



MMWEC Project 2015A

Municipal Ratepayer Briefing

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Agenda

- MMLD & Project Overview – GM 30 minutes
- Questions & comments
 - Mass state elected officials and administrators
 - Local government elected officials and administrators/employees
 - Marblehead electric ratepayers
 - Others



Overview Topics

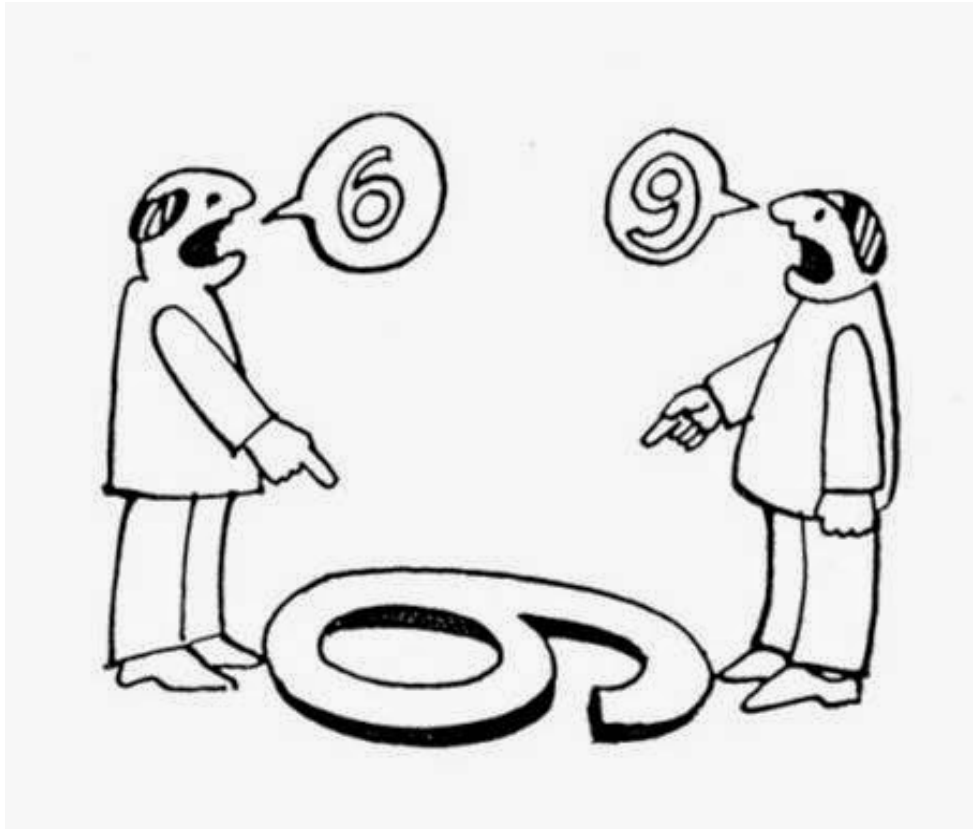
1. Marblehead MLD's power portfolio
2. Marblehead in ISO-NE – NEMA Zone
3. MMWEC and Project 2015A in Peabody
– How does it fit with our mission?
4. Other alternatives considered?
5. Project costs & the costs of shutting down the project now



Project 2015A docs available on the MMLD website

- This presentation
- Link to the MMWEC Project 2015A website
<https://www.project2015a.org>
- Mass 2050 DeCarbonization Roadmap -12/2020
- Mass DEP Final Air Quality Approval – 9/2020
- Project Financing for DPU Bond approval 3/2021
- ISO newswire articles – capacity scarcity 2018
- Commonwealth Magazine op-ed article – 6/2021

This is a six or a nine meeting



Recognize and respect that we will hear more than one point of view



Marblehead Overview & Power Portfolio



Our Mission: Built on Four Pillars

Affordable
Reliable

Environmentally
Safe **Responsible**





Clear Differences - Municipal Light Depts. vs Investor Owned Utilities

Key Distinctions	Municipal Light Dept. (MLD)	Investor Owned Utility (IOU)
Presence in Mass.	41 MLPs -15% of Mass state	3 IOUs -85% of Mass state
Who owns it?	Local townspeople	Private shareholders
Type of Business	Local Gov't - Not for Profit	Private - For Profit
Who sets Prices?	Local MLD	State DPU
<i>Can Own Power Generation?</i>	YES	NO
<i>Can Enter Long-Term Power Agreements?</i>	YES	NO



We Use Multiple Fuels to Generate Electricity

Fuel Source	Carbon Free	Renewable	Fossil Fuels – GHG generating
Nuclear	Yes	No	
Hydro	Yes	Some	
Wind	Yes	Yes	
Solar	Yes	Yes	
Natural Gas			Yes
Oil			Yes
Coal			Yes



2020 Marblehead Energy & Capacity Power Portfolio

Power Resources	2020 Energy Supplied		Capacity Supplied	
	MWh	%	MW	%
Millstone	13,935	14%	1.9	5%
Seabrook	13,324	13%	1.7	4%
NYPA	10,122	10%	1.3	3%
Berkshire Wind 1	2,671	3%	0.1	0%
Stony Brook Intermediate	2,551	3%	8.2	20%
Hancock Wind	2,483	2%	-	0%
Berkshire Wind 2	2,198	2%	-	0%
Eagle Creek Hydro	1,682	2%	-	0%
Hydro Quebec	1,099	1%	0.8	2%
Marblehead Wilkins Plant	28	0%	5.0	12%
Stony Brook Peaking	24	0%	2.1	5%
Wyman 4	-	0%	-	0%
Project 2015A	-	0%	-	0%
Project 2020A	-	0%	-	0%
Bi-lateral Contracts	37,159	37%	5.4	13%
Interchange/Spot Power	13,349	13%	15.5	37%
	100,625	100%	42.0	100%



Mass Climate Bill - signed Mar 26, 2021

“Next Generation Roadmap for Mass Climate Policy”

MLP min greenhouse gas (GHG) emissions standards*

- 2030 50% of MMLD sales from non-carbon emitting energy plants
- 2040 75% of MMLD sales from non-carbon emitting energy plants
- 2050 net zero emissions (up to 15% carbon-emitting, with equal offset)

* *adopted as proposed by the Municipal Electric Assn. of Mass (MEAM)*



2020 Carbon-Free Energy Resources

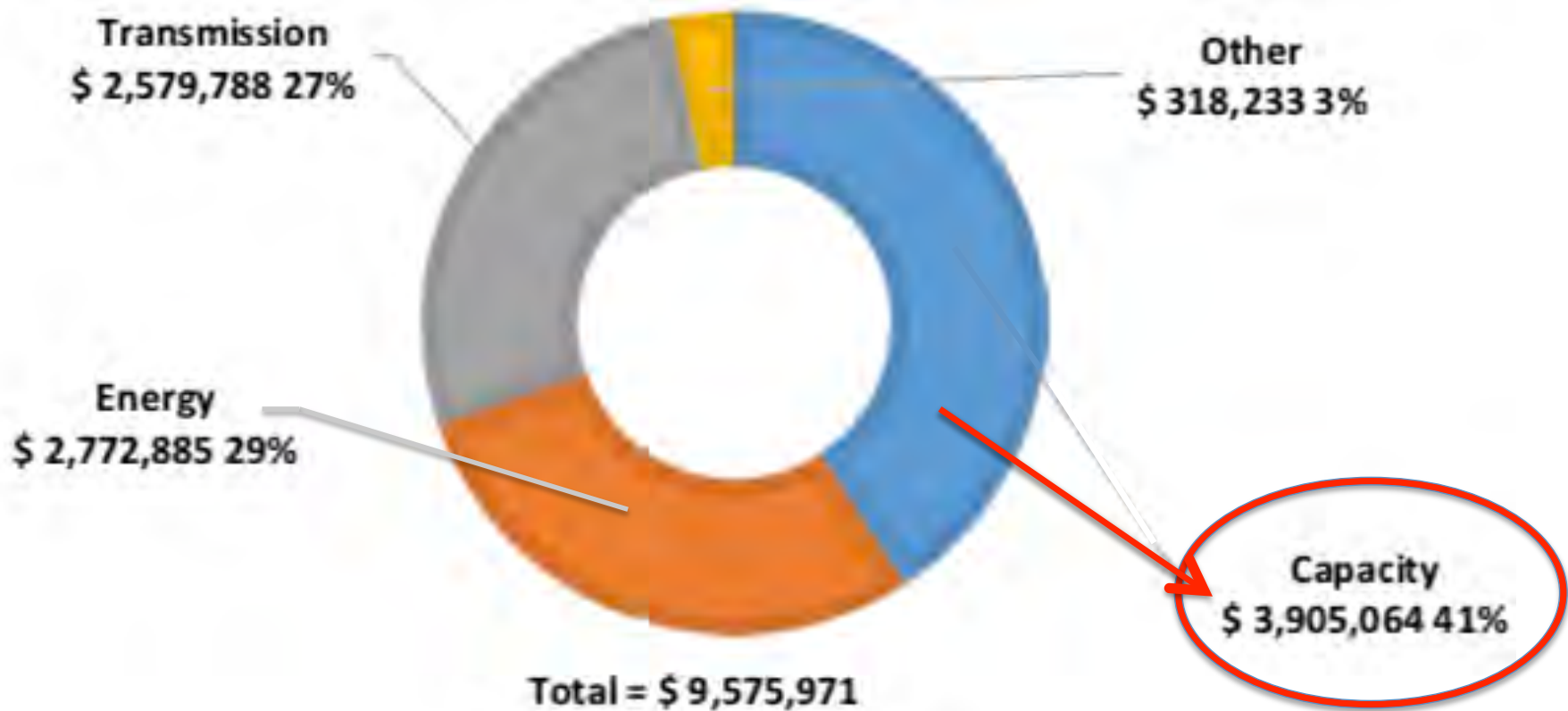
	Non-Carbon Energy Supplied to Mhd (MWh)	2020 RECs retired by or credited to MMLD*	2020 RECs sold by MMLD in 2020	Energy-Only Purchases without RECs
Non-Carbon Power Generators				
Millstone 3	13,935	13,935		
Seabrook	13,324	13,324		
New York Power Authority	10,122	10,122		
Hydro Quebec	1,099	1,099		
Berkshire Wind 1	2,671		2,671	
Berkshire Wind 2	2,198		2,198	
Hancock Wind	2,483			2,483
Eagle Creek Hydro	1,682			1,682
MLP Solar Rebate Program	34	34		
Non-Carbon Supply Total	47,548	38,480	4,869	4,165
<i>2020 MMLD Electrical Sales</i>	100,625	100,625	100,625	100,625
<i>Non-Carbon % of Sales</i>	47%	38%	5%	4%

