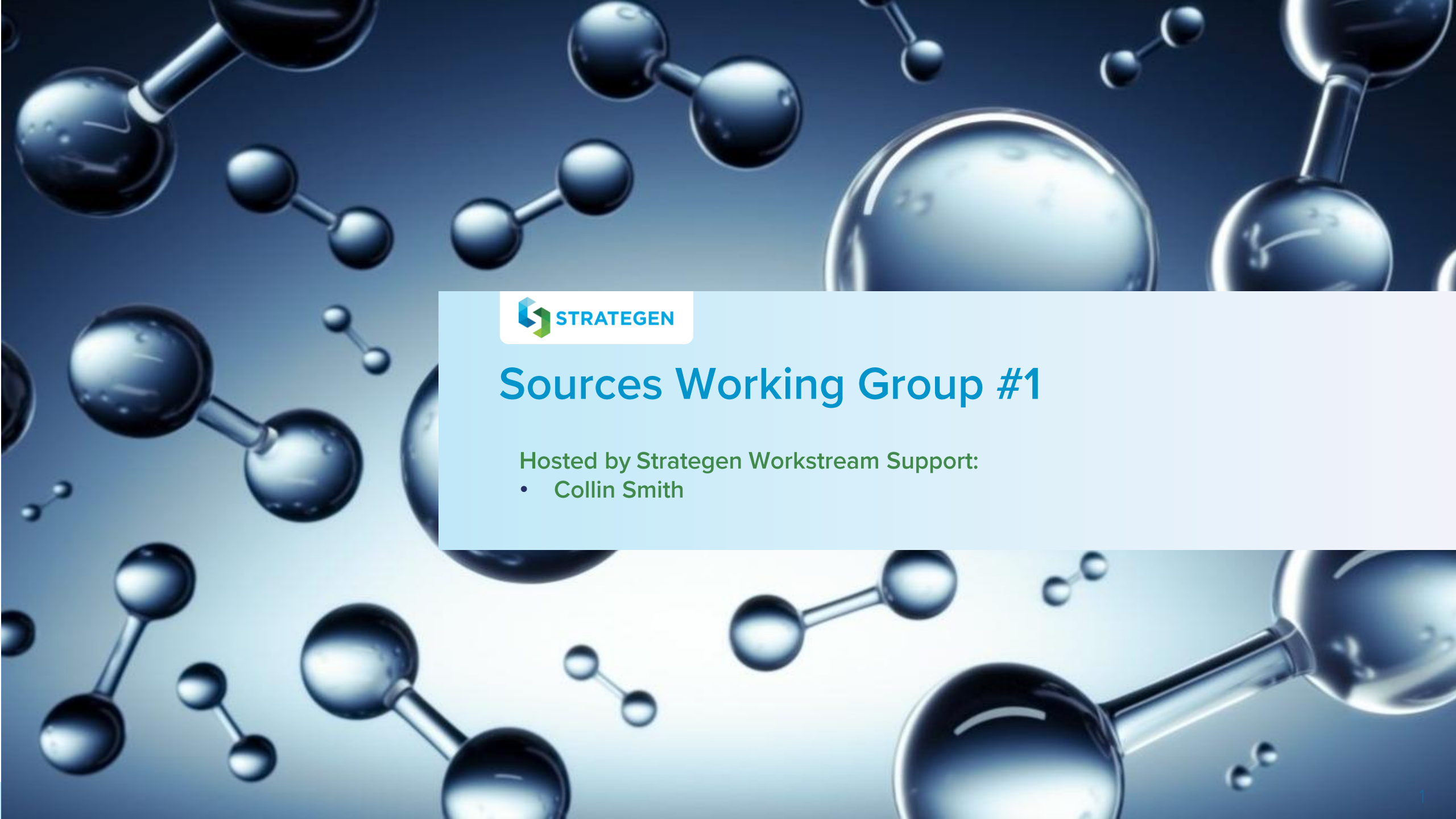


Sources Working Group #1

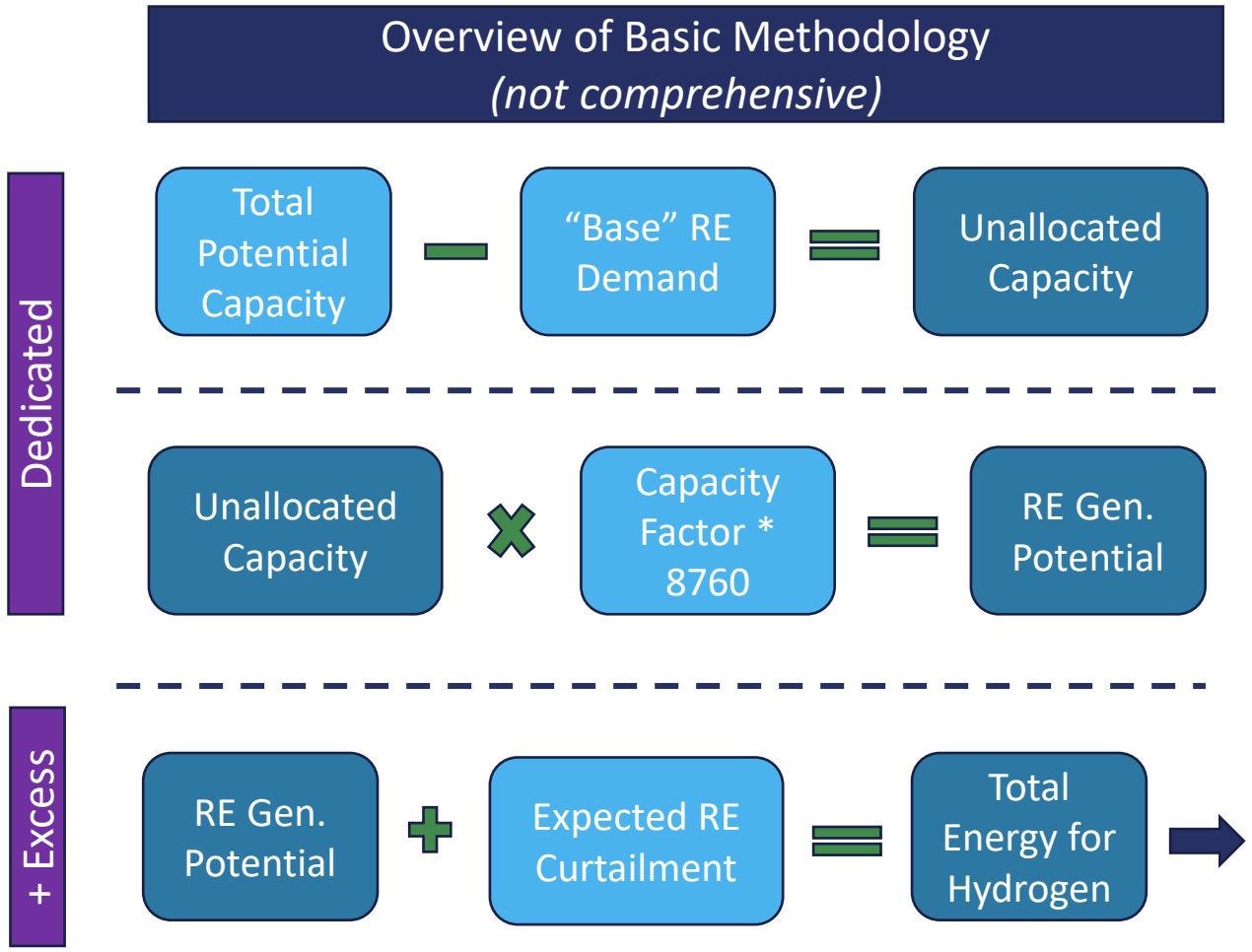
Hosted by Strategen Workstream Support:

- Collin Smith

Agenda

Overview and Introductions	10 min
Review of Working Group Charter and Schedule	10 min
Presentation and Discussion of Analytical Methodology and Initial Findings	40 min

Methodology for determining H2 production potential must account for opportunity to use both “dedicated” and “excess” renewable energy



Factor	Description	Source
Total Potential Capacity	Total MW of capacity that can be reasonably be built out for the given resource	NREL
“Base” RE Demand	Amount of renewable energy needed for basic decarbonization needs	DEEP
Average Capacity Factor	Average rate at which MW of production capacity can be converted to MWh of energy generation in CT	NREL, DEEP
Expected RE Curtailment	Percent of annual energy generation expected to be curtailed that could be diverted to H2 production	DEEP
Technical Hydrogen Production Potential	Expected H2 production based on available energy and energy required to produce 1 kg of hydrogen	Conversion

DEEP's Decarbonization IRP provides several scenarios to evaluate "Base" Renewable Energy Demand for decarbonization

Gross Load Case	Resource Portfolio Scenario		Summary
Base	BR	Reference	Business-as-usual; assumes continuation of existing, "known and knowable" energy policies
