



**RENEW Northeast (RENEW)
Proposed Economic Study:
Impact of Maine Upgrades Identified in ISO-NE's
Strategic Transmission Analysis for Wind Integration**

Presented to the Planning Advisory Committee
April 22, 2015



About RENEW

RENEW is a consortium of renewable energy developers and environmental advocates whose mission involves coordinating the ideas and resources of its members with the goal of increasing environmentally sustainable energy generation in the Northeast from the region's abundant, indigenous renewable resources. RENEW focuses on grid-scale renewable resources and the benefits of transmission investment to deliver renewable energy to load centers.

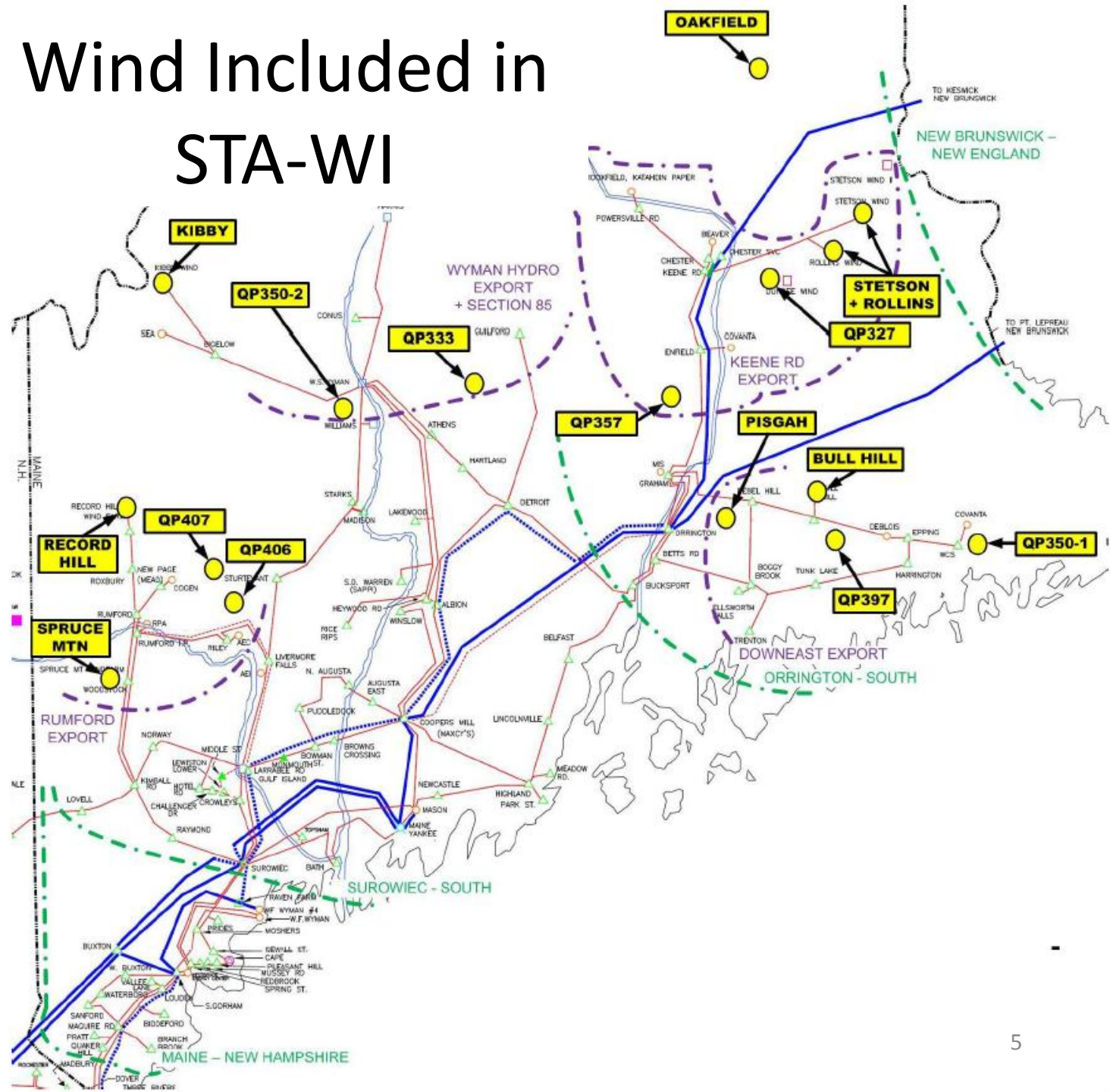
Strategic Transmission Analysis for Wind Integration