* Note: This is the applicable % for calculating annual performance vs Mass Climate Law goals:



Capacity is the Largest Cost Component in MMLD's 2020 Wholesale Power Cost

MMLD 2020 Actuals

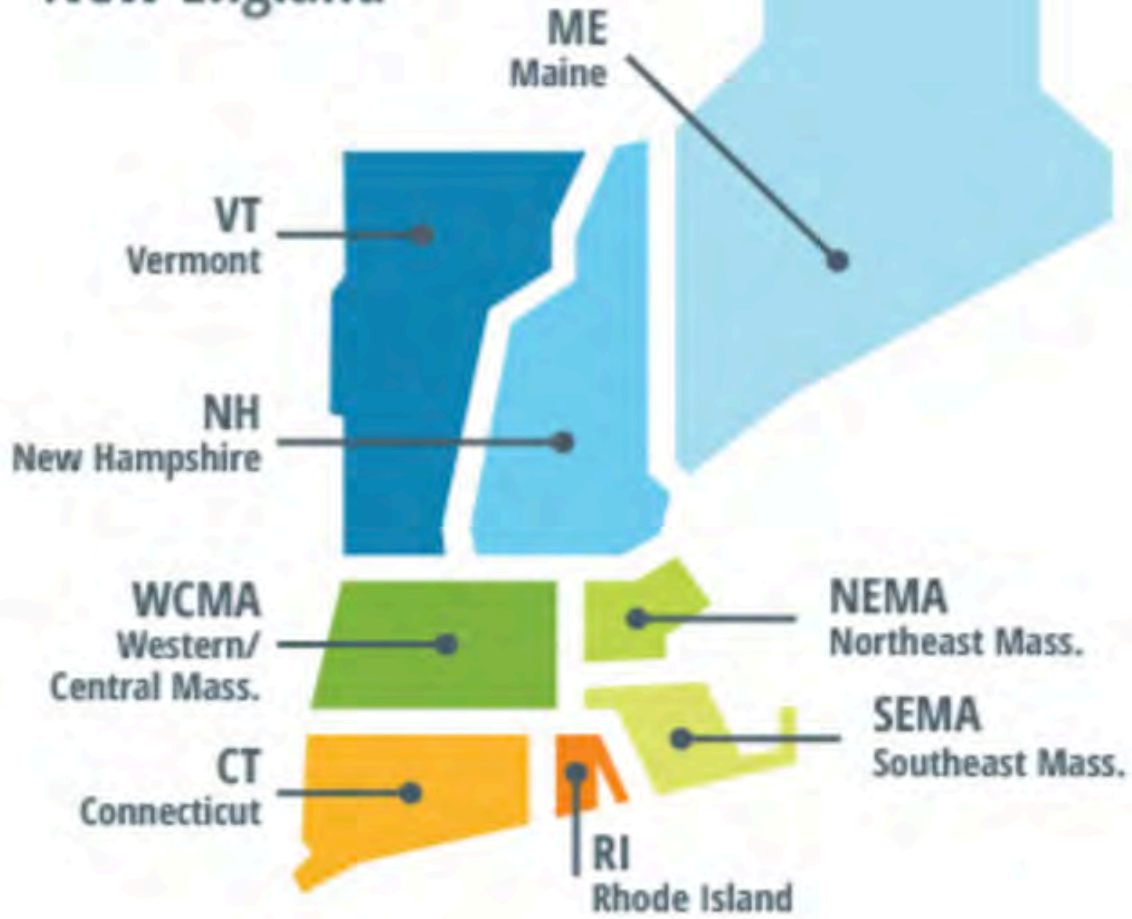




Marblehead in ISO-NE NEMA Zone



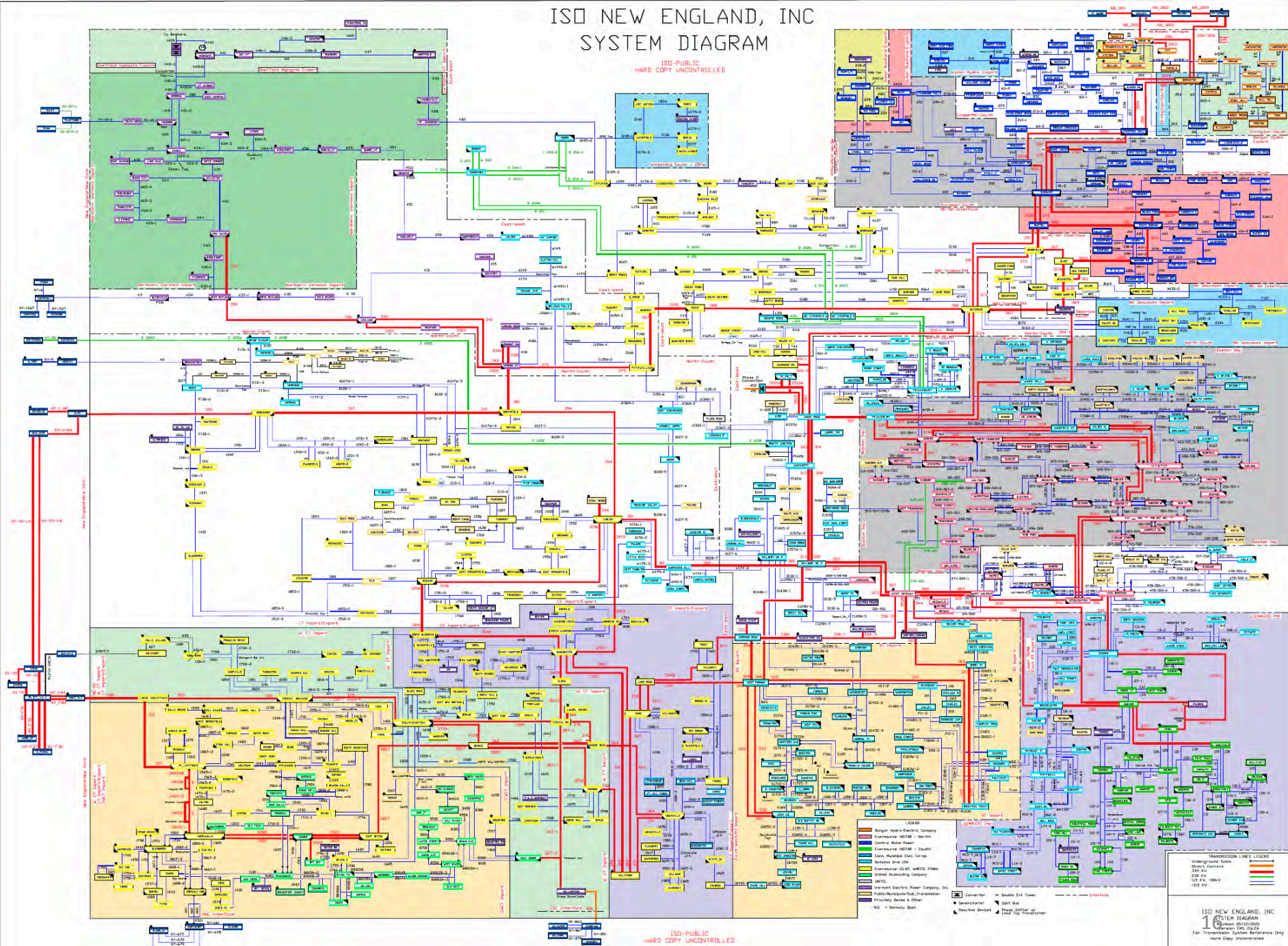
Wholesale Load Zones in New England



Source: ISO New England

ISO NEW ENGLAND, INC SYSTEM DIAGRAM

ISO-PUBLIC
HARD COPY UNCONTROLLED



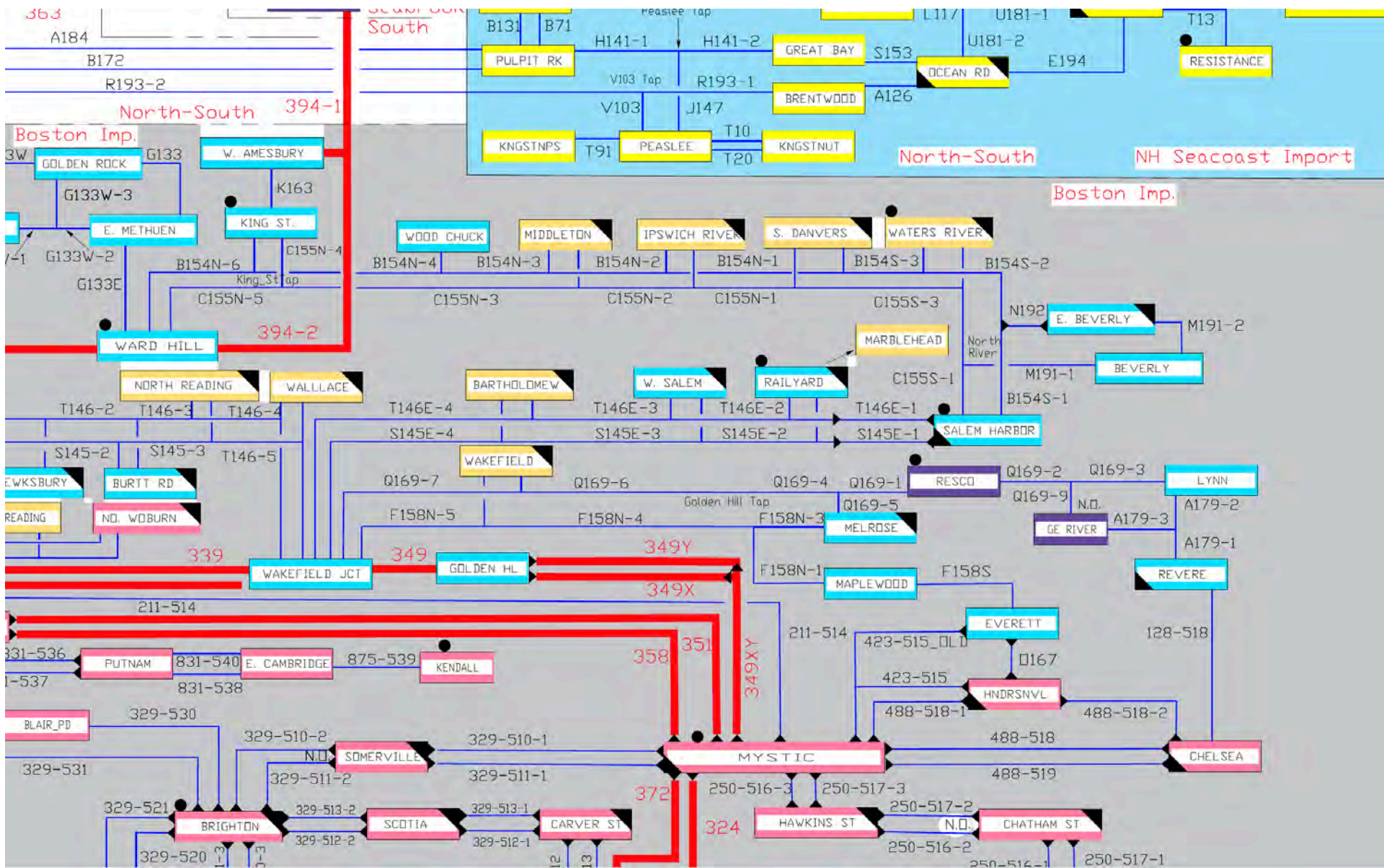
LEGEND

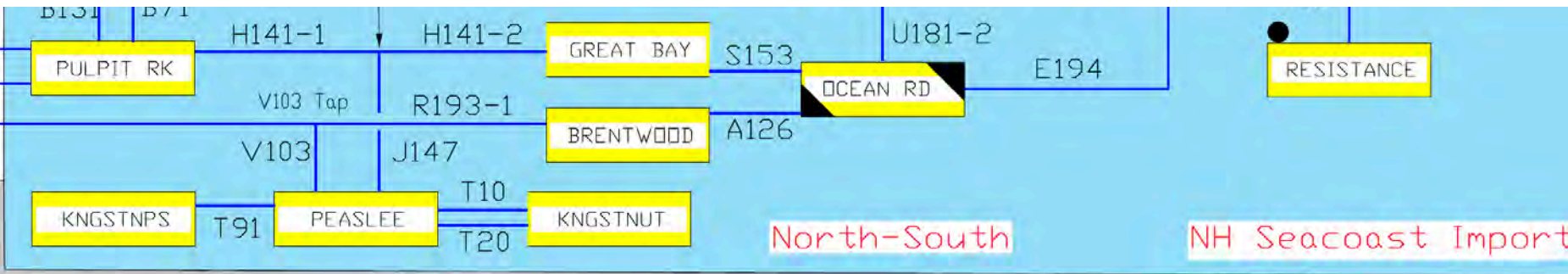
- Orange: Bangor Hydro-Electric Company
- Green: Connecticut NEEL - Nertco
- Blue: Connecticut NEEL - Sudds
- Yellow: Connecticut NEEL - Sudds
- Red: Connecticut NEEL - Sudds
- Light Blue: Connecticut NEEL - Sudds
- Dark Blue: Connecticut NEEL - Sudds
- Light Green: Connecticut NEEL - Sudds
- Dark Green: Connecticut NEEL - Sudds
- Light Purple: Connecticut NEEL - Sudds
- Dark Purple: Connecticut NEEL - Sudds
- Light Yellow: Connecticut NEEL - Sudds
- Dark Yellow: Connecticut NEEL - Sudds
- Light Orange: Connecticut NEEL - Sudds
- Dark Orange: Connecticut NEEL - Sudds
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- Light Blue-Gray: Connecticut NEEL - Sudds
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- Dark Red-Gray: Connecticut NEEL - Sudds

SYMBOLS

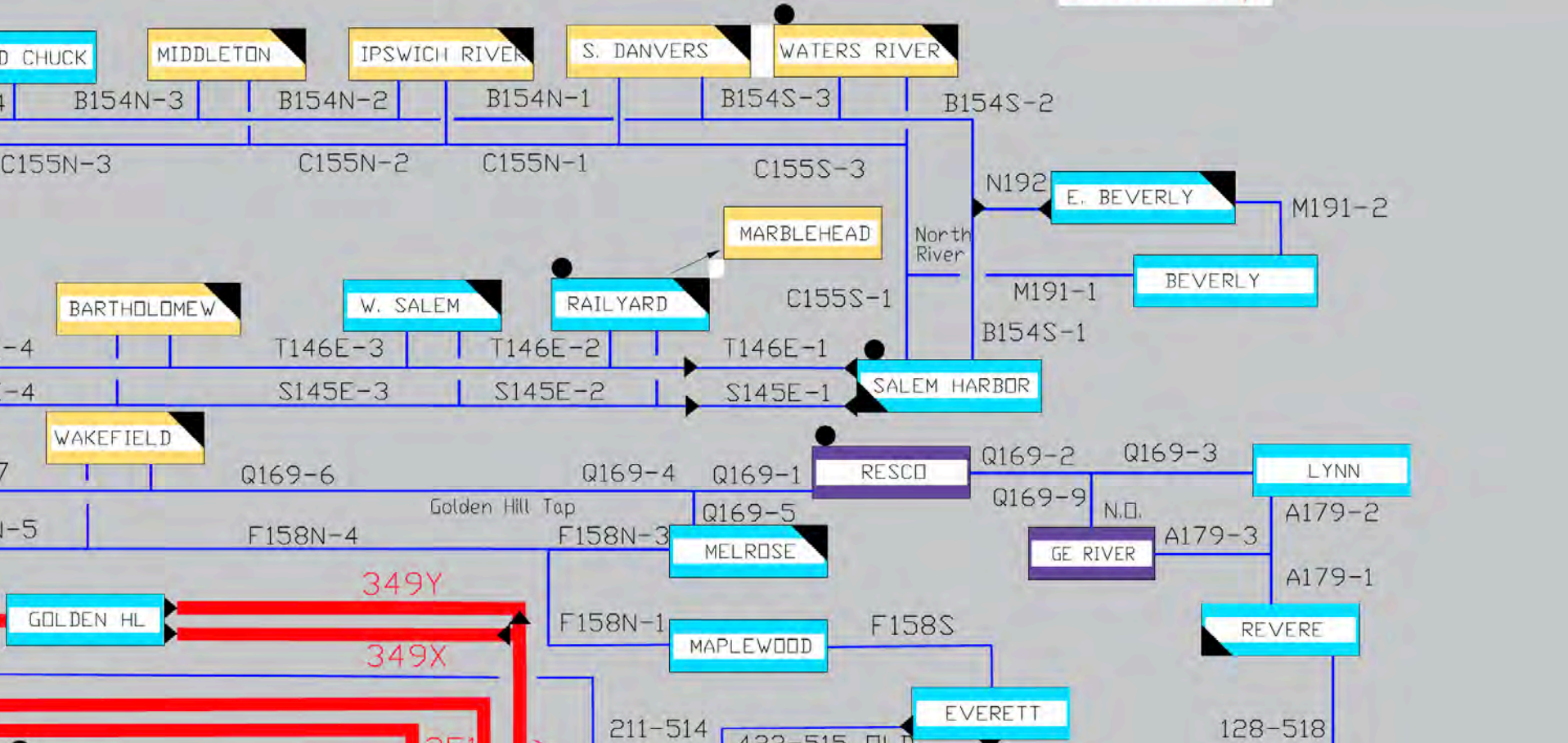
- Circle with 'C': Converter
- Circle with 'T': Transformer
- Circle with 'S': Substation
- Circle with 'B': Busbar
- Circle with 'L': Line
- Circle with 'R': Reactor
- Circle with 'D': Dam
- Circle with 'H': Hydro
- Circle with 'N': Nuclear
- Circle with 'G': Gas