	BB	Balanced Blend	Deploys least cost resources to meet the 100% Zero Carbon Target assuming Millstone retires
	BS	BTM Solar PV Emphasis	Assumes an increased amount of behind the meter (BTM) solar is deployed, then deploys least cost resources to meet the 100% Zero Carbon Target
	BM	Millstone Extension	Assumes Millstone continues operating beyond 2029 (the end of Connecticut's current contract) and then deploys least cost resources to meet the 100% Zero Carbon Target
	BT	No Transmission Constraint	Eliminates transmission constraints, then deploys least cost resources to meet the 100% Zero Carbon Target
Electrification	ER	Reference	Business-as-usual; assumes continuation of existing, "known and knowable" energy policies
	EB	Balanced Blend	Deploys least cost resources to meet the 100% Zero Carbon Target assuming Millstone retires
	ES	BTM Solar PV Emphasis	Assumes an increased amount of BTM solar is deployed, then deploys least cost resources to meet the 100% Zero Carbon Target
	EM	Millstone Extension	Assumes Millstone continues operating beyond 2029 (the end of Connecticut's current contract) and then deploys least cost resources to meet the 100% Zero Carbon Target
	ET	No Transmission Constraint	Eliminates transmission constraints, then deploys least cost resources to meet the 100% Zero Carbon Target