- ISO-NE Strategic Transmission Analysis for Wind Integration (STA-WI) is an ongoing series of studies with objective of:
 - Understanding transmission constraints which can limit variable energy resources in New England
 - Considering scope of transmission upgrades to mitigate constraints
- Focused so far on upgrades that do not require major new transmission construction

STA-WI PAC presentations

- Dec 2013: Discussed local constraints in Maine
- May 2014: Discussed regional constraints in Maine
- Dec 2014: Maine update considering overall system dynamic behavior

Wind Included in STA-WI



STA-WI Background

- Maine wind Included in STA-WI
 - Downeast: 34 MW existing, 152 MW additional
 - Keene Road: 144 MW existing, 85 MW additional
 - North of Orrington: 0 MW existing, 150 MW additional
 - Wyman Hydro: 134 MW existing, 284 MW additional
 - Rumford: 73 MW existing, 57 MW additional
 - Total: 385 MW existing, 728 MW additional
- Conceptual upgrades identified that would accommodate all of the studied wind (except the additional wind behind Keene Road) with limited anticipated curtailment

Local Upgrades Identified

- 500 MVAR Static VAR Compensator (SVC) at Maine Yankee 345 kV S/S
- Rebuild of Wyman Hydro Substation
- Addition of series breakers at Albion Road, Coopers Mills and Livermore Falls
- Rebuild of Section 242 from Heywood Road to Winslow*
- Rebuild of Section 66 from Rebel Hill to Epping*
- Rebuild of Section 59 from Epping to Columbia (3 miles)
- 205 MVAR of 115kV shunt capacitors for voltage support in Western Maine
- 30 MVAR of 115kV shunt capacitors for voltage support in Downeast Maine
- 50% Series Compensation on Line 64

* Already in Regional System Plan (“RSP”)



Regional Upgrades Identified

- 275 MVAR of 115kV shunt capacitors for voltage support in Western and Southern Maine
- Two 25 ohm, Thyristor-Controlled Series Compensation devices in Sections 388 and 3023