- Circle with 'C': Coal
- Circle with 'O': Oil
- Circle with 'S': Solar
- Circle with 'W': Wind
- Circle with 'G': Geothermal
- Circle with 'B': Biomass
- Circle with 'H': Hydrogen
- Circle with 'F': Fuel Cell
- Circle with 'P': Piezoelectric
- Circle with 'M': Magnetohydrodynamic
- Circle with 'T': Thermoelectric
- Circle with 'E': Electrochemical
- Circle with 'S': Supercapacitor
- Circle with 'B': Battery
- Circle with 'C': Capacitor
- Circle with 'I': Inductor
- Circle with 'R': Resistor
- Circle with 'D': Diode
- Circle with 'T': Transistor
- Circle with 'M': Motor
- Circle with 'G': Generator
- Circle with 'A': Amplifier
- Circle with 'O': Oscillator
- Circle with 'M': Modulator
- Circle with 'D': Demodulator
- Circle with 'F': Filter
- Circle with 'S': Switch
- Circle with 'C': Control
- Circle with 'P': Protection
- Circle with 'M': Measurement
- Circle with 'S': Signaling
- Circle with 'C': Communication
- Circle with 'D': Data
- Circle with 'M': Management
- Circle with 'I': Information
- Circle with 'S': Security
- Circle with 'A': Access
- Circle with 'C': Configuration
- Circle with 'M': Maintenance
- Circle with 'R': Repair
- Circle with 'D': Diagnosis
- Circle with 'T': Treatment
- Circle with 'P': Prevention
- Circle with 'M': Monitoring
- Circle with 'C': Control
- Circle with 'S': Supervision
- Circle with 'D': Dispatch
- Circle with 'M': Management
- Circle with 'I': Information
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- Circle with 'D': Dispatch

ISO NEW ENGLAND, INC
16
For Transmission System Reference Only
Hard Copy Uncontrolled





Boston Imp.





