those facts and arguments as to their decisional relevance and weight.

While the 2010 peak load forecast suffers from many of the same limitations as the initial 2009 forecast, we find that it is minimally sufficient for use in this proceeding to evaluate the Company's assertion of need. Given that the load flow models showed significant thermal and voltage violations using the much lower 2009 forecast, and that the estimated peak load for 2018 was already breached in 2010, the accuracy of the forecast proves not to be critical to our decision that contingency planning demonstrates a need for energy resources, and that some action must be taken.

We also support the Attorney General's perspective that economic efficiency, as well as reliability, has relevance to a finding of need. While the $316 million of out-of-merit dispatch costs for running Canal units for reliability purposes halted in August 2009 following the short-term measures, the possibility exists that ISO-NE could once again force Canal units to operate in this manner to the great financial detriment of SEMA ratepayers who would shoulder the above-market costs, as they did previously. Alleviating the risk of such costs returning to the bills of SEMA ratepayers is indeed an economic benefit that fulfills the Siting Board's "economic efficiency" rationale for project need.

We concur with the Company, ISO-NE and the Attorney General that an N-1-1 contingency of sequentially losing both 345 kV lines serving Tremont East is a combination that NERC requires NSTAR to evaluate. Modeling of the transmission system, with the Canal units typically turned off and with electric flow into the area greater than 460 MW, shows that thermal overloads and low voltage conditions, perhaps even voltage collapse, would ensue under N-1-1. In other words, the "firm transmission capacity" of the existing transmission system after an N-1-1 loss of two transmission elements is approximately 460 MW.

Peak loads in Tremont East have exceeded 460 MW since 1994. There is no credible evidence in the record that peak net load levels will be significantly reduced in the future. Thus, even with a minimally sufficient load forecast, the Board concludes that future peak loads in Tremont East will continue to significantly exceed 460 MW. Accordingly, NSTAR's load flow modeling of the performance of its Lower SEMA transmission system at loads of 601 to 662 MW is consistent with recent actual loads and was reasonable and proper.

The Siting Board views the ability to posture the system after the loss of one of the 345 kV lines, made possible by the short-term measures, as an additional energy resource and therefore a potential means to solve the transmission need indicated by the load flow modeling. Especially since it may be combined with one or more non-transmission alternatives, system posturing may provide or at least be an integral part of the optimal solution that meets the reliability need in the Tremont East area. Without at least posturing the system after a first contingency loss, Tremont East would be subject to thermal violations and voltage collapse after a second contingency at high loads. For these reasons, the Siting Board finds that additional energy resources are needed for Tremont East.

IV. ALTERNATIVE APPROACHES TO MEETING THE IDENTIFIED NEED

A. Standard of Review

G.L. c. 164, § 69J requires a project proponent to present alternatives to the proposed facility which may include: (a) other methods of transmitting or storing energy; (b) other sources of electrical power; or (c) a reduction of requirements through load management.[17] In implementing its statutory mandate, the Siting Board requires a petitioner to establish that, on balance, its proposed project is superior to alternative approaches in terms of reliability, cost, and environmental impact in its ability to meet the identified need. In addition, the Siting Board requires a petitioner to consider reliability of supply as part of its showing that the proposed project is superior to alternative project approaches. National Grid Worcester, EFSB 09-1/ D.P.U. 9-52/9-53, at 19; GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 32; Cambridge Electric Light Company, 12 DOMSB 305, at 321 (2001) ("CELCo/Kendall").

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[17] G.L. c. 164, § 69J also requires an applicant to present "other site locations." This requirement is discussed in Section V.A, below.

B. Project Approaches Identified by NSTAR

In its initial Petition, NSTAR presented ten potential approaches (including the Project) that could conceivably meet the need identified by the Company. NSTAR determined that two of the alternatives did not meet or could not "reasonably meet" the identified Project need and, therefore, NSTAR did not analyze them further in its Petition. However, all ten of the Project approaches are presented below.[18]

1. Non-Transmission Alternatives Identified by NSTAR

a. "Do Nothing" Alternative

According to NSTAR, Canal Station has been dispatched out of merit historically to provide coverage for second contingency events, such as the potential loss of the 345 kV lines serving Tremont East. NSTAR's "no-build" alternative would require that Canal Station run out of merit on heavy load days when peak demand exceeds the transmission system capabilities in Lower SEMA (Exh. NSTAR-1, at 3-5). The Company stated that "NSTAR ratepayers in Lower SEMA would continue to pay the cost of this out-of-merit operation" which would worsen as load in Tremont East continues to grow (id.). In the longer term, NSTAR voiced concern that the two aging Canal units could require substantial modifications in response to changing USEPA requirements for once-through cooling technology, that might lead to the units "being removed from service." NSTAR contends that the do nothing alternative "does not meet the project need, and was, therefore, eliminated from any further consideration" (id. at 3-6).

b. Quick-Start Conventional Generation Alternative

NSTAR evaluated an alternative of installing two General Electric 7FA frame gas turbine units at the Canal site, which would have a combined summer rating of 314 MW (Exh. NSTAR-1, at 3-7, 3-22). NSTAR stated that these turbines would provide more than the 248.4 MW of additional Installed Capacity ("ICAP") necessary to satisfy double contingency reliability requirements through the end of the 2022 planning period, and that it would be the least expensive quick-start gas turbine option (Exh. NSTAR-1, at 3-7).

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[18] Several of the alternatives identified by NSTAR were of considerable interest to other parties in the proceeding, who relied on interrogatories, cross-examination, and, in some cases, direct testimony to develop and put forth their own views and proposals regarding Project alternatives. These are described in Section IV.D, below, and ultimately became the focus of the discussion in this proceeding regarding Project alternatives.

NSTAR consultant Levitan and Associates, Inc. ("Levitan") estimated that the capital cost required of the quick-start turbine generation owner would be approximately $365 million (id.). Levitan estimated the present value cost of the GE 7FA frame units (accounting for energy sales revenue and energy price suppression) at $182.4 million, versus $85.7 million for the proposed Project (id. at fig. 2-11). Given this cost disparity, NSTAR noted that "the quick start generation is inferior to the proposed transmission solution" (id. at 3-7).

With regard to environmental impacts, NSTAR concluded that, with assumed construction at the existing Canal site, the quick-start turbine units would entail only limited temporary environmental impacts (id. at 3-22). Once operational, NSTAR noted that the units would produce incremental air pollution and have a higher heat rate than would a combined cycle generator (id.).

c. Demand Response Alternative

NSTAR stated in 2010 that there were 7.4 MW of Real Time Demand Response ("RT DR") resources that can be activated within 30 minutes in Tremont East (Exh. NSTAR-1, at 3-7). Levitan estimated that 20.1 MW of RT DR resources had cleared the forward capacity market for 2012 (id. at 3-8). According to the Company, a Project alternative relying solely on RT DR would necessitate an additional 160 MW of RT DR for 2012, with subsequent increases to match projected load growth (id. at 3-9). NSTAR stated that this level of Demand Response in Tremont East is far beyond the market penetration levels achieved in New England or any other region. Levitan provided an extrapolated cost estimate of the required RT DR levels, which was a present value of $266 million (id.; Exh. NSTAR-1(2-1) at 51). NSTAR noted that, because there is proportionally less industrial and large commercial load in Tremont East, the RT DR potential in Tremont East would be even more limited than in other areas, making the alternative infeasible (Exh. NSTAR-1, at 3-9, 3-10).

NSTAR stated that there would be no temporary or operational environmental impacts, provided that the full requirement for RT DR is met by load shedding rather than emergency generation (id. at 3-22). Further, NSTAR stated that there would be an avoided emissions benefit (id.).

d. Renewable Energy Generation

As of September 2010, NSTAR reported a total capacity of existing renewable energy projects of about 3.3 MW, mostly from wind, within Tremont East, with proposals for another 40 MW or so of land-based wind turbines (Exh. NSTAR-1, at 3-10). The proposed Cape Wind project would have a maximum output of 468 MW and an anticipated average annual output of 170 MW (id. at 3-11, n.17). NSTAR asserted that, because wind and solar projects are intermittent, these renewable energy sources do not contribute to firm power supply for a given area at any specific time, although they would produce energy over the course of the year (id. at 3-12). NSTAR concluded that renewable energy generation would not meet the need and did not consider the alternative further.

2. Transmission Alternatives Identified by NSTAR

a. The Proposed Project

The Company included the proposed Project, as described in Section I.A, above, among the other Project alternatives for economic and environmental evaluation and comparison purposes (Exh. NSTAR-1, at 3-22). NSTAR estimated the capital cost of the proposed project at approximately $102 million, for the Company's preferred route (id. at 3-14; Tr. 4, at 587).[19] The estimate includes contingency of about $5 million (Tr. 4, at 646). NSTAR did not otherwise have an estimate of the accuracy of the estimate (i.e., range of error) (id.). NSTAR submitted a request to have the cost paid through the regional transmission tariff, and ISO-NE has granted the request (Exhs. EFSB-C-2(S2); EFSB-C-2(1)(S2)). For comparison with other alternatives, NSTAR estimated the revenue requirement for the Project for the first year at about $16.6 million (RR-EFSB-11).[20]

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[19] The $102 million figure does not include an $8.3 million cost item for separating the two existing 345 kV circuits that are on shared structures for the crossing of the Cape Cod Canal onto separate structures (Tr. 4, at 587). The circuit separation would occur with any alternative (id.), so it is omitted from the comparison. A subsequent Project figure of $106 million ($98 million without the circuit separation) was presented by the Company but the original figure is used here so that cost estimates for all alternatives are of the same vintage.

[20] Load in Massachusetts would pay about 46 percent of Project costs, of which about 23 percent would be paid by load in SEMA, of which less than half would be paid by what NSTAR characterized as the "benefitted load" in Tremont East (Tr. 4, 551).

b. Carver to Bourne 345 kV Transmission

The Carver-to-Bourne 345 kV alternative would differ from the proposed project chiefly by locating a new 345 kV/115 kV substation near the existing Bourne Switching Station, and moving existing Bourne Switching Station functions to the new substation, instead of using the existing Line 120 to carry 345 kV power to an independent new 345 kV/115 kV substation in West Barnstable (Exh. NSTAR-1, at 3-15). The estimated cost was approximately $140 million (id.). NSTAR stated that the temporary and operational environmental impacts of this alternative are limited, and comparable to those of the Project given the use of existing ROW. However, the reconstruction of the Bourne Switching Station means that there would be reliability risks during construction resulting from outages of six 115 kV lines (id. at 3-22).

c. Brayton Point to Cape Cod 345 kV Transmission

A Brayton Point-to-Cape Cod 345 kV alternative would link Lower SEMA to power sources in the Fall River area, would include about 40 miles of new transmission line, and would cost an estimated $155 million to $163 million, depending on whether it were tied to existing Line 120 and a new substation in West Barnstable, or tied to a new substation at Bourne (Exh. NSTAR-1, at 3-16). Some of the existing rights-of-way between Brayton Point and Bourne are relatively narrow and might need to be expanded to accommodate a new line (id.). NSTAR noted that the temporary and operational environmental impacts of this alternative are comparable to the Carver to Bourne alternative, as are the reliability considerations (id. at 3-22).

d. Transmission at 115 kV

NSTAR developed and evaluated a transmission alternative restricted to 115 kV lines and equipment. The option would include 35 miles of new, replacement, or upgraded transmission lines, some extending from Carver Substation through Tremont Substation to Bourne Switching Station, and a separate link in the New Bedford area (Exh. NSTAR-1, at 3-17, fig. 3-8). The option would require over 300 million volt-amperes reactive ("MVAR") of reactive compensation for voltage support for high load periods, and station work at Bell Rock, Industrial Park, Mendall Road, Tremont, Carver, and Bourne substations (id. at 3-17). NSTAR indicated that the outages of existing lines required for this option would present a reliability risk during its construction (id. at 3-18). NSTAR estimated the cost at approximately $170 million (id.).

NSTAR noted that there would be temporary environmental impacts related to the significant expansion of the Carver Switching Station.

e. Submarine Cable, Pilgrim Station to Canal

This alternative would entail a 19-mile undersea 345 kV cable from the switchyard at Pilgrim Nuclear Station to Canal Substation, with an estimated cost of $348 million (Exh. NSTAR-1, at 3-19). The environmental impacts noted by NSTAR include the disruption of 184 acres of seabed for the installation.

f. Submarine Cable, Seabrook Station to Canal

This alternative would use a 90-mile length of undersea 345 kV direct current cable from the Seabrook Nuclear Power Station in New Hampshire to Canal Substation; it would cost an estimated $670 million (Exh. NSTAR-1, at 3-19). Environmental impacts would stem from placement of the cable in the seabed using a jet plow or alternative installation techniques.

3. NSTAR Assessment of Project Alternatives

NSTAR assessed the Project as having the lowest cost among the alternatives, and limited environmental impacts (Exh. NSTAR-1, at 3-21). NSTAR stated that terminating the 345 kV line in West Barnstable, rather than at Bourne, brings a strong power supply to the central area of Cape Cod (id.). On the basis of these merits, the Company selected the proposed project as the best solution to project need.[21]

C. Project Approaches Evaluated by ISO-NE

ISO-NE stated that it oversees New England's wholesale electricity markets, ensures the reliable operation of the regional power system, and conducts the regional transmission planning process (ISO Brief at 7). With the emergence of competitive generation markets, ISO-NE evaluates market responses to identified needs. If ISO-NE is not satisfied that market responses appear adequate to provide reliability support, ISO-NE will move forward in its planning process

[21] The Siting Board agrees with NSTAR that none of the other nine project alternatives described and evaluated by the Company would be the preferable solution, for the reasons cited by NSTAR. See Section IV.F, below, for analyses of the additional alternatives evaluated in the proceeding.

with stakeholders to address resource needs, with solutions that often include transmission projects (Tr. 10, at 1466).

In the Lower Southeastern Massachusetts Area Long Term Solution Study Report ("Solutions Report") dated April 2010 ISO-NE identified the proposed Project as its preferred solution for identified reliability concerns from among the eight possible projects (Exh. ISO-FM at 3). Mr. Frank Mezzanotte of ISO-NE pointed out that ISO-NE's process is not designed to evaluate a comprehensive range of resource alternatives (Exh. AG-ISO-1-7). Instead, ISO-NE evaluates transmission alternatives if no market responses "come forward" (id.).

D. Project Approaches Evaluated During the Proceeding

Parties in the proceeding relied on interrogatories, cross-examination, and, in some cases, direct testimony to develop and put forth their own views and proposals regarding Project alternatives. Through its discovery and examination, Siting Board Staff also explored the Company's proffered alternatives as well as some additional approaches. The Project alternatives record developed by Staff and parties can be grouped in the following general categories: (1) load-shedding on the transmission system; (2) reducing net load in Tremont East through a combination of environmentally oriented actions such as demand-side measures (including efficiency and demand response) and supply-side resources (such as distributed generation and renewable resources); (3) operation of the existing Canal units during high load periods; and (4) construction of new gas turbine units proposed by GenOn for the Canal site (a modification of NSTAR's "Quick-Start Conventional Generation" alternative). It should be noted these Project alternatives are not mutually exclusive, and that potentially, they could be combined into hybrid strategies to meet the identified need.

1. Load Shedding

NSTAR provided information about load shedding in its Petition in its section on Project need, rather than as a Project alternative. As noted in Section III, above, the Siting Board views preparation for load shedding as an alternative to the Project.

Sandwich contends that load shedding is a reasonable response by ISO-NE and NSTAR to the "very unlikely" possibility of losing both 345 kV lines in a second contingency situation, which NSTAR uses as a basis of its Project proposal (Exh. SAN-PLC-1, at 24; Sandwich Comments on Issues Memo at 7). Sandwich's witness Mr. Chernick noted that, prior to the

short-term measures in Lower SEMA, the loss of both 345 kV lines without Canal units in operation "could bring down the transmission system in a large part of SEMA and require lengthy restoration procedures" (Exh SAN-PLC-1, at 22). Following the completion of those upgrades in the summer of 2009, Mr. Chernick contends "…the prospect of unlikely, limited, short-duration outages is no longer problematic" (id). Mr. Chernick supported this contention by pointing to ISO-NE statements in the January 2009 "Long-Term Report of ISO New England Inc." required pursuant to the FERC SEMA Settlement Agreement ("Long-Term Report") that Tremont East can be postured so that load-shedding after a second contingency would be selective, meaning that up to approximately one-third of the Tremont East load could be shed on an N-1-1 contingency,[22] that an outage could be rotated within Cape Cod,[23] and that service could be served as demand subsides when temperatures recede (id. at 23; Exh. EFSB-N-3(1) at 4-5, n.11).

As noted in Section III and described in the Long Term Report, ISO-NE, NSTAR, and National Grid committed to developing an operations guide that would incorporate posturing for load-shedding to maintain overall system reliability during contingencies, in lieu of dispatching the Canal units for LSCPR (Exh. EFSB-N-3(1) at 4-5). Mr. Chernick acknowledged that the Long-Term Report indicates that at the highest loads, or if loads grow, there is a risk of dropping the entire Cape load on the second contingency (Exhs. SAN-PLC-1, at 4; SAN-PLC-3, at 13). Mr. Chernick asserted that it would be reasonable for the Board to find the risk of such an event

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22 According to ISO-NE's 2009 Long-Term Report, operators can posture the Tremont East system selectively, after a first contingency, to drop up to approximately one-third of Tremont East load (i.e., about 225 MW) on a second contingency (Exh. EFSB-N-3(1) at 4, n.11). When Tremont East loads are high enough that dropping 225 MW would not avoid voltage collapse on a second contingency, operators must posture the system to drop all customers east of Bourne Switching Station – i.e., all customers on the Cape and Islands (id.; Exh. SAN-NSTAR-2-20). Mr. Chernick's understanding is that net Tremont East loads over about 630 MW require this more severe posturing (Exh. SAN-PLC-1, at 24).

23 NSTAR's ability to shed load at individual stations, which could be used following a second-contingency loss of load, allows for rotation of a blackout (Exh. SAN-PLC-1, at 23, 26). Mr. Chernick quotes NSTAR as stating "Every load serving substation within NSTAR and Tremont East in particular can be shed individually from the transmission system by remotely or locally opening the step-down transformer breaker that supplies the substation" (id., citing Exh. SAN-NSTAR-2-18).

acceptable, due to its rarity.[24] Mr. Chernick contrasted the expected rarity of an N-1-1 outage with the reported frequency and duration of outages that Cape customers typically experience, 1.2 times per year, for a total of two hours without power per year (Exhs. SAN-PLC-1, at 24; SAN-PLC-3, at 10).

While taking issue with several aspects of the Load Interruption Guideline, Sandwich contends that, at peak loads of almost 700 MW, load shedding of less than 200 MW could be sufficient given the remaining capacity of the 115 kV lines, in conjunction with shifting some loads to other substations, demand response and local generation. Sandwich notes that this level of load interruption would be "well under the ISO Proposal limits" (Town of Sandwich Comments on Issues Memorandum at 6-7).[25]

2. Reducing Net Load

The parties in this proceeding generally acknowledge that a need for energy resources can be met in a variety of ways that may include non-transmission alternatives on both the supply-side and the demand-side of the electric power market. Demand-side resources include energy efficiency and demand response while supply-side resources include utility-scale generation resources, and a range of distributed generation technologies such as combined heat and power, renewables, and back-up or emergency generators. In its filing, the Company gave

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[24] Sandwich argues that with a book life of 40 years, the Project would have no more than a 1.6 percent chance of solving an outage in its lifetime, calculated from an outage interval for double outages at high load that it considers implausibly conservative of 2500 years (Sandwich Comments on Issues Memo at 5). Using another set of assumptions of outage likelihood that he also considered implausibly conservative, Mr. Chernick extrapolated that load shedding is economically preferable to the Project if avoiding an outage is worth less than $100,000 per customer (Exh. SAN-PLC-3, at 5).

[25] Sandwich acknowledges that the actual configurations of the Tremont East substations could present a difficulty in limiting how much load would need to be shed. Given that some of the substations are served by both 115 kV and 345 kV lines, it may be difficult to posture them for the second contingency without overburdening the remaining 115 kV system. The Town calls this a "design decision" by NSTAR that prevents the 115 kV system from providing its full measure of load carrying capacity in the event of an N-1-1 contingency. To address this limitation, the Town urges NSTAR to develop its "evolving Smart Grid infrastructure to quickly change switch settings remotely and minimize loss of load, in the extremely rare event of a double 345 kV outage at a peak hour" (Sandwich Comments on Issues Memorandum at 7).

some consideration to these alternative approaches, and concluded that most were not feasible alternatives, and that none was superior to the Project based on cost, reliability and environmental impacts. In contrast, Sandwich and GenOn put forth specific proposals and arguments favoring these non-transmission alternatives, and challenging the Company's selection of the Project.[26]

Mr. Chernick recommends that the Board reject NSTAR's Petition in favor of what he describes as a "least cost solution for meeting those needs, including enhanced energy-efficiency programs, local renewables, combined heat and power ("CHP"), demand response and distributed generation" (Exh. SAN-PLC-1, at 4, 5). In Mr. Chernick's view, aggressive pursuit of these resources could mitigate peak loads, but would not eliminate the possibility of dropping some load on a second contingency. Thus, a more feasible approach to reducing net load combines it with load posturing as described above. Mr. Chernick contends that ISO-NE procedures for addressing a resource need should ensure that a least-cost solution be supported by the same loads that would pay for a transmission solution (id. at 5). He advises that if a need for additional resources develops in future years, NSTAR should establish a multi-party process to determine the least-cost solution, including non-transmission alternatives (id. at 4, 5).

Based on his extrapolation of existing efficiency programs, Mr. Chernick contends that the Company's projection of energy efficiency savings in Tremont East is understated by about 30 MW in 2013 and 75-80 MW in 2018. Peak loads could be even lower, he asserts, by increasing incentives for demand response in Tremont East, and by making deeper investment in energy efficiency in Tremont East. As for supply-side resources, Mr. Chernick again finds that the Company has understated the potential contribution that renewables and CHP could or should provide in Tremont East, thereby reducing the need for new transmission. In particular, he suggests that NSTAR take actions to encourage development of these resources including giving preferences to resources in Tremont East and assisting customers in developing projects. He notes that in its recent renewables RFP, NSTAR was offered at least two projects in Tremont East, as well as capacity from Cape Wind, but chose projects outside Tremont East, and mostly outside Massachusetts.

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[26] Non-transmission alternatives include the use of Canal Station, in its current form, or as the site of new quick start gas turbines. These specific topics are addressed in separate sections infra.