→ **Primary scenario**

→ *Potential scenario*

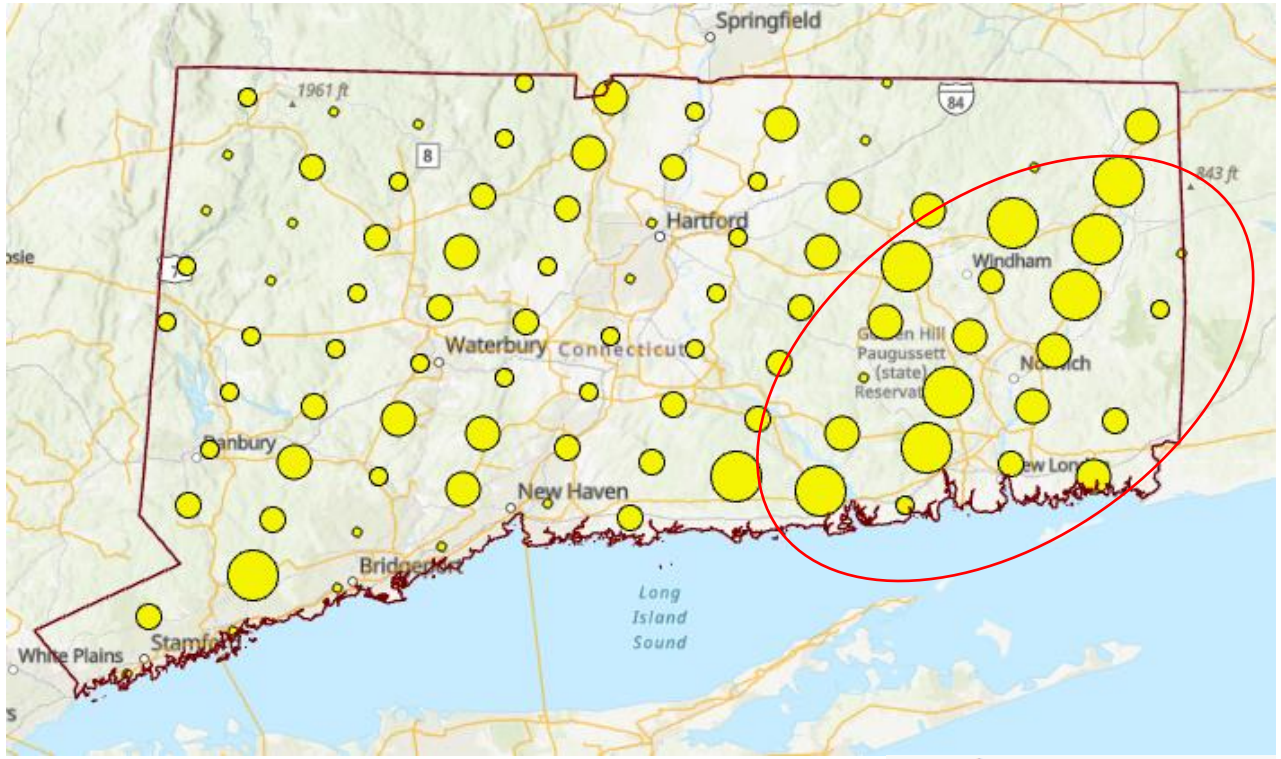
→ *Potential scenario*

→ *Potential scenario*

Sample Calculation: 2040 production potential from "excess" renewable energy (based on "Balanced Blend" scenario)	
Incremental Solar Capacity	3,316 MW
Incremental Onshore Wind Capacity	352 MW
Incremental Offshore Wind Capacity	3,745 MW
Regional Curtailment Rate	6.8%
H2 Production Potential	**30 kt**

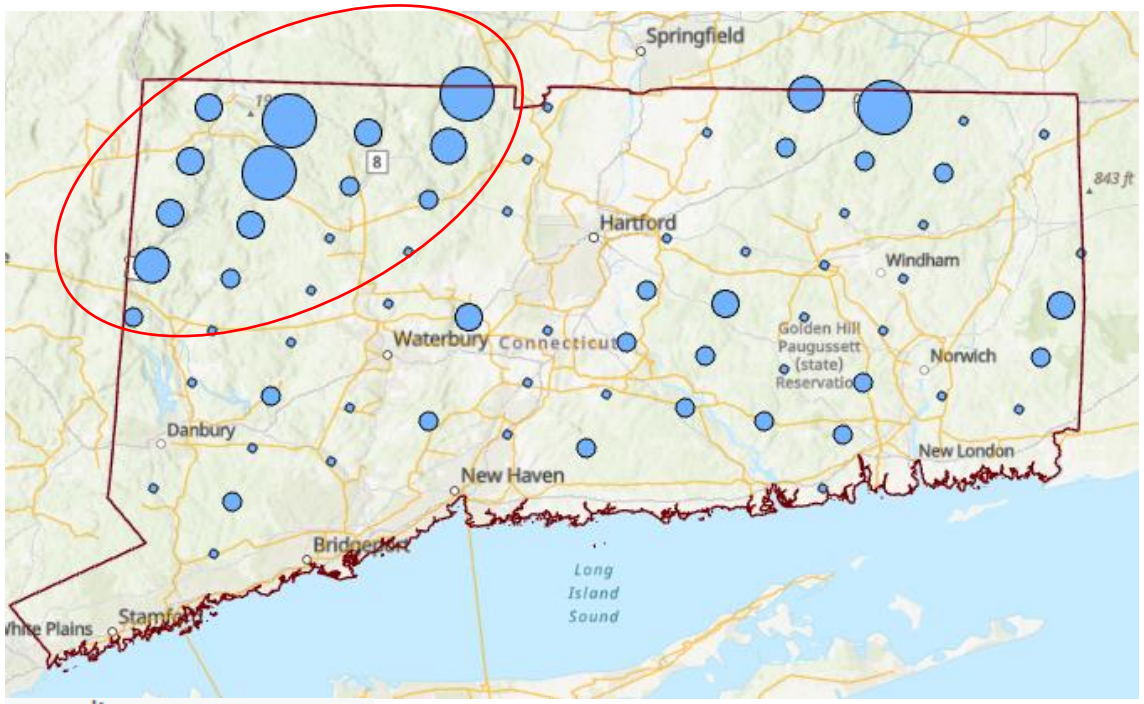
Some potential to produce H2 from solar, particularly in southeast CT