Potential Interface Limit Increases

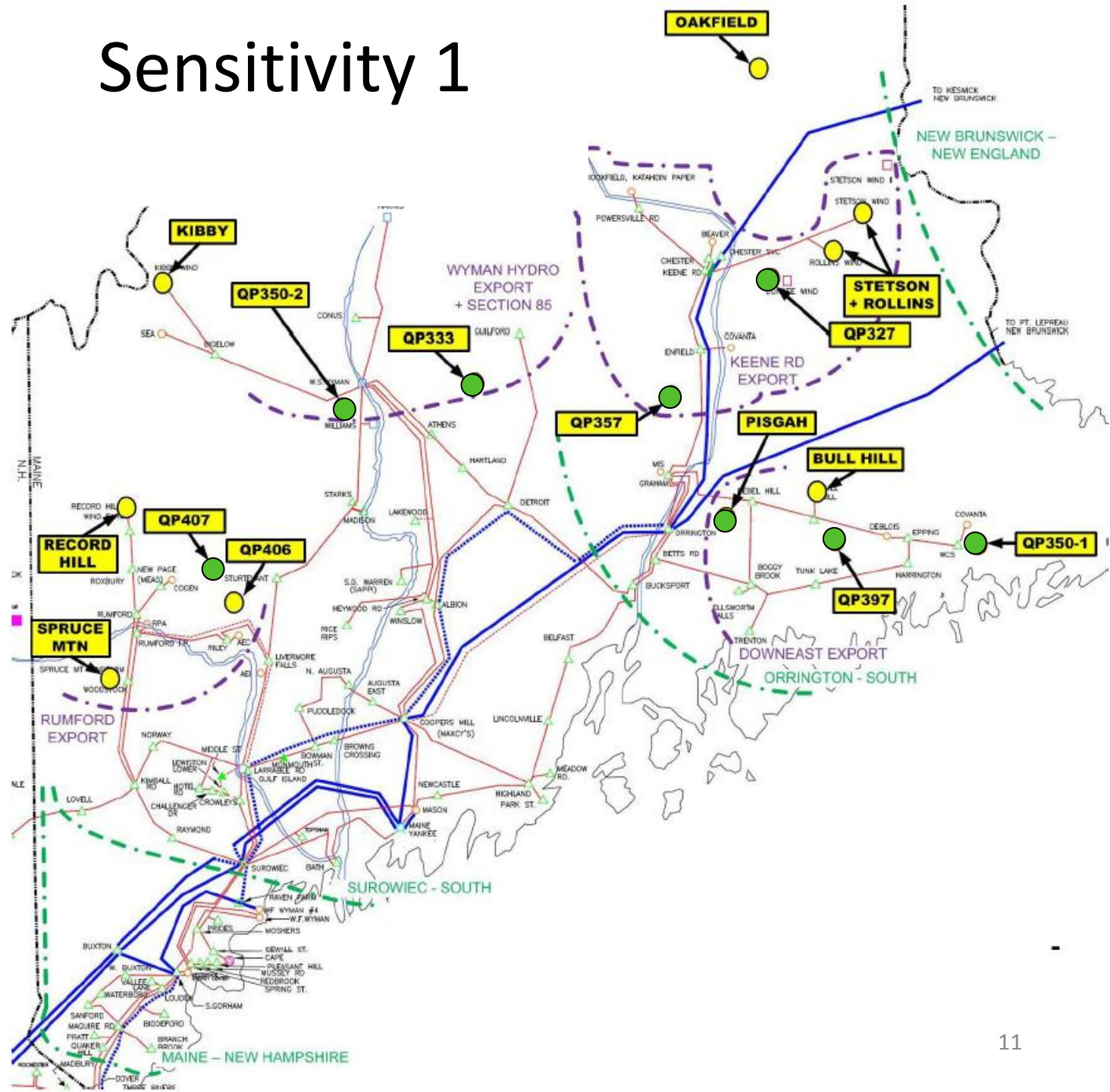
- 275 MW improvement in Orrington-South
- 500 MW improvement in Surowiec-South
- 300 MW improvement in ME-NH

RENEW Economic Study Request

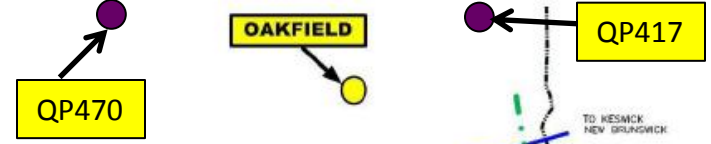
- Evaluate the economic impact of adding the identified upgrades that are not already part of the RSP
- The base case would use the same generation assumptions as the STA-WI and evaluate the system with and without the new transmission
- Two sensitivities would evaluate the impact with less/more wind development