3. Operation of Existing Canal Units

As noted above, there are two existing large generation units at Canal Station. If either unit is generating power at the time of an N-1-1 contingency involving the two 345 kV lines that cross the canal, no thermal or voltage violations would ensue (and no load would be dropped). Since the units are typically out-of-merit even at relatively high load levels, customers would have to pay the LSCPR for operating the units. The Canal units are not well-suited for peaking operation because they require most of a day to ramp up to produce power. As a result, to provide a full measure of local contingency reliability, system operators would have to call up the units in advance, incurring LSCPR costs, when temperatures and loads are forecast to be high.[27]

To better estimate costs to consumers of operating the existing Canal units to avoid violations or loss of load, Staff requested that ISO-NE calculate what it would have cost in 2010 to operate a Canal unit on days when loads could have been predicted to exceed the capacity of the two 115 kV transmission lines. ISO-NE estimated that the cost to run one Canal unit for reliability purposes, instead of being prepared to shed load on a second contingency, would have been approximately $37 million in 2010 (RR-EFSB-ISO-4). Of this amount, about $17 million would have been recovered in energy sales, and the remaining $20 million in uplift costs would be allocated to customers (RR-GEN-ISO-3). According to ISO-NE, the uplift cost would be borne by Lower SEMA ratepayers (id.). GenOn disputed the estimate[28] and suggested that a more accurate net cost for running Canal for LSCPR might be $10 million per year (GenOn Brief at A-8).

Regarding the impact of environmental regulations on the Canal units, GenOn evaluated the requirements and "hypothetical modes of compliance with the pending regulations under Section 316(b) of the Clean Water Act, the Cross-State Air Pollution Control Rule" and the Maximum Achievable Control Technology for Utility Air Toxics ("MACT") Rule (id. at A-4).

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[27] Having a Canal unit operating at times of high load would mean that this alternative would also provide protection in the event of a simultaneous (N-2) outage of two 345 kV lines.

[28] ISO-NE stated that it estimated Canal's costs using sensitive market information. ISO-NE had concerns about distribution of sensitive market information even subject to a protective order. Staff did not seek to obtain access to the sensitive market information. As a result, parties and Staff were not able to review the details of the ISO's estimate.

GenOn contends that, the Cross-State Air Pollution Control Rule does not apply to generators in Massachusetts, and that the MACT Rule will not affect either of the units given electrostatic precipitators already present and the units' low capacity factors (id.). For 316(b) compliance, GenOn asserts that Canal Station will be able to comply with the final rules with some minor operating limitations and minor expenditures for upgrades to existing intake screens (id. at A-5).

4. New Generation at Canal

To address the Tremont East reliability needs identified by NSTAR, GenOn proposed to construct by January 2015, two 198.5 MW Siemens SGT6-5000F(3) gas-fired quick-start turbines, with ultra-low sulfur distillate ("ULSD") as a back-up fuel ("GenOn gas turbines") (Exh. GENON-SK-1, at 3). These units are designed to reach 300 MW of output in ten minutes and full load output of 398 MW in twelve minutes (id.).[29] GenOn would construct these units at the existing Canal site, which it argued is a sensible location given the site already houses appropriate infrastructure such as fuel storage and grid connections and power generation is an activity that enjoys local support (id. at 8, 9; Tr. 8, at 1027). GenOn witness Dr. Ira Shavel found that, relative to NSTAR's Project, the GenOn gas turbines would reduce costs for Massachusetts and New England ratepayers by $144.3 million and $446.3 million, respectively, during the 2013 – 2022 planning period. GenOn attributed the savings to displacing higher cost oil- and gas-fired generation, and the resulting price suppression of the New England electric market. (Exh. AG-GENON-1-3(b)).

GenOn's gas turbines would require financial support in the form of a long-term contract, as GenOn maintains that the project is not feasible with market income alone (Tr. 8, at 1121). GenOn estimated the total cost to construct its proposed gas turbines at either $266 or $279 million (in 2011 dollars), depending on its contracting approach (Exh. GENON-SK-1,

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[29] GenOn asserted that despite repeated efforts, it was unable to persuade ISO-NE to include a quick-start generation solution for inclusion in the 2009 Long-Term SEMA Study, nor did ISO-NE undertake an economic study of the Canal repowering proposal as requested by GenOn in 2009. GenOn's contends that NSTAR also rebuffed its attempts to discuss the proposed solution and contract terms and refused to "discuss or consider any proposal from GenOn" (GenOn Initial Brief, at 22). NSTAR's witness Robert Clark, Director of Transmission Business Strategy, attempted to explain that refusal by indicating, in essence, that if an option is not considered by ISO-NE in the transmission planning process there is no need for NSTAR to consider it (Tr. 2, at 289).

at 6). Fixed operations and maintenance costs were estimated to be approximately $4.9 million per year (id.). GenOn stated that it would be willing to enter into a fixed-price contract for construction and operation of its facilities, such that any construction cost over-runs would be borne by GenOn (Exh. GENON-AMC-1). As a dual-fuel unit, the GenOn Alternative would be able to avoid a need for more expensive firm gas supplies, and could switch to ULSD if gas supplies were not available.

E. Positions of the Parties

1. NSTAR

NSTAR argues that project alternatives must add sufficient transmission capacity to eliminate overloads; that generation alternatives would have to either be economic to run in merit or capable of providing full output within ten minutes of starting and would need to be available by 2013 (Company Brief at 33) – a combination of criteria that none of the non-transmission alternatives would meet. The Company argues that it is not reasonable or feasible to rely on demand response to meet the identified need; that load shedding and/or paying existing Canal units for LSCPR is "unacceptable"; and that the identified generation alternatives in the record are inferior to the Project due to cost, reliability, and timing reasons (id. at 50, 35, 39-47).

NSTAR asserts that its proposed Project is the superior alternative for meeting an important reliability need in the Tremont East portion of the Company's service territory and that the Project was vetted through an open and transparent stakeholder process, and ultimately approved by ISO-NE for inclusion in the Regional System Plan. NSTAR contends that it is "critically important that the Board get these issues right in this proceeding, not only for customers in Lower SEMA, but also for a host of other needed transmission projects that will soon be coming before the Siting Board using the same planning process and the same objective of providing customers safe, reliable and economic service" (Jan 12, 2012 EFSB Meeting Tr. at 20).

NSTAR argues that deterministic modeling has been firmly established for over 50 years, and that probabilistic evaluation of alternatives is too uncertain for the Board to rely on. NSTAR argues that, to the extent NSTAR and ISO-NE do not comply with national criteria, both could be subject to fines or other sanctions (Company Reply Brief at 11). In sum, NSTAR cautions that the use of probabilistic analysis to evaluate the Project, or alternatives, is not proper or

consistent with relevant standards, procedures, and precedent and should be rejected by the Board.

With respect to load shedding, NSTAR asserts that reliability standards do not allow for substantial load shedding, except as a short-term practice to meet the reliability requirements (Company Brief at 37). Moreover, the Company asserts, the Siting Board's overriding statutory mandate "to provide a reliable energy supply" for the Commonwealth is not properly achieved when load shedding is used in a manner that can result in large increments of loss of load on a long-term basis (id.). NSTAR suggests that up to 25 MW of load shedding is a potentially acceptable planning level, but that the levels under consideration for Tremont East are beyond amounts discussed or implemented by transmission planners (id. at A-9).

In looking at on-Cape quick-start gas turbines as a reliability solution, the Company argues that both its own conceptual quick-start unit and GenOn's proposed two-unit gas turbine facility for the Canal site are inadequate (id. at 41). In both cases, the Company concluded that the capital costs were too high relative to the Project, the energy market revenues too low to offset the higher capital costs, and the construction lead times too long to offer a timely, cost-effective, reliability alternative to the Project. Further, the Company notes that the contractual costs to support construction and ongoing operation of the quick-start units would be borne entirely by NSTAR's ratepayers (and/or other electric distribution companies) whereas costs of the Project would be apportioned across New England. The Company asserts that the price suppression benefits identified by GenOn's witness Dr. Shavel were grossly overstated due to unrealistic assumptions about in-service dates for the GenOn gas turbines and various modeling and market representation anomalies in his analysis.

With respect to the role of the existing Canal units, NSTAR argues that the units are not suited to address the reliability need because they take close to a full day to reach full load from a cold start, and do not cycle on and off quickly. Further, relying on them for second contingency protection is too expensive given the uplift cost that would be incurred. Finally, NSTAR believes that continued compliance by Canal Station with new USEPA regulations for Section 316(b) cooling and air toxics could be difficult and that the units face an uncertain economic and regulatory future that could lead to unit retirement.

The Company defends its treatment of demand-side management, renewable energy and emergency generator resources, in its determination of the Local Sourcing Requirement ("LSR"),

(which is the difference between the net peak load forecasts and the 460 MW import capability 115 kV system into Tremont East). The Company asserts that only 7.4 MW of RTDR has cleared the forward capacity market, and that an additional 161 MW would be needed in 2012, plus annual increments of five to ten MW to provide second contingency protection. While the Company calculates a theoretical net present value cost of $266 million to obtain this quantity or RT DR over the ten-year period, it does not believe these quantities are attainable. With regard to renewables, the Company included all installed capacity and other projects that have cleared the FCM. Following ISO-NE practices, the Company notes that intermittent resources, such as offshore wind, are modeled at only ten percent of nameplate capability for capacity purposes.

The Company maintains that it has fully and reasonably accounted for all available energy efficiency measures in its 2009 and 2010 load forecasts, based on its recent energy-efficiency three-year plan, as approved by the Department, but did not make further assumptions about the results of future plans. The Company argued that Sandwich, in contrast, relies on undocumented expectation of virtually limitless levels of energy efficiency with any supporting documentation (NSTAR Issues Memo Comments at 21).

2. ISO-NE

ISO-NE supports the Company's view that the Project was found to be the preferred solution in the regional planning process and should be approved by the Siting Board (ISO-NE Brief at 1). ISO-NE notes that it is responsible for conducting long-term regional transmission planning for the New England region. As part of that process, ISO-NE plans and requires transmission system upgrades throughout New England to maintain system reliability, improve the efficiency of system operations, increase transfer capability, service major load pockets and reduce locational dependence on generating units. ISO-NE states that the regional planning process is open to a wide variety of stakeholders, all of whom have the opportunity to provide input through the Planning Advisory Committee ("PAC"). The resulting needs assessments performed by ISO-NE incorporates market responses that include not just transmission, but generation, distributed generation, demand response and energy efficiency. Where market responses are insufficient to eliminate identified needs, ISO conducts a "backstop" solutions study to develop regulated transmission solutions, which is the process that led to the Company's Project (id. at 19).

ISO-NE takes strong exception to Mr. Chernick's testimony that the Siting Board should take into consideration a cost-benefit process whereby the probability of outages including their scope and duration is weighed against the cost of a reliability solution. ISO-NE contends that accepting loss of loads as a probabilistic policy choice, without fully understanding the potential durations, impacts and societal consequences of widespread loss of load is misguided and should be rejected by the Siting Board. ISO-NE finds Mr. Chernick's attitude toward outages to be "relatively cavalier" – essentially, a view that they merely constitute reduced comfort levels for customers, and that in more serious outage situations, customers with more critical needs should be prepared with their own backup power sources (id. at 23-24).

ISO-NE contends that the "planning process already does consider to some extent the possibility that selective outages might ameliorate a given need, depending on the duration of a given outage and the number of customers affected" (id. at 26). However, ISO-NE contends that, given the particular facts involved, load shedding for Lower SEMA is not an appropriate long-term solution for area reliability needs.

ISO-NE also argues against using the GenOn gas turbines, on the basis that it is not known whether the GenOn gas turbines will be built (id. at 29). GenOn has not secured a place in the ISO-NE interconnection queue for the turbines, has not secured permits, and has not bid into the forward capacity market (id. at 30).

3. GenOn

GenOn argues that NSTAR is planning for the past, is incorrect in asserting that no reliance may be placed on load interruption, and is assuming that Massachusetts will fail to achieve its goals with respect to energy efficiency and contributions on peak from community wind, photovoltaic, combined heat-and-power, and off-shore wind resources (GenOn Brief at 1, 16). GenOn argues that NSTAR is treating energy efficiency as a withering resource, when future opportunities for additional savings can be anticipated, and argues further that limiting consideration of renewable projects to those that have cleared the Forward Capacity Market is unnecessarily restrictive (id. at 16-18). With respect to an alternative of operating the existing Canal units to protect against an N-1-1 loss of load, GenOn notes that the ISO-NE cost estimate for this alternative came in after the close of hearings and so was not subject to cross-examination, that it was based on a New England load cut-off rather than on Tremont East load, and that it is without foundation (id. at A-8). GenOn argues that ISO-NE's estimate of

$20 million for 2010 is too high, in part because operation of Canal units for local protection could be limited to days on which loads would otherwise require posturing to drop the entire Cape and Islands load (id.). This more limited use would cost less than operating Canal units on all days that loads exceed the firm capacity of the 115 kV lines (id.). GenOn argues that NSTAR's characterization of regulatory risks to the continuing operation of Canal overlooks key elements of the regulations that would give greater flexibility or outright exemptions for facilities such as Canal that have very low capacity factors or the particular types of environmental control equipment already in place at the facility.

GenOn notes that with the short-term measures and ISO-NE posturing load for post-first contingency protection, NSTAR has completely eliminated its uplift payments to Canal for LSCPR payments, which were zero in the last few months of 2009 and all of 2010 (GenOn Brief at 11). GenOn contends that the immediate goals of ending dependence on Canal Station for second contingency protection has already been achieved and argues that in the 39 years since the second 345 kV line was added, the loss of both 345 kV lines has only occurred one time, and the resulting loss of load was, in fact, caused by a transmission system operator error (id. at 11). With the short-term measures in place, and the current posturing procedures to selectively shed load, GenOn states that, "[i]n essence, ratepayers are providing post-first contingency protection service (i.e., local second contingency protection) to themselves free of charge" (id. at 13).

GenOn argues that NSTAR should properly have evaluated the GenOn gas turbine alternative in its Petition, since GenOn had previously approached NSTAR with ideas for addressing NSTAR's reliability concerns (id. at 22). GenOn argues that price suppression legitimately should be counted as a benefit (except where a generation unit is being proposed for the sole purpose of depressing market prices), and that consideration of price suppression makes its generation alternative superior to the proposed Project in terms of cost to Massachusetts ratepayers (id. at 28, A-6). GenOn argues that ratepayers would be exposed to cost overruns if the transmission alternative is selected, whereas GenOn would be willing to cap its capital cost contingency, absorbing this risk itself (id. at A-15). GenOn also argues that the new gas turbines it proposes would have minimal incremental environmental impacts (id. at 34). GenOn argues that, unlike the flexibility benefits new peaking generation in the region would bring, the proposed Project is only good for providing what the other two 345 kV lines already provide,

and that a broader analysis would show that GenOn's alternative provides better reliability benefits (id. at 37, A-12).

GenOn's proposal in this proceeding, discussed infra, is that new quick start gas turbines at the Canal site would best meet the need for new energy resources in Tremont East (if need is shown to exist). However, GenOn also sees the existing Canal units as an interim solution until "NSTAR conducts a transparent and competitive alternatives review" that could lead to selection of appropriate new generating units to provide local reliability benefits.

4. Sandwich

According to Sandwich, NSTAR would have the Siting Board believe that that load shedding is never an alternative to building a transmission line; [30] that the probability of events does not matter for transmission planning; that transmission planning is too complex for the Siting Board to consider the probability of outcomes; and that, since ISO-NE believes that its process considers all alternatives adequately, there is no need for Siting Board review of a project approved by ISO-NE (Exh. SAN-PLC-3, at 1, 2).

Sandwich urged the Board to not delegate all planning issues to ISO-NE (Tr. 11, at 1676). Sandwich's witness Mr. Chernick asserted that the improvement in reliability provided by the proposed project should be compared to its cost to determine whether its implementation is reasonable (Exh. SAN-PLC-3, at 9). Mr. Chernick noted that the case is unusually straightforward because Tremont East forms a nearly radial part of the transmission system, where analysis of the probabilities of events may be more fruitful than at locations with more complex interconnections (Tr. 11, at 1684, Sandwich Brief at 11; see also Tr. 1, at 67). Mr. Chernick argued that transmission projects may not be cost-effective when posturing for a low likelihood loss-of-load to avoid system problems, and that load-shedding is a reasonable response for rare events, as long as the load-shedding would contain the problem (Tr. 11, at 1628). Based on the low likelihood of an N-1-1 contingency, and the low likelihood of an outage in Tremont East from such a contingency, Mr. Chernick extrapolated that the project would be worth implementing if avoiding outages is worth $1 million per outage per customer

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30 Sandwich argues that NSTAR provided no on-point citations to published planning requirements to buttress the Company's claim that acceptance of a substantial loss of load following an N-1-1 contingency is not allowed.

(id. at 1684). Mr. Chernick contrasted the low likelihood of an N-1-1 contingency to a historical frequency of 1.2 outages per year for NSTAR customers, considering all causes (Exh. SAN-PLC-3, at 10).

Sandwich argues that NSTAR's 2009 load forecast is inconsistent with the Commonwealth's energy policies, including the Green Communities Act, the Massachusetts Clean Energy and Climate Plan for 2020, and the Global Warming Solutions Act – and that NSTAR "continues to favor the building of more transmission" as it seems to be predicting failure to achieve "higher levels of energy efficiency savings" (Sandwich Brief at 18). Sandwich argues that implementation of energy efficiency programs will keep load growth flat over the next nine years, and is consistent with the Commonwealth's efficiency goals (id. at 19).

Sandwich argues that the GenOn gas turbines would bring a mix of benefits additional to local reliability: capacity revenues, energy sales, reserve market revenues, plus some price suppression (Tr. 11, at 1646). Mr. Chernick expressed a hope that ISO-NE, "which purports to consider non-transmission alternatives, would design the forward capacity market in such a way that a resource that's getting revenues as a non-transmission alternative to a transmission line would be able to count those revenues in demonstrating that a project is in the market" and could therefore be eligible for capacity revenues (id. at 1648). In this way, benefits that a project provides that are outside of markets can be "counted" as a comparative advantage in the market side of the electric power industry.

Sandwich argues that, to the extent the proposed project erodes revenue opportunities of the Canal units, the Town will eventually experience an erosion of tax revenue (Sandwich Brief at 3).[31] Mr. George Dunham, witness for and Town Administrator of Sandwich, stated that Sandwich received $2.2 million of tax revenue for the Canal units for the year ending June 30,

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[31] Mr. Dunham related that he had been told by GenOn's public relations director that the proposed project would make the Canal units less active and contribute to a retirement decision (Tr. 11, at 1544). Mr. Dunham indicated that in negotiating tax valuation, GenOn links the value of the units to the amount of time the units run and the amount of electricity generated (Tr. 11, at 1529). Mr. Chernick predicted that the proposed Project would have a slight adverse economic impact on the Canal units (Tr. 11, at 1609). With respect to the GenOn turbine alternative, Mr. Dunham expressed a preference for new units because the tax assessment is more straight-forward and there would be less air emissions, compared to the existing Canal units (Tr. 11, at 1536-1537).

2011 (Tr. 11, at 1545). For these reasons, Sandwich requests that the Siting Board reject NSTAR's petition (Sandwich Brief at 3).

5. Attorney General

The Attorney General contends that load-shedding is not a long-term solution (AG Brief at 15). The Attorney General describes relying on the existing Canal units as costly (id.). With respect to the GenOn gas turbines, the Attorney General suggests that price suppression may be artificial and may only be short-term (id. at A-5). The Attorney General is concerned that benefits of price suppression "will be socialized across New England," while costs would be localized (id.). The Attorney General finds the Levitan/NSTAR estimate of price suppression more convincing than the Charles River/GenOn estimate, is concerned that the proposed GenOn gas turbines would fail to clear in the capacity markets, argues that ratepayers could end up paying more than with NSTAR's proposal, and argues further that the GenOn gas turbines may not be sufficient to meet planning reliability criteria (id. at 13-15). In addition, the Attorney General expressed concern that attention to probabilities could run afoul of planning requirements, potentially and unfairly leading to imposition of fines on ISO-NE and NSTAR (AG Brief Attachment at 1). Overall, the Attorney General requests that the Siting Board grant NSTAR's Petition (AG Brief at 2).

To "ensure that the Project is constructed in the most cost-effective manner, consistent with the public interest and to serve the public convenience," the Attorney General recommends that the Siting Board require quarterly and supplemental compliance filings by NSTAR to the Siting Board and all parties in the case (id.).

F. Analysis and Findings on Project Approaches

In meeting the need for energy resources found in Section III, above, the Company has presented for the Siting Board's review a proposed transmission facility and a variety of Project alternatives consistent with the mandates of G.L. c. 164, § 69J. The Board recognizes and appreciates the active involvement and creative, solution-oriented thinking of the Company and other parties in the proceeding regarding the development and presentation of Project alternatives and the many important issues related thereto.

NSTAR's presentation of Project alternatives included description and evaluation of four non-transmission alternatives and five transmission alternatives to the Project. Several of the

transmission alternatives were inferior to the Project with respect to reliability, as assessed by the Company, and each was distinctly more expensive. None of the transmission alternatives appears to have significant environmental advantages relative to the Project. On this basis, the Siting Board agrees with the Company that the Project is preferable to all of the transmission alternatives. With respect to non-transmission alternatives, modifications to the Company's originally-presented alternatives were developed during the proceeding; these are evaluated below.

The Company described the use of Canal for second contingency protection as a "Do Nothing" alternative, but this term seems misapplied, as Canal Station has not been dispatched out-of-merit for second contingency protection since August 2009, following the completion of the short-term measures to the Lower SEMA transmission system. In fact, the record shows that the actual strategy in place in Tremont East at present is to address the threat of a second contingency with controlled load shedding through the use of posturing. Posturing in Tremont East is a practice that has been developed and coordinated by NSTAR, as the Transmission Operator, and ISO-NE, which has responsibility for maintaining the reliability of the New England bulk power system.

The record reveals that the combination of the short-term measures and posturing has been very effective in eliminating the significant financial burden of relying on Canal for second contingency protection and in maintaining a reliable transmission system for Tremont East. There is no dispute in the record about the effectiveness of the short-term measures, coupled with posturing in alleviating out-of-merit costs to Lower SEMA ratepayers without any degradation – thus far – to actual transmission system performance. The divergence of views about posturing revolves around whether it constitutes a viable strategy going forward, and if so, to what degree.

Inherently, when posturing is used as a planning strategy, it implies a willingness to accept some customer outages, when contingencies occur, in order to preclude significantly more severe scenarios of line overloads and voltage violations potentially leading to system equipment damage, voltage collapse, and/or cascading blackouts. As described by ISO-NE, posturing for a second contingency in Tremont East is feasible for shedding up to about one-third of peak load. The Company identifies 600 MW as the Tremont East load level above which all of Cape Cod and the Islands must be postured for interruption after the first contingency (NSTAR Reply Brief

at 26).[32] Below a load of 600 MW, the system would be postured such that up to around one-third of Cape and Islands customers would be shed in the event of the second contingency. The record shows that the 600 MW peak load for Tremont East was exceeded by the 2010 peak of 664 MW. Thus, without the operation of Canal Station units, recent actual peak load levels were high enough that under a second contingency scenario, service to Cape Cod, Martha's Vineyard, and Nantucket would have been dropped. As noted by the parties, to the extent that peak loads grow and the 600 MW level is exceeded more frequently, exposure to blackouts in Tremont East would also increase.

The next question that arises is whether the present use of load shedding comports with the Siting Board's statutory requirements and precedent as well as established planning standards. The Company, ISO-NE and the Attorney General all assert that short-term operational provisions for load shedding should not form the basis of long-term plans. They further contend that load shedding exposure at the present level is not acceptable under reliability requirements established by NERC, NPCC and ISO-NE, and that ISO-NE's acceptance of the present load shedding procedures is predicated on the Company's efforts to build the Project. The draft Load Interruption Guideline would not accept load shedding of the entire Cape and Islands from an N-1-1 contingency. The Attorney General acknowledges the Siting Board's authority to balance factors, but cautions the Siting Board that denial of the Project would put the region's electric reliability at risk. NSTAR and the Attorney General also suggested that sanctions could be imposed if the Project is not built.