2040 production potential from solar (based on "Balanced Blend" scenario)	
Total Potential Capacity	27,854 MW
Incremental Solar Capacity *(i.e. "Base RE Demand)*	3,316 MW
Unallocated Capacity	24,538 MW
Average Capacity Factor	16.7%
H2 Production Potential	**695 kt**



Orange lines indicated major electrical transmission infrastructure

H2 production from onshore wind is limited by resource constraints



capacity_mw
- 0.024300 - 0.583200
- 0.583201 - 1.676700
- 1.676701 - 3.596400
- 3.596401 - 6.731100
- 6.731101 - 13.753800

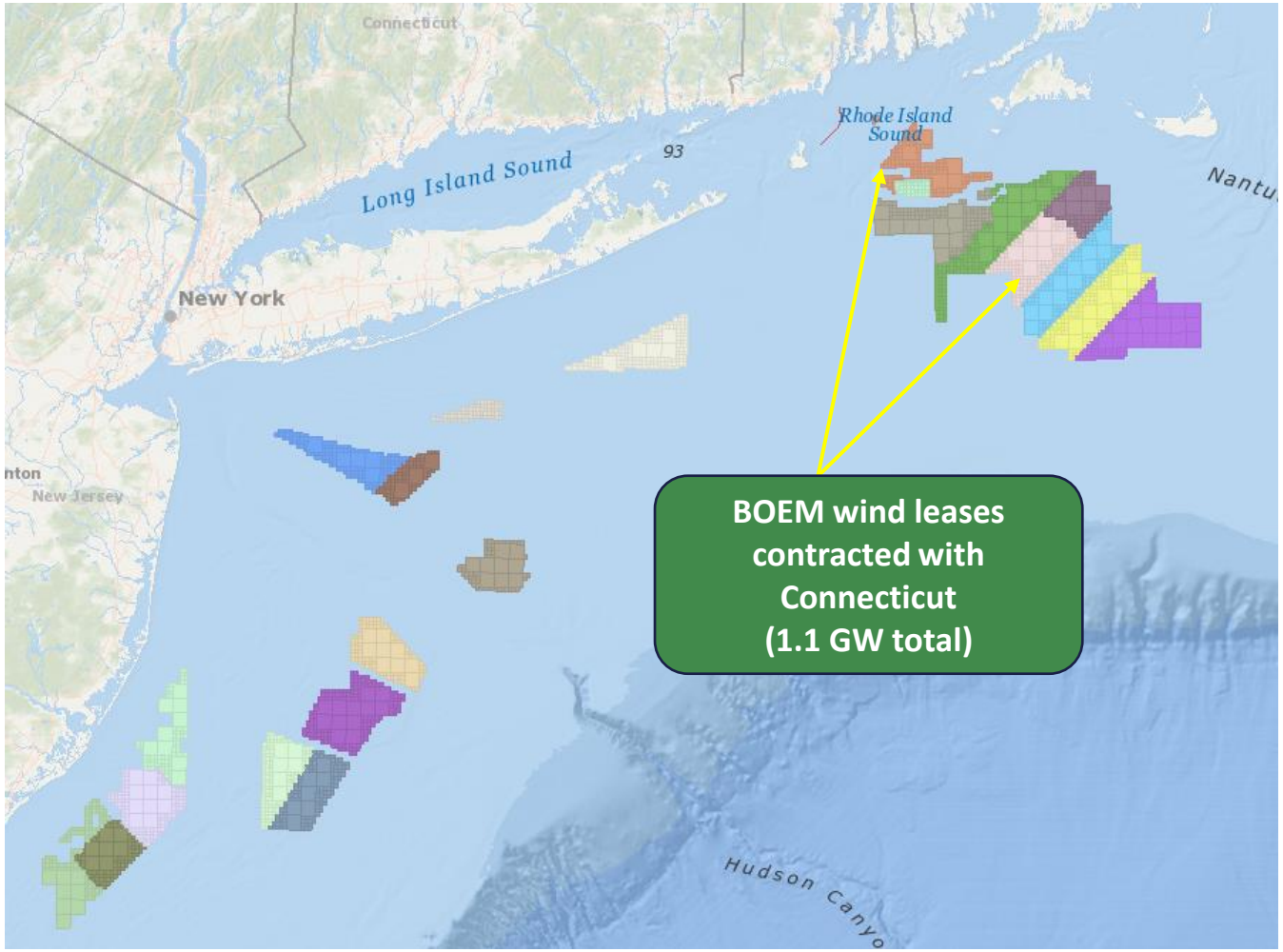
Orange lines indicated major electrical transmission infrastructure

Under a "limited" scenario view, onshore wind resource is already fully committed across most decarbonization scenarios