MMWEC & Project 2015A in Peabody



MMWEC - Mass Municipal Wholesale Electric Company

- A special purpose non-profit, public corporation and Mass political subdivision, created in 1976. (Chapter 775, Acts of 1975)
- Enterprise-funded by participating Mass MLDs.
- Develops electric power projects for opt-in MLDs and can issue tax-exempt, long term revenue bonds. \$5 Billion issued to date
- Created 6 new renewable energy power projects in the last decade - ___ MW capacity
- Developed, financed and/or manages dispatch of 5 utility-scale battery systems in last 6 years



8 MMWEC Power Agreements in Last 10 Years. 90+ MW Carbon Free Power ; All decrease GHG

Facility	Location	Power Source	Power (MW)	ISO Market	Operating License
Berkshire Wind Phase 1	Hancock, MA	Wind	15.0	Energy	2011-open
Eagle Creek Hydro	NH – 6 sites	Hydro	11.56	Energy	2014-2033
Hancock Wind	Ellsworth, ME	Wind	37.5	Energy	2016-2041
Berkshire Wind Phase 2	Hancock, MA	Wind	4.6	Energy	2019-open
Wyman # 4	Yarmouth, ME	Oil		Capacity	(sold in 2019)
Hydro-Quebec	Quebec, CAN	Hydro	15.0	Energy	2020-2025
Project 2015	Peabody, MA	Natural Gas/Oil	55.0	Capacity	2022-
Project 2020A	Ludlow, MA	Solar	6.9	Energy	2022- ²¹

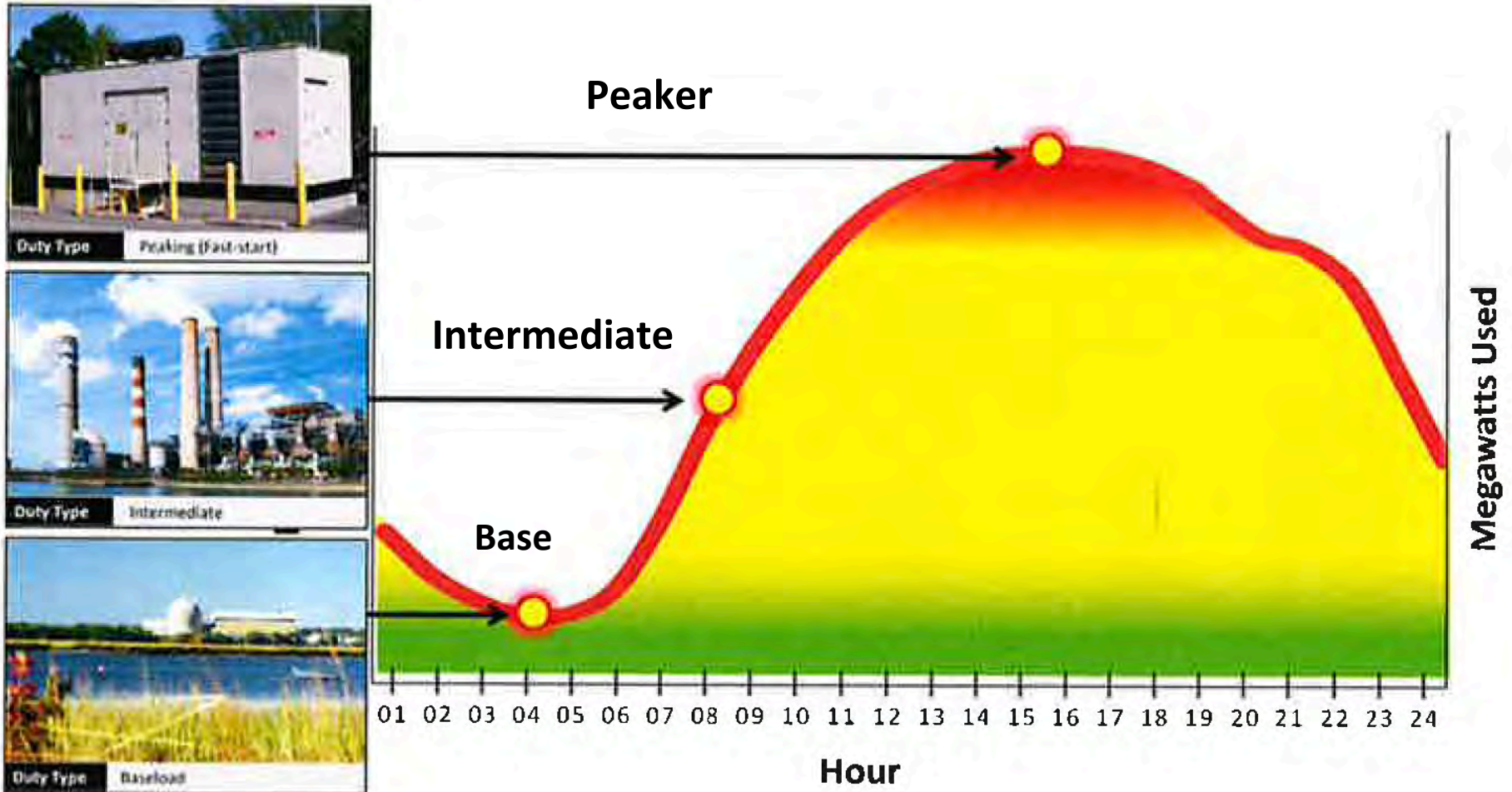


Project 2015A Overview

- A 55 MW low carbon reliability resource to participate in ISO-NE capacity market (not in the energy market)
- To be built on 0.6 acres at the existing Peabody MLP Waters River site
- 14 participating municipal light departments MLDs/MLPs
- A fast-start, dual-fuel (natural gas or oil) plant, with lower GHG emissions than 94% of comparable facilities
- Anticipate low capacity market runtime, 240 hours/year, aligning with Mass 2050 Decarbonization Roadmap
- New, future-proof gas turbine technology, capable of burning green hydrogen
- No impact on participating MLDs Mass Climate Bill clean energy goals for 2030, 2040, 2050



Types of Generators on the Grid





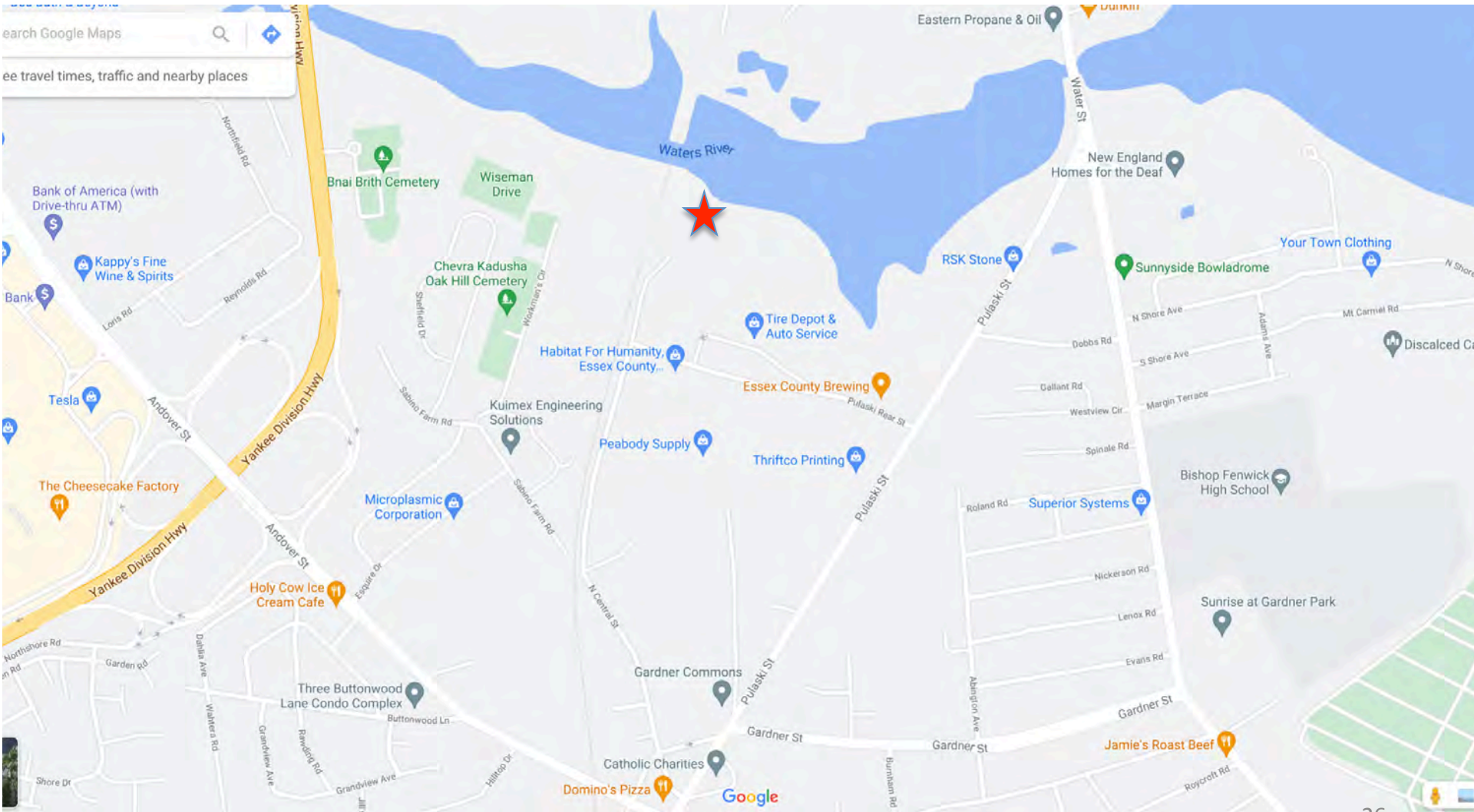
Project 2015A Timeline

- Late 2016- MMWEC presented project to MLDs
- Jan 2017- MMLD Board signed the Project Sales Agreement (PSA) in open session
- 2017-20 - Vendor selection, plant design & engineering
- Sept 2020 – Received Final Air Quality Plan Approval from Mass Dept. of Environmental Protection (DEP)





Project 2015A Timeline

- April 2021- DPU hearing for Tax-exempt Bond adequacy approval
- May 2021 – 30-day min project pause for info sharing with the public and consideration of alternatives
- Fall 2021- Planned construction start
- Summer 2022- Plant operational