There has been considerable debate in the record about the probabilities associated with contingency events, and, more fundamentally, whether probabilistic assessments have any legitimate role to play in Siting Board review of project alternatives presented in G.L. c. 164,

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[32] The 600 MW figure approximates a number originally contained in the confidential (CEII) version of the Company's response to RR-EFSB-9. This number was redacted from the public version of the response, but the approximated figure, 600 MW, was used in the Company's Reply Brief at 26. The 600 MW figure is an important fact in the Board's alternatives analysis, but as the Siting Board historically has accorded significant deference to parties' assertions of CEII status for evidence submitted in Board proceedings, the figure was withheld from the public record of the case until the fourteenth day of evidentiary hearings. The Siting Board urges the Company in the future to be more careful in its assertions of CEII status, so that relevant information is not needlessly kept from public scrutiny.

§ 69J petitions. Given ISO-NE's use of deterministic methods in reliability planning, NSTAR, ISO-NE and the Attorney General have cautioned the Siting Board about adopting a probabilistic approach as incompatible with ISO-NE's, and quite complex to develop and use. However, the Siting Board sees value in probabilistic assessments as a complement to deterministic approaches. Indeed, ISO-NE is currently in the process of reviewing stakeholder comments on ISO-NE's draft load shedding guidelines, which acknowledge the probabilistic nature of transmission outages and their duration.

The Board views the draft Load Interruption Guideline as helpful in providing some consistency in how transmission operators determine the manner that load shedding is used, and under what circumstances. The Board would note that underlying the Load Interruption Guideline is an implicit premise that reliability planning does not, and should not, take place in the realm of absolutes, where 100 percent transmission grid reliability must be achieved regardless of the cost. The Guideline appears to acknowledge the need for balancing the tradeoffs between ratepayer costs and transmission reliability and the expectation that transmission-owning utilities will perform the balancing called for by the Guideline. For potential projects that provide only de minimis improvements in reliability (e.g., extremely low-probability contingency events) and involve high cost to ratepayers, the Siting Board will continue to question the appropriateness of such proposals submitted under G.L. c. 164, § 69J. The Board supports ISO-NE in its attempt to develop appropriate load-shedding guidelines that comport with our statutory mandate to balance reliability with cost and environmental impact considerations.

The Siting Board concurs with the Company, ISO-NE and the Attorney General that continuing to rely on a plan to shed load is not a superior solution to the identified need, because the entire load of Cape Cod and the Islands should not be exposed to the risk of an outage from an N-1-1 contingency over multiple days each summer. Peak loads have already crossed well beyond the threshold at which posturing would place at risk a substantial portion of, if not the entire, Cape and Islands loads.

With regard to reducing net loads through demand-side measures and renewable and other supply side resources, Sandwich contends these resources could be combined with the loss of load alternative to reduce the potential amount of interrupted load to an acceptable level. However, there is no question that at least a sizeable fraction of the Cape and Islands load would

be dropped on the second contingency, if this option were selected, because peak loads are so far above the firm capacity of the 115 kV lines. Prospects for sufficient, future net load reductions are too uncertain to rely on such reductions as a means to reduce the loss of load to an amount that would be acceptable to the Board. The Board finds that, even in combination with an aggressive pursuit of demand-side and supply side resources, posturing for load loss is not the preferred alternative for meeting the identified need in this case.

With regard to the availability, performance and cost of the existing Canal units to meet capacity requirements in Tremont East, there is no dispute that the units have high air emissions relative to new generation, are slow to ramp up and down, and would impose substantial out-of-merit dispatch costs if operated for local reliability service for the foreseeable future. Had the Canal units been operated for second-contingency reliability protection in 2010, ISO-NE estimated ratepayers would have been charged about $20 million for uplift payments to Canal. The proposed Project's estimated revenue requirement for the first year is about $16.6 million, somewhat less than the ISO's hypothetical 2010 uplift charges for 2010.[33] It is likely that operating the Canal units as a precautionary measure to avoid load interruption under N-1-1 conditions will be far more expensive than NSTAR's proposed Project in the future as the Project's revenue requirement diminishes over time, and the price disparity between oil and gas continues. Expenditures required by USEPA could further increase costs of relying on the Canal units. With no clear cost, impact, or reliability advantage relative to the Company's proposed Project, the Siting Board finds that using the existing Canal units for local reliability purposes is not the preferred alternative for meeting the identified need.

GenOn has proposed adding quick-start turbines at its site on the edge of the Cape Cod Canal, or elsewhere on Cape Cod. While the canal location proposed by GenOn is attractive from a land use perspective since it is already developed as an industrial site, addition of turbines would still be a visible change, and the turbines would add some local noise and local air emissions. New gas turbines at this location would provide a number of different benefits for energy consumers, including local reliability benefits, energy capacity, and energy supply. At present, energy and capacity revenues of a generation project are low, leaving ratepayers to bear

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[33] Furthermore, the $16.6 million cost of the Project is expected to be spread across ratepayers throughout New England, while the uplift charges would likely be spread only among SEMA ratepayers.

fixed contractual costs that would be required by GenOn to proceed commercially. While the net benefits asserted by GenOn are theoretically possible depending on an array of optimistic assumptions, we are not persuaded that a peaking unit with a very low capacity factor (of two to five percent) would run a sufficient number of hours to provide the enormous price suppression effects GenOn has asserted are compensatory for Lower SEMA ratepayers who would shoulder many of the fixed costs of developing this project (see Exh. GENON-SK-1, at 8). We also share the concerns expressed by NSTAR that the development and permitting schedule put forth by GenOn is overly optimistic, and that it could easily be several years until the units would be online, able to provide the intended reliability benefit. Therefore, the Siting Board finds that construction of the GenOn gas turbines is not the preferred alternative for meeting the identified need.

The proposed Project offers sufficient transmission capacity to serve Tremont East load in the event that the other two 345 kV lines become unavailable in the N-1-1 contingency described in Section III. The proposed Project would require tree clearing and structure placement along the entire transmission right-of-way, among other impacts, but would have essentially no noise or air emissions during operation. The Project would cost $98 million, excluding the double-circuit separation aspect of the project that is needed along with any alternative. Unlike the GenOn gas turbines, a fixed maximum capital cost would not be set for the proposed Project. The Board agrees with the Attorney General's related concern about monitoring Project costs. See Section V.G, below, for further discussion.

Accordingly, after reviewing the Project and each of the alternatives presented in this proceeding, the Siting Board finds that constructing the proposed Project is, on balance, superior to the alternative project approaches in terms of cost, environmental impact, reliability and the ability to address the identified need.

V. ROUTE AND SITE ALTERNATIVES

A. Route Selection

1. Standard of Review

G. L. c. 164, § 69J requires a petition to construct to include a description of alternatives to the facility including "other site locations." Thus, the Siting Board requires an applicant to demonstrate that it has considered a reasonable range of practical siting alternatives and that its proposed facilities are sited in locations that minimize cost and environmental impacts. To do

so, an applicant must meet a two-pronged test. First, the applicant must establish that it developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner which ensures that it has not overlooked or eliminated any routes which, on balance, are clearly superior to the proposed route. Second, the applicant must establish that it identified at least two noticed sites or routes with some measure of geographic diversity. New England Power Company, EFSB 09-1/D.P.U. 09-52/09-53, at 19-20 (2011) ("National Grid Worcester"); Western Massachusetts Electric Company, EFSB 08-2/D.P.U. 08-105/08-106, at 42 (2010) ("GSRP"); Massachusetts Municipal Wholesale Electric Company, 12 DOMSB 18, at 92 (2001).

2. The Company's Route Selection Process

The proposed Project includes constructing a new 345 kV transmission line and tying it into an existing line capable of carrying 345 kV – specifically, to the section of Line 120 extending from a point adjacent to Bourne Switching Station to West Barnstable (Exh. NSTAR-1, at 1-12). The new part of the line could start either at Carver Substation in Carver or at Pilgrim Station Switchyard in Plymouth (id. at 4-3 to 4-4). NSTAR identified and screened eight distinct routes for new transmission from the starting point to a point on Bournedale Road in Bourne (id. at 4-4, 4-5). Only one route was identified for the 1.4-mile portion of the route from Bournedale Road, across the Cape Cod Canal to Bourne Switching Station (id. at 4-30). According to the Company, no other feasible route exists for this portion (id.). For the remainder of the routes, NSTAR looked to link existing corridors, such as highways and existing utility rights-of-way, between the endpoints (id. at 4-5). The eight routes from Carver Substation or Pilgrim Station Switchyard to Bournedale Road included five overhead routes, one underground route and two route variations (id.). Screening for cost, environmental impacts, and reliability reduced the eight potential routes to three routes, all limited to overhead construction (id. at 4-10 to 4-12).

For the next step in its route selection process, NSTAR compared the three remaining routes, designated herein as the Primary Route, the Alternative Route, and the Eastern Route, with respect to cost, environmental impacts and reliability.

The costs of the routes were estimated based on the existing conditions of the routes, preliminary design of the new 345 kV line on each route, existing facilities, construction conditions, the need to relocate or reconstruct existing facilities, extent of wetland and need for

clearing along the ROW (id. at 4-21). NSTAR's preliminary cost estimates were $32.8 million for the Primary Route, $43.7 million for the Alternative Route, and $49.5 million for the Eastern Route (id.).

NSTAR's environmental analysis of the routes was based on 16 criteria identified by the Company: wetlands, wetland conversion, vernal pools, rare species, stream crossings, groundwater resources, tree clearing, number of residences where tree clearing removes buffer to the ROW, visual impacts, historic resources, archaeological sensitivity, residences, sensitive receptors, conservation and recreation lands, access points, and length of line built or rebuilt (Exh. NSTAR-1, at 4-23, 4-24). The Company assigned weights to each criterion reflecting the judgment of the Company as to the relative importance of the criteria, and also prepared an alternative weighting scheme that was more sensitive to visual impact and conservation and recreation lands (id. at 4-25). The Company then compiled a raw score, a weighted score and an alternative weighted score (id. at 4-25, 4-26). Under each of the three scoring schemes, the Primary Route received the lowest score, indicating that, according to the Company's analysis, it was superior to the other routes with respect to environmental impacts (id. at 4-27). The Eastern Route would impact fewer wetlands within work zones, fewer stream crossings and fewer groundwater resources than both the Primary and Alternative Route, but would have the greatest impacts of the three routes in all of the other areas, including more than double the amount of tree clearing than the Primary Route, and 30 percent more rare species habitat within work zones (id. at 4-25). For these reasons, the Company proceeded to evaluate and compare only the Primary and Alternative routes (id. at 4-26).

In past decisions, the Siting Board has found various types of criteria to be appropriate for identifying and evaluating route options for transmission lines and related facilities. These types of criteria include natural resource issues, land use issues, community impact issues, cost and reliability. GSRP, EFSB 08-1/D.P.U. 08-105/08-106, at 46-47; New England Power Company, 4 DOMSB 109, at 167 (1995). The Siting Board also has found the specific design of scoring and weighting methods for chosen criteria to be an important part of an appropriate site selection process, and in some cases, the Board has identified the appropriate site selection process and in some cases it has identified the appropriate allocation of weights among the broad categories of environmental concerns, cost and reliability. GSRP, EFSB 08-21/D.P.U. 08-105/08-106, at 47; Boston Edison Company, 19 DOMSC 1, at 38-42 (1989). Here, the Company

developed numerous screening criteria, which it used to evaluate the routing options. These criteria generally encompass the types of criteria that the Siting Board previously has found to be acceptable. The Company also developed a quantitative system for ranking routes based on compilation of weighted scores across all criteria. This is a type of evaluation approach the Siting Board previously has found acceptable. Further, the Company identified and compared a large number of potential routes, eight in total. After choosing three viable candidate routes, the Company applied its scoring criteria three times, giving different weights to different impacts in each iteration.

The Siting Board finds that the Company has developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner which ensures that it has not overlooked or eliminated any routes which are clearly superior to the proposed Project.

3. Geographic Diversity

The three routes selected by the Company share a single endpoint, while the Primary and Alternative Routes originate at a common location and the Eastern Route originates at a distinct location. The 16.6-mile Primary Route travels east from the Carver Substation through Carver and Plymouth, then southeast to Bournedale Road in Bourne (Exh. NSTAR-1, at 4-14, 4-15). The 18-mile Alternative Route travels south from Carver Substation through Carver and into Middleborough, then travels east through Rochester, Wareham, Plymouth and to Bournedale Road in Bourne (id. at 4-16, 4-17). The 16.6-mile Eastern Route originates at the Pilgrim Station Switchyard, travels south through Plymouth and then to Bournedale Road in Bourne (id. at 4-18). The Primary and Alternative Routes both start at Carver Substation and meet at Bournedale Road but are otherwise distinct and largely a few miles apart. The Eastern Route starts several miles to the east of the Primary and Alternative Routes, but shares 9.3 miles heading south to Bournedale Road with the Primary Route. The Siting Board finds that the Company has identified a range of practical transmission line routes with some measure of geographic diversity.

4. Conclusions on Route Selection

The Company has: (a) developed and applied a reasonable set of criteria for identifying and evaluating alternative routes in a manner which ensures that it has not overlooked or eliminated any routes which are clearly superior to the proposed project, and (b) identified a

range of practical transmission line routes with some measure of geographic diversity. Therefore, the Siting Board finds that the Company has demonstrated that it examined a reasonable range of practical siting alternatives.

B. Environmental Impacts of Transmission Line

1. Standard of Review

In implementing its statutory mandate under G.L. c. 164, § 69H, the Siting Board requires a petitioner to show that its proposed facility is sited at a location that minimizes costs and environmental impacts while ensuring a reliable energy supply. To determine whether such a showing is made, the Siting Board requires a petitioner to demonstrate that the proposed route for the facility is superior to the alternative route on the basis of balancing cost, environmental impact, and reliability of supply. GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 48; National Grid Worcester, EFSB 09-1/D.P.U. 09-52/09-53, at 30; Russell Biomasss LLC, EFSB 07-4/D.P.U. 07-35/07-36, at 50 (2009).

Accordingly, in the sections below, the Siting Board examines the environmental impacts, reliability and cost of the proposed facilities along the Primary and Alternative Routes to determine: (1) whether environmental impacts would be minimized; and (2) whether an appropriate balance would be achieved among conflicting environmental impacts as well as among environmental impacts, cost and reliability. In this examination, the Siting Board compares the Primary Route and the Alternative Route to determine which is superior with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

2. Introduction

As noted above, the 18-mile Primary Route and 19.4-mile Alternative Route follow entirely distinct ROWs from the Carver Substation to their intersection in Bourne west of the Cape Cod Canal (Exh. NSTAR-1, at 4-15 to 4-17). Both routes include a 1.4-mile segment which starts at the intersection point of the Primary and Alternative Routes, crosses the Cape Cod Canal and ends at Bourne Switching Station, and any impacts associated with that portion of the Project would occur regardless of which route is chosen. The impacts associated with the Primary Route, the Alternative Route and the common section crossing the Cape Cod Canal are discussed in detail below.

The new 345 kV line along the Primary Route includes approximately 4.4 miles in Carver, 11.8 miles in Plymouth and 0.4 miles in Bourne (Exh. NSTAR-1, vol. II, at fig. 1). The 345 kV line along the Alternative Route includes approximately 3.5 miles in Carver, 3.7 miles in Middleborough, 0.6 miles in Rochester, 7.6 miles in Wareham, 2.2 miles in Plymouth and 0.4 miles in Bourne (id. at fig. 5). Both routes include the additional 1.4-mile shared section in Bourne, which includes the canal crossing. The two routes are shown in Figure 2, attached.

Impacts associated with alterations at Carver Substation, and the proposed terminal substation in West Barnstable are discussed separately in Section V.F, below.

3. Wetlands and Water Resources

The construction and development of the proposed Project will result in both temporary and permanent impacts to wetlands associated with the following activities: the use of swamp mats for movement of heavy machinery and grading and filling of access roads, ROW clearing, and structure installation (Exh. NSTAR-1, at 5-20). The proposed Project may also impact surface water and drinking water supplies (id. at 5-35 to 5-37).

a. Primary Route

Most of the Primary Route is not in or near wetlands (Exh. NSTAR-1, at 5-27). The Primary Route includes approximately 39 acres of delineated vegetated wetlands including forested wetlands, shrub swamps, emergent wetlands, and commercial cranberry bogs (id.). The majority of these wetlands are located in Carver; the remainder, in Plymouth, are mostly associated with open water bodies (id.). Tree clearing within the ROW would convert approximately 4.7 acres of forested wetland into scrub-shrub wetland (id.). Placement of swamp mats would result in approximately 1.2 acres of temporary wetlands impacts, and structure installation would result in the elimination of approximately 196 square feet of wetland (Exh. EFSB-G-3(S2), at 5-2).

The Primary Route crosses 13 streams and water bodies and the ROW contains 5.1 acres of open water (Exh. NSTAR-1, at 5-35). There are approximately 188 acres of protected water supply areas within 300 feet of the Primary Route (id. at 5-38). These include Massachusetts Department of Environmental Protection ("MassDEP") approved Zone II wells, and surface water supply watershed, and a local Water Resource Protection District.

The Company stated that mitigation for both temporary and permanent wetland impacts will be implemented in accordance with the rules and regulations of, and in consultation with the Army Corps of Engineers, MassDEP and local conservation commissions (Exh. NSTAR-1, at 5-30). Surface vegetation and contours of the temporarily affected wetlands would be substantially restored (id.). Permanent impacts would be replaced in-kind proximate to the water body or waterway of the lost area, in an amount at least equal to that of the permanently filled area (id.). The total amount of wetland replication will be determined after the completion of the Project and the Company anticipates that all replicated wetlands will be within the ROW (id.). The Company will be submitting Notices of Intent to the conservation commissions in Carver, Plymouth, Bourne and, Barnstable (Exhs. EFSB-W-1; EFSB-G-3(a)(6)).

With respect to groundwater and drinking water resources, the Company will use proper spill containment gear and materials in order to contain any inadvertent spills or leaks that take place while re-fueling or lubricating equipment on the ROW (Exh. NSTAR-1, at 5-39). In addition, the Company would not re-fuel or lubricate any machinery within 100 feet of marked wetlands, bogs, streams or ponds (id.; EFSB-W-4).

b. Alternative Route

The Alternative Route includes approximately 58 acres of delineated vegetated wetlands very similar in nature to those on the Primary Route (Exh. NSTAR-1, at 5-28). Tree clearing within the ROW would convert approximately 7.9 acres of forested wetland into scrub-shrub wetland (id. at 5-24). Placement of swamp mats would result in temporary impacts, while structure installation would result in permanent impacts (id. at 5-30).

The Alternative Route crosses 19 streams and water bodies and the ROW contains 5.2 acres of open water (id. at 5-35, 5-36). There are approximately 271 acres of protected water supply areas within 300 feet of the Alternative Route, including interim wellhead protection areas, MassDEP approved zone II, and wells (id. at 5-35).

The wetland mitigation and groundwater and drinking water precautions described above for the Primary Route would also be implemented for the Alternative Route (id. at 5-30, 5-39).

c. Common Impacts

The 1.4-mile common portion of the routes from the intersection point west of the Cape Cod Canal to the Bourne Switching Station east of the canal contains a small, isolated wetland

just south of Bournedale Road (Exh. NSTAR-1, at 5-29). This portion of the route crosses the Cape Cod Canal, which is a man-made ocean level canal, with no associated vegetated wetlands (id.). No wetland impacts are anticipated with respect to this portion of the proposed Project (id.). The common portion traverses approximately 987 linear feet of a zone II area and there is a public water supply within approximately 160 feet of the edge of the ROW (id. at 5-39).

The new 345 kV line will span the Cape Cod Canal, with vertical clearance approximately equal to the clearance of the existing transmission lines (id. at 5-37). The Company stated that it will comply with Army Corps of Engineers minimum clearance requirements (id.). The Company anticipates that Army Corps permitting will maintain the current existing clearance, which is approximately 165 feet above mean high tide (id.). The conductors will be strung across the Cape Cod Canal using helicopters, and no in-water work will be required (id.). Permits to cross above the canal are nevertheless required and the Company will seek necessary permits from the Army Corps of Engineers under Section 10 of the Rivers and Harbors Act of 1899 (id.).

The Company stated that in recent years residents of the Cape Cod region have raised concerns over the use of herbicides and the potential for contaminating drinking water sources (Tr. 6, at 894). NSTAR stated that it follows state regulations with respect to what herbicides may be used in areas of protected water supplies and also in and near other sensitive areas such as wetlands (id. at 894-895). In addition, the Company stated that it has worked and will continue to work with municipalities, as well as the Cape Cod Commission, to address concerns regarding herbicide use (id.).

d. Conclusion on Wetland and Water Resource Impacts

Based on the above, the Primary Route impacts approximately 30 percent less wetland acreage than the Alternative Route. The Primary Route also includes fewer surface water bodies and has less acreage of protected drinking water supply resources in and around the ROW than the Alternative Route. The Siting Board finds that the Primary Route would be preferable to the Alternative Route with respect to wetlands and water resources.

For the segment of the Project from Bournedale Road to Bourne, including the canal crossing, no wetland impacts are anticipated. No in-water work will be required for the crossing of the Cape Cod Canal; however, the Company will seek permits from the Army Corps of Engineers for this portion of the Project.

The Company has indicated that it will be replicating wetlands, although the total amount of wetland replication has yet to be determined. Therefore, the Siting Board directs the Company to replace permanently altered wetlands in kind, proximate to the relevant waterbody, in an amount at least equal to the amount of the permanently altered wetlands.

The Company recognizes that local residents are concerned about the use of herbicides and their potential for contaminating water resources. The Company stated that it applies herbicides in accordance with applicable regulations and will work with municipalities and other entities to address concerns regarding herbicides. The Siting Board directs the Company to ensure that under its continuing vegetative management program, any application of herbicides must be consistent with utility right-of-way Integrated Vegetation Management Practices and applicable rules and regulations of the Commonwealth. The Siting Board further directs the Company to continue to work with the affected municipalities and the Cape Cod Commission to address concerns regarding herbicide use. The Siting Board finds that with the mitigation proposed by the Company, and with the above conditions, impacts to wetlands and water resources from transmission line construction along the Primary Route would be minimized.

4. Land Resources and Historic Resources

a. Primary Route

The Company characterized the Primary Route as traversing a variety of uses; the principal use is public and private woodland, and other uses include commercial cranberry bogs and residential development (Exh. NSTAR-1, at 5-3). Approximately nine percent of the Primary Route contains cranberry bogs and other wetlands (id.). Vegetative communities include successional brushland, cranberry bogs, cropland, forest, and forested wetland (id. at 5-60).

