CLEAN ENERGY STATES ALLIANCE
OCTOBER 23, 2020

Offshore Wind Transmission:

AN ANALYSIS OF PLANNING IN NEW ENGLAND AND NEW YORK

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Presenting today

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Motivation: Substantial off-shore wind development planned in northeast

Thousands of MW of new clean resources will need to be built to achieve decarbonization goals in New York and New England—including substantial offshore wind beyond current commitments.

A key policy challenge is **ensuring a pathway to enable the lowest-cost solutions** for delivering new clean energy from source to population centers

Region	Already Contracted	Total Committed	Potentially Needed
New England	3,112 MW	5,900 MW	25-40,000 MW by 2050
New York	1,826 MW	9,000 MW	15-25,000 MW by 2040

Sources:

Brattle Study of NE by Jurgen Weiss and Michael Hagerty, "Achieving 80% GHG Reduction in New England by 2050," September 2019.
Brattle Study for NYISO by Roger Lueken et al., "New York's Evolution to a Zero Emission Power System: Modeling Operations and Investment Through 2040." May 18, 2020.
E3, "Electric Reliability under Deep Decarbonization in New England," August 4, 2020.
E3, "Pathways to Deep Decarbonization in New York State," June 24, 2020.

Project scope and approach

In separate studies of <u>New England</u> and <u>New York</u>, we examined approaches to developing offshore transmission and associated onshore grid upgrades to reach stated offshore wind (OSW) development goals

We examined two alternatives:

1. The **"generator lead line" approach:** developers develop incremental amounts of OSW generation with project-specific generator lead lines (GLLs)
2. An alternative **"planned" approach:** Offshore transmission and onshore grid upgrades are planned to minimize overall risks and costs of achieving offshore wind and clean energy goals

The following slides provide an overview of the planned grid approach and summarize results from our two studies

Summary: the benefits of a planned offshore transmission approach

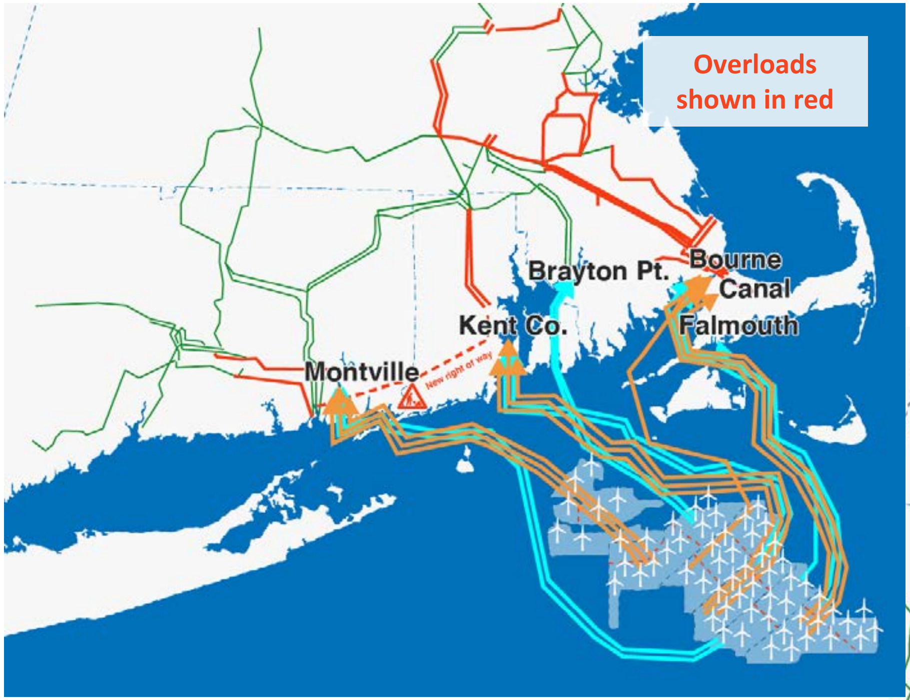
We find results that are qualitatively similar for New England and New York …

Elements we examine	A planned approach shows…
Total onshore + offshore transmission costs • **Onshore transmission upgrade costs** (more risk) • **Offshore transmission costs** (less risk)	Lower overall costs in both NE & NY • Substantially lower onshore costs • Slightly higher offshore costs
Losses over offshore transmission	Reduced losses
Impact to fisheries and environment	Substantially lower impacts
Effect on generation & transmission competition	Increased competition
Utilization of constrained landing points	Improved landing point utilization
Enabling third-party customers	Improved third-party participation