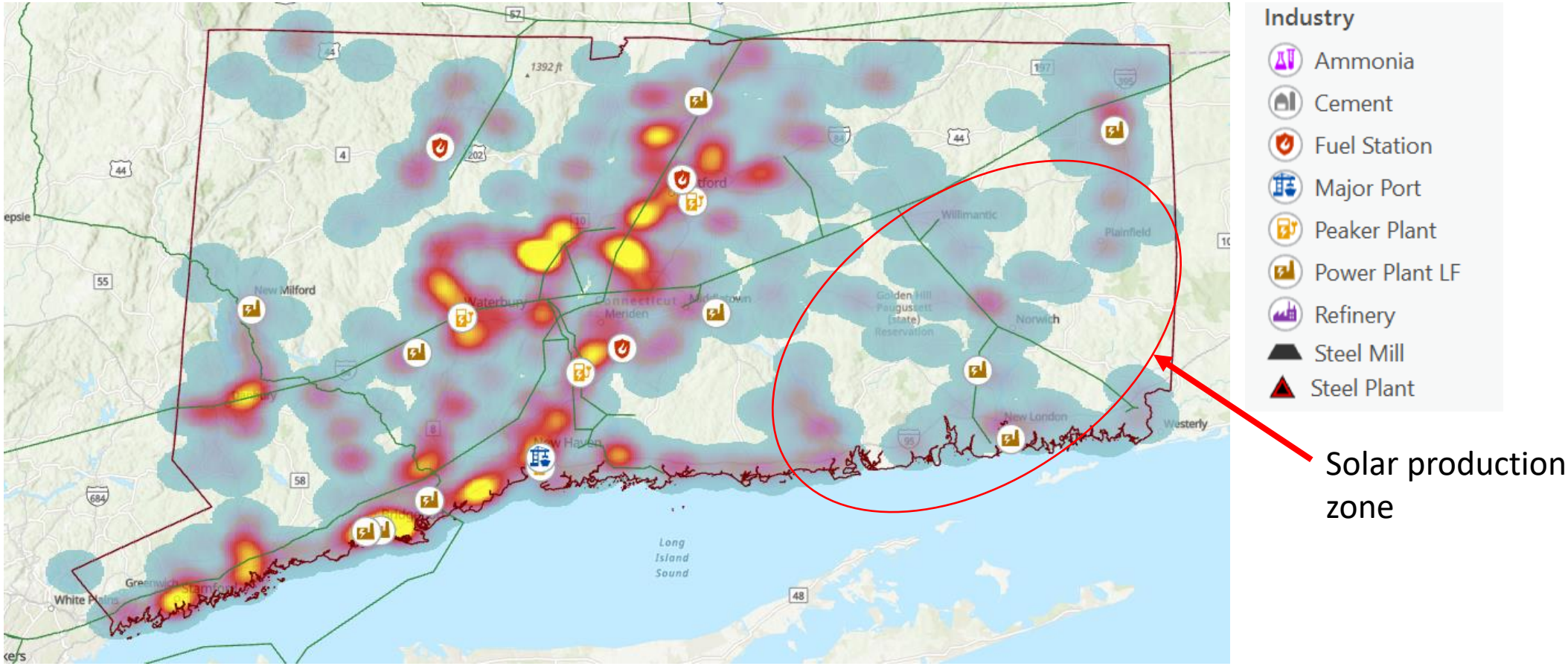
Offshore wind potential is driven by coastal lease areas that become available for development

Offshore wind resource is significant, but potentially limited by:

- **Number and location of lease areas**
- **Opportunities for direct connection to CT-based hydrogen production**



Offtaker locations match up well with gas infrastructure but not necessarily renewable energy production zones

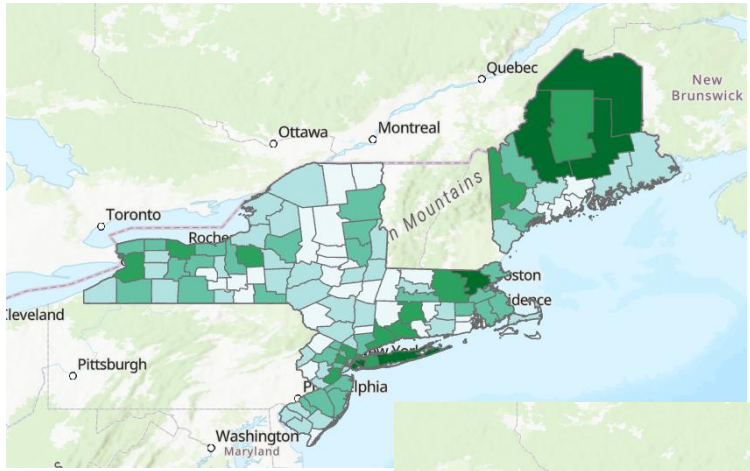


Green lines indicate gas transmission pipelines. Red/yellow heat map indicates presence of smaller manufacturing facilities

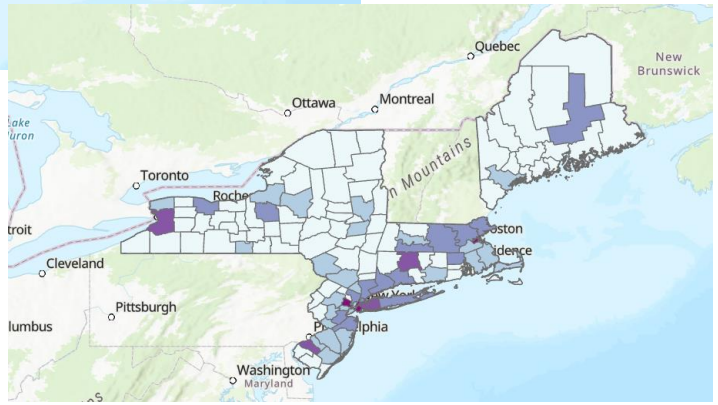
Future analysis can consider other potential energy sources for hydrogen production