There are several concentrated residential areas along the Primary Route located towards the beginning and end of the route. There is a densely-developed residential neighborhood to the north and west of Carver Substation with the closest residences along Peltola Lane in Carver (Exh. NSTAR-1, vol. II, at fig. 1). Another residential area begins approximately one mile along the ROW from Carver Substation. This area is less densely populated than the area surrounding Carver Substation, is approximately one mile long and includes several residences along and near Centre Street, South Meadow Road and Bisbee Drive in Carver (id.) This area also includes Carver High School, which is adjacent to the ROW; the closest playing field is 200 feet from the

edge of ROW, and the nearest building is over 1000 feet from the edge of ROW (Exh. EFSB-G-8). Other than Carver High School, there are no schools or playgrounds near the Primary Route (id.). The other significant residential area is in Plymouth, south of the Myles Standish State Forest ("MSSF"), and begins at Bourne Road and continues east and south passing Lunn's Way, Raymond Road and to Little Sandy Pond Road (Exh. NSTAR-1, vol. II, at fig. 1). This is a densely populated residential development with homes on both the east and west sides of the ROW (id.). There are approximately 180 residences within 300 feet of the ROW along the Primary Route (Exh. NSTAR-1, at 4-15).

The Primary Route traverses the MSSF, which is managed by the Massachusetts Department of Conservation and Recreation (id. at 5-4). The MSSF is wooded with a mix of deciduous trees and conifers (id.). Within the MSSF, the ROW crosses a pond and several roads (id. at 5-5). The Company stated that tree clearing would occur along the entire five mile portion of the ROW within the MSSF, for a width of approximately 50 feet (Tr. 5, at 771; Exh. EFSB-G-3(S2) at fig. 5-24). The total estimated amount of tree clearing along the Primary Route is 91 acres, of which 4.7 acres will be converted from forested wetland to scrub-shrub wetland (as discussed above) (Exh. NSTAR-1, at 5-24).

The Primary Route crosses nine areas of mapped rare species habitat, for a total of approximately 449 acres (id. at 5-31). There are 21 protected species, including plants and both vertebrate and invertebrate animals (id. at 5-32). The Company estimates that approximately 100 acres of mapped habitat would be disturbed during construction (id. at 5-33). The Company has and continues to consult with the Natural Heritage and Endangered Species Program ("NHESP") regarding impacts to rare species habitat (id. at 5-34). As a result of consultation with the NHESP, the Company will develop and implement a Construction Period Monitoring and Protection Plan for eastern box turtles (Exh. EFSB-G-3(S2) at 5-15, 5-16). NHESP also required that the Company minimize impacts to species habitats by use of best management practices, including: fencing off or otherwise avoiding discrete locations where known plant and invertebrate species or habitats exist; confining construction vehicles to existing, maintained ROW access roads to the greatest extent practicable; and development of restoration plans for temporary staging and equipment lay down areas and limited habitat restoration or improvements within the ROW (id. at 7-10).

There are no previously identified historical resources located within the Primary Route; however, there are 16 such resources located within one-half mile of the ROW (Exh. NSTAR-1, at 5-40). The Primary Route is located within the vicinity of 16 previously recorded archaeological sites (id. at 5-41). Approximately 33 percent of the ROW is classified as moderately sensitive and approximately six percent was identified as having a high sensitivity for containing archaeological resources (id.). Under the supervision of the Massachusetts Historical Commission ("MHC"), the Company has conducted studies within areas of moderate to high sensitivity for containing archaeological resources. If potentially significant resources are identified during construction, it is anticipated that the design of the line can be adjusted to avoid impacts to those resources (Exh. EFSB-G-3(S2) at 5-20).

Despite prohibitions by DCR, off-road vehicles have regularly used the ROW within the MSSF for recreation (id. at 5-21)). In order to discourage illegal use of the ROW by off-road vehicles, the Company stated that it will maintain existing and install some new barriers and gates at access points where possible, improve signage, create obstructive brush piles and monitor off-road vehicle use on the ROW within the MSSF (id. at 5-22, 5-23; Tr. 5 at 779-780).

b. Alternative Route

NSTAR characterized the Alternative Route as traversing a variety of land uses similar to those of the Primary Route, including public and private woodland, commercial cranberry bogs and residential areas (Exh. NSTAR-1, at 5-7). Approximately 28 percent of the Alternative Route crosses wetlands, considerably more than the Primary Route, and aerial photographs demonstrate that the Alternative Route traverses more unforested areas than the Primary Route (Exh. NSTAR-1, Vol. II, at fig. 6)

The Alternative Route passes a similar number of homes, compared to the Primary Route (Exh. NSTAR-1, at 4-18). By comparison, however, residences along the Alternative Route are spread out along most of the route instead of concentrated in a few neighborhoods (Exh. NSTAR-1, vol. II, at fig. 1). The Alternative Route shares Carver Substation as an originating point with the Primary Route, and from there south for approximately 1.2 miles, there is a relatively low density residential area (id. at fig. 5). Approximately eight miles further along the ROW there is another small neighborhood just north of Interstate 495 in Wareham, which includes Penikese Street, Acoaxet Lane and Charltonne Furnace Road (id.). North of the ROW and just west of the Rochester town line, there is another small neighborhood including Glen

Charlie Road and Lake Shore Drive in Wareham (id.). Finally, there is a very sparsely populated residential area near Valley Substation in Plymouth along Bournehurst Drive and near Horse Pond Tap along Yearling Run Road in Bourne (id.). There are approximately 185 residences within 300 feet of the ROW along the Alternative Route (Exh. NSTAR-1, at 4-18).

Unlike the Primary Route, the Alternative Route does not traverse any part of the MSSF. Vegetative communities include successional brushland, cranberry bogs, forest, forested wetland, and pasture (id. at 5-60). Approximately 27 acres of tree clearing would occur on the Alternative Route, including approximately 7.9 acres of forested wetland (id. at 5-24). There are no schools or playgrounds near the Alternative Route (Exh. EFSB-G-8).

The Alternative Route contains approximately 185 acres of mapped rare species habitat for seven protected species, including plants and vertebrate and invertebrate animals (Exh. NSTAR-1, at 5-33). The Company estimated that approximately 90 acres of habitat mapped for these species would be disturbed during construction (id.).

The Alternative Route passes through one inventoried historic area, and is located within one-half mile of 22 historic resources (id. at 5-42). There are 38 previously-recorded archaeological sites located in the vicinity of the Alternative Route (id. at 5-43). Over 30 percent of the ROW was classified as having a high sensitivity for containing archaeological resources (id.).

c. Common Impacts

The 1.4-mile common portion of the ROW crossing the Cape Cod Canal traverses a sand pit, the Cape Cod Canal and a small section of the Massachusetts Military Reservation (Exh. NSTAR-1, at 5-62). Within the common portion of the ROW including the canal crossing, there are four protected species and approximately 60 acres of mapped rare species habitat (id. at 5-34). The Company noted that much of the mapped habitat within the common portion is within the canal itself and is located at a considerable distance from the spanning structures (id.).

There is one inventoried historic resource area within the common portion of the ROW, and 16 resources within one-half mile of the ROW (id. at 5-45). The 1.4-mile common portion has ten previously recorded archaeological sites within the ROW and the entire portion is classified as having a low sensitivity for containing archaeological resources (id.).

d. Conclusion on Land Resources and Historic Resources

The Alternative Route would result in significantly less tree clearing than the Primary Route, and contains less mapped priority habitat for rare species. However, the amount of habitat that would be disturbed during construction is similar for both routes. The Primary Route passes through MSSF for 5.1 miles, while the Alternative Route does not. The Primary Route and Alternative Route both pass through several residential communities of varying densities, and have very similar number of residences within 300 feet of the ROW. With respect to historic and archaeological resources, the Alternative Route is proximate to more inventoried historic resources, and there is a higher likelihood of encountering archaeological resources with the ROW along the Alternative Route. Overall, the Siting Board finds that the Alternative Route would be preferable to the Primary Route with respect to land resources and historic resources.

For the segment of the Project from Bournedale Road to Bourne, the land resources are minimal. Much of the mapped priority habitat is within the canal and will not be impacted by construction. To mitigate impacts to rare species on the Primary Route, the Company will develop and implement a plan to protect eastern box turtles during Project construction. There are few significant historical resources within the ROW and the sensitivity for archaeological resources within the ROW is low.

The Siting Board finds that with implementation of the monitoring and protection plan for the eastern box turtle, impacts to land resources and historic resources from transmission line construction along the Primary Route would be minimized.

5. Noise Impacts

Construction noise impacts can perhaps best be understood in terms of the different stages that will take place in sequence at a particular monopole installation location along the ROW. Since these tasks will be completed regardless of the route chosen, they are described here. Construction noise impacts specific to each route will be addressed below.

The construction events that will take place in sequence along the entire ROW are: clearing and preparation of level work areas at each pole location; excavation for and pouring of concrete foundations for monopoles; delivery of pole segments; erection of poles; installation of davits, insulator strings and hardware; placement of pull rope using a helicopter, followed by installation of conductors; placement of grounding wire; and pole site cleanup and revegetation (Exh. EFSB-NO-6). Land clearing work would take approximately one week per mile; pole

foundation excavation and placement work will take two or three days per pole; pole erection will require one day per pole; helicopter placement will take several days for the entire route; conductor installation will take up to one week per mile; and site cleanup/revegetation will require about one day per pole (id.). Typical noise-generating equipment to be used along the ROW are: excavators, chainsaws, chippers, vibratory pile driver, cranes, concrete mixer trucks, vibratory concrete mixer, portable generators, and helicopters (Exhs. EFSB-NO-2; EFSB-NO-3).

Construction is planned to take place from 7 a.m. to 6 p.m. on weekdays (Exh. EFSB-NO-1). The Company stated that exceptions to these hours may be necessary for certain construction phases, such as installation of conductors over the Cape Cod Canal, transporting large pieces of equipment, and cutovers (id.). The Company does not anticipate construction taking place on Saturdays; however, it may be required to meet exigent schedule demands (id.). The Company stated that construction taking place outside the typical hours will be coordinated with the relevant municipality (id.). NSTAR asserted that there will be no measurable noise associated with the operation of the transmission line on either route (Exh. NSTAR-1, at 5-63).

a. Primary Route

For purposes of predicting construction noise impacts, the Company assumed that the nearest residence along the Primary Route is 50 feet from the closest point of the activity (Exh. EFSB-NO-3). The Company calculated maximum construction noise levels for tree clearing and transmission poles construction and wire installation assuming several pieces of noisy construction equipment operating simultaneously (id.). The noisiest phases would be during tree-clearing and helicopter wire-stringing, where the maximum noise levels at the closest residence would be 92 A-weighted decibels ("dBA") and 96 dBA, respectively (id.). The Company characterized the ambient noise along the Primary Route as primarily quiet wooded open-space from Carver Substation through the MSSF, and a relatively quiet residential area south of the MSSF (Tr. 5, at 722-723).

There are approximately 29 homes within 50 feet of the edges of the ROW, 49 homes within 50 to 100 feet, and a total of 180 residences located within 300 feet on the Primary Route (RR-EFSB-22; RR-EFSB-27 3) Of the 29 homes within 50 feet of the edge of the ROW, 14 homes are located in the 1.2 mile segment at the beginning of the Primary Route from Russell Holmes to Bisbee Lane, and nine homes are located in the 2 to 2.5 mile segment in the Lunn's Road vicinity (id.).

b. Alternative Route

The Company used the same assumption for the Alternative Route, regarding the nearest residence, as for the Primary Route. Because the same equipment would be used regardless of which route is chosen, the maximum noise impacts would be the same, with tree-clearing and helicopter wire-stringing resulting in maximum noise levels of 92 dBA and 96 dBA at the nearest residence, respectively (Exh. EFSB-NO-3). The Company characterized ambient noise along the Alternative Route as varying between quiet rural/open-space, with highway traffic noise around the crossing of Interstate 495, and noisier mixed commercial and industrial areas to the east of the I-495 crossing (Tr. 5, at 723-724).

There are approximately 40 homes within 50 feet of the edges of the ROW, 16 homes within 50 to 100 feet, and a total of 185 residences located within 300 on the Alternative Route (Exh. RR-EFSB-22).

c. Common Impacts

The same construction techniques and sequence will be applied along the common portion crossing the canal, except for the actual stringing of wires across the canal, which will require helicopters (Exh. NSTAR-1, at 5-16). There are no residences along the 1.4-mile segment, so construction noise impacts would be negligible (id. at 5-63).

d. Conclusion on Noise Impacts

Based on the above, construction along both the Primary Route and the Alternative Route would result in significant impacts to residences near the ROW. The total number of residences which would be affected is nearly the same for both routes; however, there are more residences very close to the edges of the ROW along the Alternative Route. Ambient noise levels along the ROWs are likely to be fairly similar, but slightly quieter conditions are likely to prevail along the Primary Route than along the Alternative Route. Construction noise impacts on the segment of the Project from Bournedale Road to Bourne would be very minimal as there are no residential receptors in that area. The Siting Board finds that the Primary and Alternative Routes are comparable with respect to construction noise impacts.

Because of the noisy nature of transmission line construction, the Siting Board directs the Company to conduct all construction between the hours of 7 a.m. and 6 p.m. on weekdays only, and excluding holidays.. To the extent the Company finds that construction performed outside of

these hours or on weekends or holidays is necessary, the Company shall seek written permission from the relevant municipal authority prior to the commencement of such work, and provide the Siting Board with a copy of such permission. If the Company and municipal officials are not able to agree on whether weekend, holiday, or extended weekday construction should occur, the Company may request prior authorization from the Siting Board, provided that it also notifies the relevant municipal authorities in writing of such request. Further, the Siting Board directs the Company, in consultation with the towns of Carver, Plymouth, Bourne, and Barnstable, to develop a community outreach plan for project construction. This outreach plan should, at a minimum, set forth procedures for providing prior notification to affected residents of: (a) the scheduled start, duration, and hours of construction; (b) any construction the Company intends to conduct that, due to unusual circumstances, must take place outside of the hours detailed above; and (c) complaint and response procedures including contact information and a dedicated project hotline for complaints.

The Siting Board finds that, with implementation of the conditions above, the noise impacts from transmission line construction along the Primary Route would be minimized.

6. Visual Impacts

a. Primary Route

Presently, the Primary Route ROW consists of two 345 kV above ground transmission lines. One 345 kV circuit is supported on wooden H-frame structures with an average height of 75 feet, while the other is supported on steel lattice structures with an average height of 110 feet (Exh. NSTAR-1, at 5-53, 5-54; Tr. 7, at 710). For a distance of 7.2 miles from the Carver Substation to the State Forest Transition Station, which is within the MSSF, the ROW is 300 feet wide, and currently cleared to a width of between 190 feet and 210 feet; south of that point the ROW is 330 feet wide and currently cleared to a width of between 210 feet to 230 feet (Exh. NSTAR-1, at 5-53).

The proposed new 345 kV circuit would be constructed on steel monopoles on the northern or eastern side of the ROW (id. at 5-54). From Carver Substation to the State Forest Transition Station, vertical monopoles would range from 87.2 feet to 139 feet, with an average height of 110 feet; and from the Transition Station south, delta-configured monopoles approximately 105 feet tall (maximum 110 feet) would be used (id.; Exh. EFSB-V-7). Between 35 feet and 65 feet of tree clearing along the northern or eastern edge would occur along the

entire ROW (Exh. NSTAR-1, at 5-54). The Company estimated that as a result of tree clearing, approximately seven residences along the Primary Route would lose the entirety of the vegetative screening that currently exists between the homes and the ROW, and approximately 61 residences would experience a reduced vegetative buffer between the homes and the ROW (Exh. EFSB-V-2). In addition, there are several areas along the ROW, particularly in the 2- to 2.5-mile Lunn's Road residential area in Plymouth where residences already have a prominent view of the ROW and will continue to have a direct view following the addition of the proposed new circuit (Exhs. NSTAR-1, at 5-57; EFSB-V-3). The homes would experience an increased visual impact due to the addition of the new transmission line. The Company has stated that it would work with affected residences to mitigate the visual impacts of the Project (Exh. NSTAR-1, at 5-57). The Company has agreed to discuss possible vegetative screening and pole placement plans with affected abutters before construction begins (Exh. EFSB-V-10). The Company stated that visual mitigation could include new vegetative screening, which would be located off the ROW on private property (Exh. EFSB-V-2).

b. Alternative Route

Presently, the Alternative Route ROW has several different configurations consisting of two or more 115 kV transmission lines and one or more distribution lines depending on the segment (Exh. NSTAR-1, at 5-54). For the first 8.5 miles south from Carver Substation, the ROW has two 115 kV circuits supported on a single line of double-circuit towers, and for four of those 8.5 miles there are two additional 115 kV circuits each supported on a set of wooden H-frame structures (id. at 5-55, 5-56). The double circuit towers are an average of 105 feet tall and the H-frame structures are in the 60-80 feet high range (id.; Tr. 5, at 709). This 8.5-mile segment varies in width from 100 feet to 205 feet and is currently cleared to a width of between 105 feet to 170 feet (Exh. NSTAR-1, at 5-55). From Tremont Substation eastward, there are two 115 kV circuits on H-frame structures about which there is conflicting testimony whether the existing structures are about 55 feet tall or are between 60 and 80 feet high; there is also one or two distribution circuits along portions of the route (id. at 5-55, 5-56; Tr. 5, at 709). This 9.8-mile segment varies in width from 175 feet to 205 feet and is currently cleared to a width of between 130 feet and 170 feet (Exh. NSTAR-1, at 5-55, 5-56).

The proposed new 345 kV circuit along the Alternative Route would be constructed using steel monopoles from the Carver Substation to the Wareham Substation with an average height

of 105 feet, and from Wareham Substation east with an average height of 115 feet (Exh. NSTAR-1, at 5-55, 5-56). Between 25 feet and 55 feet of clearing would be required along the entire ROW (id.). The Company estimated that as a result of tree clearing six residences along the Alternative Route would lose the entirety of the vegetative screening between their residence and the ROW, and approximately 13 residences would experience a reduced vegetative buffer (Exh. EFSB-V-2). As with the Primary Route, there are areas along the ROW where residences already have a prominent view of the ROW, particularly just south of Carver Substation and along Acoaxet Lane in Wareham, that will continue to have a direct view following the addition of the proposed new circuit (Exh. EFSB-V-3). The homes would experience an increased visual impact due to the addition of the new transmission line.

c. Common Impacts

Presently, the portion of the ROW which crosses the Cape Cod Canal has two sets of double circuit lattice structures, one carrying two 345 kV circuits and one carrying two 115 kV circuits (Exh. NSTAR-1, at 5-57). Because the existing circuits span the canal, they are very prominent and visible from nearby points and the canal itself (id.).

The proposed new 345 kV circuit would be constructed on steel monopoles, the existing double circuit lattice structures carrying the existing 345 kV circuits would be removed, and the existing 345 kV circuits would be moved on to two new sets of steel monopoles (id.). The double circuit lattice structures currently carrying two 115 kV circuits would remain the same (id.).

d. Conclusions on Visual Impacts

Based on the above, it is difficult to differentiate between the two route alternatives. Construction on the Primary Route ROW would result in a larger number of residences experiencing a more prominent view of the ROW. Specifically, 61 homes along the Primary Route would experience a reduction in visual buffer versus 13 homes along the Alternative Route. However, the Primary Route ROW is relatively wide and already dominated by the existing large, 345 kV transmission lines, while the Alternative Route has smaller existing transmission lines and a narrower ROW. Therefore, construction of the new lines along the Alternative Route may result in the new transmission line appearing large and dominant by comparison. Based on these factors the Siting Board finds that the visual impacts of the Primary

and Alternative Routes are comparable. Because construction of the proposed transmission line will have visual impacts on a large number of nearby residences, the Siting Board directs the Company to implement an off-site screening program for affected residences to include the following requirements:

(a) upon completion of construction the Company will notify in writing by first class mail with delivery confirmation all owners of property located on or abutting the ROW of the option to request that the Company provide off-site screening. The Company will follow up with a phone call to non-responding property owners for whom a phone number is accessible. The off-site screening may include, but it not limited to, shrubs, trees, window awnings and fences, provided that the Company's operating and maintenance requirements for its ROW facilities are met;

(b) provide property owners with a selection of generic renderings of possible mitigation approaches. Such renderings shall be for guidance purposes only, and shall not limit a property owner's ability to request different mitigation;

(c) meet with each property owner who requests mitigation to determine the type of mitigation package the Company will provide, provided that the Company has received a response from the property owner within three months of receipt of the Company's written notification;

(d) honor all property owners' requests for reasonable and feasible mitigation that are submitted within six months of a meeting with the Company and/or its consultants;

(e) provide a warranty to property owners to ensure that all plantings are established and replaced if needed at the end of one year from the date of planting, provided that the property owners reasonably maintain the plantings;

(f) submit to the Siting Board for its approval, at least three months before the conclusion of construction, a draft of the notification letter to property owners prior to mailing; and

(g) submit a compliance filing within 18 months of completion of construction detailing: (i) a list of all properties that were notified of the available off-site landscaping, (ii) the number of property owners that responded to the offer for off-site mitigation, (iii) a list of any property owners whose requests were not honored, and the rationale therefore, (iv) a general description of the types of off-site landscaping provided, and (v) the average cost of landscaping per property, broken down by installation, material, and design costs.

The Siting Board finds that with implementation of the condition above, that visual impacts from transmission line construction and operation along the Primary Route would be minimized.

7. EMF Impacts

The Company modeled pre-project and post-project electric and magnetic field levels for both the Primary Route and the Alternative Route, as well as the common segment including the canal crossing (Exh. EFSB-E-1). In addition, the Company estimated electric and magnetic field impacts for the portion of the Project which involves changing the voltage on an existing transmission line from 115 kV to 345 kV (id.).[34] The Company's modeling of magnetic field strengths was based on estimated peak and annual average loads for 2013 (id.). A summary of modeled magnetic field levels in milligauss ("mG") is provided and discussed below.

a. Primary Route

There are approximately 29 residences within 50 feet of the edges of the ROW along the Primary Route: (1) from Carver Substation to the State Forest Transition Station, there are approximately five residences north of the ROW and 14 residences south of the ROW within 50 feet; (2) from the Transition Station to Plymouth Crossover Station, there are approximately three residences north of the ROW and five residences south of the ROW within 50 feet; and (3) from Plymouth Crossover Station to Bournedale Road, there is one house on the north and one house on the south side of the ROW within 50 feet (Exh. EFSB-V-1(a)). The modeled pre-project and post-project magnetic field levels for the Primary Route are summarized in Table 2, below. Note that the edge-of-ROW magnetic field levels provided below are representative of levels at the edge of the ROW, whereas the residences accounted for above are located up to 50 feet from the edge of the ROW. Because magnetic field levels drop rapidly with distance from the source, the peak magnetic field levels at any given residence within the 50 feet would be equal to or less than the maximum levels listed in Table 2, below (Exh. NSTAR-1, at 5-65).

[34] The uprating of this line involves no construction; therefore, discussion of this segment is omitted from the other portions of this decision discussing environmental impacts.

