

# Greening the Grid

## Transmission System Evolution for a Decarbonizing New England

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Restructuring Roundtable  
March 13<sup>th</sup>, 2020



## Greening the Grid

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- > Need is clear: 100GW to 200GW of renewables by 2050
- > No longer about whether – focus now on what the green grid looks like & how to build it
- > What – numerous studies by Brattle, ISO-NE, NREL, WIRES, Anbaric, and more...
- > How
  - > Competition is vital
    - > Controlling cost
    - > Ensuring viability
  - > Authority
    - > State-level
    - > Regional?
    - > [National?]



# Back to the Future?

## New England 2030 Power System Study

Report to the New England Governors



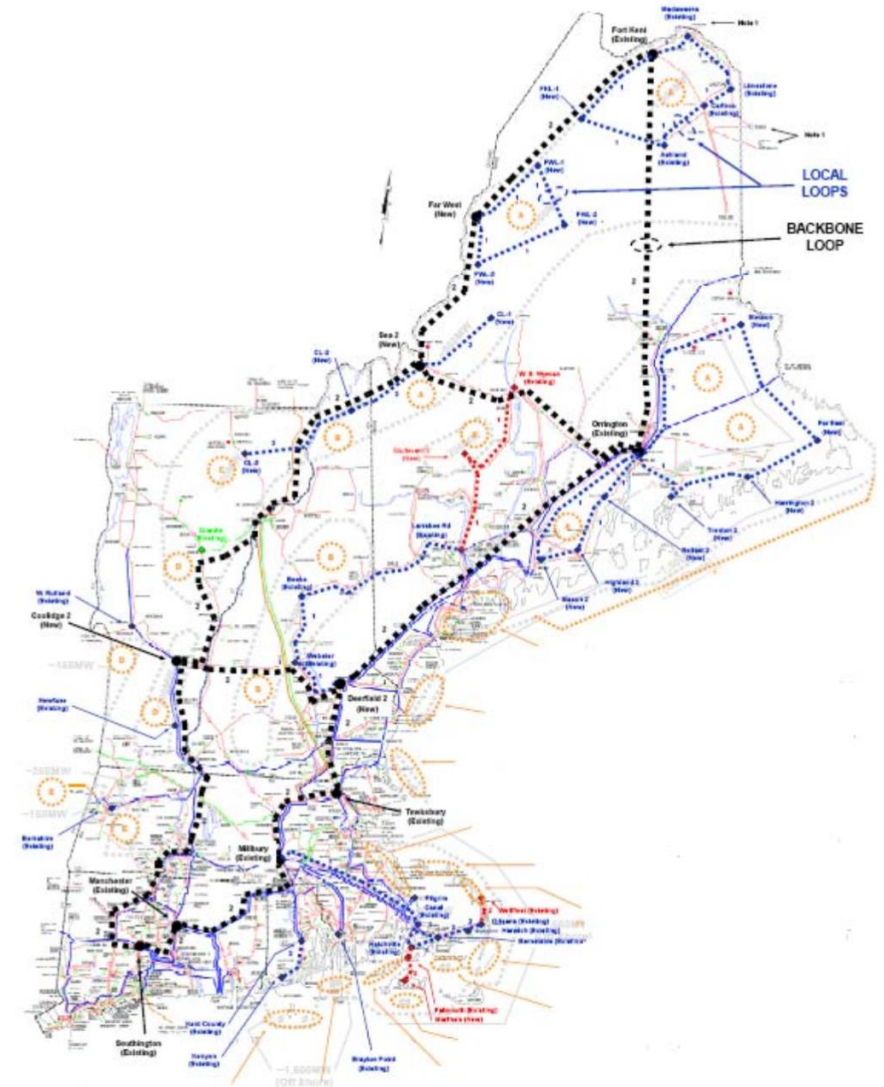
2009 Economic Study:

Scenario Analysis of Renewable Resource Development

Percentage of Electric Energy Provided in Modified Scenarios, by Fuel Type

Modified Scenarios	Coal	Gas	Nuclear	Wind	EE/DR/EG	Hydro/PS	Other (a)
Base case with 5,500 MW wind 4,000 MW offshore plus 1,500 MW inland (near the coast)	13%	25%	23%	12%	15%	4%	8%
Base case with 5,500 MW wind plus 3,000 MW Québec and New Brunswick Interchange	12%	18%	23%	15%	15%	9%	8%
12,000 MW wind case plus 3,000 MW Québec and New Brunswick Interchange	9%	11%	22%	26%	15%	9%	7%