Sensitivity 1

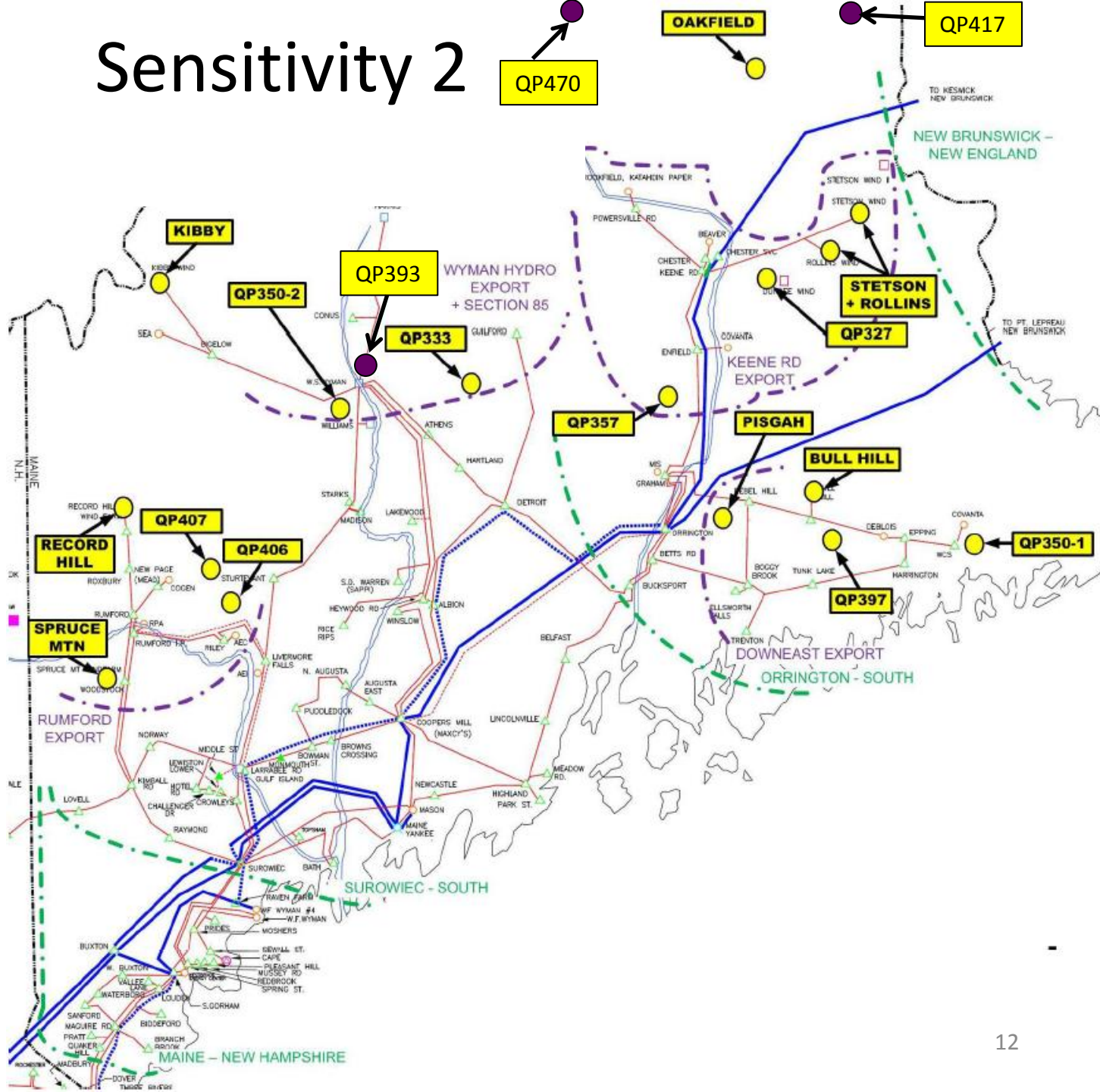
- Exclude those wind farms that were neither operational nor under construction as of April 1, 2015
- These projects are shown here in green
- Excludes 522 MW from STI-WI base case



Sensitivity 2



- Include all wind from STI-WI plus three representative large projects in the queue
- Shown here in purple in their approximate location
- Additional 934 MW



Economic Metrics

- Regional production costs
- Load Serving Entity (LSE) Energy Expense, broken down by zone
- Average zonal LMP
- LMPs at select locations
- Unhedged congestion costs
- Revenue to resources by type
- FCM CONE and Net CONE
- Capacity Load Obligation Charges
- Cost of supplying total operating reserve
- Cumulative net present value of the reduction in total costs to supply the system load resulting from the STA upgrades, reported annually over a ten year study period

System Condition Metrics

- Transmission System Metrics
 - Interface MW flows
 - Percent of time interface at limit
- Fuel consumption,
 - Gas consumption of electric generating units
 - Fuel oil inventories (and rates of depletion during high utilization periods)
 - Coal inventories (and rates of depletion)
- Emissions
 - CO₂
 - NO_x
 - SO₂
 - Ozone and non-ozone season emissions will be extracted

Cost Metrics

- We also request ISO-NE develop a high level cost estimate for the transmission upgrades identified in the STA-WI Study that are not already part of the RSP
 - The net present value of the carrying cost of these upgrades should also be reported (using a ten year study period)
- Any economic benefits may then be weighed against the costs.

Assumptions

- Additional detail about the request and assumptions is contained in the request document posted with the meeting materials.