Table 2. Peak Magnetic Field Levels – Primary Route

Segment	Pre Project (mG)			Post Project (mG)		
	Maximum	Edge of ROW		Maximum	Edge of ROW (# of homes within 50 ft)	
		North	South		North	South
Carver Substation to State Forest	70.1	8.6	5.2	77.4	22.8 (5)	6.1 (14)
State Forest to Plymouth Crossover	88.9	5.6	8.4	72.9	19.0 (3)	6.4 (5)
Plymouth Crossover to Bournedale Road	88.9	5.6	8.4	64.2	3.3 (1)	22.0 (1)

(Exh. EFSB-E-7)

The largest increase in magnetic field levels is 14.2 mG on the north edge of the ROW from Carver Substation to the State Forest Transition Station, where the existing level of 8.6 mG increased to 22.8 mG with the Project. The Company stated that it considered different structure types and concluded that monopoles would yield the lowest edge-of-ROW magnetic fields, and after further investigation chose to use a vertical monopole for the portion of the transmission line from Carver Substation to the State Forest Transition and a delta configuration for the remainder of the new transmission line (Exh. NSTAR-1, at 5-66). Finally, the Company compared the edge-of-ROW magnetic field levels for different phasing configurations and chose the configuration that would result in the lowest edge-of-ROW magnetic field levels (Exh. EFSB-E-9).

At Siting Board Staff's request, the Company evaluated an alternative ROW configuration in the vicinity of several neighborhoods along the Primary Route, moving the locations of both existing and proposed conductors away from the northern/eastern side of the ROW, where the new line is to be added, in an attempt to mitigate magnetic field impacts. The alternative configurations would result in reduced magnetic field levels for between two and three residences (depending on which alternative was chosen) but would result in *increased* magnetic field levels for between seven and eleven residences (depending on which alternative was chosen). Incremental construction cost for these alternative configurations ranged from

$2.2 million to $9.8 million, and the Company stated that implementation would also involve line outage coverage costs of at least $16 million (RR-EFSB-27).

b. Alternative Route

There are approximately 40 residences within 50 feet of the edges of the ROW along the Alternative Route: (1) from Carver Substation to Tremont Substation there are approximately five residences to the north of the ROW and six residences to the south of the ROW within 50 feet; (2) from Tremont Substation to Wareham Substation there are approximately seven residences to the North and seven residences to the south of the ROW within 50 feet; and (3) from Wareham Substation to Bournedale Road there are approximately thirteen residences to the north and two residences to the south of the ROW within 50 feet (Exh. EFSB-V-1b). The modeled pre-project and post-project magnetic field levels for the Alternative Route are summarized in Table 3, below. As with the Primary Route, note that the edge of ROW magnetic field levels provided below are representative of the levels at the edge of the ROW, whereas the residences accounted for above are anywhere between zero and 50 feet from the edge of the ROW. Because magnetic field levels drop rapidly with distance from the source, the peak magnetic field levels at any given residence within the 50 feet would be equal to or less than the maximum levels listed in Table 3, below (Exh. NSTAR-1, at 5-65).

Table 3. Peak Magnetic Field Levels – Alternative Route

Segment	**Pre Project (mG)**			**Post Project (mG)**		
	Maximum	Edge of ROW		Maximum	Edge of ROW (# of homes within 50 ft)	
		North	South		North	South
Carver Substation to Tremont Substation	68.2	34.1	5.2	66	33.0 (5)	13.0 (6)
Tremont Substation to Wareham Substation	59.6	10.9	3.7	44.8	6.1 (7)	24.0 (7)
Wareham Substation to Bournedale Road	59.6	5.0	16.4	46	21.0 (13)	8.5 (2)

(Exh. EFSB-E-7, errata)

The largest increase in magnetic field levels is 20.7 mG on the southern edge of the ROW between Tremont Substation and Wareham Substation. Because the Alternative Route is relatively narrow and already contains other transmission lines, the Company chose to use a vertical monopole.

c. Common Impacts

The Company projected electric and magnetic field levels for the portion of the Project from Bournedale Road, crossing the Cape Cod Canal and continuing to the Bourne Switching Station (new construction) and from the Bourne Switching Station to the proposed new substation in West Barnstable (no new construction) (Exh. EFSB-E-7). For this entire portion of the Project the projected magnetic field levels with the proposed Project in place are lower than existing levels (id. at 17-18). The highest post-project edge-of-ROW magnetic field level along this portion of the Project is 11 mG; the existing level at this location is 17 mG (id.).

d. Conclusions on EMF Impacts

The Alternative Route has approximately 20 residences which could potentially experience magnetic field level increases over 10 mG, while the Primary Route has approximately nine residences which could potentially experience an increase of over 10 mG. While the Alternative Route also has the highest modeled single post-project edge-of-ROW magnetic field level, 33 mG, that is a decrease from existing levels; the highest along the Primary Route is 22.8 mG. The Primary Route has fewer residences within 50 feet of the edge-of-ROW, and fewer residences which could be exposed to higher and larger increases in magnetic fields than the Alternative Route. Therefore, the Siting Board finds that the Primary Route is preferable to the Alternative Route with respect to magnetic field levels.

The Company considered some additional measures in the hopes of reducing magnetic field impacts for residences near the ROW, but those measures actually increase magnetic field impacts, as well as increasing Project costs. With respect to the segment of the Project from Bournedale Road to Bourne, the magnetic field levels at the edge-of-ROW all decrease.

The Siting Board finds that the magnetic field impacts from transmission line construction and operation along the Primary Route would be minimized.

8. Traffic

a. Primary Route

The Company asserts that project construction will have minimal impacts to traffic (Exh. NSTAR-1, at 5-19). The Company anticipates temporary roadway closures and would notify the relevant municipality prior to any road closings and would post traffic details to ensure the safety of the public (id.). The Company does not anticipate that delivery of materials or equipment would necessitate traffic control, but will consult with the relevant municipalities to ensure there are no traffic or safety concerns (Exh. EFSB-T-3).

The Company would prepare staging or supply yard areas for temporary storage or material and parking for heavy equipment, as well as sanitation facilities, dumpsters and material recycling facilities (Exh. NSTAR-1, at 5-13). The Company anticipates that it will be the responsibility of the construction contractor to locate and arrange for staging areas (Exh. EFSB-T-1). However, the Company stated that there will likely be several staging areas along the Project route, some within the ROW and some adjacent to the ROW, and none are expected to exceed one acre in area (id.). Staging areas are selected based on their proximity to the work site, and consideration is given to sites which avoid environmentally sensitive and residential areas wherever possible (Exhs. EFSB-T-1, EFSB-T-5).

Different stages of construction will require different sizes of work crews, ranging from crews of four workers each, to crews of twelve workers each (Exh. EFSB-T-2). Construction workers will park their personal vehicles at either the work location or an off-ROW staging area (id.).

b. Alternative Route

The anticipated traffic impacts associated with the Alternative Route would be similar to those anticipated for the Primary Route. In addition, the Alternative Route crosses Interstate 495 in two locations (Exh. EFSB-T-4). Prior to scheduling construction work crossing I-495, the Company would consult with the Massachusetts State Police regarding safety (id.).

c. Analysis

The potential traffic impacts of both the Primary and Alternative Routes would be minimal. The Company has stated that it would consult with the relevant municipality or agency when planning any road closings or interstate crossings. For both routes, the Company has not

specified the number or location of staging or laydown areas, but estimates that they would be on NSTAR-owned land and occupy one acre or less. Based on the above, the traffic impacts of the Primary Route and the Alternative Route are comparable.

Because the Company will not know the details of the number and location of the staging and laydown areas until a contractor is selected, and because the Project passes through several residential areas, there is a possibility that some support sites may be located in such a way as to exacerbate traffic and noise impacts in those residential areas. Further, guidelines for construction worker parking have not been developed, for example, prohibitions on arriving too early or parking on residential streets. Therefore, the Siting Board directs the Company to submit for Siting Board approval a draft support site and substation/switching station plan, prior to the commencement of Project construction, to be developed with input from the communities where the support sites will be located. The plan should include both a written description and map of the specific location of each support site including the boundaries of each support site, and a description of all the activities that will occur at each site. The plan should describe: (a) the hours that activities will occur; (b) an estimate of the timeline for the use of each support site; (c) the duration and location of police details and/or flagmen if proposed; (d) maintenance of the support site to avoid impacts to the surrounding properties; (e) use restrictions; (f) additional mitigation as appropriate; (g) plans to return the site to its original use and condition; and (h) a description of how community input was obtained.

In addition, although traffic impacts associated with the project will be temporary in nature, the Company provided little information with respect to the specifics of traffic control. Therefore, the Siting Board directs the Company, in consultation with municipalities and Company contractors, to develop and implement a traffic management plan to minimize traffic disruption, which includes, but is not limited to, the following measures: (1) signs erected to identify construction work zones; (2) police details and/or flagmen to direct traffic near public road crossings; and (3) police details and/or flagmen to direct traffic at construction work sites along roads. Given the above conditions, the Siting Board finds that the traffic impacts from construction and operation of the transmission line along the Primary Route would be minimized.

9. Air Impacts

As a transmission facility, operation of the proposed Project along either the Primary Route or the Alternative Route generally would not contribute to air impacts. Emissions from construction vehicles are a concern, however. The Company has committed that all diesel-powered non-road construction equipment with engine horsepower (hp) ratings of 50 and above used for 30 or more days over the course of Project construction will have EPA-verified (or equivalent) emission control devises installed, such as oxidation catalysts or other similar technologies (Exh. NSTAR-1, at 5-18). Further, in prior cases, Companies have also committed to minimizing air quality impacts by using ultra-low sulfur diesel fuel and requiring that all construction vehicles (whether operated by the Company or by a construction contractor) limit vehicle idling to no more than five minutes in most cases. Here, the Company has not addressed these latter forms of mitigation.

Based on the above, air impacts from the Primary Route and the Alternative Route are comparable. The Siting Board directs the Company, as the Company has agreed, that all diesel-powered non-road construction equipment with engine horsepower ratings of 50 and above to be used for 30 or more days over the course of Project construction must have USEPA-verified (or equivalent) emission control devices, such as oxidation catalysts or other comparable technologies (to the extent that they are commercially available) installed on the exhaust system side of the diesel combustion engine. Prior to the commencement of construction, the Company shall submit to the Siting Board certification of compliance with this condition and a list of retrofitted equipment, including type of equipment, make/model, model year, engine horsepower, and the type of emission control technology installed.

Further, the Siting Board directs the Company that all off-road construction equipment used during Project construction shall use ultra-low diesel fuel, and that idling be limited to no more than five minutes whenever practicable. The Siting Board finds that, with the implementation of the above conditions, air impacts from construction and operation of the transmission line along the Primary Route would be minimized.

10. Other Impacts

The substation upgrades performed during the Project construction would involve some potentially hazardous materials. One material that would be used at several substations is sulfur hexafluoride ("SF_6,") and is described in greater detail where substation impacts are discussed, in

Section V.F.1.a, below. Another hazardous material is mineral oil dielectric fluid ("MODF"), which is used in transformers at substations (Exh. EFSB-S-1). Secondary containment is included where any MODF is stored or used, and any accidental release of MODF would trigger an alarm (id.). NSTAR maintains a 24/7 response program that would be called up in the event of a spill (id.). MODF would be used at substations regardless of which route was used. Based on the above, the Siting Board finds hazardous materials use impacts along the Primary and Alternative Routes are comparable. Given the inclusion of secondary containment and NSTAR's 24/7 response program, the Siting Board finds that hazardous materials impacts along the Primary Route would be minimized.

Mr. Kerry LaLiberte, an intervenor in this proceeding and an abutter to the ROW in Carver, raised several issues with respect to the location of the proposed new transmission line (see LaLiberte comments on Issues Memorandum (Dec. 22, 2011); Jan. 12, 2012 EFSB Meeting Tr. at 90-94). As designed, the proposed 345 kV transmission line along the Primary Route would cross part of Mr. LaLiberte's property (see id.). Mr. LaLiberte and the Company met and agreed to several measures designed to address Mr. LaLiberte's concerns, largely involving changing some existing and proposed structure locations (see id.). The Siting Board directs the Company to construct the new transmission line in accordance with the following restrictions and requirements, as agreed to by the Company and Mr. LaLiberte: (1) the Company will relocate existing line 322, currently located on H-frame structures, onto new structures closer to the center of the ROW in the vicinity of Mr. LaLiberte's home, so that the new transmission line will be no closer to the edge-of-ROW than existing Line 322 is today, adjacent to Mr. LaLiberte's home; (2) to the greatest extent possible, the Company will not remove trees from the buffer which currently exists between Mr. LaLiberte's home and the transmission lines; and (3) the Company will address Mr. LaLiberte's concerns with respect to noise and vibration from existing Line 322.

C. Cost

The Company estimated that the total Project cost, incorporating new transmission on the Primary Route, would be $110 million (Exh. NSTAR-1, at 1-13). The costs that would be incurred regardless of which route is chosen include: construction work at Carver Substation ($6 million), transmission line construction from Bournedale Road to Bourne, including the canal crossing and double-circuit tower separation ($18 million), construction at Bourne

Switching Station ($4 million), new substation construction ($22 million), and looping the existing line into and out of the new substation ($2 million) (id. at 1-14). The Company estimates that transmission line construction from Carver Substation to Bournedale Road along the Primary Route would cost $32.8 million, and along the Alternative Route would cost $43.7 million (id. at 5-70). The Company states that the Alternative Route is more expensive largely because it contains a greater amount of wetlands than the Primary Route, which requires more mitigation and increases the length of construction (id. at 5-70). Accordingly, the Siting Board finds that the Primary Route is preferable to the Alternative Route with respect to cost.[35]

D. Reliability

The Company claims that there is no meaningful difference in reliability between the Primary Route and the Alternative Route (Exh. NSTAR-1, at 5-71). The Company's proposed Project would result in the three 345 kV lines serving Tremont East sharing about nine miles of ROW, from a point in MSSF in Plymouth to Bourne Switching Station on Cape Cod (Tr. 4, at 667-671). Sandwich identified three possible common-cause failures for two parallel transmission lines: a brush fire, a low or crashing airplane, and a tornado or other intense storm (Tr. 11, at 1592). Sandwich pointed out that such an event taking the two existing lines out of service would have a reasonably high chance of also taking out a new third line (id. at 1595). The Siting Board notes that the Alternative Route may have a reliability advantage insofar as it would not result in all three of the 345 kV lines supplying Cape Cod sharing a ROW for approximately nine miles, as would be the case for the Primary Route.[36] On this basis, the Siting Board finds that the Alternative Route would be preferable to the Primary Route with respect to reliability.

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35 GenOn compiled cost increase data from recent transmission projects in New England (RR-EFSB-GEN-5(S)(1); EFSB Issues Memorandum at 13 (December 22, 2011)). The data showed cost increases of 14 to 172 percent over the original cost estimates for the identified projects, including a cost increase of 143 percent for the SEMA short-term measures (id.). As a result of its concerns regarding potential cost overruns, the Siting Board in Section V.G, below, directs the Company to provide the Board with a certified pre-construction Project cost estimate and with subsequent semi-annual reports of projected and actual construction costs. See Transcript of January 12, 2012 EFSB Meeting, at 39-42; 99-100; 106-108.

36 ISO-NE indicated that it does not get involved in the selection of one route over the other, as the route and environmental evaluation and decision solely rests with the Transmission owner, regardless of reliability (Jan. 12, 2012 EFSB Meeting Tr. at 82-83).

E. Conclusions on Route Comparison

The Siting Board found, above: (1) that the Primary Route is preferable to the Alternative Route with respect to wetlands and water resource impacts, and magnetic field impacts; (2) that the Alternative Route is preferable to the Primary Route with respect to land use resources and cultural and historical resources; and (3) that the Primary Route and the Alternative Route are comparable with respect to traffic, noise, visual, air, and hazardous materials impacts. The Siting Board notes, however, that the difference in impacts between the Primary and Alternative Routes, with respect to wetlands and water resources is significant, while the difference in impacts to land use, historic and archaeological resources is relatively small. Given the above comparison, the Siting Board finds that the Primary Route is preferable to the Alternative Route with respect to environmental impacts. Finally, the Siting Board finds that the Primary Route is preferable to the Alternative Route with respect to cost and the Alternative Route is preferable to the Primary Route with respect to reliability.

The Alternative Route would be more likely to provide continuity of service in an N-1-1 or N-2 loss of the two existing 345 kV lines, because it is geographically more separate from those existing lines and so less likely to be simultaneously affected by localized events such as a plane crash, a tornado, or brush fire. However, the increased reliability would come with an incremental cost of approximately $11 million and would have overall greater adverse environmental impacts. The likelihood of such a contingency actually occurring in any given year is very small, and the added cost and adverse impacts described above seem, on balance, to outweigh the reliability benefits of the Alternative Route. The Siting Board therefore finds that the Primary Route is preferable to the Alternative Route with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

F. Substations

1. Terminal Substation

The proposed Project effectively brings 345 kV power to the mid-Cape area, whereas previously 345 kV power was limited to an area along the canal. The Project therefore includes installation of new equipment to convert 345 kV power to 115 kV in West Barnstable, near the end of the previously-constructed 345 kV-capable transmission line 120 (Exh. NSTAR-1, at 4-35). The proposed substation would include one 345/115 kV transformer, a 345 kV circuit

breaker and disconnect switches, foundations, containment, and a six-breaker 115 kV switching facility (id.). The footprint of the proposed substation would be approximately 400 feet by 250 feet and encompass approximately 2.25 acres (id. at 4-36). The Company identified two suitably-sized, NSTAR-owned parcels with immediate access to existing transmission ROWs, referred to as the Oak Street site and the Service Road site (id.).

The Oak Street site is a 15.4-acre site located off Oak Street in West Barnstable, just north of Route 6 (Exh. NSTAR-1, at 4-36). Part of the site is currently occupied by an existing substation, and is otherwise undeveloped (id.). As measured from the planned fence line, the distance to the nearest residence is approximately 310 feet, and the distance to the nearest property line is approximately 280 feet. There is a 200-foot wide wooded buffer between the nearest residence and the site (id. at 4-37; RR-EFSB-23). There are several residences more than 500 feet from the nearest proposed fence line with significant intervening wooded buffers (Exh. NSTAR-1, at 4-37).

The Service Road site is a 5.3-acre site located off Service Road in West Barnstable (id. at 4-38). The site is currently partially occupied by an NSTAR ROW and communications tower, and is otherwise undeveloped (id.). As measured from the planned fence line, the distance to the nearest residence is about 235 feet, and the distance to the nearest property line is approximately 80 feet (id. at 4-39; RR-EFSB-23). There are six residences located within 300 feet of the proposed substation (Exh. NSTAR-1, at 4-38).

NSTAR stated that the Town of Barnstable, given the two sites, has expressed a preference that the terminal substation be built at the Oak Street Site (Tr. 5, at 752). NSTAR stated that Barnstable was chiefly concerned about adequate visual screening from Oak Street, and also about visibility from Route 6 (id.).

a. Environmental Impacts

i. Wetlands and Water Resources

The Oak Street site contains one small vegetated wetland south of the existing substation (Exh. NSTAR-1, at 5-29). The Company stated that it will design the substation at the Oak Street Site to avoid this wetland (id.; Tr. 5, at 760)). There are no wetlands on or near the Service Road site (Exh. NSTAR-1, at 5-29). There are no surface water resources on or near either the Oak Street or Service Road sites (id. at 5-37).

The Oak Street site is located within a Barnstable Aquifer Protection District (id. at 5-39). The Aquifer Protection District includes all areas in the town that do not fall within a Wetland or Groundwater Protection District (Tr. 5, at 761). The Service Road site is located within Barnstable's Groundwater Protection District (Exh. NSTAR-1, at 5-30). The Groundwater Protection District carries more restrictive limitations than the Aquifer Protection District (id. at 5-39).

ii. Land Impacts and Cultural Impacts

There is no mapped Priority or Estimated Habitat on or in the vicinity of the Oak Street Site or the Service Road Site (Exh. NSTAR-1, at 5-34).

The Oak Street site is located within the Old King's Highway Regional Historic District listed in the State Register of Historic Places (id. at 5-47). There are an additional four listed resources within one-half mile of the site (id.). The Company stated that it will be in consultation with the Old King's Highway District Commission to ensure that the proposed substation is consistent with the district (Exh. EFSB-G-3(S5) at 1-18). There are no previously recorded archaeological sites within the Oak Street site, and there are four previously recorded sites within the vicinity of the site (Exh. NSTAR-1, at 5-48). Half of the site was identified as having moderate or high sensitivity for containing archaeological resources (id.).

The Service Road site is within one-half mile of the Old King's Highway Historic District (id. at 5-49). There are no previously recorded archaeological sites within the Service Road site, and there are three previously recorded archaeological sites located in the vicinity (id.). Half of the Service Road site was identified as having moderate or high sensitivity for containing archaeological resources (id.).

iii. Noise Impacts

As with transmission line construction, substation construction would typically take place between the hours of 7 a.m. and 6 p.m., weekdays, and will last approximately eight to ten months at the terminal substation site (Exh. EFSB-NO-1; Tr. 5, at 737). Typical noisy construction equipment at the substation site includes excavators and bulldozers, dump trucks, cranes, concrete mixer trucks, and soil compactors (Exh. EFSB-NO-2). The Company calculated a maximum construction noise level at the nearest residence based on simultaneous use of several noisy pieces of equipment at 92 dBA (Exh. EFSB-NO-3). The Company characterized

the ambient noise near the substation sites as dominated by noise from Route 6 (Exh. NSTAR-1, at 5-64).

The proposed terminal substation at either site will include a 345 to 115 kV low-noise transformer that, nevertheless, does generate some noise (id. 5-63; Exh. EFSB-NO-8; Tr. 5, at 742). The Company measured background noise levels at several points adjacent to both substation sites and calculated the noise generated by the new transformer (Exh. NSTAR-1, at 5-64). The closest residence to the Oak Street site may experience a 4.6 dBA increase over nighttime noise levels, with a 5.2 dBA increase at the closest residential property line. The closest residences (approximately eleven) to the Service Road site may experience an increase of 7.1 dBA over nighttime noise levels, with a 15.8 dBA increase at the closest residential property line (id. at 5-65).[37]

iv. Visual Impacts

As described above, the footprint of the proposed terminal substation will be approximately 400-feet by 250 feet, and will encompass approximately 2.5 acres (Exh. NSTAR-1, at 5-58). The tallest new facilities will be no more than 25 feet tall, with the exception of the poles which will carry the transmission line into and out of the substation, which will be approximately 90 feet tall (id.).

There are no residences that will have a partial or unobstructed view of the Oak Street Site. The Oak Street Site is located on the same property as an existing NSTAR substation, and approximately 200 feet north of Route 6 (id.). The proposed new substation at the Oak Street site would be visible from Oak Street and Route 6 where the existing ROW is cleared, but there is a partial intervening tree buffer (id.). The West Barnstable Civic Association raised concerns with the Company with respect to views of the existing and new substation from Oak Street and Route 6 (Tr. 5, at 752). .

There are three residences that have a partial view of the Service Road Site (Exh. EFSB-V-4). The Service Road site is also adjacent to Route 6, and is and parallel to Service Road and

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[37] In order to meet the MassDEP Noise Pollution Policy limiting an increase in L_{90} ambient to less than 10 dBA, the Company indicated it would be required to install a sound wall at the Service Road site (Exh. EFSB-NO-5).

therefore the proposed new substation at the Service Road site would also be visible from Route 6 and partially visible from Service Road (Exh. NSTAR-1, at 5-59).