Potential Energy Sources	Potential Restrictions
Nuclear	Usage rates of existing in-state nuclear plants
Biomass	Supply and competing uses
Biomethane	Supply and competing uses, possibly definition of clean hydrogen

Biomass



Biomethane



Discussion Questions

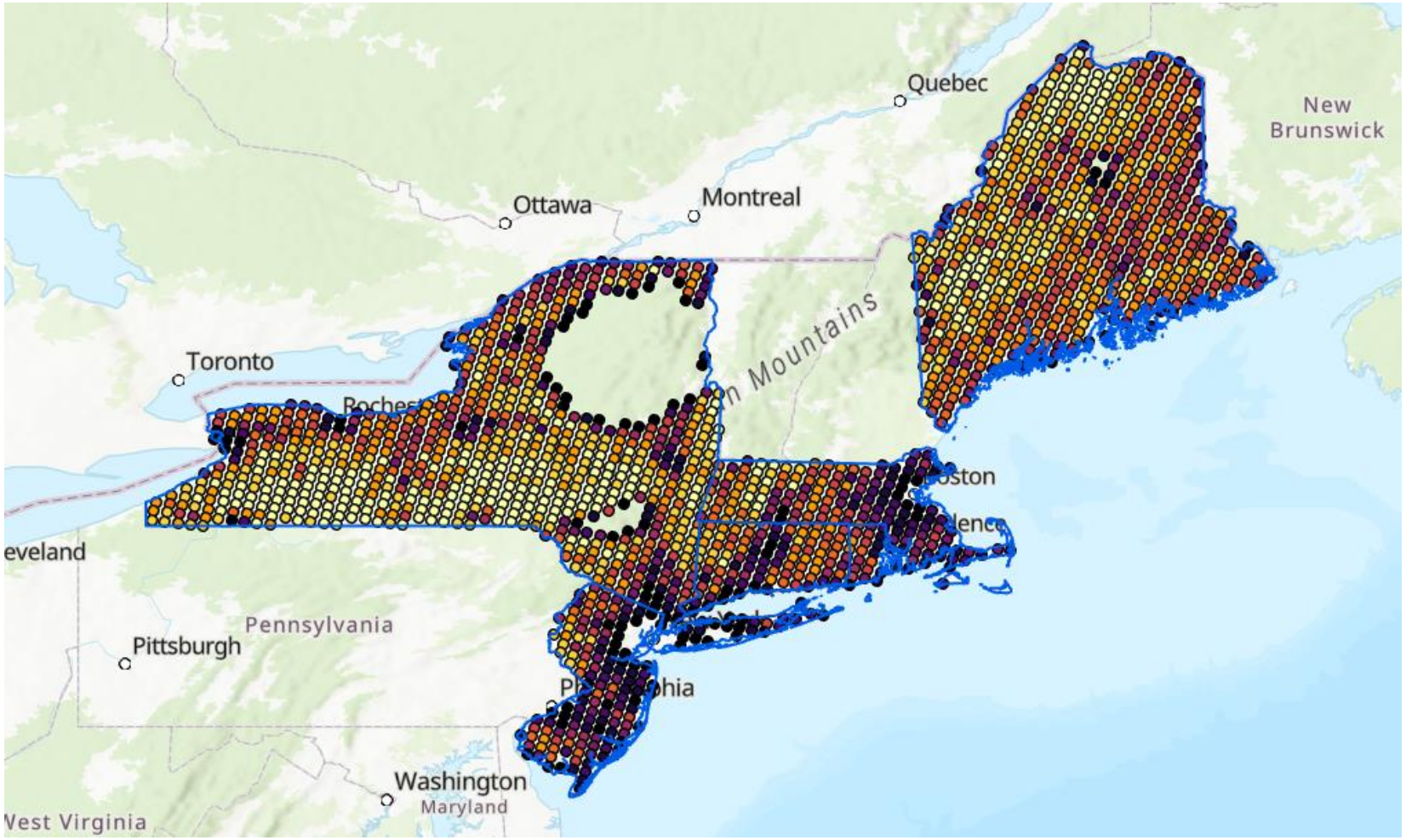
+ **How can the methodology presented here be refined to provide better insights?**
+ **What are the most useful scenarios from the DEEP IRP to investigate?**
+ **What sources could we reference to refine this analysis?**
  - Connecticut-specific curtailment rates
  - Nuclear plant capacity factors in 2040
+ **How restricted should we assume land is for renewable energy development?**
+ **What's the best way for offshore wind to be incorporated into hydrogen production? (e.g. dedicated resource or source of curtailed energy)?**
+ **What energy feedstocks should we prioritize for hydrogen production?**