Search Google Maps  

See travel times, traffic and nearby places

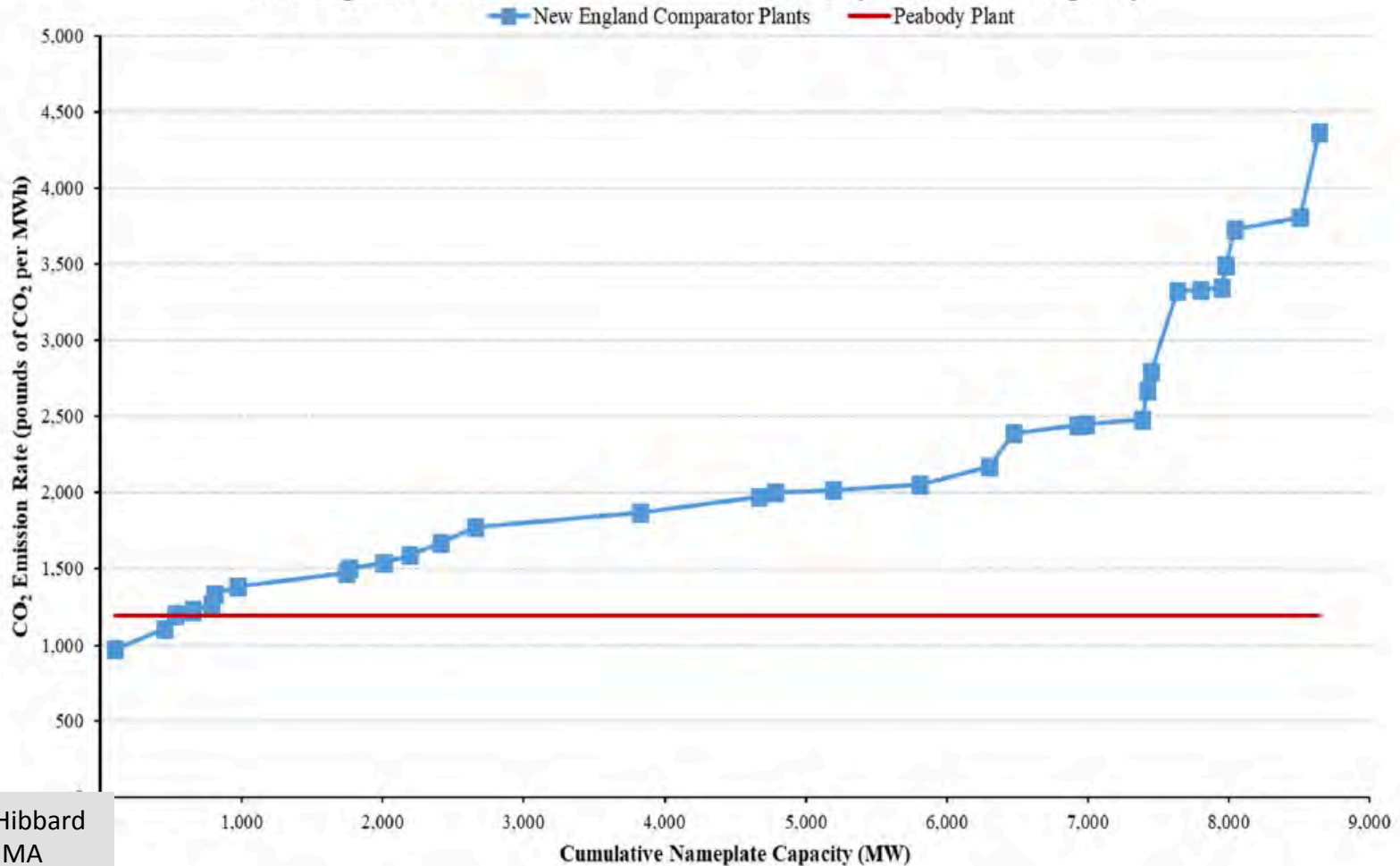


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Project 2015A Environmental Benefit: *Reduce* GHG Emissions vs. ISO's current Peaker Fleet

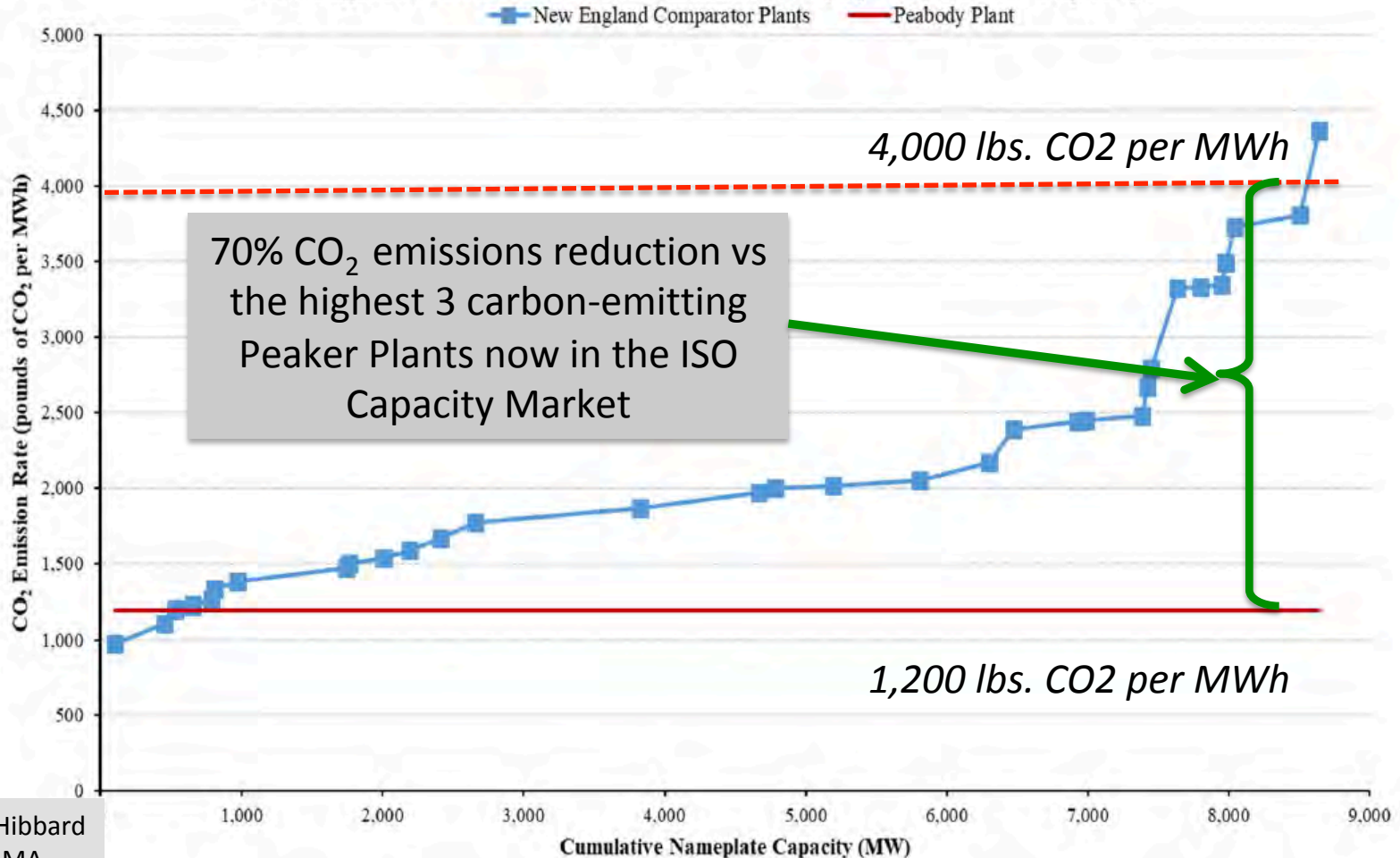
Attachment 3
New England Fossil Generator Emission Rates, by Cumulative Capacity





Project 2015A Environmental Benefit: *Reduce* GHG Emissions vs. ISO's current Peaker Fleet

Attachment 3
New England Fossil Generator Emission Rates, by Cumulative Capacity





Project 2015A can reduce Mass annual CO₂ emissions by 18,000 metric tons/yr.

Project 2015A Carbon Emissions vs. the Highest Carbon-Emitting Peaker Plants NOW in the ISO-NE Capacity Market

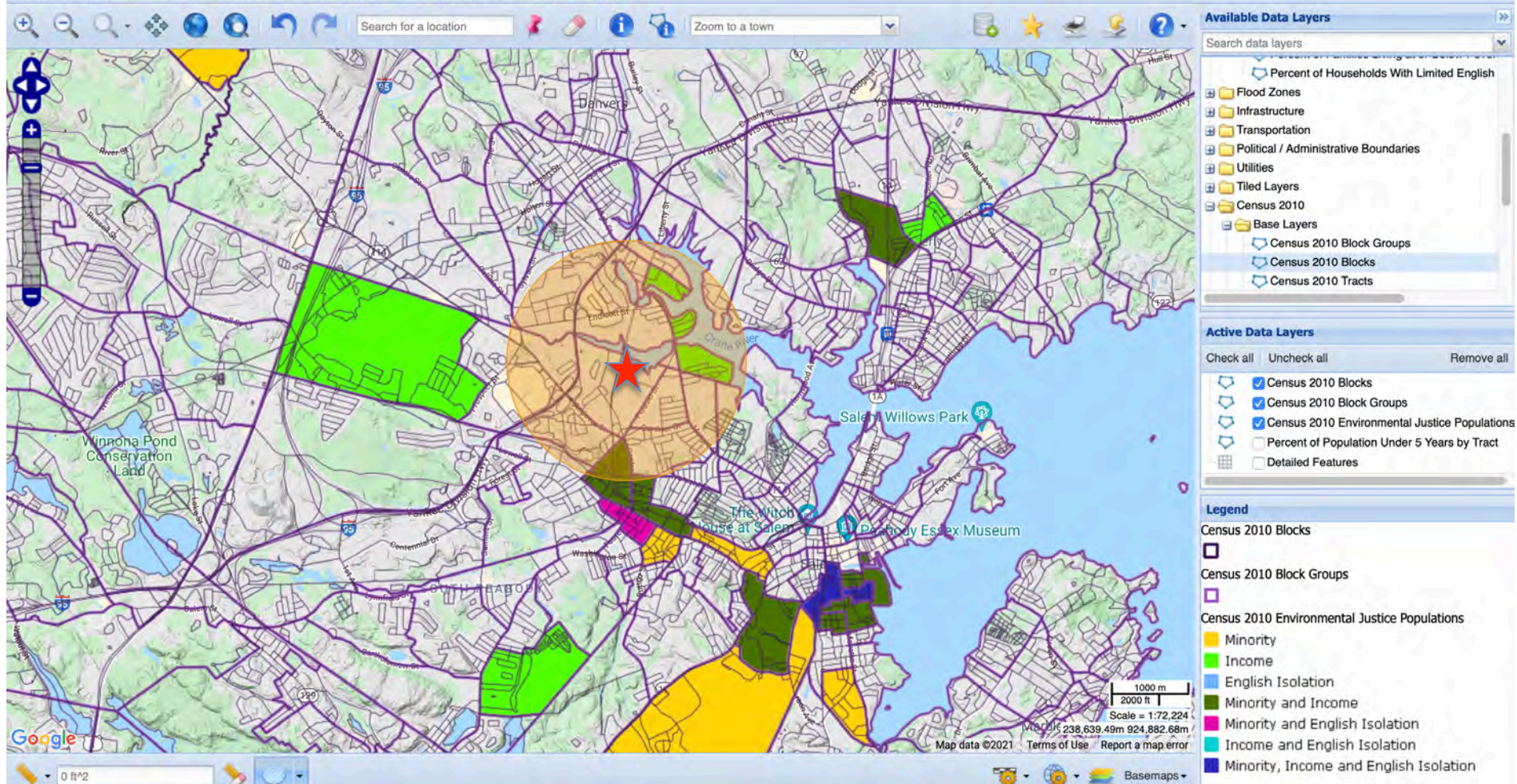
	Project 2015A	Highest Carbon emitting plants NOW in the Capacity Market (average of highest 3)	REDUCTION of CO2 emissions with Project 2015A displacing the average of the highest 3 emitters	Reduction %
CO2 emissions - Pounds per MWh	1,200	4,000	2,800	70%
MW plant capacity	60	60		
CO2 emissions when running at 60 MW, capacity lbs./hr.	72,000	240,000		
lbs./metric ton	2,205	2,205		
CO2 emissions running at 60 MW, in metric tons/hr	33	109	76	
annual runtime forecast in hours	240	240		
Annual CO2 emissions - metric tons/year	7,837	26,122	18,286	70%