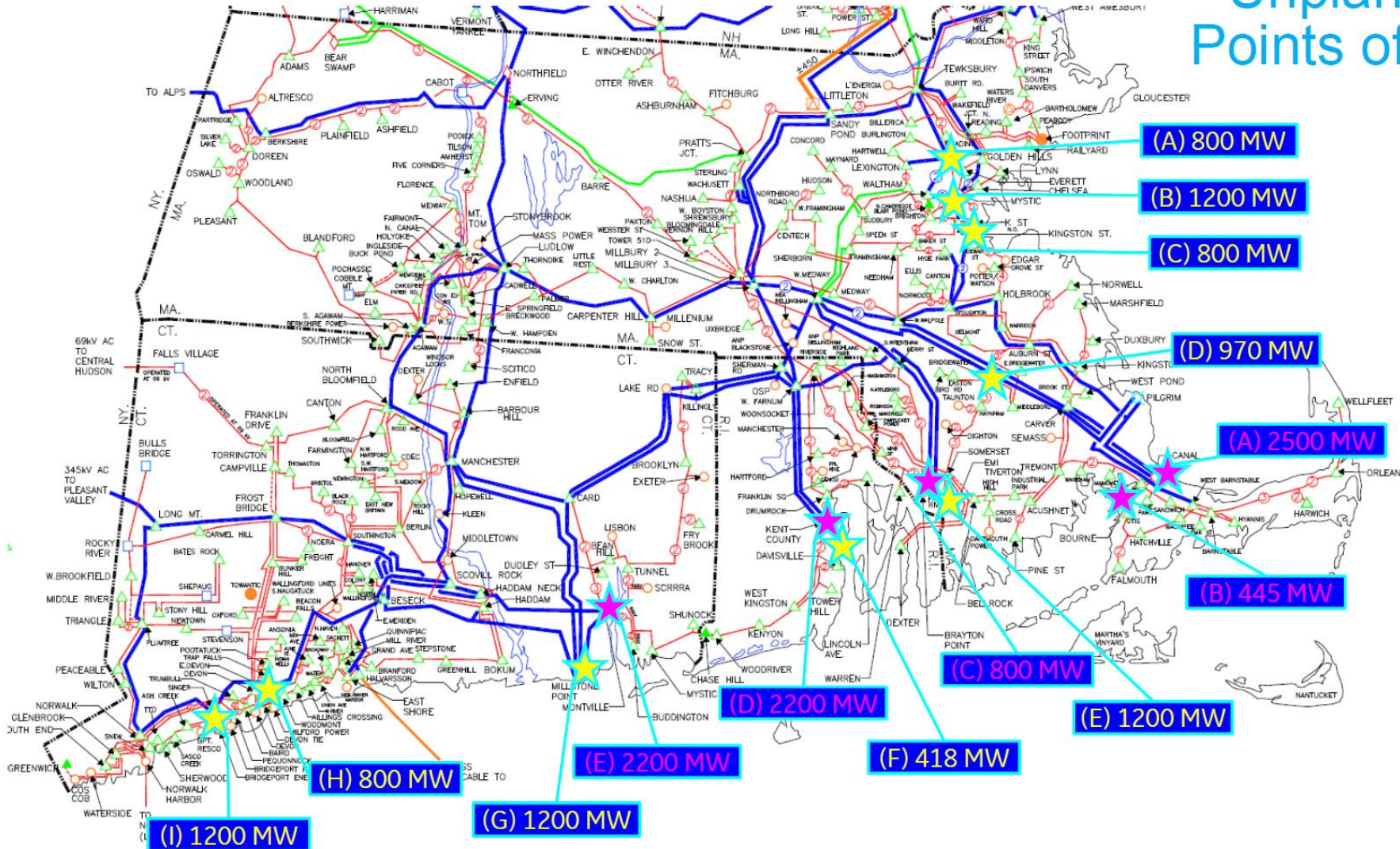
(a) "Other" includes residual fuel oil, municipal solid waste, wood/wood waste, landfill gas and other biomass gases, solar, and miscellaneous fuels.



Source: [https://www.iso-ne.com/static-assets/documents/committees/comm\\_wkgrps/prtcpts\\_comm/pac/reports/2010/economicstudyreportfinal\\_022610.pdf](https://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/prtcpts_comm/pac/reports/2010/economicstudyreportfinal_022610.pdf)