Regardless of the site chosen, the Company will supplement existing vegetation in order to reduce views of the substation from nearby roads and residences (Exhs. NSTAR-1, at 5-59; EFSB-G-3(S5) at 2-5)). The Company described that generally the screening will consist of a mixture of native deciduous and evergreen species; such screening may not entirely block views due to safety concerns, but will partially obstruct the views (Exh. EFSB-G-3(S5) at 2-3). For the Oak Street site, the Company has agreed to provide an integrated landscaping plan to encompass both the existing Oak Street substation and the new substation (Tr. 5, at 751; Tr. 7, at 976). The plan will provide vegetative screening of the substation from these roads. The substation, built at either site, will have permanently installed lighting which will be left off unless work is being conducted in the station, or in cooperation with law enforcement officials in the event of a security threat (Exh. EFSB-V-11).

v. Traffic Impacts

As with the construction of the transmission portion of the Project, the Company does not anticipate that construction of the terminal substation will negatively impact traffic (Exh. NSTAR-1, at 5-19). The Company states that terminal substation construction would require several different crews of different sizes ranging in size from four to twelve workers per crew (Exh. EFSB-T-2). As with the transmission line construction, workers would park their personal vehicles at the substation or an off-ROW staging area (id.).

vi. Air Impacts

Sulfur hexafluoride ("SF_6") gas has been identified as a non-toxic but highly potent greenhouse gas ("GHG"). The Massachusetts Clean Energy's Energy and Climate Plan[38] adopts a 2020 statewide GHG emissions limit of 25 percent below 1990 emissions levels and sets forth an integrated portfolio of policies to reach the Commonwealth's clean energy and climate goals.[39] One of the policies set forth in the Plan is reducing SF_6 emissions by 2020 equivalent to

[38] On December 29, 2010, the Secretary of Energy and Environmental Affairs issued the Massachusetts Clean Energy and Climate Plan for 2020. See G.L. c. 21N.

a reduction of 0.2 million metric tons of CO_2, which would reduce state-wide GHG emissions by approximately 0.2 percent.

NSTAR calculates SF_6 emission rates by the mass balance approach, i.e., weighing the SF6 gas left in storage at the end of the year and subtracting that amount from the weight at the beginning of the year (Tr. 5, at 764). This difference accounts for the amount used to top off equipment which had leaked as well as the gas used to fill new equipment, which can then be calculated (id. at 765).

As of December 31, 2010, NSTAR's reported system-wide nameplate capacity is 67,207 pounds of SF_6 gas (Exh. EFSB-S-2). For 2010, NSTAR reported the emission of 2,257 pounds of SF_6, for a leakage rate of 3.36 percent (id.). NSTAR would install seven new gas-insulated circuit breakers at the terminal substation that would require a total of 793 pounds of SF_6 (id.).

SF_6 equipment is filled by NSTAR or contractor personnel working under NSTAR supervision (Exh. EFSB-S-2). The equipment is typically filled once in its lifetime by NSTAR personnel who have been trained by the equipment manufacturer and follow the equipment filling instruction guide (id.). SF_6 is shipped in U.S. Department of Transportation ("USDOT") approved cylinders and is handled in accordance with the gas and equipment manufacturers' work practices (id.). NSTAR instituted a gas cylinder management program to control gas use and provide accurate tracking for reporting (id.). In addition, all gas breakers are constantly monitored for gas density (id.). When a gas loss is detected, NSTAR conducts appropriate maintenance (id.). When equipment is retired, the SF_6 gas is recovered and reclaimed by a specialty gas vendor, minimizing atmospheric releases (id.). Currently, NSTAR noted that it has been installing SF_6 breakers that have an emission rate below the industry average (id.).

As with the construction for the new transmission portion of the Project, the Company has committed that all diesel-powered non-road construction equipment with ratings of 50 hp and above used for 30 days or more over the course of Project construction will have USEPA-verified (or equivalent) emission control devises installed (Exh. NSTAR-1, at 5-18).

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[39] SF_6 is a GHG that is 23,900 times more potent than CO_2. One pound of SF_6 has the same global warming impact as eleven tons of CO_2. See the Massachusetts Clean Energy and Climate Plan for 2020, at 77.

vii. Conclusion on Terminal Substation Environmental Impacts

The Oak Street site has one isolated wetland which can be avoided during construction, and the Service Road Site has none. The Service Road site is located in a more protective drinking water protection district. Both sites are within or near the Old King's Highway Regional Historic District, and both sites have similar likelihood for containing archeological resources. Construction noise would be very similar at both sites, but the Service Road site has more residences in close proximity than the Oak Street site. Operation at the Service Road site would result in a larger increase above ambient noise levels for residences near the Service Road Site,

While there are no residences with a view of the Oak Street site, several residences would have a view of the substation were it constructed on the Service Road site, and substations at either site would be visible from nearby roadways. The traffic impacts would be similar at both sites, as would the air impacts from SF_6 and construction equipment. Based on this comparison, the Siting Board finds that the Oak Street site is preferable to the Service Road site for construction of the terminal substation with respect to environmental impacts.

b. Cost

The Company estimated that construction of the terminal substation at the Oak Street site would cost $20.4 million (Exh. NSTAR-1, at 4-39). The Company estimated that construction at the Service Road site would cost $22.0 million (id.). The equipment required at either site would be the same; however, the Service Road site would require more earth work (id.). The Siting Board finds that the Oak Street site is preferable to the Service Road site, with respect to cost.

c. Reliability

The Company assessed the reliability of the two substation sites as equal (Exh. NSTAR-1, at 4-39). Both substation sites are large enough for safe operation of the substation (id.). The Siting Board finds that the Oak Street site and the Service Road site are comparable with respect to reliability.

d. Conclusions on Terminal Substation

Based on the above, the environmental impacts at the Service Road site are greater than those at the Oak Street site. The cost of constructing the substation at the Oak Road site is less than the Service Road site and the two sites are comparable with respect to reliability. In

addition, the Town of Barnstable has expressed a preference for locating the substation at the Oak Street site. Accordingly, the Siting Board finds that construction of the terminal substation at the Oak Street site is preferable to the Service Road site.

However, in order to minimize construction noise impacts, the directive for the Company to conduct all Project construction between the hours of 7 a.m. and 6 p.m. weekdays only, excluding holidays, absent authorization from the relevant municipal authorities or the Siting Board in Section V.B.5.d, above, also applies to the terminal substation construction. The directive to develop a community outreach plan for Project construction in Section V.B.5.d, above, also applies to the terminal substation construction. With respect to operational noise impacts, there would be some increase in nighttime noise levels (4.6 dBA) which would occur due to installation of a new transformer at the terminal substation, which is within levels previously accepted by the Siting Board. NSTAR does not anticipate substantial traffic impacts at the Oak Street Site. However, we do not have substantial information about parking plans and other traffic impacts. Therefore, the condition regarding a Support Site and Substation/Switching Station Plan in Section V.B.8.c, above also applies to the terminal substation site at Oak Street.

With respect to visual impacts, no residences will have a direct view of the terminal substation, but a direct view would appear along Oak Street and Route 6. The Company has agreed to provide an integrated landscape plan for both the existing substation and the new substation located at the Oak Street site. The plan will provide vegetative screening of the substation from these roads. However, given the direct views, stated concerns by the Town of Barnstable and the exemption from site plan approval discussed below in Section VII.A.4, the Siting Board directs the Company to develop and implement the integrated landscape plan to screen the proposed substation from Oak Street and Route 6, and to consult with the Town of Barnstable regarding the plan. The Siting Board further directs the Company to submit a landscaping plan for the substation in West Barnstable for approval to the Board prior to construction.

The Company will be installing equipment at the Oak Street site which contains approximately 793 pounds of SF_6. The Company trains any employees who handle SF_6 and monitors gas density of all SF_6 containing equipment. As with the new transmission construction, NSTAR has committed to using only diesel non-road equipment with engine

ratings of 50 hp and above used for 30 or more days over the course of the Project which are equipped with EPA-verified (or equivalent) emission control devices. The condition requiring these emission control devises in Section V.B.9, above, also applies to construction at the terminal substation site. With the implementation of the conditions above, the Siting Board finds that the environmental impacts of the terminal substation at the Oak Street site would be minimized.

2. Carver Substation

Carver Substation is the existing substation where the transmission portion of the Project will originate. The existing substation is on a 13.3-acre NSTAR-owned site in Carver (Exh. NSTAR-1, at 1-9). Work at Carver Substation would expand the footprint of the substation by approximately one acre, and include installation of a new 345 kV circuit breaker position (Exh. EFSB-G-3(S2) at 2-5). Although approximately one half acre of tree clearing would occur, no homes will experience any increased visual impact from tree clearing or construction at Carver Substation (id.; Tr. 5, at 745). As with the terminal substation, Carver Substation will have permanently installed lighting which will be left off unless work is being conducted in the station, or in cooperation with law enforcement officials in the event of a security threat (Exh. EFSB-V-11). There would be no impact to wetlands or water resources at Carver Substation. The construction noise impacts at Carver Substation will be similar to those at the terminal substation, except that there is less earthwork required at Carver Substation, therefore the noise impact will be less and for a shorter duration than at the terminal substation (Tr. 5, at 736). The overall construction length for Carver Substation would be 8 to 10 months (id. at 734). With respect to air impacts, the Company has committed to using retrofitted diesel non-road construction equipment, as stated above. In addition, two new gas-insulated circuit breakers at Carver Substation will include approximately 814 pounds of SF_6. Please see discussion in Section V.F.1.a, above, with respect to NSTAR's practices regarding SF_6. With respect to traffic impacts, the impacts will be similar to those at the terminal substation, described above.

All conditions described herein that are intended to minimize impacts with respect to wetlands, land use, noise, visual, traffic, air and other environmental impacts also apply to any construction taking place at the Carver Substation. With implementation of these conditions, the Siting Board finds that the environmental impacts at Carver Substation have been minimized.

3. Bourne Switching Station

Bourne Switching Station is an existing station located in Bourne on the Massachusetts Military Reservation. In order to accommodate passage of the new 345 kV line, the station will include an expanded 115 kV bus, new switching positions with breakers and a new control house (Exh. EFSB-G-3(S2) at 5-23). However, the station footprint will not be expanded during this Project (Exh. EFSB-G-3(S5) at 2-8).[40] The changes at the station will not increase visual impacts from public ways and will not affect noise levels at the substation (Exh. EFSB-G-3(S2) at 5-23). The station is located in mapped priority habitat, and the mitigation regarding the eastern box turtle, discussed in Section V.B.4, above includes the expansion and work at Bourne Switching Station (id.). There are no wetland or water resources in the vicinity of the station (id.). SF_6 will be used in the switchgear at the Bourne Switching Station. Please see the discussion of NSTAR's practices with respect to SF_6 in Section V.F.1.a, above.

G. Monitoring Project Cost

As discussed in Section IV.E.5, above, the Attorney General recommends that the Siting Board monitor the construction progress and expenditures associated with the Project by requiring quarterly compliance filings[41] by NSTAR to the Siting Board (Attorney General Brief at 30, 31, citing GSRP, EFSB 08-2/DPU 08-105/106, at 140) (Siting Board required WMECo to provide semi-annual updates on construction costs for a 345 kV and 115 kV transmission project with ancillary facilities). The Attorney General states that the reason for the request is to ensure

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40 Initially, the design of the Bourne Switching Station would require expansion of the footprint by 0.4 acres, as well as 0.4 acres of tree clearing. Based on comments on the DEIR, the Company amended the design to include gas insulated switchgear instead of air insulated switchgear, allowing the switchgear to fit within the existing fenceline (Exh. EFSB-G-3(S5) at 2-8). However, NSTAR would construct a bridge structure for the termination of Line 120 and a small control structure outside of the fenceline (id.)

41 The filings would include, inter alia, documentation of reviews and approvals of budgets; account numbers; work order numbers; ISO-NE and NEPOOL reviews; the estimated cost and breakdown of individual expenses of complying with regulatory conditions; and on a quarterly basis and upon a schedule change of more than one month or a cost change of the project of more than one percent of the original budget, the following: the date NSTAR discovered the need for a project change, a description of the change, original and revised cost estimates, the reason for the change, and the approving entity (AG Brief at 32).

that the Project serves the public convenience and is consistent with the public interest in the event of significant cost overruns (id. at 30).

Although the Siting Board does not have jurisdiction over regulatory cost recovery, the Siting Board's statutory mandate concerning the Project is to review the need for, *cost of*, and environmental impacts of transmission lines. G.L. c 164, § 69H (emphasis added) (see GSRP at 141). However, the Siting Board finds that semi-annual compliance filings versus quarterly compliance filings, at least prior to any identified problems with cost containment, are adequate to obtain the specified information. Additionally, although we appreciate and share the Attorney General's interest in making the reporting process meaningful, given the detailed nature of the requested information, we are not persuaded that such voluminous information is necessary at this time.

Therefore, in order to review the costs of the Project, and in an effort to better understand the factors that may lead to cost overruns and delays in construction of Siting Board-approved facilities, we direct the Company, prior to the start of construction, to submit to the Board an updated and certified cost estimate for the Project. Additionally, we conclude that semi-annual compliance filings by NSTAR to the Siting Board are a reasonable and prudent condition to our approval of the proposed Project. We direct NSTAR to file semi-annual compliance reports with the Siting Board and all parties, starting within 60 days of the commencement of construction, that include projected and actual construction costs, projected and actual segment completion dates, explanations for any discrepancies between projected and actual costs and completion dates, and an explanation of the Company's internal capital authorization approval process.[42]

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[42] In its comments to the Tentative Decision, GenOn asks the Board to modify its condition that implements this reporting requirement, to state that the Board may decide to conduct a project change proceeding if the projected or actual completion costs exceed the projected cost as stated in the Final Decision. While the Board agrees with GenOn that the projected cost as stated in this decision is an integral part of the balancing of reliability, environmental impacts and cost upon which today's Final Decision rests, we decline to modify the condition at this time. If, in the future, the certified cost update or any semi-annual compliance report shows an increase in projected or actual costs, then the Board can consider and decide what course of action, including requesting a project change filing, would be proper by examining all the circumstances that arise at that time.

H. Conclusion

The Siting Board finds that the information provided by the Company regarding the Project's environmental impacts is substantially accurate and complete. Based on the information presented in Section V, above, the Siting Board finds that with the implementation of the specified mitigation and conditions, and compliance with all local, state and federal requirements, the environmental impacts of the proposed Project along the Primary Route with the Oak Street Substation would be minimized.

Based on its review of the record, the Siting Board finds that the Company provided sufficient information regarding cost, reliability, and environmental impacts to allow the Siting Board to determine whether the Project has achieved a proper balance among cost, reliability, and environmental impacts. The Siting Board finds that the proposed Project along the Primary Route with the Oak Street Substation would achieve an appropriate balance among conflicting environmental concerns as well as between environmental impacts, reliability, and cost.

VI. CONSISTENCY WITH POLICIES OF THE COMMONWEALTH

A. Standard of Review

G.L. c. 164, § 69J requires the Siting Board to determine whether plans for construction of an applicant's new facilities are consistent with current health, environmental protection, and resource use and development policies as adopted by the Commonwealth.

B. Analysis

1. Health Policies

In Section 1 of the Electric Utility Restructuring Act of 1997, the Legislature declared that "electricity service is essential to the health and well-being of all residents of the Commonwealth . . . ." and that "reliable electric service is of utmost importance to the safety, health, and welfare of the Commonwealth's citizens . . ." See c. 164 of the Acts of 1997, Sections 1(a) and (h). In Section III, above, the Siting Board found that the Project will improve the reliability of electric service in Tremont East. In addition, in Section V, the Siting Board requires the Company to use only retrofitted off-road construction vehicles to limit emissions of particulate matter during Project construction. This condition is consistent with MassDEP's Diesel Retrofit Program designed to address health concerns related to diesel emissions. In

Section V, the Siting Board finds that the proposed Project's EMF, traffic, air impacts, and hazardous materials impacts have been minimized.

Accordingly, subject to the specified mitigation and the Siting Board's conditions set forth in this Decision, the Siting Board finds that the Company's plans for construction of the Project are consistent with the current health policies of the Commonwealth.

2. Environmental Protection Policies

In Section V.B, above, the Siting Board reviews how the Project will meet various state environmental protection requirements. The Siting Board also: (1) considers the Project's environmental impacts, including those related to wetlands and water resources, endangered species, land use, historical and archeological resources, air emissions, noise and visual impacts; and (2) concludes that subject to the specified mitigation and conditions set forth in this Decision, the Project's environmental impacts have been minimized. See Section IX, below, for a discussion of the Greenhouse Gas Policy and Protocol.

Subject to the specified mitigation and conditions set forth in this Decision, the Siting Board finds that the Company's plans for construction of the Project are consistent with the current environmental protection policies of the Commonwealth.

3. Resource Use and Development Polices

In 2007, pursuant to the Commonwealth's Smart Growth/Smart Energy policy produced by the Executive Office of Energy and Environmental Affairs, Governor Patrick established Sustainable Development Principles. Among the principles are: (1) supporting the revitalization of city centers and neighborhoods by promoting development that is compact, conserves land, protects historic resources and integrates uses; (2) encouraging reuse of existing sites, structures and infrastructure; and (3) protecting environmentally sensitive lands, natural resources, critical habitats, wetlands and water resources and cultural and historic landscapes. In Section V, the Siting Board reviews the process by which the Company sited the Project. The Siting Board notes that the Project is located almost wholly within existing overhead utility rights-of-way. Additionally, the Project has been designed and conditioned to avoid or minimize impacts to natural and cultural resources.

Subject to the specific mitigation and the conditions set forth in this Decision, the Siting Board finds that the Company's plans for construction of the Project are consistent with the current resource use and development policies of the Commonwealth.

VII. ANALYSIS UNDER G.L. C. 40A, § 3 - ZONING EXEMPTIONS

Pursuant to G.L. c. 40A, § 3, the Company requests individual zoning exemptions and comprehensive zoning exemptions for the proposed Project from the Zoning Bylaws of the Towns of Carver, Plymouth, and Bourne, and the Zoning Ordinance of the Town of Barnstable.[43]

A. Individual Zoning Exemptions

1. Standard of Review

G.L. c. 40A, § 3 provides, in relevant part, that:

> Land or structures used, or to be used by a public service corporation may be exempted in particular respects from the operation of a zoning ordinance or by-law if, upon petition of the corporation, the [Department] shall, after notice given pursuant to section eleven and public hearing in the town or city, determine the exemptions required and find that the present or proposed use of the land or structure is reasonably necessary for the convenience or welfare of the public . . .

Thus, a petitioner seeking exemption from a local zoning by-law under G.L. c. 40A, § 3 must meet three criteria. First, the petitioner must qualify as a public service corporation. Save the Bay, Inc. v. Department of Public Utilities, 366 Mass. 667 (1975) ("Save the Bay"). Second, the petitioner must demonstrate that its present or proposed use of the land or structure is reasonably necessary for the public convenience or welfare. Massachusetts Electric Company, D.T.E. 01-77, at 4 (2002) ("MECo (2002) Decision"); Tennessee Gas Pipeline Company, D.T.E. 01-57, at 3-4 (2002) ("Tennessee Decision (2002)"). Finally, the petitioner must establish that it requires exemption from the zoning ordinance or by-law. Boston Gas Company, D.T.E. 00-24, at 3 (2001) ("Boston Gas Decision").

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[43] G.L. c. 40A, § 3 is a Department statute. The Department refers zoning exemption cases to the Siting Board for hearing and decision pursuant to G.L. c. 25, § 4. When deciding cases under a Department statute, the Siting Board has the power and the duty: to accept for review and approval or rejection any application, petition or matter related to the need for, construction of, or siting of facilities referred by the chairman of the department . . . provided, however, that in reviewing such application, petition or matter, the board shall apply department and board standards in a consistent manner. G.L. c. 164, § 69H.

2. Public Service Corporation

a. Standard of Review

In determining whether a petitioner qualifies as a "public service corporation" ("PSC") for the purposes of G.L. c. 40A, § 3, the Massachusetts Supreme Judicial Court has stated:

> among the pertinent considerations are whether the corporation is organized pursuant to an appropriate franchise from the State to provide for a necessity or convenience to the general public which could not be furnished through the ordinary channels of private business; whether the corporation is subject to the requisite degree of governmental control and regulation; and the nature of the public benefit to be derived from the service provided.

Save the Bay at 680. See also, Boston Gas Decision, D.T.E. 00-24, at 3-4; Berkshire Power Development, Inc., D.P.U. 96-104, at 26-36 (1997) ("Berkshire Power").[44]

b. Analysis and Conclusion

The Company is an electric company as defined by G.L. c. 164, § 1 and, as such, qualifies as a public service corporation. NSTAR Electric Company, D.P.U. 09-136//09-137, at 7 (2011) ; NSTAR Electric Company, D.P.U. 08-1, at 7 (2007); Exh. NSTAR-2, at 2. Accordingly, the Siting Board finds that the Company is a public service corporation for the purposes of G.L. c. 40A, §3.

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[44] The Department interprets this list not as a test, but rather as guidance to ensure that the intent of G.L. c. 40A, § 3 will be realized, i.e., that a present or proposed use of land or structure that is determined by the Department to be "reasonably necessary for the convenience or welfare of the public" not be foreclosed due to local opposition. See Berkshire Power, D.P.U. 96-104, at 30; Save the Bay at 685-686; Town of Truro v. Department of Public Utilities, 365 Mass. 407 (1974) ("Town of Truro"). The Department has interpreted the "pertinent considerations" as a "flexible set of criteria which allow the Department to respond to changes in the environment in which the industries it regulates operate and still provide for the public welfare." Berkshire Power, D.P.U. 96-104, at 30; see also Dispatch Communications of New England d/b/a Nextel Communications, Inc., D.P.U./D.T.E. 95-59-B/95-80/95-112/96-113, at 6 (1998). The Department has determined that it is not necessary for a petitioner to demonstrate the existence of "an appropriate franchise" in order to establish PSC status. See Berkshire Power, D.P.U. 96-104, at 31.

3. Public Convenience or Welfare

a. Standard of Review

In determining whether the present or proposed use is reasonably necessary for the public convenience or welfare, the Department must balance the interests of the general public against the local interest. Save the Bay at 680; Town of Truro at 407. Specifically, the Department is empowered and required to undertake "a broad and balanced consideration of all aspects of the general public interest and welfare and not merely [make an] examination of the local and individual interests which might be affected." New York Central Railroad v. Department of Public Utilities, 347 Mass. 586, 592 (1964) ("New York Central Railroad"). When reviewing a petition for a zoning exemption under G.L. c. 40A, § 3, the Department is empowered and required to consider the public effects of the requested exemption in the State as a whole and upon the territory served by the applicant. Save the Bay at 685; New York Central Railroad at 592.

Therefore, when making a determination as to whether a petitioner's present or proposed use is reasonably necessary for the public convenience or welfare, the Department examines: (1) the need for, or public benefits of, the present or proposed use; (2) the present or proposed use and any alternatives or alternative sites identified;[45] and (3) the environmental impacts or any other impacts of the present or proposed use. The Department then balances the interests of the general public against the local interest and determines whether the present or proposed use of the land or structures is reasonably necessary for the convenience or welfare of the public. Boston Gas Decision, D.T.E. 00-24, at 2-6; MECo (2002) Decision, D.T.E. 01-77, at 5-6; Tennessee Decision (2002), D.T.E. 01-57, at 5-6; Tennessee Gas Company, D.T.E. 98-33, at 4-5 (1998).