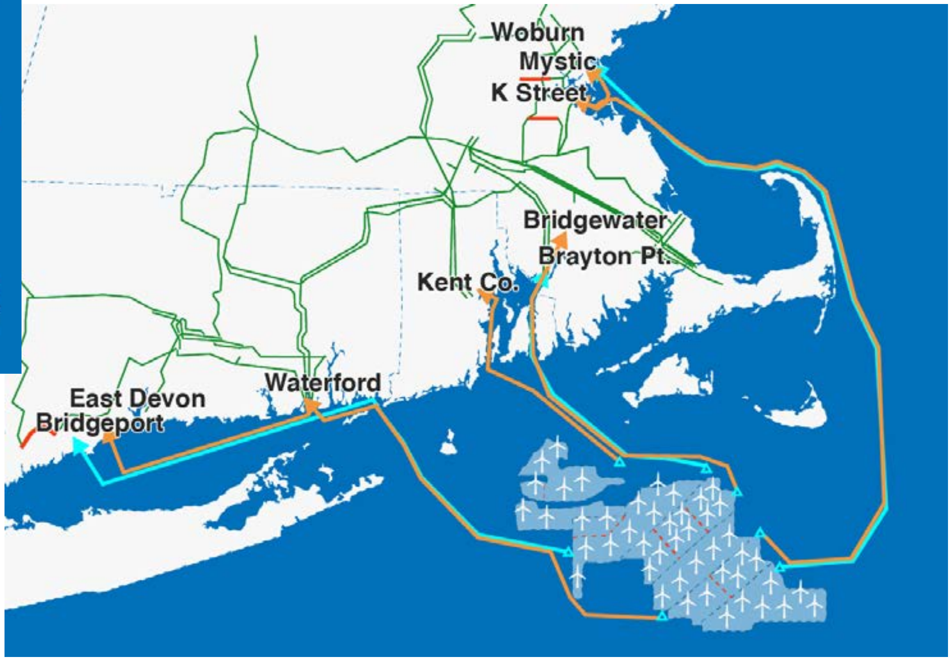
Overview of the Planned Grid Concept

Summary of two transmission approaches studied in New England (~8,400 MW OSW)