Appendix

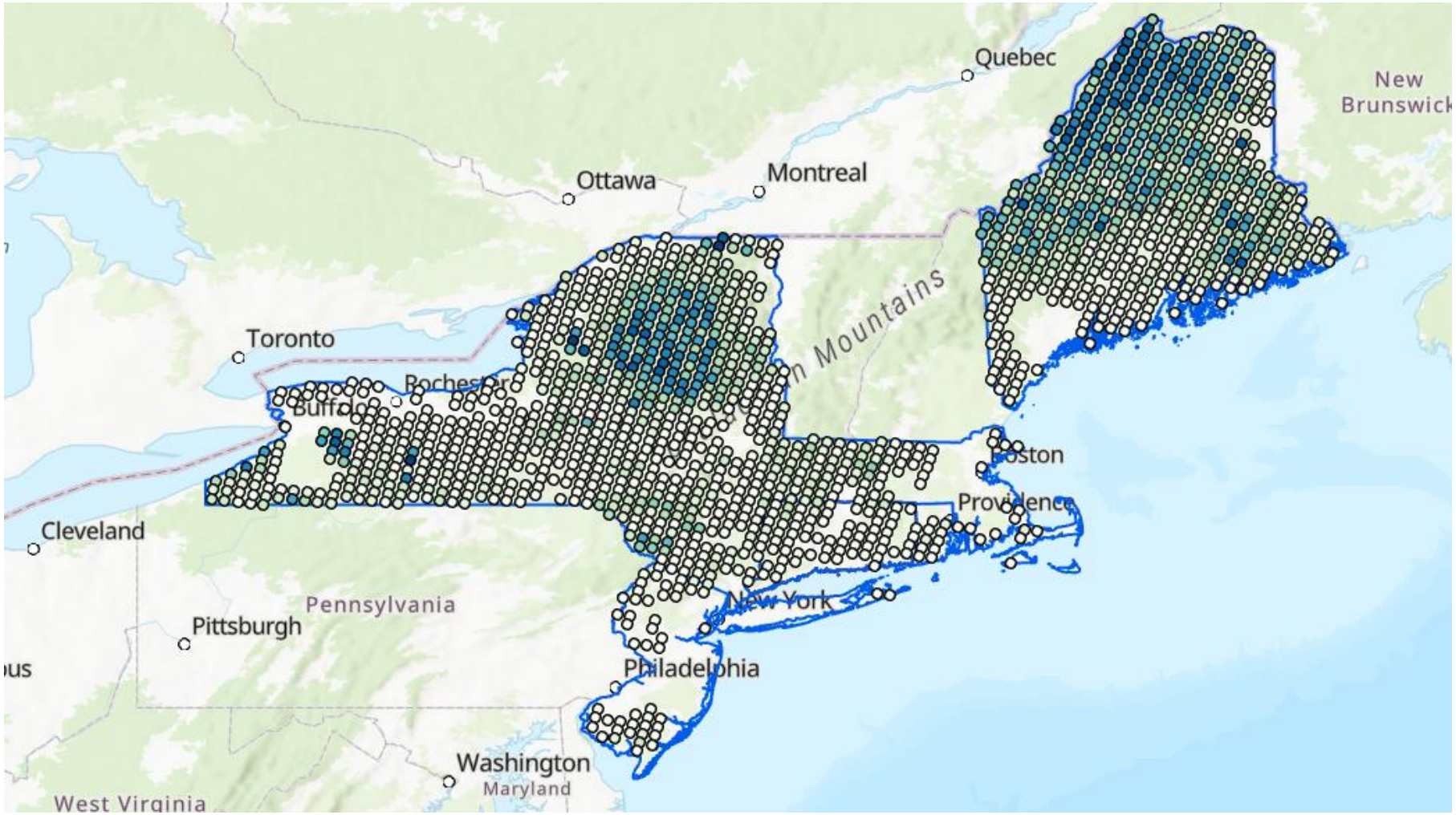
Initial estimate of H2 supply potential can be developed from available renewable energy capacity and expected curtailment rates

Factor	Description	Source	Comments
Total Potential Capacity	Total MW capacity that can be reasonably be built out for the given resource	NREL Renewable Energy Supply Curves ("Limited" setting)	*"Limited" setting tests the most conservative land availability assumptions*
Unallocated Capacity	Total Potential Capacity minus capacity that is assumed to be installed for "base" renewable energy demand	DEEP Decarbonization IRP (dependent on scenario)	*Uses assumption around renewable energy needed for other purposes*
Average Capacity Factor	Average rate at which MW of production capacity can be converted to MWh of energy generation in CT	NREL Renewable Energy Supply Curves	*Multiplied by Unallocated Capacity to calculate energy generation potential*
Expected Curtailment Rate	Percent of annual energy generation expected to be curtailed that could be diverted to H2 production	DEEP Decarbonization IRP (dependent on scenario)	*Based on total renewable energy generation in applicable scenario*
H2 Production Potential	Expected H2 production based on available energy and energy required to produce 1 kg of hydrogen	Conversion	