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[45] With respect to the particular site chosen by a petitioner, G.L. c. 40A, § 3 does not require the petitioner to demonstrate that its primary site is the best possible alternative, nor does the statute require the Department to consider and reject every possible alternative site presented. Rather, the availability of alternative sites, the efforts necessary to secure them, and the relative advantages and disadvantages of those sites are matters of fact bearing solely upon the main issue of whether the primary site is reasonably necessary for the convenience or welfare of the public. Martarano v. Department of Public Utilities, 401 Mass. 257, 265 (1987); New York Central Railroad at 591.

b. Analysis and Conclusion

With respect to need for, or public benefits of, the Project, the Siting Board found in Section III, above, that (1) the existing electric system is inadequate under certain contingencies to reliably serve current and projected loads in the Tremont East area; and (2) the proposed Project will address these reliability issues.

Regarding alternatives, in Section IV, the Siting Board analyzed a number of different project approaches other than the Company's proposed alternative that the Company might use to meet the reliability need (such as energy efficiency, demand response, and new generation) and concludes that the proposed approach is preferable to other approaches. The Siting Board also reviewed the Company's route selection process in Section V.A, and determined that the Company applied a reasonable set of criteria for identifying and evaluating routes to ensure that no clearly superior route was missed. The Siting Board also compares the benefits of the Primary and Alternative Routes and concludes that the Primary Route is preferable to the Alternative Route with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost.

Finally, regarding Project impacts, in Section V.B, the Siting Board reviews the environmental impacts of the Project and finds, while the Project may result in some local adverse impacts**,** generally, with the implementation of certain mitigation and conditions, the impacts of the Project would be minimized. The Siting Board also finds that residents in Tremont East will benefit from the Project as it will improve the reliability of electricity delivery.

Based on the foregoing, the Siting Board finds that the general public interest in constructing the Project outweighs any adverse local impacts. Accordingly, the Siting Board finds that the proposed Project is reasonably necessary for the convenience or welfare of the public.

4. Individual Exemptions Required

a. Standard of Review

In determining whether exemption from a particular provision of a zoning by-law is "required" for purposes of G.L. c. 40A, § 3, the Department looks to whether the exemption is necessary to allow construction or operation of the petitioner's project. See MECo Decision (2002), D.T.E. 01-77, at 4-5; Tennessee Decision (2002), D.T.E. 01-57, at 5; Western Massachusetts Electric Company, D.P.U./ D.T.E. 99-35, at 4, 6-8 (1999); Tennessee Gas

Company, D.P.U. 92-261, at 20-21 (1993). It is a petitioner's burden to identify the individual zoning provisions applicable to the project and then to establish on the record that exemption from each of those provisions is required:

> The Company is both in a better position to identify its needs, and has the responsibility to fully plead its own case . . . The Department fully expects that, henceforth, all public service corporations seeking exemptions under c. 40A, § 3 will identify fully and in a timely manner all exemptions that are necessary for the corporation to proceed with its proposed activities, so that the Department is provided ample opportunity to investigate the need for the required exemptions.

New York Cellular Geographic Service Area, Inc., D.P.U. 94-44, at 18 (1995).

b. Exemptions Sought and Analysis

(1) Carver

i. Exemptions Sought

The portion of the Project in Carver includes expansion of the existing NSTAR substation and construction of approximately 4.3 miles of new 345 kV transmission line (Exh. NSTAR-2, at 15; Company Brief at 161). The substation expansion work will occupy approximately one acre of NSTAR-owned property (Exh. NSTAR-2, at 3). The Company seeks exemption from certain provisions of the Carver Zoning Bylaw to construct this portion of the Project, as set forth in Table 4, below (Exhs. NSTAR-2, at 15-24; EFSB-Z-4 (S)).[46]

[46] The sources for the information in the Tables 4 through 7 are: Exhs. NSTAR-2; EFSB-Z-4(S); and EFSB-Z-5(S).

Table 4. Requested Carver Zoning Bylaw Exemptions

Subject	Zoning Bylaw Provision
Use	Sections 2230; 2210
Frontage	Sections 2320; 2340
Rear yard dimensional requirements	Section 2320
Side yard requirements	Section 2320
Lot width	Section 2320
Site plan review	Section 3100
Height	Section 2320
Landscaping	Sections 3200; 3220
Parking and loading	Section 3300
Wetlands overlay district	Section 4400
Disturbances	Section 3610
Signs	Section 3500
Water resource protection—hazardous materials	Section 4300
Erosion Control	Section 3620

ii. Analysis and Conclusion

The Carver substation is located in a residential-agricultural (RA) zoning district (Exh. NSTAR 2, at 16). In Carver, a public utility is not listed as a permitted use in this district, and the Bylaw prohibits the granting of use variances in any residential district (Exhs. NSTAR-2, at 16-17; NSTAR-2, Att. B at ¶ 5222; EFSB-Z-4(S)). Therefore, without an exemption, the Company would be precluded from constructing the Project in Carver. See G.L. c. 40A, §10. Accordingly, we find that the Company requires an exemption from the requirements in Sections 2230 and 2210 (general use regulations) and 4400 (wetlands overlay district regulations).

The Company states that two provisions of the Bylaw would require the Company to obtain a special permit, which could result in an adverse outcome, a burdensome requirement, or delay in Project construction due either to the need to obtain the special permit or to a potential appeal of the special permit decision (Exhs. NSTAR-2, at 21, 23; EFSB-Z-5(S)). We thus find that exemption from Section 3300 (parking) and 4300 (water resource protection-hazardous materials) is required. The Company asserts that compliance with certain provisions could be inconsistent with industry standards (Exh. NSTAR-2, at 20-22). For this reason, exemption from Section 3100 (site plan review), Sections 3200 and 3220 (landscaping) and Section 3500 (signs) is required. For a number of provisions, the Company is uncertain about the applicability of the provisions to the Project and states that if the provisions are applicable, variances would be required (id. at 18-20, 22-23; Exh. EFSB-Z-5(S)). Based on the legal difficulty and potential project delay involved in obtaining variances, we find that exemptions are required from Sections 2320 and 2340 (minimum frontage), 2320 (side yard dimensions), 2320 (rear yard dimension), 2320 (building height), 2320 (minimum lot width), and 3620 (erosion control).

With respect to Section 3610 (disturbances), the Company states that it requires exemption from the Section's noise restriction for both construction and operation of the substation. Section 3610, however, exempts temporary construction noise from its noise restriction (Exh. NSTAR-2, Att. B at ¶ 3610). Accordingly, the Siting Board finds that the Company requires exemption from the noise prohibition in Section 3610 only for operation of the substation.[47] Additionally, the Siting Board finds that the Company has not demonstrated that it requires exemption from the vibration, odor and flashing lights restrictions in Section 3610. These restrictions pertain to the ongoing operation of the substation rather than its construction, and, absent a showing of necessity, the Siting Board disfavors elimination of local zoning control over the ongoing operation of a proposed facility. See GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 137; Braintree Electric Light Department, 16 DOMSB 78, at 186-187 (2008) ("BELD").

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[47] The Company stated that it will mitigate operational noise of the substation as necessary to comply with the Massachusetts Department of Environmental Protection noise regulations (Exh. NSTAR-2, at 22).

(2) Plymouth

i. Exemptions Sought

The portion of the Project in Plymouth consists of modifications to the existing State Forest Transition Station, construction of the new Plymouth Crossover Station and construction of approximately 11.8 miles of new 345 kV transmission line (Exh. NSTAR-2, at 24; Company Brief at 164-165). The Company seeks exemption from certain provisions of the Plymouth Zoning Bylaw to construct this portion of the Project, as set forth in Table 5, below (Exhs. NSTAR-2, at 24-31; EFSB-Z-4 (S); EFSB-Z-5(S)).

Table 5. Requested Plymouth Zoning Bylaw Exemptions

Subject	Zoning Bylaw Provision
Use	Sections 205-38; 205-40; 205-42; Table 5
Height	Sections 205-3; 205-17; 205-20; Table 5
Design review	Section 205-12
Dimensional requirements	Section 205-22; Table 5
Frontage	Section 205-17E
Building siting and topography	Sections 205-17G; 205-18; 205-39
Signs	Section 205-19
Special permit uses	Section 205-27
Site plan review	Section 205-32
Parking	Section 205-23
Off street loading	Section 205-24
Aquifer protection overlay district	Section 205-57
Floodplain overlay district	Section 205-58
Procedures for zoning permits and special permits	Section 205-5, 205-27

ii. Analysis and Conclusion

The proposed transmission line in Plymouth traverses the rural residential (RR) and medium lot residential (R-25) zoning districts (Exh. NSTAR-2, at 24).[48] In Plymouth, utilities are not a use expressly permitted in these districts and the Zoning Bylaw does not provide the Zoning Board of Appeals with authority to grant use variances (id. at 24-25). Therefore, without an exemption, the Company would be precluded from constructing the Project in Plymouth (id.).

[48] The State Forest Transition Station and the proposed Plymouth Crossover Station are in an RR district (Exh. NSTAR-2, at 24)..

See G.L. c. 40A, § 10. Accordingly, we find that exemption is required from the use requirements in Section 205-38 (use prohibitions), 205-40 (RR district regulations), 205-42 (R-25 district regulations), Table 5 (general use requirements), Section 205-58 (floodplain overlay district regulations) and Section 205-57 (aquifer protection overlay district regulations).

The Company states that compliance with the special permit provisions in Sections 205-5 (procedures for special permits) and 205-27 (special permit uses) could result in an adverse outcome, a burdensome requirement or delay in project construction (Exhs. NSTAR-2, at 24-26; EFSB-Z-5(S)). Accordingly, we find that the requested exemptions are required. The Company states that several provisions would require it to seek a variance (Exhs. NSTAR-2, at 27-31; EFSB-Z-5(S)). Based on the legal difficulty and potential project delay involved in obtaining variances, we find that exemptions are required from Sections 205-3 (definitions), 205-17 (lot regulations), 205-20 (utility service: height restriction), Table 5 (height); 205-17E (frontage); 205-22 ; Table 5 (front and rear yard setbacks); 205-23 (off-street parking); and 205-24 (off-street loading). The Company seeks a number of exemptions on the basis of a potential conflict with industry standards (Exh. NSTAR-2, at 27-31). On this basis, exemptions to Section 205-12 (design review); 205-32 (site plan review); 205-17G ; 205-18 and 205-39 (building siting and topography); and 205-19 (signs) are required.

(3) Bourne

i. Exemptions Sought

The portion of the Project in the town of Bourne consists of the construction of approximately 1.8 miles of new 345 kV transmission line and the expansion of the existing Bourne switching station (Exh. NSTAR-2, at 32; Company Brief at 167-168). The Company seeks exemption from certain provisions of the Bourne Zoning Bylaw to construct the new transmission line, as set forth in Table 6, below (Exh. NSTAR-2, at 32-36).

Table 6. Requested Bourne Zoning Bylaw Exemptions

Subject	Zoning Bylaw Provision
Use	Sections 2200; 2210; 2220
Use	Section 2230
Use	Section 4700
Use and dimensional requirements	Section 4300
Height	Section 2500
Egress, frontage requirements	Sections 2500; 3343; 3344
Site plan review	Sections 1230-1244
Environmental controls	Section 3400
Signs	Section 3200
Parking	Section 3300

ii. Analysis and Conclusions

The proposed transmission line in Bourne would traverse the residence (R-80), scenic development (SDD), residence (R-40) and government (GD) zoning districts (Exh. NSTAR-2, at 32).[49] In Bourne, utility uses are not a permitted use in the zoning districts where the Project would be located and there is no right under the Bylaw to seek a use variance (id. at 32-33). Therefore, without an exemption, the Company would be precluded from building the Project in Bourne. See G.L. c. 40A, § 10. Accordingly, the Company's request for exemption from the use requirements in Sections 2200 and 2210 (use regulations), 2220 (use regulations schedule), 2230 (scenic development district use regulations), 4700 (water resource district use regulations), and 4300 (Bournedale overlay district use regulations) is required.

The Company states that compliance with Section 3300 (off-street parking) would require a variance (Exhs. NSTAR-2, at 36; EFSB-Z-5(S)). Based on the legal difficulty and

[49] In addition, the transmission lines would be located in the Buzzards Bay water resource district (WD), the Bournedale overlay district (BOD), and the traffic management district (TMD) (Exh. NSTAR-2, at 32).

potential project delay in obtaining a variance, exemption from this Section is required. The Company states that compliance with Section 3200 (signs) would require a special permit or sign permit (Exh. NSTAR-2, at 36). Based on the potential for an adverse outcome, a burdensome requirement or project delay, we find that exemption from this provision is required. The Company seeks exemption from Section 2500 (height) and Sections 3343 and 3344 (vehicle egress), on the grounds that it is unclear whether these requirements apply to the Project and, if applicable, variances or a special permit would be required (id. at 34). We find that the exemptions are required.

The Company seeks exemption from Section 3400 (environmental controls), on the ground that no standards are supplied in the Bylaw defining what constitutes compliance with these requirements (id. at 35). We note that there are some provisions of Section 3400 (i.e., the lighting requirements) that the Project may not be able to comply with, without conflicting with industry standards. However, the Company has not substantiated why it cannot comply with the other requirements of Section 3400.[50] These requirements pertain to the ongoing operation of the Project rather than its construction, and, absent a showing of necessity, the Siting Board disfavors elimination of local zoning control over the ongoing operation of a proposed facility. See GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 137; BELD, 16 DOMSB 78, at 186-187. Accordingly, we find that exemption is required solely from the lighting requirements in Section 3400.

The Company also seeks exemption from Sections 1230-1244 (site plan review requirements) on the ground that compliance with these requirements could result in inconsistency with industry standards and in project delay (Exh. NSTAR-2, at 34-35). We find that these exemptions are required.

(4) Barnstable

i. Exemptions Requested

The portion to be performed in the town of Barnstable consists of the construction of a new substation. The Company seeks exemption from certain provisions of the Barnstable zoning

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50 The Company stated that the equipment proposed in the improvements to the Bourne Switching Station will not impact existing noise levels at the switching station (Exh. NSTAR-1, at 5-68, 5-69).

ordinance to construct the substation, as set forth in Table 7 below (Exhs. NSTAR-2, at 36-45; NSTAR-2, at 36; Company Brief at 170).

Table 7. Requested Barnstable Zoning Ordinance Exemptions

Subject	Zoning Bylaw Provision
Use	Sections 240-10; 240-14; 240-7
Frontage	Section 240-14E
Front yard setback	Section 240-14E
Height	Section 240-14E
Accessory use	Sections 240-43; 240-44
One building per lot	Section 240-7F, 240-43
Aquifer protection overlay district	Section 240-35E
Groundwater protection overlay district	Section 240-35F
Site plan approval	Article IX
Parking	Article VI
Performance bond	Section 240-124A
Occupancy permit	Section 240-124B

ii. Analysis and Conclusions

Both of the proposed sites for the new substation are located in a residential (RF) zoning district (Exh. NSTAR-2, at 36).[51] Under the Barnstable Zoning Ordinance, utility uses are not a permitted use in this district and a variance would be required (id. at 37-41). Based on the legal difficulty and potential project delay in obtaining a variance, we find that exemption is required

[51] In addition, the Oak Street parcel is located in an aquifer protection overlay district (AP) and the Service Road site is located in a groundwater protection overlay district (Exh. NSTAR-2, at 36-37).

from Sections 240-14A C and D (RR district regulations), and 240-35E (aquifer protection overlay district) and 240-35F (groundwater protection overlay district regulations).

The Company states that compliance with Sections 240-14E (frontage, front yard setback), 240-7F(1) and 240-43 (one building per lot); 240-35F (3) (impervious surface), and 240-35F(4) (percent of site in natural state) also could require variances (id. at 39-42). Exemption from these Sections is accordingly required. The Company is uncertain whether or how Sections 240-14E (height), 240-124A (performance bond), and 240-124B (occupancy permit) apply to the Project. If applicable, variances would be required (id. at 39, 44-45). Based on the legal difficulty and potential project delay involved in obtaining variances, we find that exemption from these Sections is required. The Company seeks exemption from the site plan approval requirements in Article 9 of the Bylaw, on the ground that compliance with these requirements could result in inconsistency with industry standards and in project delay (id. at 42-43). We find that the exemption is required.

With respect to Section 240-10 (prohibited uses), the Company states that the prohibition against injurious, noxious or offensive uses is subjective and undefined. The Company asserts that, once operational, the substation will emit sound and light that, subjectively, could be considered injurious, noxious or offensive (Exh. EFSB-Z-18). Section 240-10 does not contain an exemption for temporary construction impacts. Accordingly, the Siting Board finds that exemption from Section 240-10 is required with respect to operational noise and lighting and with respect to potential construction-related emissions of dust, smoke, vibration, noise and light.

5. Community Outreach

The Siting Board favors the resolution of local issues on the local level whenever possible to reduce local concern regarding any intrusion on home rule authority. Thus, the Siting Board encourages zoning exemption applicants to consult with local officials, and in some circumstances, to apply for local zoning permits, prior to seeking zoning exemptions from the Department under G.L. c. 40A, § 3. National Grid Worcester, EFSB-09-1/D.P.U. 09-52/09-53, at 75-77; GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 132-133); Russell Biomass LLC, EFSB 07-4/DPU 07-35/07-36, at 60-63 (2009) ("Russell").

The Company in this case did not apply to the towns for any local zoning relief before filing its Zoning Petition with the Department. However, the Siting Board has held that applying for local zoning permits in advance of filing a zoning exemption petition is not required

where to do so would likely be futile, or where the Company has met the spirit and intent of Russell by engaging in outreach with the affected municipalities regarding the Company's plan to seek zoning relief from the Department. Other factors supporting a finding that the spirit and intent of Russell have been met are that the affected municipalities do not object to the Company seeking such relief; and that the Company has made a good faith effort to abide by the reasonable recommendations of the municipalities with respect to the Project. National Grid/Worcester, EFSB 09-1/D.P.U. 09-52/09-53, at 76-77; see also, GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at132-133.[52]

With respect to outreach to local authorities, NSTAR states in its Zoning Petition that it engaged in "substantial and good faith consultations" with officials in all four of the Towns regarding the Project, including consultations regarding the need for zoning exemptions from the Department (Exh NG- 2, at 9).[53] In each case, the Company stated, it presented the Project scope, the reason for the Project, and the impacts to the town (Exh. EFSB-Z-1). The Company stated that, in the meetings, a local town zoning officer or representative was present and the Company discussed in a general manner the need for zoning exemptions from certain town requirements as well as the need for a more comprehensive zoning exemption (id.). In the meetings with each town, the Company asserted, "the Company's approach to zoning exemptions was acknowledged and there were no objections noted" (id.). The Town of Carver affirmatively stated in a letter that it had no issues relative to the Company's plan to seek zoning exemptions from the Department (Exh. EFSB-Z-1(S) Att. E). None of the four affected municipalities intervened in the proceeding.

With respect to abiding by the reasonable recommendations of the towns regarding the Project, the Company has committed to fulfilling project-related requests received from the

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52 In accord, Department of Public Utilities zoning exemption decisions: e.g., Tennessee Gas Pipeline Company, D.P.U. 11-26, at 26 (2012); New England Power Company, D.P.U. 09-136/09-137, at 34-37 (2011); New England Power Company, D.P.U. 09-27/09-28, at 47 (2010); Western Massachusetts Electric Company, D.P.U. 09-24/09-25, at 33 (2010).

53 These meetings were held prior to the filing of NSTAR's Zoning Petition. NSTAR also met with Town representatives after the filing of the Zoning Petition (Exh. EFSB-Z-1(S).

Towns of Barnstable and Carver.[54] Specifically, as requested by the Town of Barnstable and the West Barnstable Civic Association, the Company will provide a new landscaping plan for and will replace previous landscaping that is no longer present on the Oak Street substation site (Tr. 7, at 976). As requested by the Town of Carver, the Company will provide the town with keys to the barriers that prevent public roadway access to the ROWs, and will allow the town to install a radio repeater on one or more transmission poles to assist the town with its emergency communications system (Tr. 7, at 978-979).

6. Conclusion on Request for Individual Zoning Exemptions

As described above, the Siting Board finds that (1) the Company is a public service corporation; (2) the proposed use is necessary for the public convenience or welfare of the public; and (3) with the exceptions noted immediately following, the specifically named zoning exemptions set forth in Tables 4 through 7 are required for construction of the Project within the meaning of G.L. c. 40A, § 3.

Regarding Section 3610 of the Carver Zoning Bylaw, exemption is required only with respect to operational noise. Regarding Section 3400 of the Bourne Zoning Bylaw, exemption is required only with respect to operational lighting. Regarding Section 240-10 of the Barnstable Zoning Ordinance, exemption is required with respect to operational noise and lighting and with respect to potential construction-related emissions of dust, smoke, vibration, noise and light.

Accordingly, with the exceptions noted above, the Siting Board grants the Company's request for the individual zoning exemptions listed in Tables 4 through 7.

B. Comprehensive Zoning Exemptions

1. Standard of Review

The Company has requested a comprehensive exemption from all four of the town zoning codes. The Siting Board will grant such requests on a case-by-case basis and only where the applicant demonstrates that issuance of a comprehensive exemption could avoid substantial public harm by serving to prevent a delay in the construction and operation of the proposed use.. National Grid Worcester, EFSB 09-1/D.P.U. 09-52/09-53, at 81; GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 135.

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[54] The Towns of Bourne and Plymouth did not make project-related requests of the Company in terms of project changes or mitigation measures (Tr. 7, at 975-976).

2. Company Position

The Company identifies the time-sensitive nature of the proposed Project as the chief basis for its request for comprehensive zoning exemptions from the four zoning codes (Exh. NG-2, at 46-47; Company Brief at 173-174). The Company also points out that comprehensive exemptions would allow the Project to go forward on a timely basis if provisions beyond those identified are deemed applicable to the Project, or if new zoning requirements are adopted in any of the towns prior to completion of the Project (Exh. NSTAR-2, at 46-47; Company Brief at 173-174).

3. Analysis and Conclusion

The granting of a comprehensive exemption falls under a stricter standard of review than the granting of individual exemptions. It is not enough to be required for construction of the project; the granting of a comprehensive exemption must also avoid substantial public harm. As compared to the granting of individual zoning exemptions, which are tailored to meet the construction and operational requirements of a particular project, the granting of a comprehensive exemption serves to nullify a municipality's zoning code in its entirety with respect to the project under review. Thus, compared to the granting of individual zoning exemptions, which entail specific demonstrations that an exemption is required, a comprehensive zoning exemption constitutes a broader incursion upon municipal home rule authority. In the absence of a showing that substantial public harm may be avoided by granting a comprehensive exemption, the granting of such extraordinary relief is not justified. Tennessee Gas Pipeline Company, D.P.U. 11-26, at 31 (2012); NSTAR Electric Company, D.P.U. 08-1, at 36-37 (2009); Russell, EFSB 07-4/D.P.U. 07-35/07-36, at 71-72; Massachusetts Electric Company, D.T.E. 04-81, at 24 (2009); Tennessee Gas Pipeline Company, D.T.E. 01-57, at 11 (2002).