Current GLL Approach

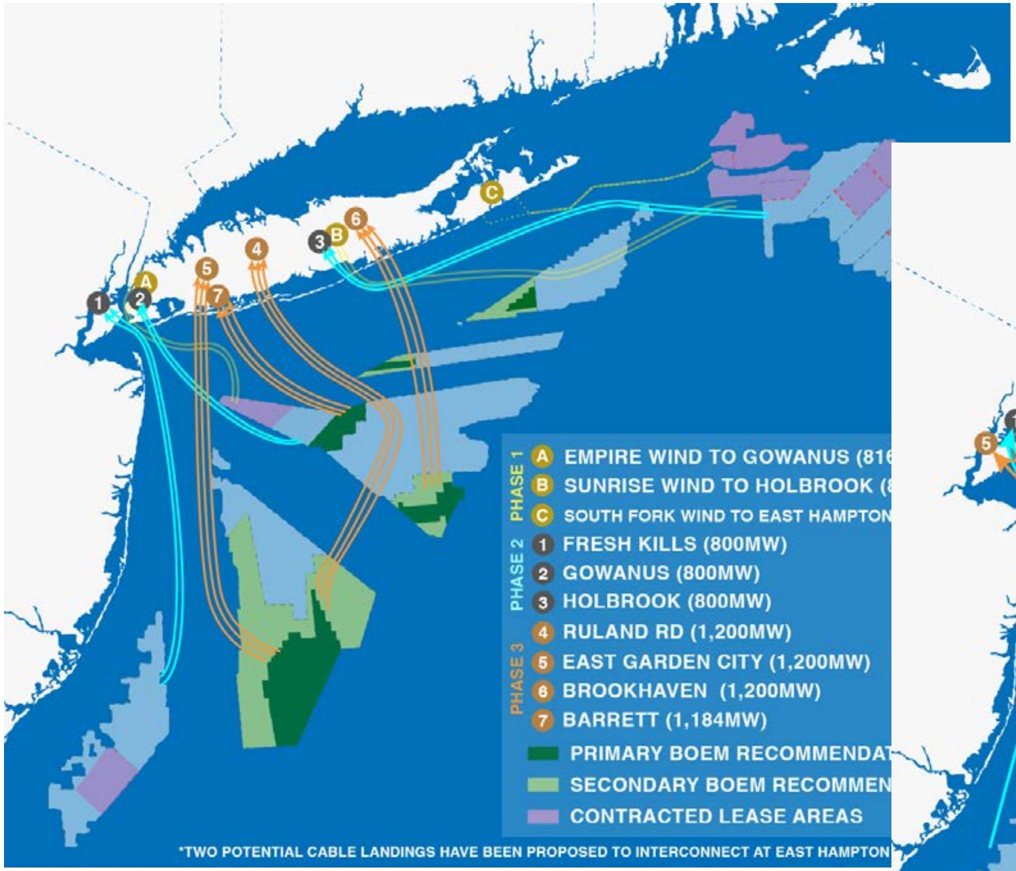


Planned Approach

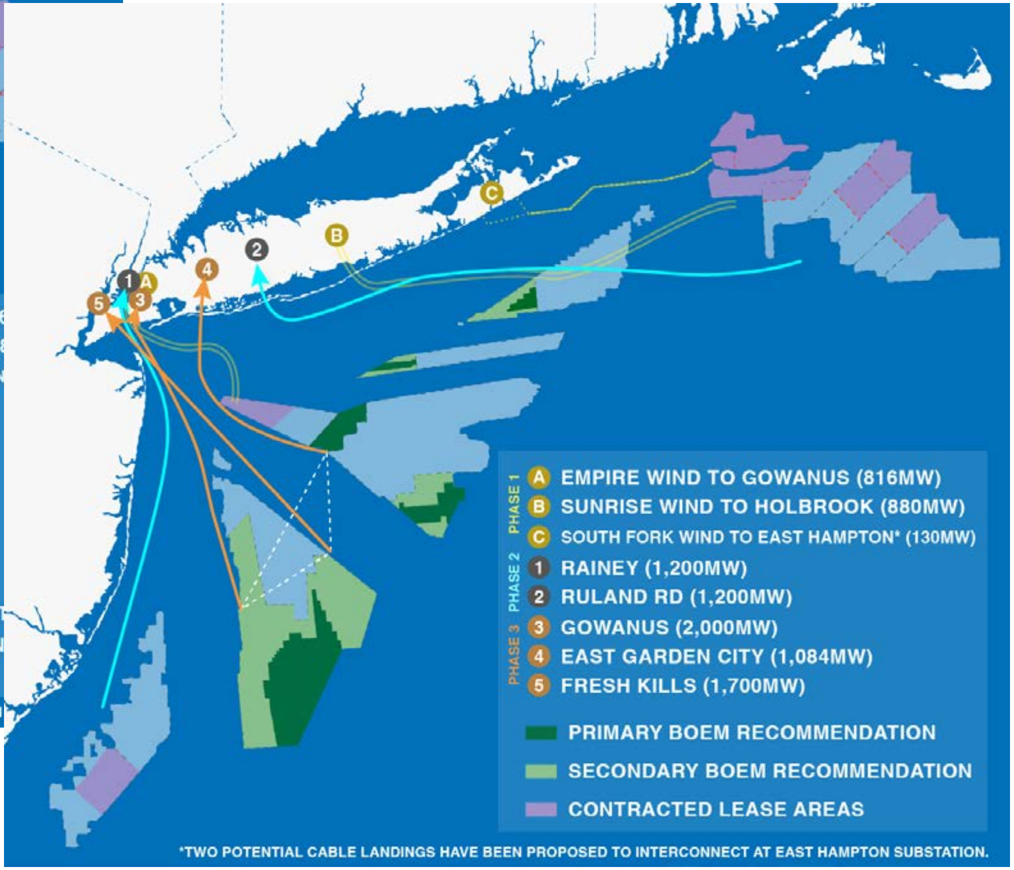


Summary of two transmission approaches studied in NY (9,000 MW OSW)

Current GLL Approach



Planned Approach



Note: Phase 1 is already contracted using HVAC cables.