* based on chart data presented in Paul Hibbard testimony, Attachment 3 "New England Fossil Generator Emission Rates, by Cumulative Capacity"



Climate Change Vulnerability Map

Provided by [Massachusetts Dept. of Public Health - Bureau of Environmental Health](#)





U.S. EPA & Mass DEP have developed Ambient Air Quality Standards to protect our public health and welfare

Six air contaminants known as criteria pollutants

- Nitrogen Dioxide (NO₂)
- Sulfur Dioxide (SO₂)
- Particulate Matter (PM)
 - PM₁₀ – respirable particulate ≤ 10 micron diameter
 - PM_{2.5} – fine particulate ≤ 2.5 micron diameter
- Carbon Monoxide (CO)
- Ozone (O₃)
- Lead (Pb)



Mass DEP Final Air Quality Plan Approval – Sept 2020

“The results of the cumulative impact analysis show that under no condition did the Facility’s worst-case emissions in combination with emissions from the existing interactive sources plus measured ambient background levels result in concentrations which exceeded the applicable NAAQS*/MAAQS.” - DEP Final Approval, Page 12

*NAAQS: National Ambient Air Quality Standard
MAAQS: Mass. Ambient Air Quality Standard



Predicted Total Pollutant Concentrations are Below Federal & Mass AQ Standards for all pollutants

Table D						
Criteria Pollutant	Averaging Period	Modeled Impact, Project Plus Waters River Station (ug/m ³)	Ambient Background (ug/m ³)	Modeled Impact Plus Ambient Background (ug/m ³)	NAAQS/MAAQS (ug/m ³)	Percent Below AQ Standards
NO ₂	Annual	2.53	10.3	12.8	100	87%
	1-Hour	95.31	65.8	161.1	188	14%
SO ₂	Annual	0.01	1.3	1.3	80	98%
	24-Hour	0.32	5.6	5.9	365	98%
	3-Hour	1.07	11.2	12.3	1,300	99%
	1-Hour	0.63	10.8	11.4	196	94%
PM _{2.5}	Annual	0.29	5.5	5.8	12	52%
	24-Hour	4.28	17.0	21.3	35	39%
PM ₁₀	Annual	0.41	13.2	13.6	50	73%
	24-Hour	11.12	29.0	40.1	150	73%
CO	8-Hour	63.34	649	711	10,000	93%
	1-Hour	130.87	1,221	1,352	40,000	97%

Source: Mass DEP Project 2015A Final Air Quality Plan Approval, page 11



Predicted Total Pollutant Concentrations are Below Federal & Mass AQ Standards for all pollutants

Criteria Pollutant	Averaging Period	Cumulative Modeled Impact, Project Plus Existing Interactive Sources (ug/m³)	Ambient Background (ug/m³)	Cumulative Modeled Impact Plus Ambient Background (ug/m³)	Primary NAAQS/ MAAQS (ug/m³)	Percent Below AQ Standards
NO ₂	1-Hour	96.92	65.8	162.7	188	13%
PM _{2.5}	24-Hour	4.75	17.0	21.8	35	38%
PM ₁₀	24-Hour	9.31	29.0	38.3	150	74%

Source: Mass DEP Project 2015A Final Air Quality Plan Approval, page 12



Project 2015A low GHG emissions level - put in context

Compared to:

- Existing power plant emissions at colleges, hospitals and north shore locations
- The dramatic, decade-long drop in Mass power plant emissions
- The slower decline in US power plant emissions
- Recognition that the **total** emissions from all Mass large power plants is under 1% of the US total



GHG Emissions from selected Mass stationary sources

2019 Total Reported Direct Emissions - US EPA

Location	1,000 Metric Tons CO ₂ e
Fore River Energy Center - Weymouth	1,769
Mystic - Charlestown/Everett	908
Medical Area Total Energy Plant (MATEP) - Brookline Ave, Boston	257
Salem Harbor Station	215
MIT Central Plant - Cambridge	123
UMass Amherst	110
GE - Lynn Plant	93
UMass Medical - Worcester	85
Harvard University - Cambridge	83
Pfizer- Andover	45
Boston University	44
Rousselot - Peabody	43
Northeastern University - Boston	30
Logan Airport - East Boston	29
Stony Brook - Ludlow	26
Wellesley College	21
Mass General Hospital- Charlestown Navy Yard*	7.9
Project 2015A - Peabody	7.8

(highest in Mass)



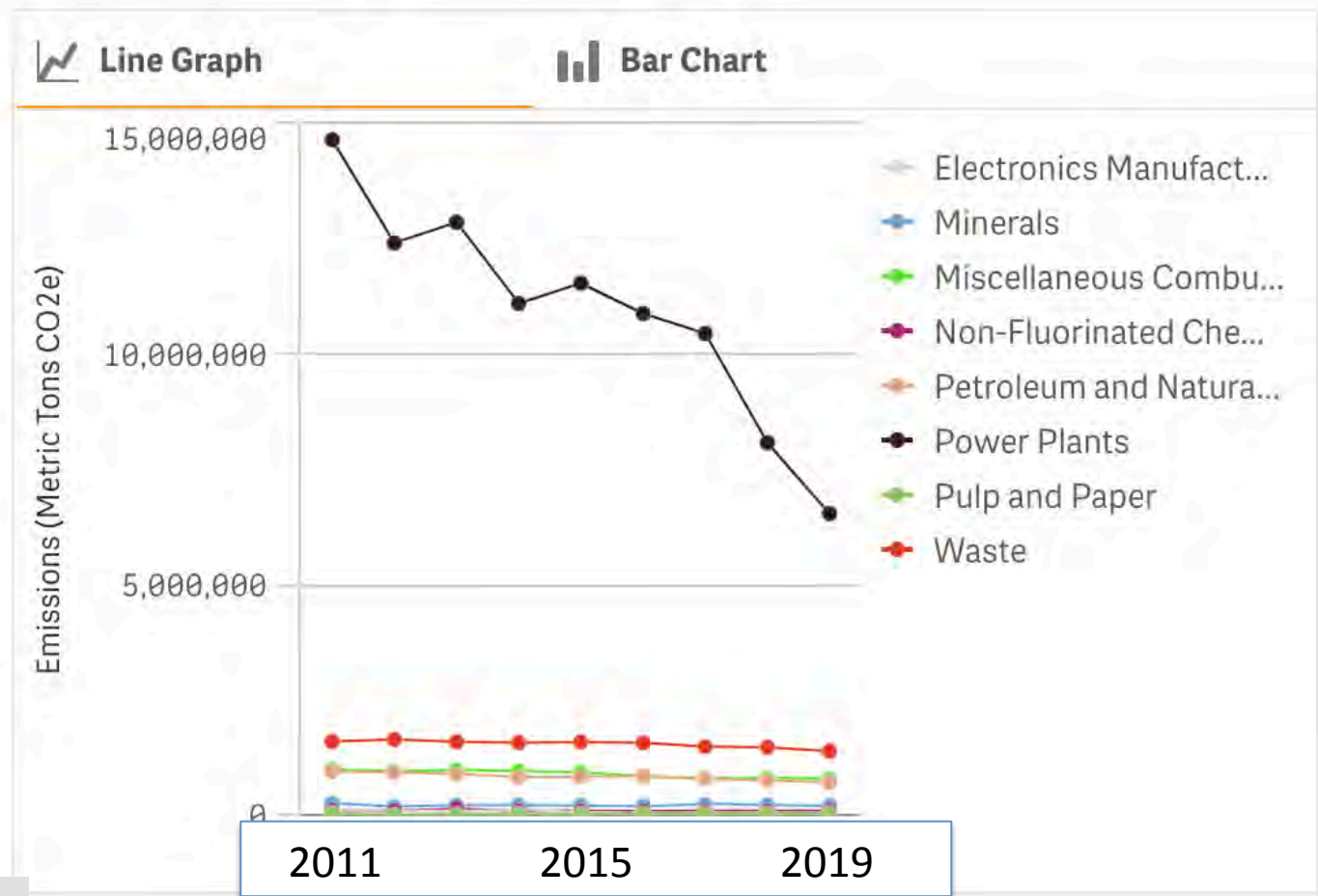
Mass Power Plant Emissions

2011-2019 Trends (plants over 25K metric tons only)