# Offshore Transmission – where to connect?

## Unplanned vs. Planned Points of Interconnection

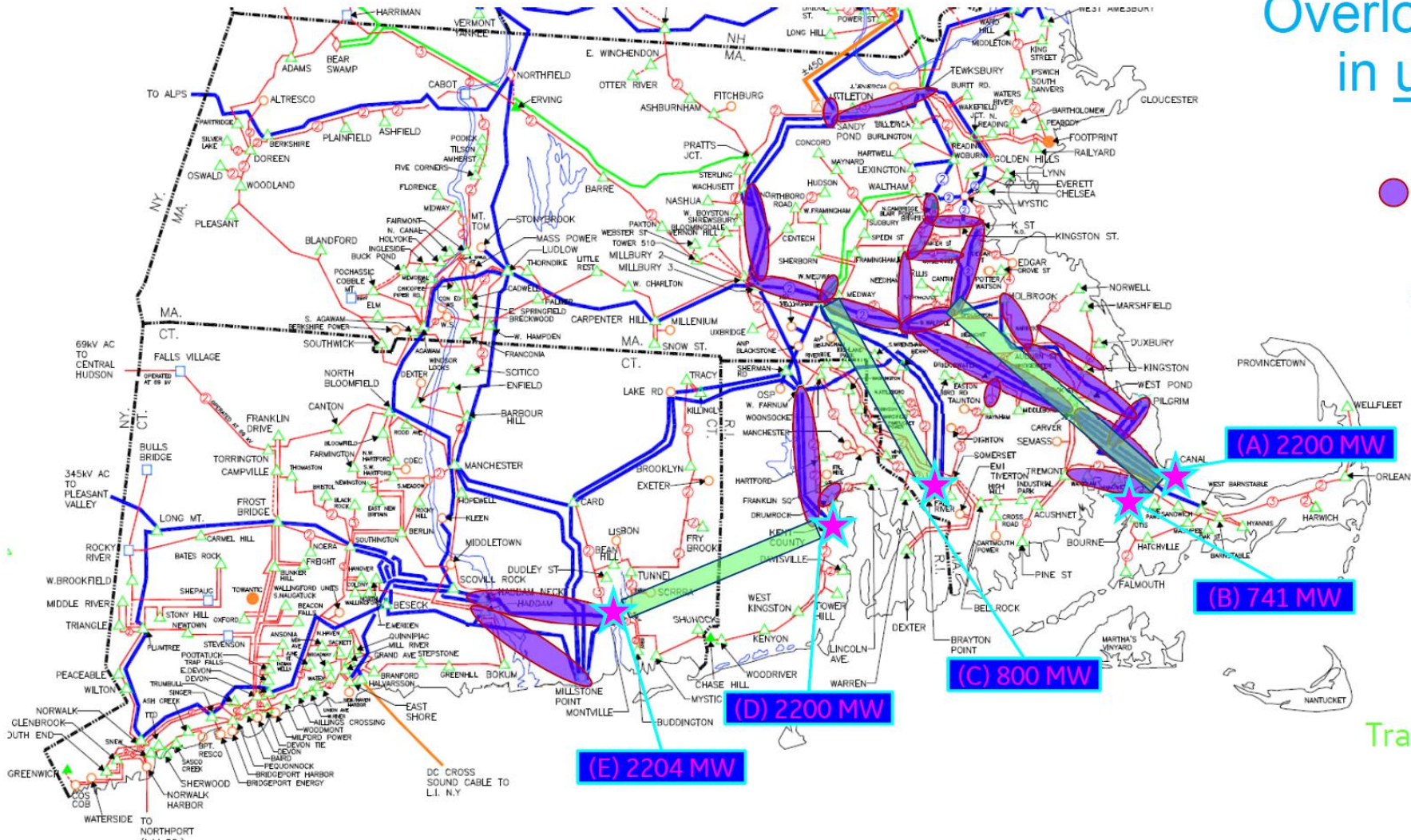


- ★ **Unplanned POI**
  - » 8.145 GW
  - » 5 POI
  - A. Canal 345 kV
  - B. Bourne 345 kV
  - C. Brayton Point 345 kV
  - D. Kent County 345 kV
  - E. Montville 345 kV
  
- ★ **Planned POI**
  - » 8.588 GW
  - » 9 POI
  - A. Woburn 345 kV
  - B. Mystic 345 kV
  - C. K Street 345 kV
  - D. Bridgewater 345 kV
  - E. Brayton Point 345 kV
  - F. Kent County 345 kV
  - G. Millstone 345 kV
  - H. East Devon 345 kV
  - I. Singer 345 kV