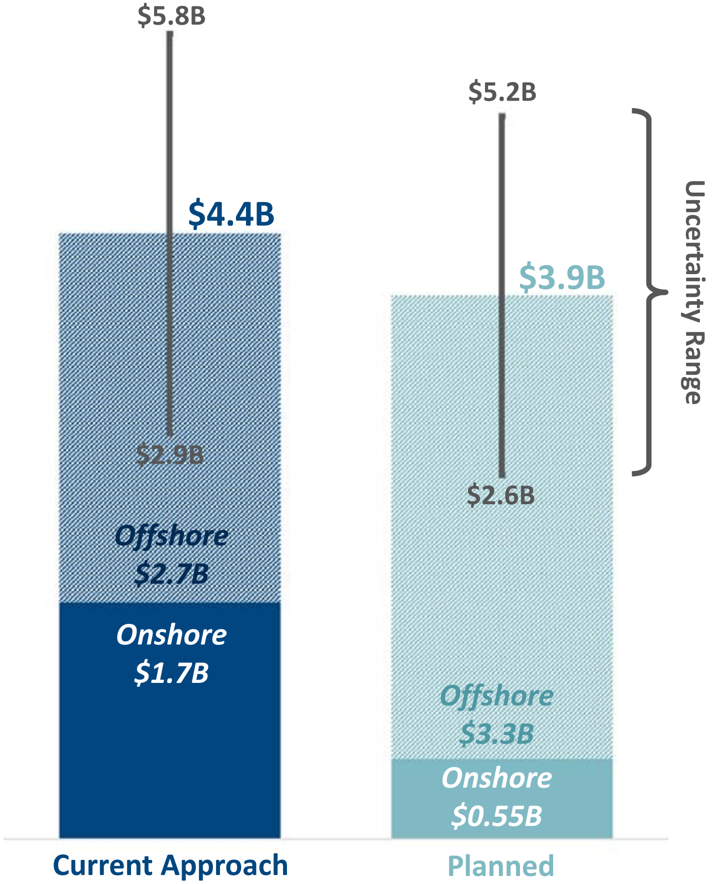
Benefits of a Planned Grid

Total costs of transmission are expected to be lower under a planned approach

Even including the more costly offshore transmission equipment, total costs of onshore upgrades plus offshore transmission are estimated to be lower under a planned than the current GLL approach in both New England and New York

The planned approach to building offshore transmission can enable significant long-term cost savings and avoid some of the higher risks associated with onshore upgrades

Comparison of Total Onshore Plus Offshore Transmission Costs in New England
(Evaluated for next 3,600 MW OSW)

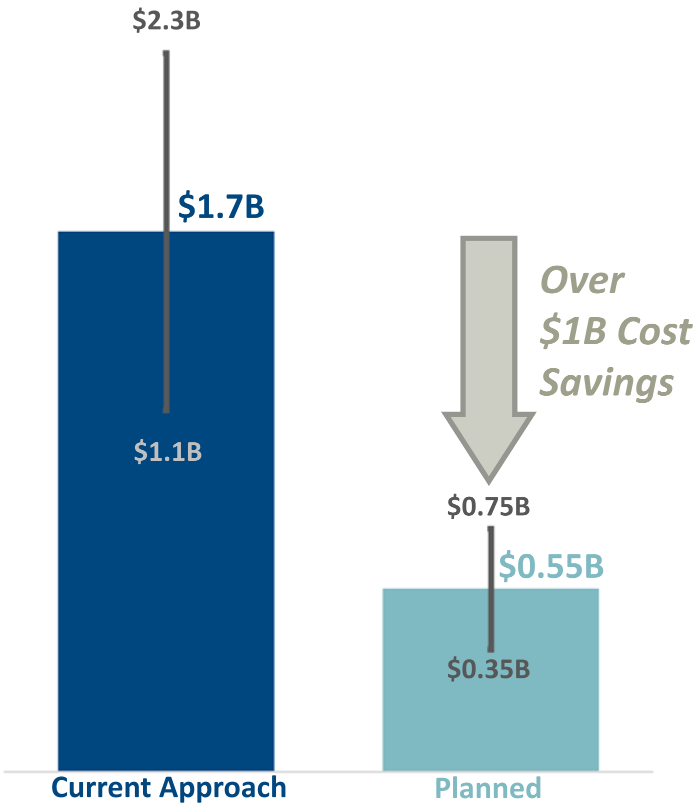


Planning ahead avoids onshore transmission upgrades that otherwise would be needed

Planned transmission can **significantly reduce need, costs, and risks of onshore upgrades** in both New England and New York, where multiple factors make upgrades difficult to permit and have led to a history of delays and budget overruns

The fewer onshore upgrades needed under the planned approach imply <u>substantially reduced risks</u> associated with onshore upgrades relative to current GLL approach

Planning Could Reduce Onshore Upgrade Costs by $1.1B in <u>New England</u>
(Evaluated for next 3,600 MW OSW)