2019 - 6.5 Million Metric Tons CO₂e

56% decline 2011-2019

Trends in Direct GHG Emissions by Sector

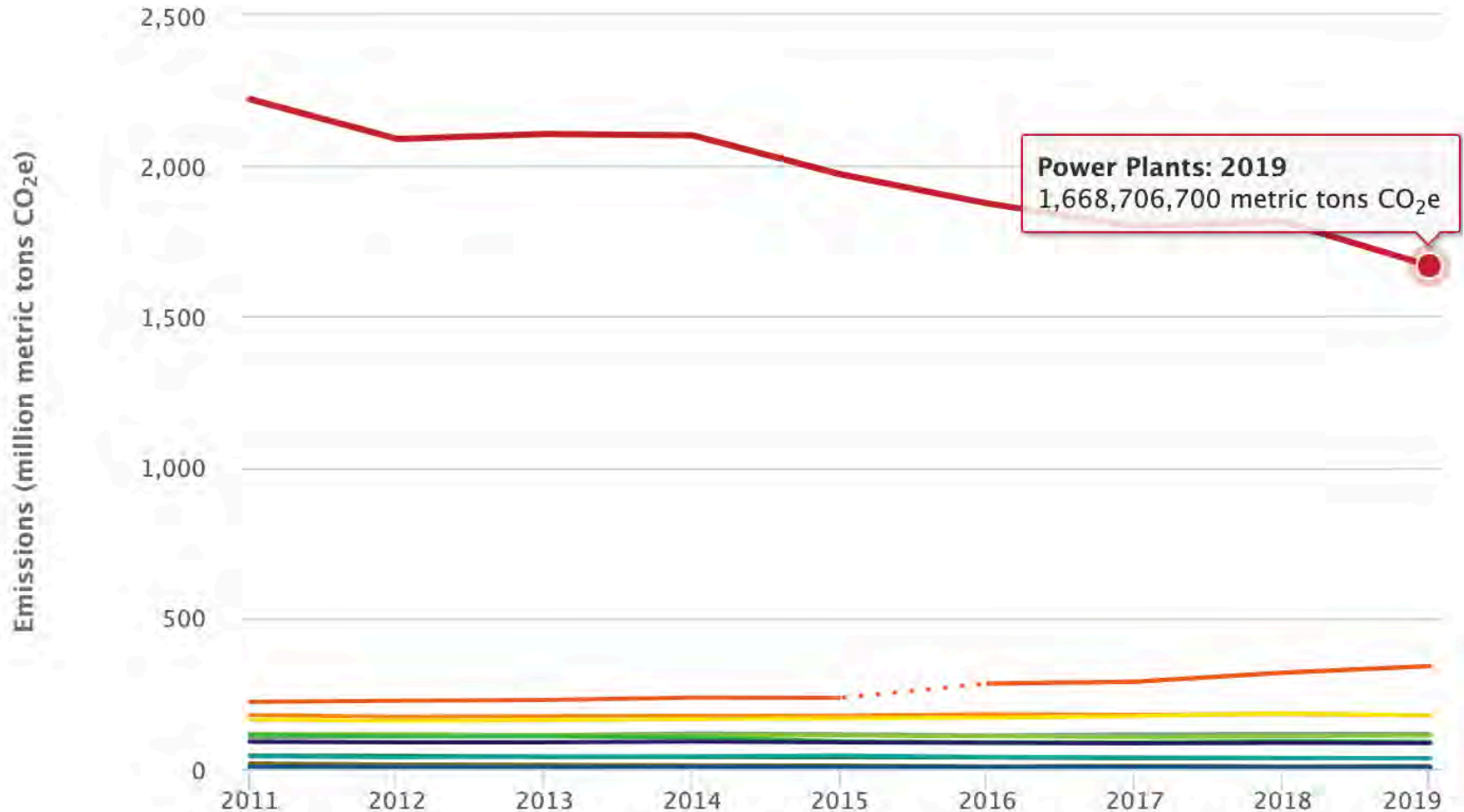


data as of 9/26/2020



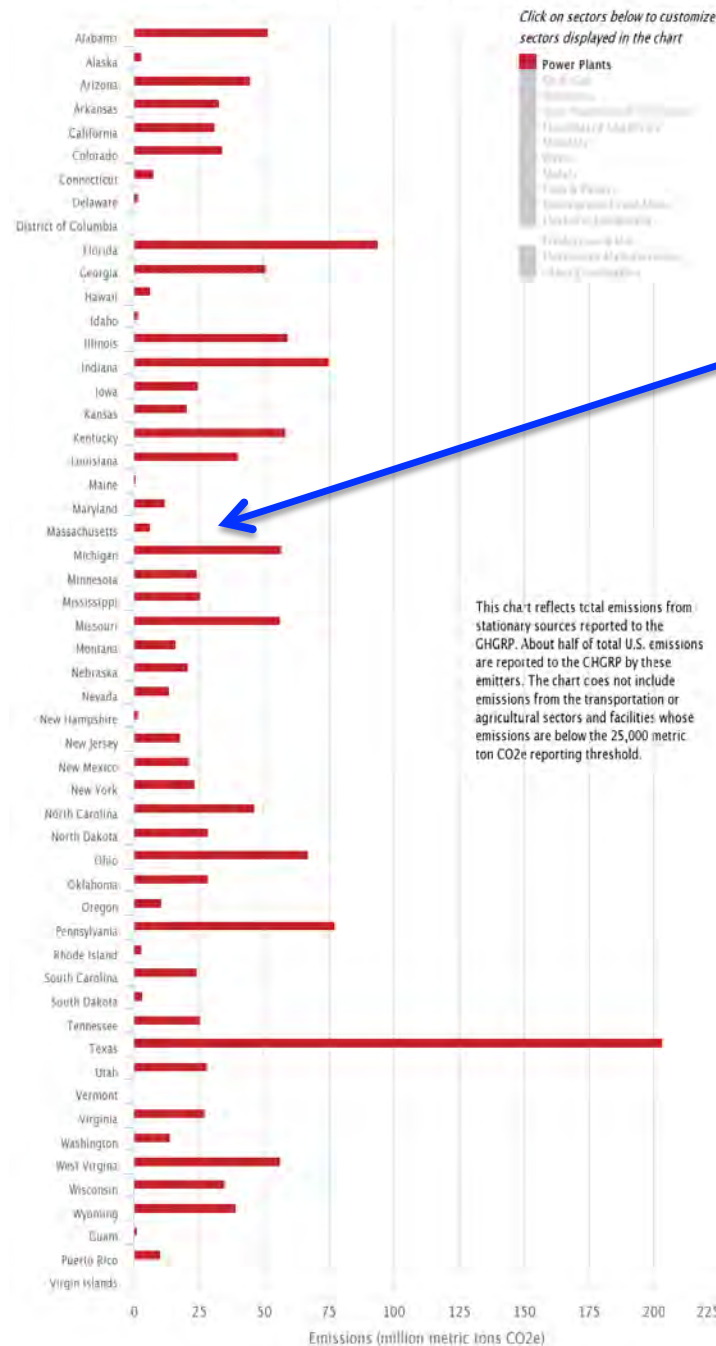
2011-19 US GHG emissions

2019- 1,668 million metric tons CO₂e





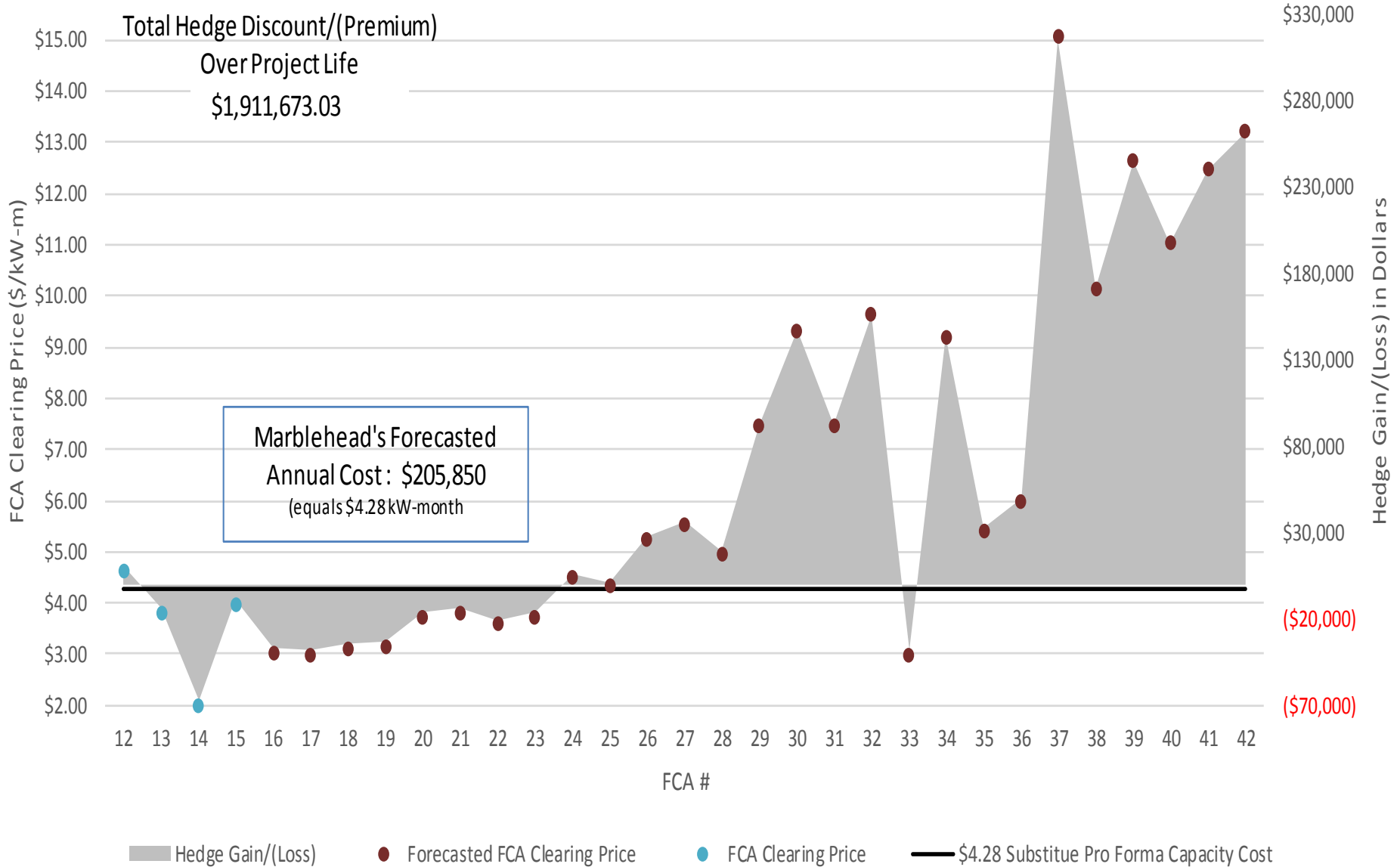
Annual Reported GHG Emissions from All Sectors



The 6.5 M metric tons in Mass is **0.4%** of the 1,668 M metric tons in the US. *Massachusetts emissions are lost in the round-off.*

FCA Capacity Clearing Prices & Forecasted Hedge Discount/(Premium)

Marblehead's Share of Project 2015A is 4.426%





Lower Grid Reliability Ahead?