# Onshore Upgrades: Unplanned Approach/Status Quo

Overloaded elements in unplanned build



● Design Contingency

★ Scenario 1 POI  
8.145 GW

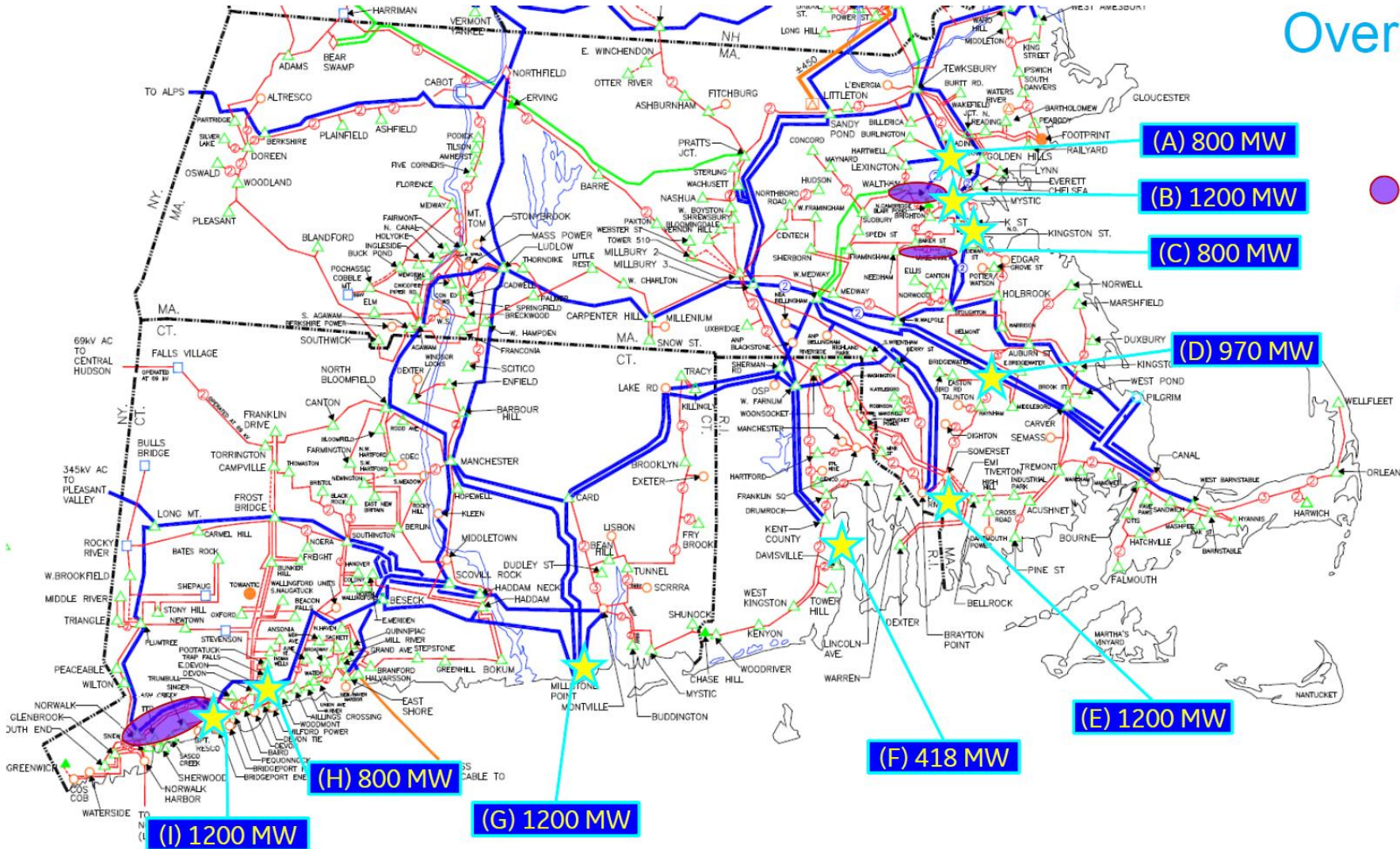
» 5 POI

- A. Canal 345 kV
- B. Bourne 345 kV
- C. Brayton Point 345 kV
- D. Kent County 345 kV
- E. Montville 345 kV

Potential 345kV  
Transmission Reinforcements  
Identified by ISONE



# Onshore Upgrades: Planned Approach



Overloaded elements  
in planned build

● Design Contingency

★ Scenario 2 POI  
8.588 GW

» 9 POI

- A. Woburn 345 kV
- B. Mystic 345 kV
- C. K Street 345 kV
- D. Bridgewater 345 kV
- E. Brayton Point 345 kV
- F. Kent County 345 kV
- G. Millstone 345 kV
- H. East Devon 345 kV
- I. Singer 345 kV

## Challenges with Overland Transmission Projects

- > Onshore transmission is difficult to permit and construct
- > Recent traditional onshore transmission projects in New England have exceeded budgets significantly
- > Project delays will be detrimental to consumers, the environment and public health
- > Real risk of stalling offshore wind – onshore wind in Maine was crippled by lack of transmission