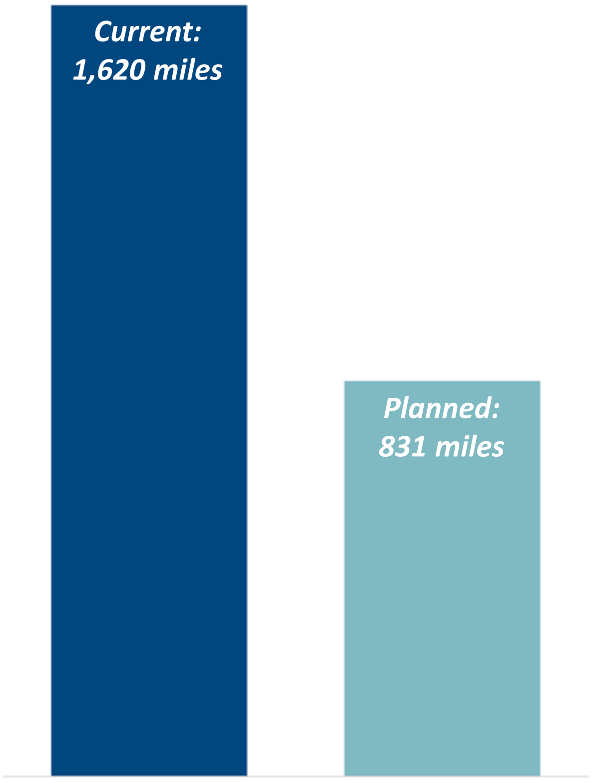
Reduced impacts to fisheries, coastal communities, and the marine environment

Better planning can **reduce the cumulative effects of offshore transmission on fisheries, coastal communities, and the marine environment**

Fewer cables results in **less disruption and impacts on the marine and coastal environment**

Minimizing the number of offshore platforms, cabling, seabed disturbance, and cables landing at the coast **reduces impacts on existing ocean uses and marine/coastal environments** to the greatest practical extent

Comparison of Total Length of Undersea Transmission Under GLL and Planned Approaches in NE
(Excluding Already-Contracted Projects)



Increased competition among OSW generation developers

Competition among developers of OSW generation would be enhanced, yielding a range of potential cost savings

Minimum savings → **Higher potential savings**

The planned, competitive approach would simplify a major strategic decision for developers

Today, developers must bid before they have accurate information about their transmission upgrade costs. Removing these risks from the offshore generation procurement should lead to lower bids because of the reduced risk premium alone

Ultimately, it could increase participation and competition in OSW solicitations.

In Europe, planned transmission approaches have enhanced head-to-head competition leading to **zero-subsidy bids** in recent procurements (see case study details in appendix)

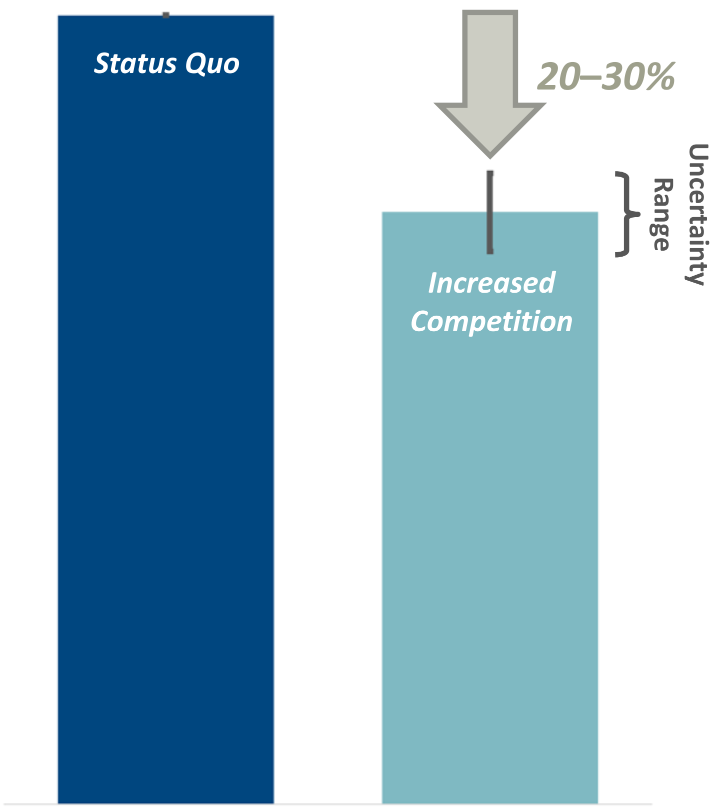
We anticipate more willing bidders and more competition with increased access to transmission (though overall still limited by number of leaseholders)

Increased competition among offshore transmission developers

Offshore transmission developers would compete to build planned transmission. This direct competition would put downward pressure on costs to ratepayers (further lowering costs beyond that described on previous slides)

- Studies of onshore transmission indicate that competitive procurement enables "significant innovation and cost savings of 20–30%" relative to the costs incurred by incumbent transmission companies; the costs of conducting the competitive processes are small compared to the savings*
- Studies of offshore transmission costs in the U.K. similarly indicate that competition across independent offshore transmission owners reduced costs 20–30% compared to generator-owned transmission (driven by lower operating costs and financing costs from improved allocation of risk and reduced risk premium)**