Numerous Department of Public Utilities cases that have considered and granted comprehensive exemptions involved reliability-based projects that were time-sensitive and spanned several municipalities and with disparate zoning ordinances. See New England Power Company, D.P.U 09-136/09-137, at 49 (2011); New England Power Company, D.P.U. 09-27/09-28, at 52 (2010); Western Massachusetts Electric Company, D.P.U. 09-24/09-25, at 36 (2010).

Here, while the Project is reliability-based, complex, and involves the zoning ordinances of four separate municipalities, the record also shows that the short-term measures that the Company implemented in 2008 and 2009 have significantly reinforced the Lower SEMA system,

and alleviated the short-term financial burdens that were being imposed in the Lower SEMA market because of out-of-market operation of Canal. In fact, the Canal units, which had been used extensively out of merit prior to the short-term transmission enhancements in Lower SEMA, were no longer being dispatched out of merit for double contingency avoidance purposes in 2010 and 2011 (Tr. 8, at 996; RR-EFSB-GEN-1(1)).

We also note that only one of the affected four municipalities has affirmatively indicated its support for a comprehensive exemption (Exh. EFSB-Z-1(S) Att. E). Had the Company secured similar expressions of support for a comprehensive zoning exemption from each of the affected municipalities, the Board may have viewed the grant of the requested comprehensive zoning exemptions differently, knowing that municipal home rule prerogatives were being shown appropriate, due deference. The Board has articulated these concerns previously and expressed its reasoning in prior decisions. See GSRP, EFSB 08-2/D.P.U. 08-105/08-106, at 136-137; National Grid Worcester, EFSB 09-1/D.P.U. 09-52/09-53, at 81-82.

While the Board has found infra that the Project is needed, and should go forward, the record does not support a finding that the Project is so acutely time-sensitive under present conditions that comprehensive zoning exemptions are necessary to prevent substantial public harm. Nor, is the Board fully satisfied that each of the municipalities affected by the requested grant of comprehensive zoning exemptions has affirmatively indicated its support for such an approval. Accordingly, NSTAR's request for a comprehensive zoning exemption is denied.

C. Decision on G.L. c. 40A, § 3

The Siting Board finds pursuant to G.L. c. 40A, § 3 that construction and operation of the Company's proposed facility is reasonably necessary for the public convenience or welfare of the public. Accordingly, subject to the mitigation set forth in this Decision, and the conditions set forth in Section X, below, and subject to the exceptions set forth in Section VII.A.6, above, the Siting Board approves the Company's petition for individual exemptions from the provisions of the Town of Carver, Town of Plymouth, and Town of Bourne Zoning Bylaws and the Town of Barnstable Zoning Ordinance as set forth in Tables 4 through 7 above. The Siting Board denies the Company's petition for comprehensive exemptions.

VIII. ANALYSIS UNDER G.L. C. 164, § 72

A. Standard of Review

G. L. c. 164, § 72, requires, in relevant part, that an electric company seeking approval to construct a transmission line must file with the Department a petition for "authority to construct and use . . . a line for the transmission of electricity for distribution in some definite area or for supplying electricity to itself or to another electric company or to a municipal lighting plant for distribution and sale . . . and shall represent that such line will or does serve the public convenience and is consistent with the public interest. . . . The [D]epartment, after notice and a public hearing in one or more of the towns affected, may determine that said line is necessary for the purpose alleged, and will serve the public convenience and is consistent with the public interest."[55]

The Department, in making a determination under G.L. c. 164, § 72, is to consider all aspects of the public interest. Boston Edison Company v. Town of Sudbury, 356 Mass. 406, 419 (1969). Section 72, for example, permits the Department to prescribe reasonable conditions for the protection of the public safety. Id. at 419-420. All factors affecting any phase of the public interest and public convenience must be weighed fairly by the Department in a determination under G.L. c. 164, § 72. Town of Sudbury v. Department of Public Utilities, 343 Mass. 428, 430 (1962). In evaluating petitions filed pursuant to G.L. c. 164, § 72, the Department relies on the standard of review established for G.L. c. 164, c. 40A, § 3 for determining whether the proposed Project is reasonably necessary for the convenience or welfare of the public.

B. Analysis and Decision

Based on the record in this proceeding and the above analyses in Sections III through VI, and with implementation of the specified mitigation measures proposed by the Company and conditions set forth by the Siting Board in Section X, below, the Siting Board finds pursuant to G.L. c. 164, § 72 that the proposed transmission line and ancillary substation upgrades are necessary for the purpose alleged, will serve the public convenience, and are consistent with the

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[55] Pursuant to G.L. c. 164, § 72, the electric company must file with its petition a general description of the transmission line, a map or plan showing its general location, an estimate showing in reasonable detail the cost of the line, and such additional maps and information as the [Siting Board] requires.

public interest. Thus, subject to the conditions below, the Siting Board approves the Company's petition under G.L. c. 164, §72.

IX. SECTION 61 FINDINGS

The Massachusetts Environmental Policy Act ("MEPA") provides that "[a]ny determination made by an agency of the Commonwealth shall include a finding describing the environmental impact, if any, of the Project and a finding that all feasible measures have been taken to avoid or minimize said impact." G.L. c. 30, § 61. Pursuant to 301 C.M.R. § 11.01 (3), these findings are necessary when an Environmental Impact Report ("EIR") is submitted by a petitioner to the Secretary of Environmental Affairs, and should be based on such EIR. Where an EIR is not required, G.L. c. 30, § 61 findings are not necessary. 301 C.M.R. § 11.01 (3). The record indicates that a DEIR and FEIR were required for NSTAR's proposed transmission Project. Therefore, a finding under G.L. c. 30, § 61 is necessary for the Company's Zoning Petition and its Section 72 Petition.[56]

The Siting Board recognizes the Commonwealth's policies relating to greenhouse gas emissions, including G.L. c. 30, § 61 and the Executive Office of Energy and Environmental Affairs Greenhouse Gas Emission Policy and Protocol. The Siting Board notes that this proposed Project will have minimal greenhouse gas emissions as it is an overhead transmission line. As such, the Project will not have direct emissions from a stationary source or indirect emissions from energy consumption.[57] The Siting Board addresses indirect emissions from off-road construction vehicles and equipment and use of SF_6 at substations in Sections V.B and V.F.

In Sections V.B, and V.F, above, the Siting Board conducted a comprehensive analysis of the environmental impacts of the Project and found that the impacts of the Project along the Primary Route with the Oak Street Substation would be minimized and that the Project along the

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[56] The Siting Board is not required to make a G.L. c. 30, § 61 finding under G.L. c. 164, §69J as the Siting Board is exempt from MEPA filing requirements.

[57] The Secretary's Certificate on the Environmental Notification Form issued November 5, 2010 states "The Lower SEMA 345 kV Transmission Project is subject to the MEPA Greenhouse Gas Emissions and Protocol Policy because it requires an EIR. MassDEP and DOER indicate that this project will produce minimal greenhouse gas emissions. I therefore find that this project falls within the Policy's de minimus exception." (Exh. G-3 (S2)).

Primary Route would achieve an appropriate balance among conflicting environmental concerns as well as among environmental impacts, reliability, and cost. Accordingly, the Siting Board finds that all feasible measures have been taken to avoid or minimize the environmental impacts of the proposed facilities.

X. DECISION

The Siting Board's enabling statute requires the Siting Board to implement the provisions contained in G.L. c. 164, §§ 69H to 69Q, so as to provide a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. G.L. c. 164, § 69H. In addition, the statute requires that the Siting Board determine whether plans for the construction of energy facilities are consistent with current health, environmental protection, and resource use and development policies as adopted by the Commonwealth. G.L. c. 164, § 69J.

In Section III, above, the Siting Board found that additional energy resources are needed under certain contingencies to reliably serve Lower SEMA .

In Section IV, above, the Siting Board found that the Project is, on balance, preferable to alternative project approaches in terms of reliability, cost, environmental impact, and in its ability to meet the identified need.

In Section V.A, above, the Siting Board found that the Company has developed and applied a reasonable set of criteria for identifying and evaluating alternatives to the proposed project in a manner which ensures that it has not overlooked or eliminated any routes which are clearly superior to the proposed project. The Siting Board also found that the Company has identified a range of practical transmission line routes with some measure of geographic diversity. As a result, the Siting Board found that NSTAR has demonstrated that it examined a reasonable range of practical siting alternatives.

In Sections V.B, and V.F, above, the Siting Board found that the Primary Route with the Oak Street Substation is preferable to the Alternative Route with respect to providing a reliable energy supply for the Commonwealth with a minimum impact on the environment at the lowest possible cost. In Section V.H, the Siting Board found that with the implementation of the specified mitigation and conditions, and compliance with all local, state and federal requirements, the environmental impacts of the proposed Project would be minimized.

In Section VI, above, the Siting Board reviewed environmental impacts of the proposed

Project in light of current health, environmental protection, and resource use and development policies as adopted by the Commonwealth. As evidenced by the findings in Section VI, the proposed Project along the Primary Route would be generally consistent with the Commonwealth's health policies, environmental protection policies, and resource use and development policies.

Accordingly, the Siting Board approves the Company's petition to construct the Project using the Primary Route, as described herein, subject to the following Conditions A through L.

In addition, the Siting Board has found pursuant to G.L. c. 164, § 72 that NSTAR's proposed facilities are necessary for the purpose alleged, and will serve the public convenience and is consistent with the public interest, subject to the following Conditions A through L.

In addition, the Siting Board has found pursuant to G.L. c. 40A, § 3 that construction and operation of the Company's proposed facilities are reasonably necessary for the public convenience or welfare. Accordingly, the Siting Board approves NSTAR's petition for an exemption from certain provisions of the Zoning By-laws of Carver, Plymouth and Bourne, and the Zoning Ordinance of Barnstable, as enumerated in Section VII, above. The Siting Board denies the Company's petition for a comprehensive exemption from the operation of the Zoning By-laws of Carver, Plymouth and Bourne, and the Zoning Ordinance of Barnstable, as described in Section VII.

The Siting Board APPROVES the Company's Consolidated Petitions subject to the following conditions:

A. To mitigate wetlands and water resource impacts, the Siting Board directs the Company to replace permanently altered wetlands in kind, proximate to the relevant waterbody, in an amount at least equal to the amount of the permanently altered wetlands.

B. The Siting Board directs the Company to ensure that under its continuing vegetative management program, any application of herbicides must be consistent with utility right-of-way Integrated Vegetation Management Practices and applicable rules and regulations of the Commonwealth. The Siting Board further directs the Company to

continue to work with the affected municipalities and the Cape Cod Commission to address concerns regarding herbicide use.

C. To mitigate noise impacts the Siting Board directs NSTAR to conduct all Project construction between the hours of 7 a.m. and 6 p.m. on weekdays only, and excluding holidays. To the extent the Company finds that construction performed outside of these hours or on weekends or holidays is necessary, the Company shall seek written permission from the relevant municipal authority prior to the commencement of such work, and provide the Siting Board with a copy of such permission. If the Company and municipal officials are not able to agree on whether weekend, holiday, or extended weekday construction should occur, the Company may request prior authorization from the Siting Board, provided that it also notifies the relevant municipal authorities in writing of such request.

D. To mitigate construction impacts, the Siting Board directs NSTAR, in consultation with the Towns of Carver, Plymouth, Bourne, and Barnstable, to develop a community outreach plan for project construction. This outreach plan should, at a minimum, set forth procedures for providing prior notification to affected residents of: (a) the scheduled start, duration, and hours of construction; (b) any construction the Company intends to conduct that, due to unusual circumstances, must take place outside of the hours detailed above; and (c) complaint and response procedures including contact information and a dedicated project hotline for complaints.

E. To minimize visual impacts, the Siting Board directs NSTAR to implement an off-site screening program to include the following requirements:

a. upon completion of construction the Company will notify in writing by first class mail with delivery confirmation all owners of property located on or abutting the ROW of the option to request that the Company provide off-site screening. The Company will follow up with a phone call to non-responding property owners for whom a phone number is accessible. The off-site screening may include, but it not limited to, shrubs, trees, window awnings and fences, provided that the Company's operating and maintenance requirements for its ROW facilities are met;

b. provide property owners with a selection of generic renderings of possible mitigation approaches. Such renderings shall be for guidance purposes only, and shall not limit a property owner's ability to request different mitigation;

c. meet with each property owner who requests mitigation to determine the type of mitigation package the Company will provide, provided that the Company has received a response from the property owner within three months of receipt of the Company's written notification;

d. honor all property owners' requests for reasonable and feasible mitigation that are submitted within six months of a meeting with the Company and/or its consultants;

e. provide a warranty to property owners to ensure that all plantings are established and replaced if needed at the end of one year from the date of planting, provided that the property owner reasonably maintains the plantings;

f. submit to the Siting Board for its approval, at least three months before the conclusion of construction, a draft of the notification letter to property owners prior to mailing; and

g. submit a compliance filing within 18 months of completion of construction detailing: (i) a list of all properties that were notified of the available off-site landscaping; (ii) the number of property owners that responded to the offer for off-site mitigation; (iii) a list of any property owners whose requests were not honored, and the rationale therefore; (iv) a general description of the types of off-site landscaping provided; and (v) the average cost of landscaping per property, broken down by installation, material, and design costs.

F. To mitigate construction impacts, the Siting Board directs NSTAR to submit for Siting Board approval a draft support site and substation/switching station plan, prior to the commencement of project construction, to be developed with input from the communities where the support sites will be located. The plan should include both a written description and map of the specific location of each support site including the boundaries of each support site, and a description of all the activities, including construction worker parking, that will occur at each site. The plan should describe: (a) the hours that activities will occur; (b) an estimate of the timeline for the use of each

support site; (c) the duration and location of police details and/or flagmen if proposed; (d) maintenance of the support site to avoid impacts to the surrounding properties; (e) use restrictions; (f) additional mitigation as appropriate; (g) plans to return the site to its original use and condition; and (h) a description of how community input was obtained.

G. To mitigate traffic impacts, the Siting Board directs NSTAR to, in consultation with affected municipalities and Company contractors, develop and implement a traffic management plan to minimize traffic disruption, which includes, but is not limited to, the following measures: (1) signs erected to identify construction work zones; (2) police details and/or flagmen to direct traffic near public road crossings; and (3) police details and/or flagmen to direct traffic at construction work sites along roads.

H. The Siting Board directs that all diesel-powered non-road construction equipment with engine horsepower ratings of 50 and above to be used for 30 or more days over the course of project construction must have USEPA-verified (or equivalent) emission control devices, such as oxidation catalysts or other comparable technologies (to the extent that they are commercially available) installed on the exhaust system side of the diesel combustion engine. Prior to the commencement of construction, the Company shall submit to the Siting Board certification of compliance with this condition and a list of retrofitted equipment, including type of equipment, make/model, model year, engine horsepower, and the type of emission control technology installed.

I. The Siting Board directs the Company that all off-road construction equipment used during project construction shall use ultra-low diesel and that idling be limited to no more than five minutes whenever practicable.

J. The Siting Board directs the Company to construct the new transmission line in accordance with the following restrictions and requirements, as agreed to by the Company and Mr. LaLiberte: (1) the Company will relocate existing line 322, currently located on H-frame structures, onto new structures closer to the center of the ROW in the vicinity of Mr. LaLiberte's home, so that the new transmission line will be no closer to the edge-of-ROW than existing line 322 is today, adjacent to Mr. LaLiberte's home

(2) to the greatest extent possible, the Company will not remove trees from the buffer which currently exists between Mr. LaLiberte's home and the transmission lines and (3) the Company will address Mr. LaLiberte's concerns with respect to noise and vibration from existing line 322.

K. The Siting Board directs the Company to develop and implement the integrated landscape plan to screen the proposed substation from Oak Street and Route 6, and to consult with the Town of Barnstable regarding the plan. The Siting Board further directs the Company to submit the landscape plan to the Board for approval prior to construction of the Oak Street Substation.

L. The Siting Board directs the Company, prior to the start of construction, to submit to the Board an updated and certified cost estimate for the Project. The Siting Board further directs NSTAR to file semi-annual compliance reports with the Siting Board and all parties, starting within 60 days of the commencement of construction, that include projected and actual construction costs, projected and actual segment completion dates, explanations for any discrepancies between projected and actual costs and completion dates, and an explanation of the Company's internal capital authorization approval process.

Because the issues addressed in this Decision relative to this facility are subject to change over time, construction of the proposed facility must commence within three years of the date of this Decision.

The Siting Board notes that the findings in this decision are based on the record in this case NSTAR has an absolute obligation to construct and operate its facilities in conformance with all aspects of its proposal as presented to the Siting Board. Therefore, the Siting Board requires the Company to notify the Siting Board of any changes other than minor variations to the proposal so that the Siting Board may decide whether to inquire further into a particular issue. The Company is obligated to provide the Siting Board with sufficient information on changes to the proposed Project to enable the Siting Board to make these determinations.

The Secretary of the Department shall transmit a copy of this Decision and the Section 61 findings contained herein to the Secretary of the Executive Office of Energy and Environmental Affairs and the Company shall to serve a copy of this decision on the Towns of Carver,

Plymouth, Bourne, and Barnstable; and the Boards of Selectmen of the Towns of Carver, Plymouth, and Bourne and the Town Council of the Town of Barnstable; the Planning Boards of the Towns of Carver, Plymouth, Bourne and Barnstable; the Zoning Boards of Appeals of the Towns of Carver, Plymouth, Bourne, and Barnstable, within five days of its issuance. The Company shall certify to the Secretary of the Department within ten business days of issuance that such service has been made.

M. Kathryn Sedor

M. Kathryn Sedor
Presiding Officer

Dated this 27th day of April, 2012

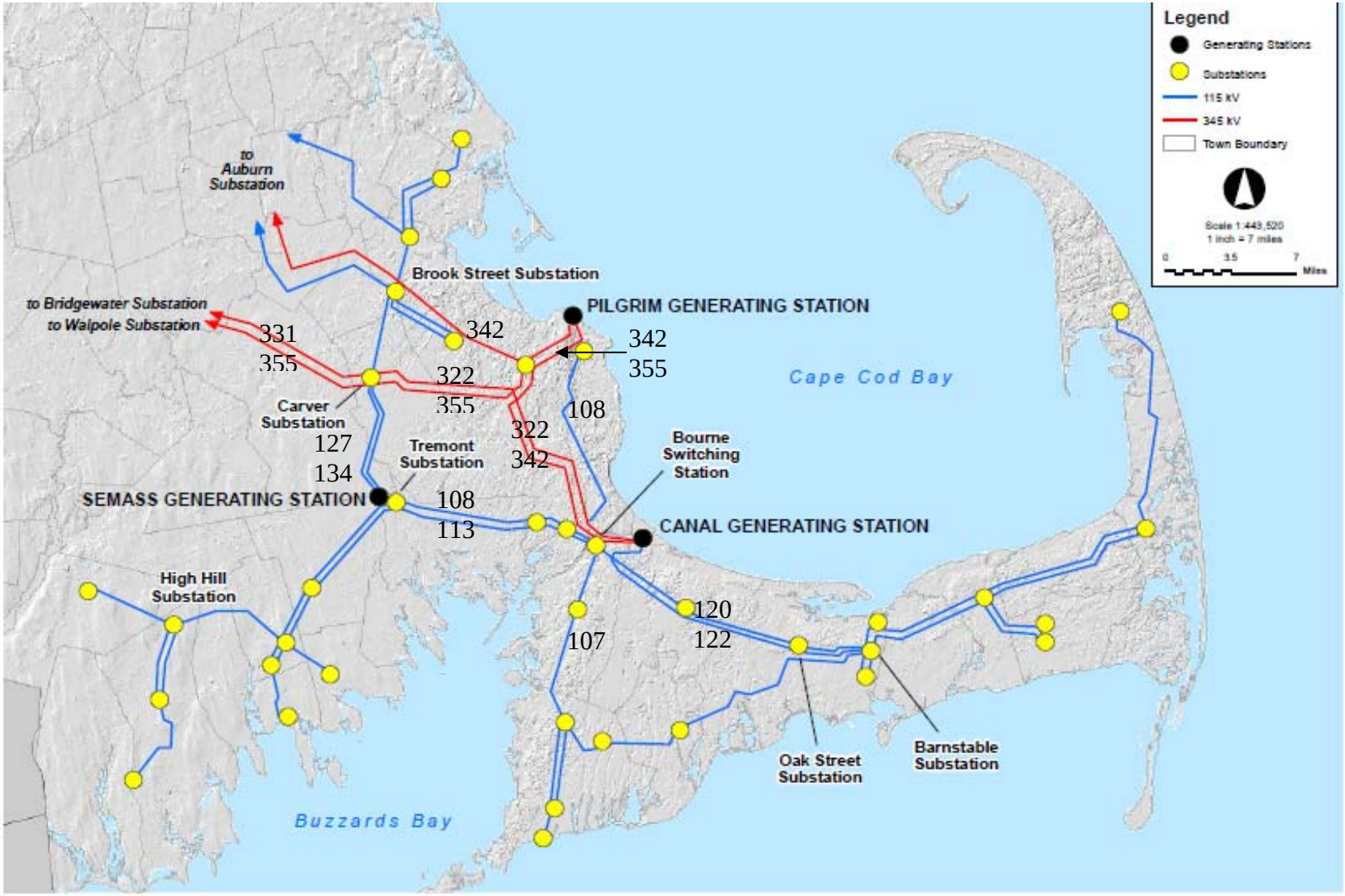
APPROVED by the Energy Facilities Siting Board at its meeting of April 12, 2012, by the members present and voting. Voting for approval of the Tentative Decision as amended: Steven Clarke, (Acting Energy Facilities Siting Board Chair/Designee for Richard Sullivan, Secretary, Executive Office of Energy and Environmental Affairs); Jolette A.Westbrook, Commissioner, Department of Public Utilities; Mark Sylvia (Commissioner, Department of Energy Resources); Laurel Mackay (Designee for Commissioner, Department of Environmental Protection); Victoria Maguire (Designee for Secretary, Executive Office of Housing and Economic Development); Kevin Galligan, Public Member; Dan Kuhs, Public Member; and Penn Loh, Public Member.

Steven Clarke, Acting Chair
Energy Facilities Siting Board

Dated this 27 day of April, 2012

EFSB 10-2/D.P.U. 10-131/10-132

Figure 1. Transmission System Map of Lower SEMA



Exh. EFSB-G-1.

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Figure 2. Primary and Alternative Routes from Carver Substation to Bournedale Road

Exh. NSTAR-1, at Fig. 1-5

Appeal as to matters of law from any final decision, order or ruling of the Siting Board may be taken to the Supreme Judicial Court by an aggrieved party in interest by the filing of a written petition praying that the order of the Siting Board be modified or set aside in whole or in part. Such petition for appeal shall be filed with the Siting Board within twenty days after the date of service of the decision, order or ruling of the Siting Board, or within such further time as the Siting Board may allow upon request filed prior to the expiration of the twenty days after the date of service of said decision, order or ruling. Within ten days after such petition has been filed, the appealing party shall enter the appeal in the Supreme Judicial Court sitting in Suffolk County by filing a copy thereof with the clerk of said court. (Massachusetts General Laws, Chapter 25, Sec. 5; Chapter 164, Sec. 69P).