### Performance of recent traditional New England transmission projects\*



**79%**

Budget Exceedance



**\$1.7B**

Cost Overrun



**5.4 years**

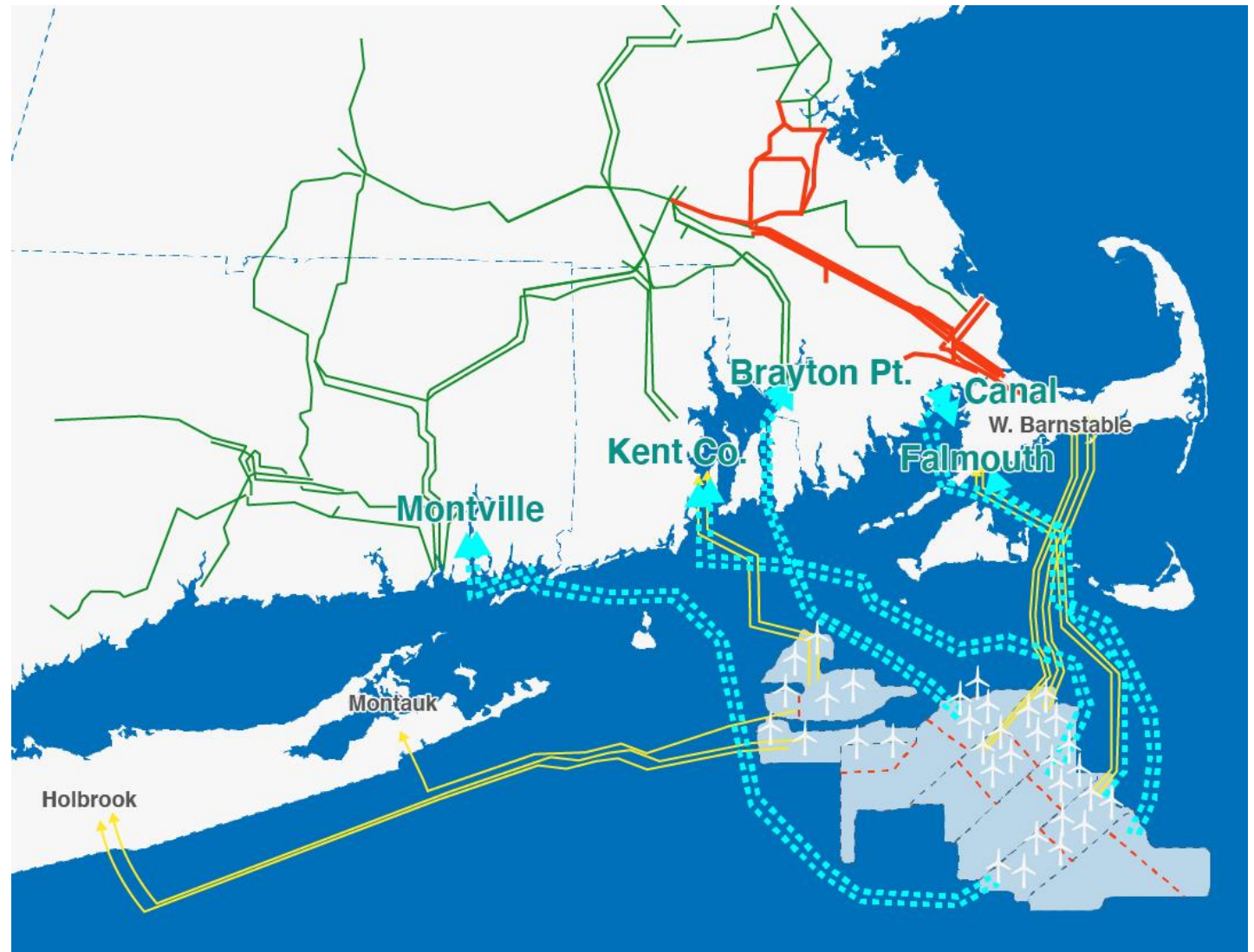
Project Duration

\*Source: [https://www.iso-ne.com/static-assets/documents/2015/02/a2\\_nht\\_greater\\_boston\\_cost\\_analysis\\_public.pdf](https://www.iso-ne.com/static-assets/documents/2015/02/a2_nht_greater_boston_cost_analysis_public.pdf)

## The Offshore Grid – Unplanned Buildout (1)

Phase 1: next 3,600MW

- > Four 800MW HVAC projects = 8 cables
- > One 400MW HVAC project = 1 cable
- > 694 miles of marine cabling
- > 8% losses = 288MW