Anticipated Cost Impact of Competition to Develop Offshore Transmission



Issues Unique to New York

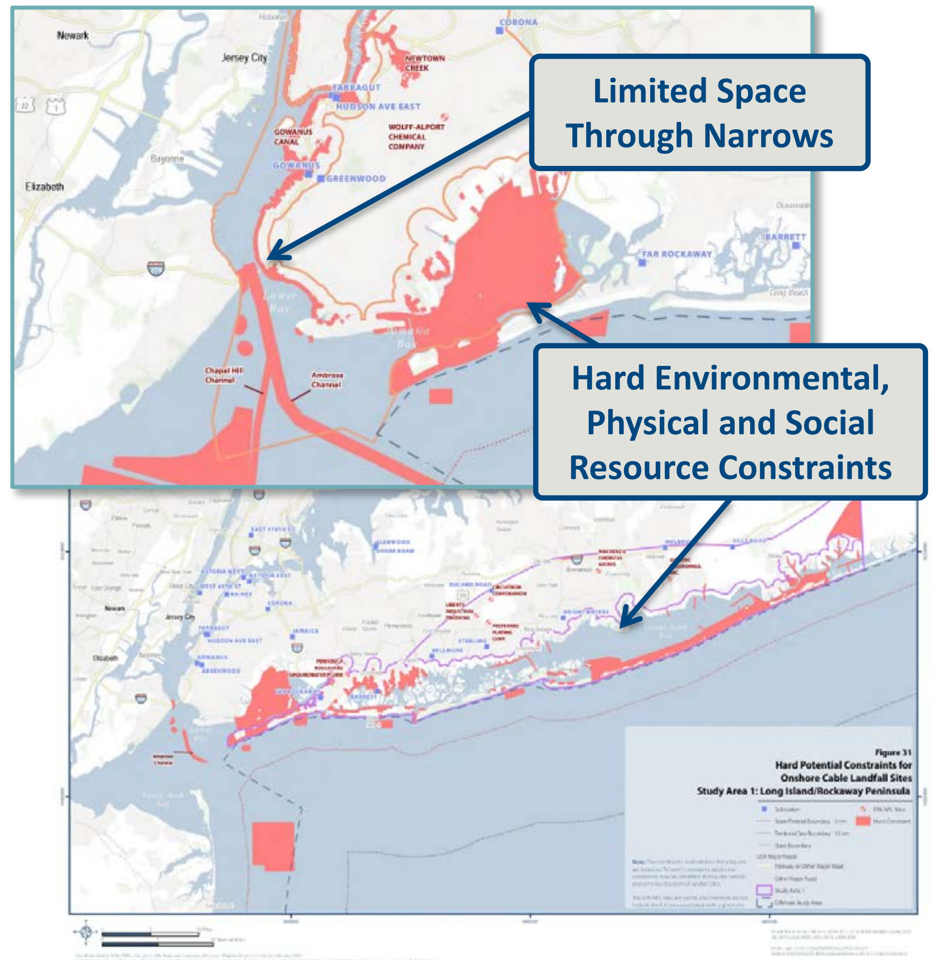
Constrained access routes require efficient offshore transmission to meet goals at low cost

There are a limited number of robust POIs for connecting offshore wind to the onshore grid and limited access routes to these POIs

If each OSW project builds a separate GLL to the onshore transmission system, **viable landing sites and cabling routes will become constrained. A planned transmission approach can make better use of the limited landing sites**

The clearest example of this is the cable approach route through the <u>**Narrows**</u> to reach POIs in New York Harbor