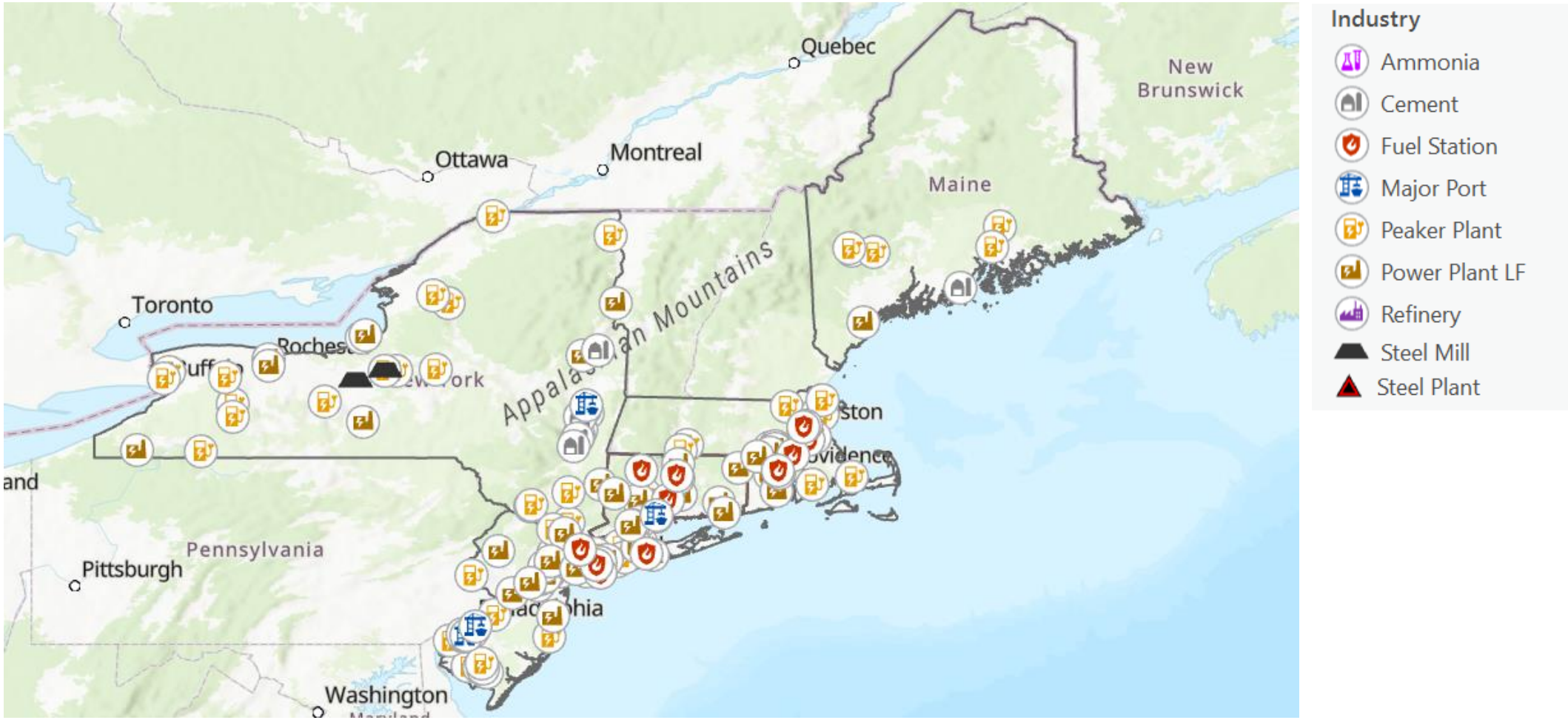
Northeast Regional Hub – Solar Production Potential



Northeast Regional Hub – Wind Production Potential

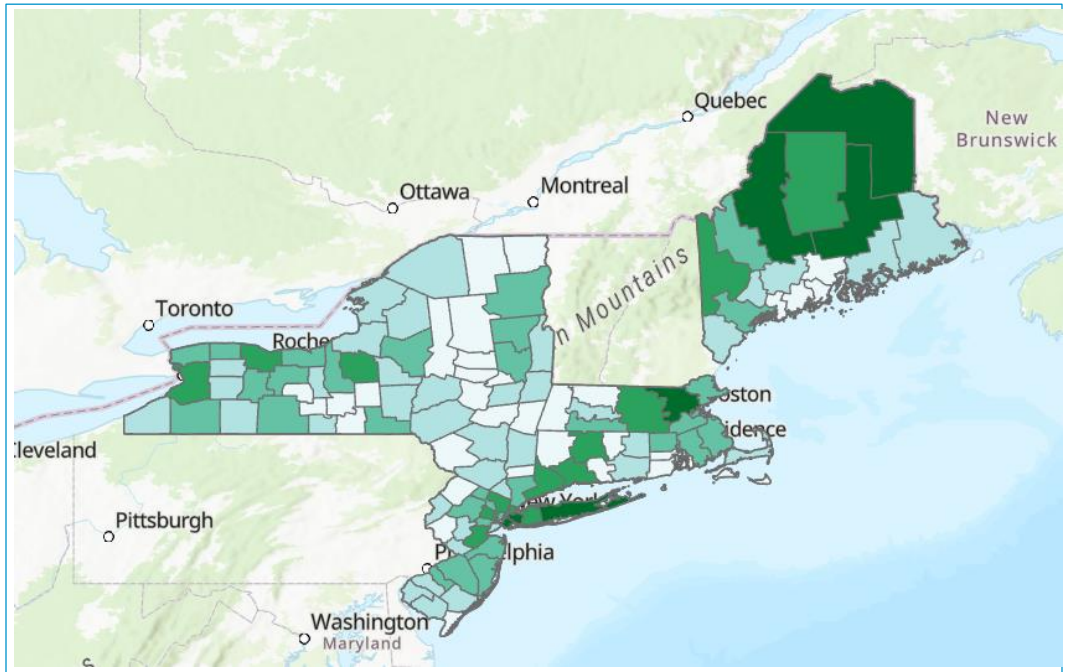


Northeast Regional Hub – Major Offtakers



Biomass and Biomethane Heat Maps

Biomass



Biomethane