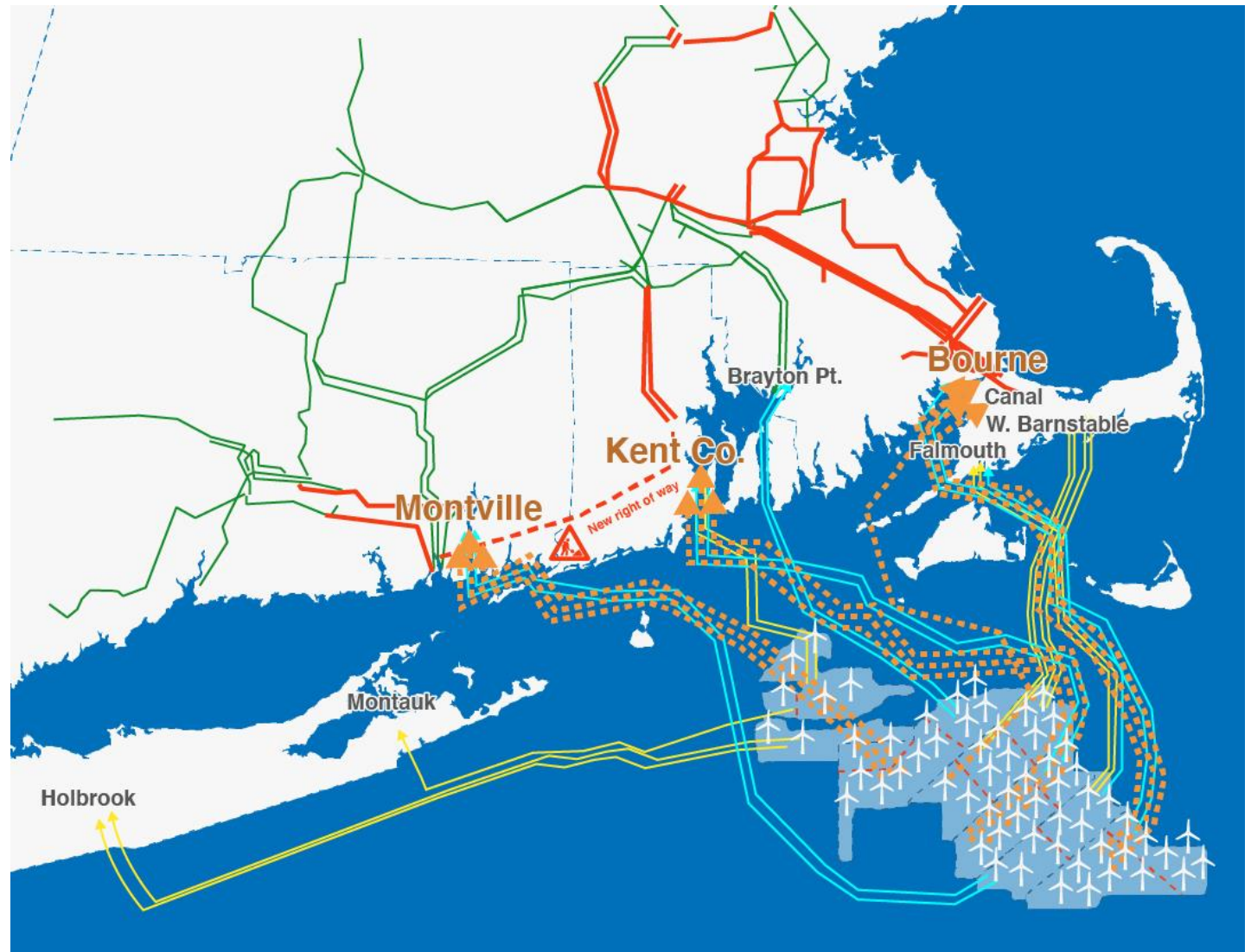




## The Offshore Grid – Unplanned Buildout (2)

Phase 2: full 8,200MW

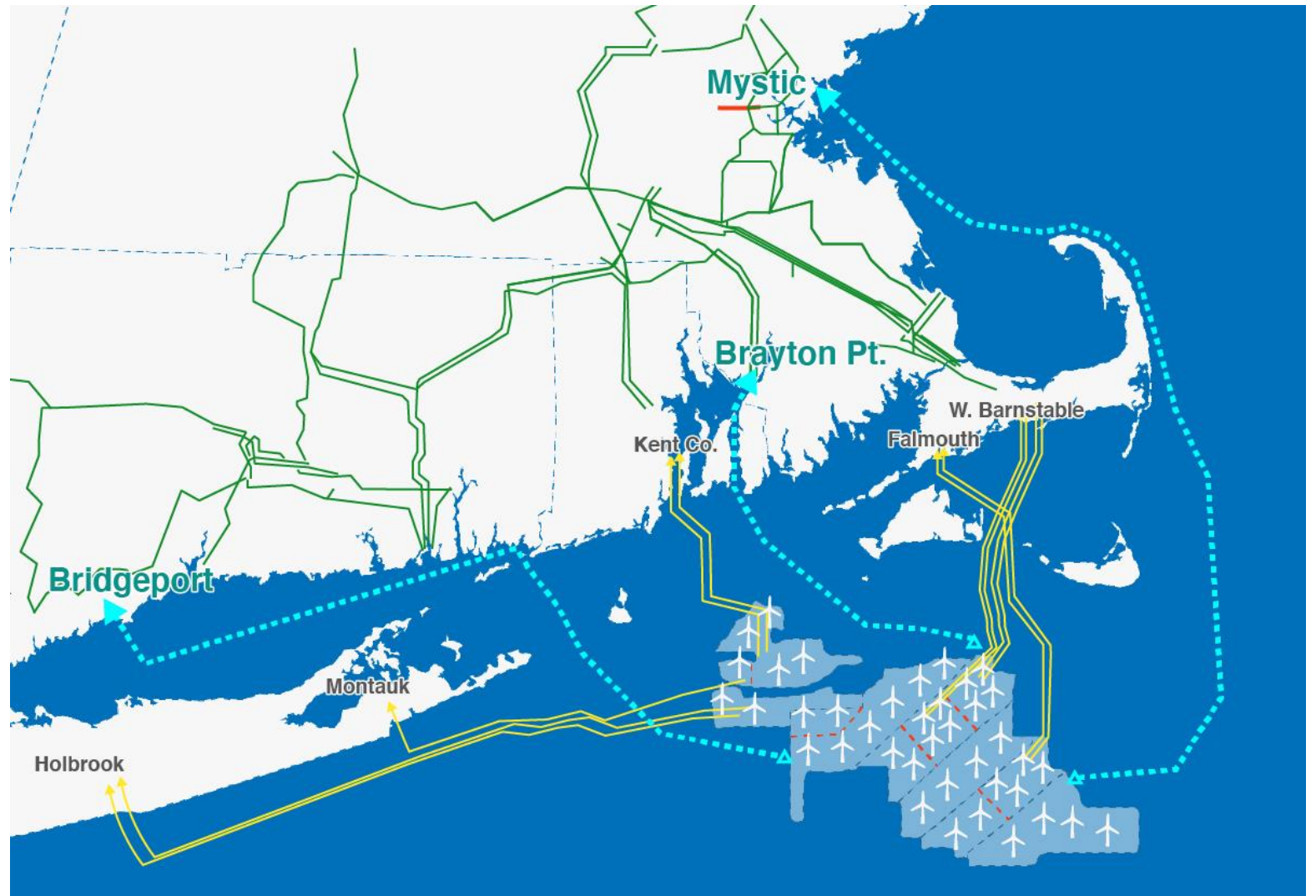
- > Three 1,400MW HVAC projects = 9 cables
- > One 400MW HVAC project = 1 cable
- > 926 miles of marine cabling = 1,620 total miles
- > 8% losses = 656MW total lost capacity



## The Offshore Grid – Planned Buildout (1)

Phase 1: next 3,600MW

- > Three 1,200MW HVDC projects = 3 cables
- > 356 miles of marine cabling
- > 3% losses = 108MW