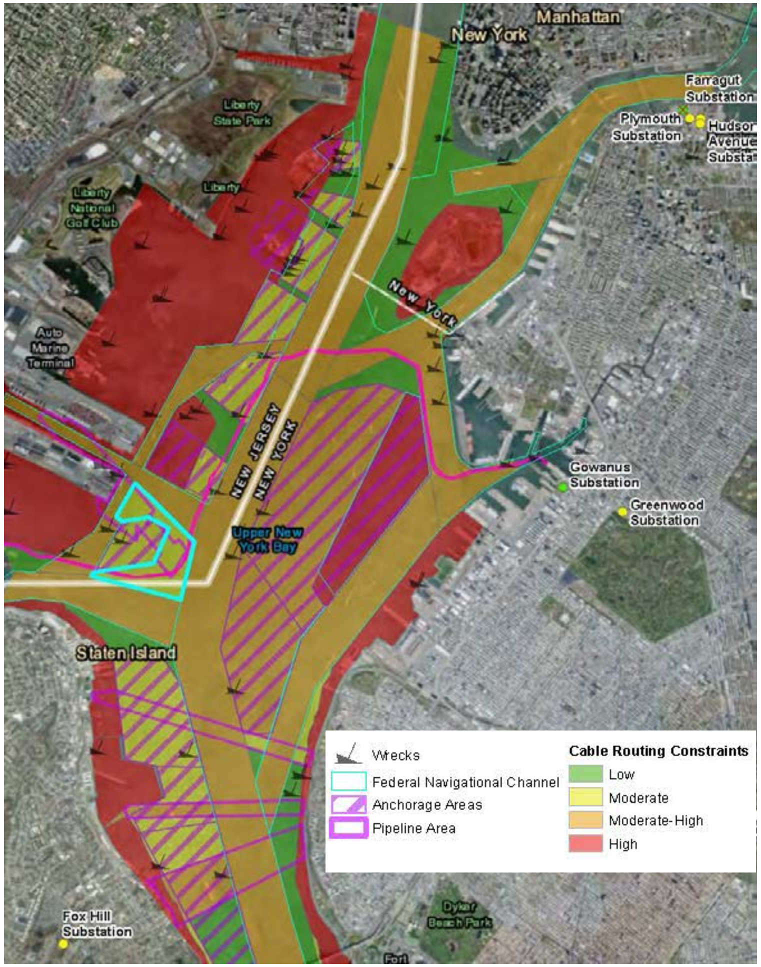
Landing Limitations along NY Coast



Narrows likely has space for only four cables, suggesting maximizing utility of route is key

- **Major constraints to routing through the Narrows and the Upper Bay** are physical width of suitable seabed, federal navigation projects (FNPs) (channels and anchorages), cable spacing requirements, and competing uses
  - All potential routes are heavily constrained by navigational aspects in the Upper Bay: primarily the inner harbor anchorages and federal navigational channels
- In The Narrows and Upper Bay of NYC harbor, **maximal transmission capacity in the available space may be achieved most efficiently by using HVDC technology** to connect clusters of OSW farms to a grid that has been extended offshore
- Given the constraints in the Upper Bay, it is likely **four routes could access NY Harbor**
- Not utilizing Narrows effectively **risks limiting ability to cost-effectively route OSW transmission into New York City** and meet climate goals without large costs

NY Harbor Route Constraints



Source: Analysis of Narrows constraints by Intertec (see Appendix C for details).

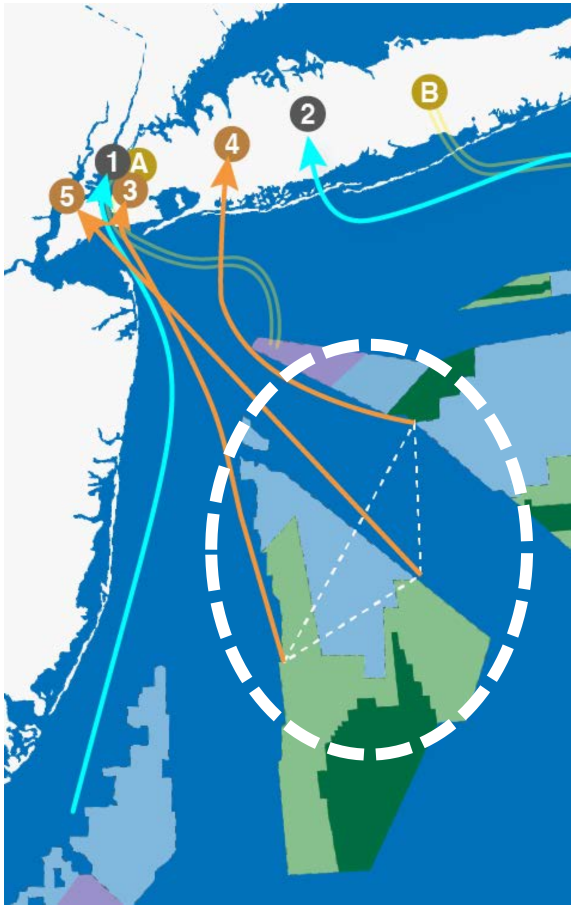
Future curtailments are high in each scenario and require planners' attention

Preliminary analyses indicates much higher curtailment (~18%) under both scenarios studied with 9,000 MW of OSW

The risk of high curtailments can be addressed under a planned approach by:

- Further planning analysis to optimize to optimize the transmission configuration to reduce curtailments
- Integrated planning of NY's 3,000 MW storage goal with offshore transmission
- Future networking of HVDC cables into an offshore grid to move OSW injections to less congested POIs (which also reduces risks from transmission outages)