Three Factors are converging...cause for concern

1. The **Mass 2050 Pathways to renewable energy** (wind & solar) is a shift to *intermittent* power sources, dependent on our unpredictable New England weather.
2. **The Mass 2050 Pathway to Electrify** transportation and heating will significantly increase demand...double, triple, or higher? vs. today's load
3. The North Shore is in a **“transmission constrained” ISO-NEMA Load zone**. Delivering adequate transmission of electricity today into NEMA during peaks & outages is a known issue.



Lower Grid Reliability Ahead?

- **Most at risk: Our most vulnerable residents during extreme winter cold conditions:**
 - the elderly and individuals needing at-home medical devices.
 - Will we see rolling brown outs (as in California)
 - Or experience an unplanned outage during extreme cold conditions (Texas)?



Ensuring Grid reliability is no accident

- Read about ISO reliability resources and procedures implemented, in reaction to the combination of a extreme multi-day cold weather conditions, an a large baseload energy plant offline: [Jan 08, 2018](#)
- Read about ISO procedures invoked due a capacity shortage condition caused by hot weather on Labor Day, 2018: [Sept 03, 2018](#)



Project costs and the costs of shutting down Project 2015A

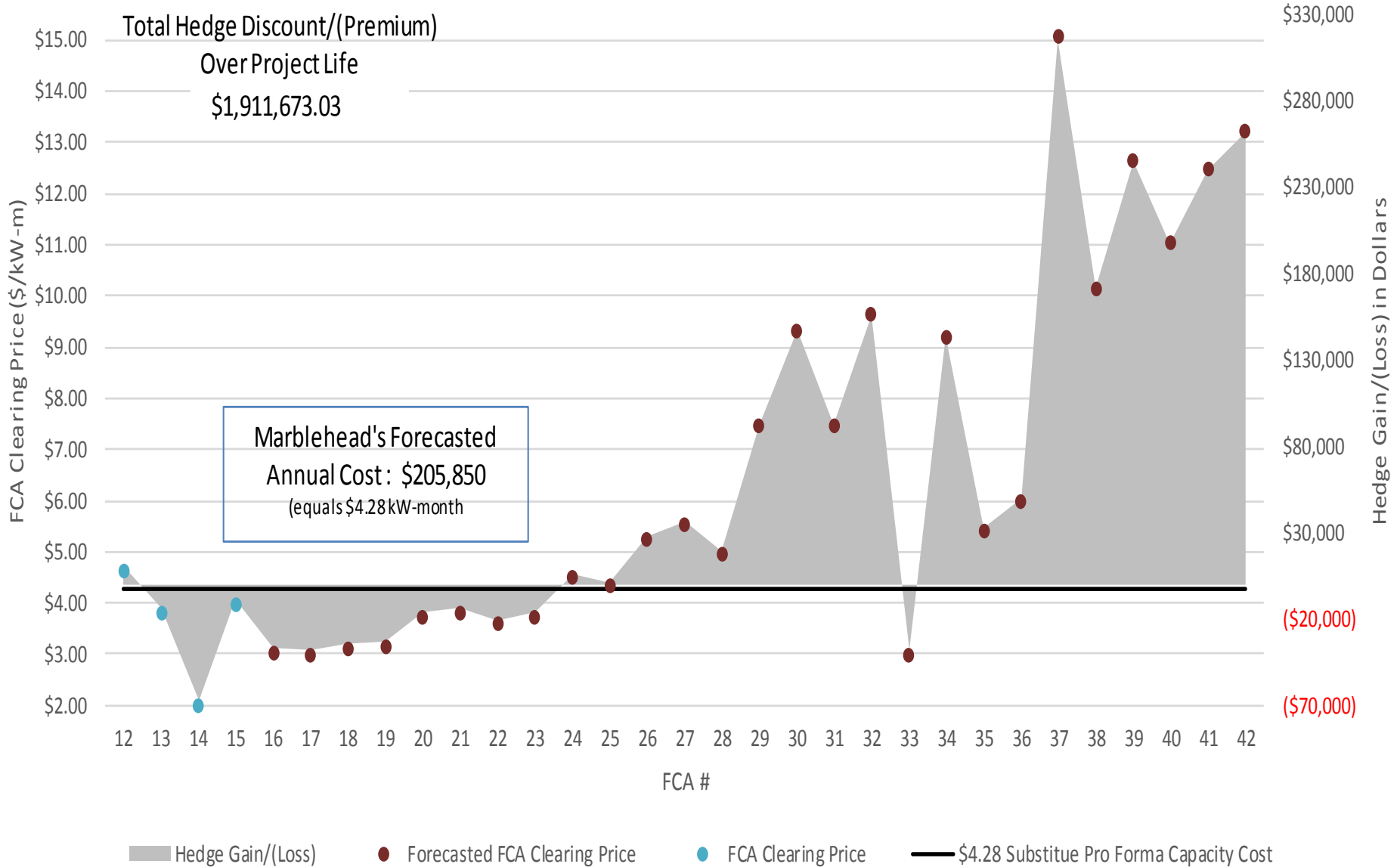


Project 2015A Costs

Project 2015A Project Costs		(\$ millions)
Subtotal Cost of Acquisition and Construction	\$64.98	
Subtotal Contingencies	\$1.76	
Subtotal		\$66.74
Capitalized Project Costs & Prelim Capital Costs	\$8.44	
Contingencies for Potential Added Costs	\$1.45	
Subtotal	\$9.89	
Subtotal: Cost of Acquisition and Construction		\$76.63
Add: Contingency for Covid related issues (10% of construction)	\$7.66	
Total Cost of Acquisition and Construction		\$84.30
Contingency subtotal	\$10.87	

FCA Capacity Clearing Prices & Forecasted Hedge Discount/(Premium)

Marblehead's Share of Project 2015A is 4.426%





Saying No to Project 2015A now...has a hefty cancellation price tag

- MMLD has paid \$430,000 to date.
- **Plus:** MMLD \$900,000 estimated share of cancellation fees on the engineering & construction contract in place. *Due on a cancellation decision.*
- **Plus:** Our share of offloading our ISO Capacity Market commitments for the next 3 years.
- **Plus:** Longer term financial risk of higher Capacity Supply Obligations payments to ISO vs self-supplying capacity from Project 2015A ownership for 30+ yrs.



Other Alternatives



Battery Storage System use models have significant differences

	Marblehead Resource	ISO Capacity Market
System Placement	Behind the MLD meter	An ISO Grid resource in front of the MLD meter
Operating Objective	<ul style="list-style-type: none"> Shave (reduce) MMLD peak loads 	<ul style="list-style-type: none"> ISO Peak load response Grid Reliability – respond to resource outages
Dispatch Duration Needed	<ul style="list-style-type: none"> Run during forecasted peaks 2-4 hours 	<ul style="list-style-type: none"> Run as long as ISO-NE requires; 10-15-20 hours; multiple days
Consequence of Not Running	<ul style="list-style-type: none"> Missed opportunity to lower Mhd Capacity or transmission payments 	<ul style="list-style-type: none"> Pay for Performance penalty \$5500/MWh Lower Reliability during outages leading to brownouts or worse



A battery storage solution is not a viable option

- Requires much more land than is available onsite
3-5 acres vs 0.5 acres available
- Is much more expensive to purchase and install
- Does not provide the same level capacity market reliability
- Puts North Shore residents at higher risk in the event of an outage during a multi-day extreme cold winter weather event.



Mhd Wilkins Plant Run Logs

Date	Day of Week	Run Hours in Full Day	Run Consecutive hours?
22-Jan-14	Weds	12.55	No
23-Jan-14	Thurs	18.90	Yes
24-Jan-14	Fri	18.90	Yes
25-Jan-14	Sat	0.00	na
26-Jan-14	Sun	5.73	Yes
27-Jan-14	Mon	16.60	Yes
28-Jan-14	Tues	18.82	Yes
Total		93.22	



Replace the Wilkins 5MW Plant with a battery Jan 22-28, 2014

- Generator capacity - 5 MW
- Run time 93 hours
- Required to supply 465 MWh to the Grid over 7 days

How can you meet the supply requirement with a Tesla Megapack utility battery?



Tesla MegaPack Utility Battery Option

Tesla Megapack config for 465 megawatt hours			Price/MWh	Extended Price	Land area required acres
Energy (MWh)					
100MW/400 MWh battery	400 MWh		\$250,000	\$100,000,000	2.5
22 additional Megapacks	65 MWh		\$300,000	\$6,600,000	0.4
Interconnection				20,000,000	
Total				\$126,600,000	2.9

Tesla Megapack utility battery		MMWEC quote	Land area required acres
(152 MegaPacks)	100MW/400 MWh battery	\$100,000,000	2.5
	Interconnection	<u>\$20,000,000</u>	
		\$120,000,000	

	Energy (MWh)	Est Current Price*	Land area required acres
Individual Megapack*	3	\$300,000	
MegaPacks For 65 MWh config	22	\$6,600,000	0.4

* estimate on Cleantechnia.com 2020-10-05



2nd Option: Convert Natural Gas Plant to Green Hydrogen

- Current 2015A turbine is capable of conversion
- Stated as an option in the Mass 2050 Decarbonization Plan for natural gas plants
- Green hydrogen is generated by electrolysis using *excess* offshore wind energy when generation exceeds demand
- MMWEC evaluating potential pathways with DOER



Types of Hydrogen

- **Green** hydrogen or renewable hydrogen is made from renewable energy via electrolysis.
- **Pink** hydrogen is made from electrolysis using nuclear power.
- **Blue** hydrogen is made from natural gas coupled with carbon capture.
- **Gray** hydrogen is made from natural gas SMR.
- **Brown** hydrogen is made from coal gasification plus SMR.



MMWEC Project 2015A

Municipal Ratepayer Briefing

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