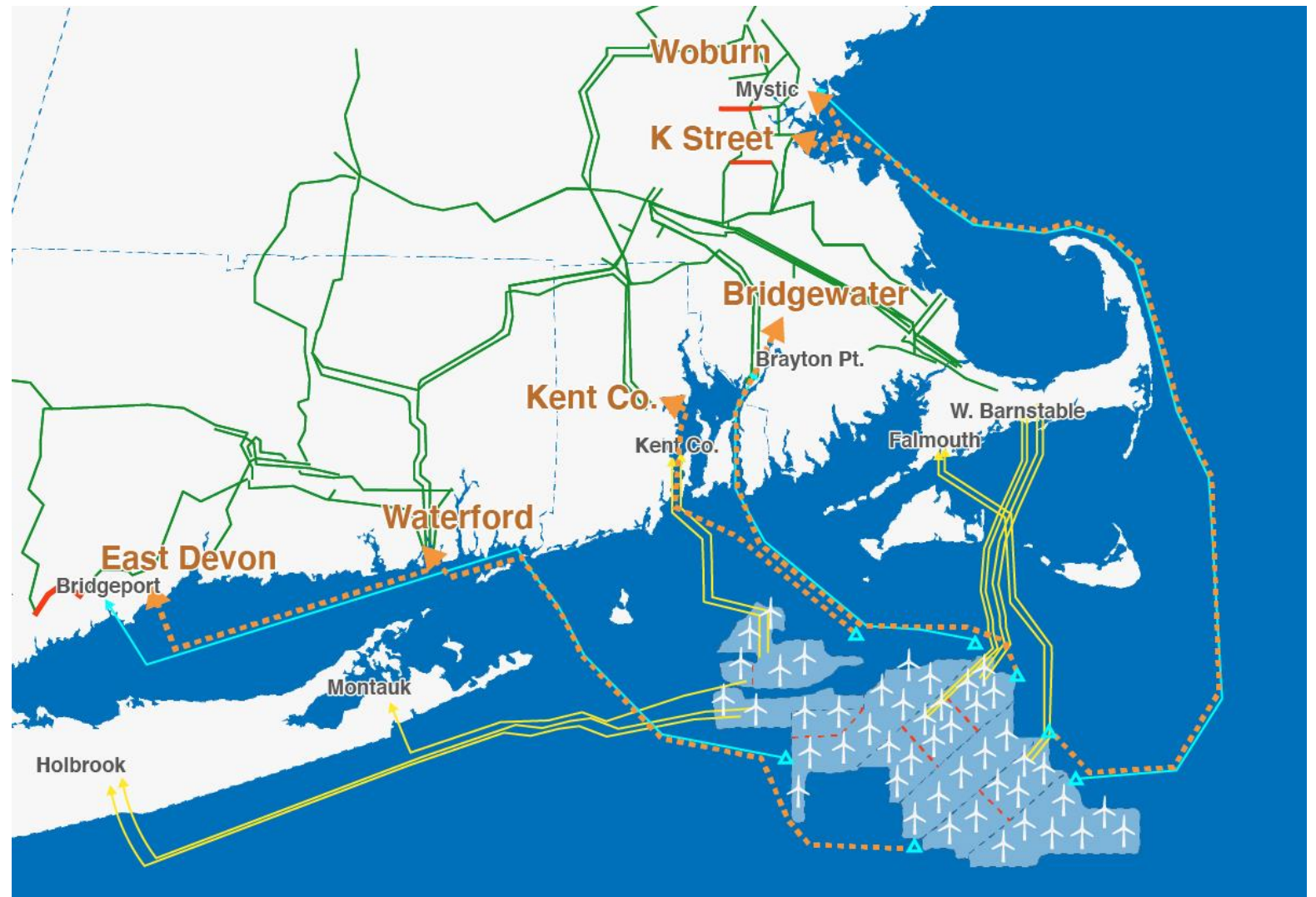




## The Offshore Grid – Planned Buildout (2)

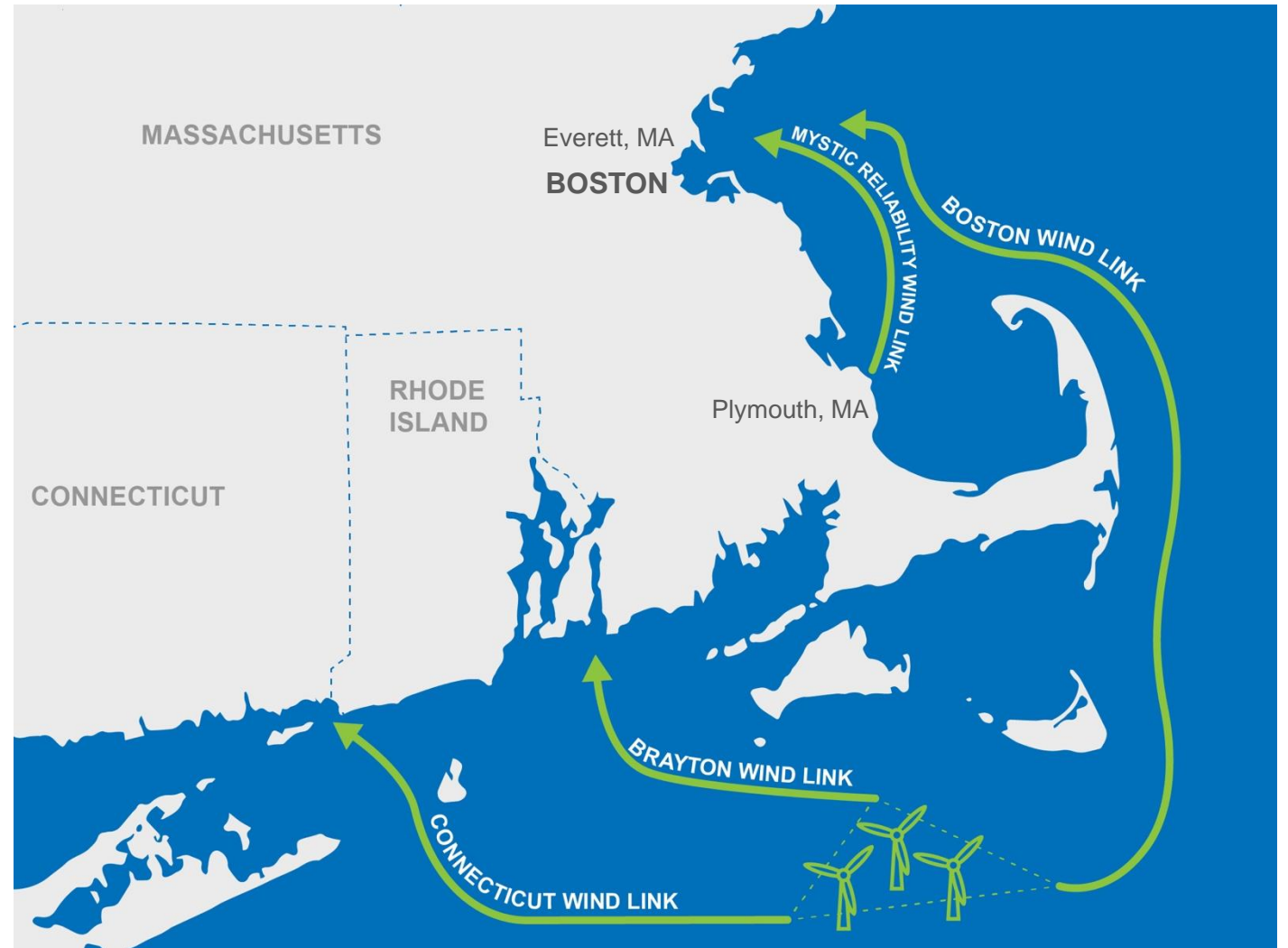
Phase 2: full 8,600MW

- > Three HVDC projects with 5 cables
  - > 2,000MW to Connecticut
  - > 1,600MW to Greater Boston
  - > 1,000MW to Bridgewater
  - > +One 400MW HVAC project to Rhode Island with 1 cable
- > 474 miles of marine cabling = 831 total miles; 49% reduction from unplanned approach
- > 3% losses = 258MW total lost capacity; 398MW more offshore wind than unplanned approach



## Phased Development of Southern New England OceanGrid

- > With well-planned transmission offshore wind can meet almost half of New England's energy needs
- > The Southern New England OceanGrid would achieve near-term offshore wind goals – with expandability to realize full 14,500MW potential of existing lease areas
- > Phase 1 projects include:
  - > **Mystic Reliability Wind Link**
  - > **Boston Wind Link**
  - > **Brayton Wind Link**
  - > **Connecticut Wind Link**





# Procuring Independent Offshore Transmission

Straightforward approach using available information and proven regulatory models

## > Scope

- > Preferred Points of Interconnection
- > Flexible locations for offshore collector stations
- > Clear technical standards
- > Encourage surplus capacity

## > Process

1. Procurement for transmission
  2. Procurement for generation connecting to transmission
  3. Select winning combination
- > No generator lead lines due to conflicts of interest

## > Performance-Based Transmission Tariff modeled on 2015 Three State Procurement

## > Risk Management

- > Project sequencing
- > Penalties and rewards

## > Avoided onshore upgrades and avoided delays demonstrate cost effectiveness

## Takeaways

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- > Plan for the long term, procure for the near term