DC Technology Enables Potential Future Offshore Networking in the NY Bight



*may be higher due to must-run units

Recommendations

We recommend a planned approach to offshore transmission

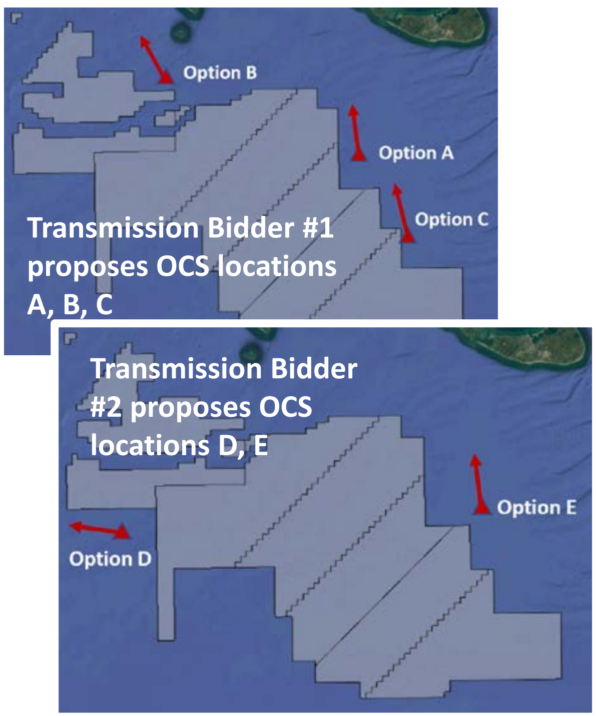
Utilizing GLLs has distinct disadvantages over planned offshore transmission

- Poor use of limited onshore POIs
- Increased seabed disturbance
- Reduced competition for transmission and off-shore wind generation
- Higher onshore transmission upgrade costs and higher overall costs in the long run

Example of separate transmission and generation procurement

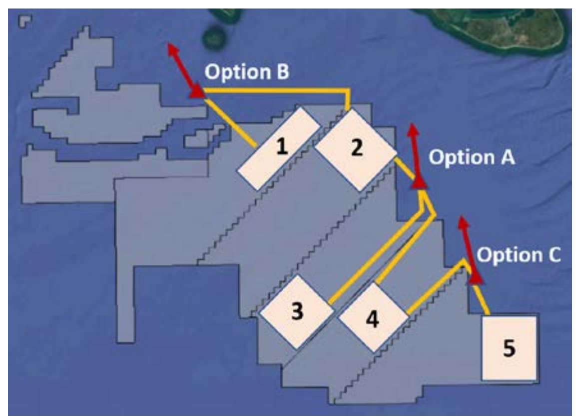
<u>Transmission</u> developers propose collector station locations A - E

Each transmission developer bids a fixed price for one or more collector station locations



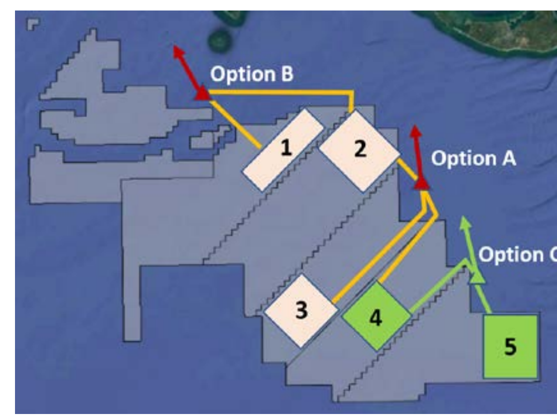
Transmission developer #1 selected; leaseholders bid <u>wind generation</u> 1-5 to collector stations A, B, C

Each generation developer bids a fixed price for one or more collector station locations



Selection of winning configuration

Wind farms 4 and 5 connecting to collector station C minimize costs of procuring specified MW quantity of offshore wind



Mitigating risk with separate generation and transmission development

The current GLL approach places development of generation and offshore transmission under a single developer, but leaves onshore upgrades with incumbent (onshore) transmission owners

- This approach reduces coordination risk between OSW and offshore transmission, but there remains project-on-project risk related to the completion of onshore upgrades

The planned offshore grid model can also address individual project-on-project risk through:

- Strong performance and completion incentives (rewards or penalties) for both transmission and generation developers to meet project deadlines
- Allowing generation developer to participate in transmission procurement, with the condition that the transmission will be open access
- Staggered transmission and generation project completion timelines (e.g., scheduling transmission project completion before generation)

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