  - > Cannot limit thinking to the next project
  
- > The green grid
  - > Known resource – offshore wind, solar, storage, onshore wind, hydro
  - > Studies, data & information to guide policymakers is available
  - > Harness the market for creative solutions
  
- > States can get started, now





# Supplemental Slides

## Mystic Reliability Wind Link Project Opportunity

- > Grid operator Independent System Operator - New England (ISO-NE) seeking competitive bids to replace retiring Mystic Generating Station with transmission
- > Proposals Submitted March 4<sup>th</sup>, 2020
- > Finalists selected Q3 2020
- > Winning project selected Q3 2021
- > Project costs recovered through regional transmission tariff paid by all New England consumers



# Phase 1—Reliability Project Details

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- > High capacity electric transmission lines from substation at the former Pilgrim nuclear station in Plymouth to substation at Mystic Power Generating Station in Everett
- > Subsea route is key for feasibility – this reliability project is **TIME CRITICAL to keep the lights on in the Greater Boston Area**
- > Provides needed energy & grid-stabilizing voltage
- > Excess capability included at no additional cost as contingency for potential delays importing hydroelectricity through Maine



# Boston Wind Link Project Opportunity

- > Massachusetts initiating Technical Session on dedicated transmission for offshore wind in first quarter 2020
- > Potential procurement in 2020
- > Transmission for up to 1600MW of capacity
- > Seeking to integrate offshore wind efficiently with onshore grid
  - > Route energy to demand centers
  - > Avoid, minimize and mitigate impacts on fisheries, environment & shoreline communities