

2016 Economic Studies

Draft Results

Planning Advisory Committee Meeting



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THE SCENARIOS - RECAP



Five Scenarios

See the NEPOOL memo and the discussion of assumptions

1. Generation fleet meeting existing Renewable Portfolio Standards (RPS) and retired units replaced with natural gas combined cycle (NGCC) units
 - Use the base assumptions, including the retirement assumption
 - Assume that targeted energy requirement for the New England states' RPS goals as of April 1, 2016 will be met by physical renewable/clean energy resources
 - Guidance on the RPS has been posted on the ISO website that provides a method of prioritizing resource types and locations
 - Replace all retired units with NGCC
 - Meet any net ICR shortfalls with additional NGCC units
2. Generation fleet meeting existing RPS and all future needs, including retirements, met with new renewable/clean energy resources
 - Same as Scenario 1, except assume all needed capacity will be met by renewable/clean energy resources
 - Assume the mix of renewable/clean energy resources provided by the RPS guidance posted on the ISO's website



Five Scenarios, cont.

See the NEPOOL memo and the discussion of assumptions

3. The “RPS-plus scenario” - Generation fleet meeting existing RPS plus additional renewable/clean energy resources and some modified base assumptions that are the same as Scenario 2 except include additional MW by 2025 and 2030 of new renewable/clean energy resources above the existing RPS requirements
 - The mix of resources and demand are very different than the historical experience
 - Specifics of Scenario 3 are discussed later in the assumptions section and will be further developed through additional discussion with the PAC

Five Scenarios, cont.

See the NEPOOL memo and the discussion of assumptions

4. Generation fleet meeting existing RPS in part through Alternative Compliance Payments with NGCC additions, and with no retirements (the “no retirement scenario”)
 - Use Scenario 1, except assume: (a) RPS requirements are met first physically with renewable/clean energy resources that are interconnected to the system, under construction or have an approved I.3.9 as of April 1, 2016, and then through alternative compliance payments for any RPS requirements not physically met; (b) any new generation resources added to meet NICR will be NGCC units; and (c) no retirements
5. Existing fleet meeting existing RPS in part through Alternative Compliance Payments and retirement replacement with NGCC additions
 - Same as Scenario 4, except use retirement assumption and replace retired units as needed to meet NICR with NGCC generation



RESULTS AND OBSERVATIONS

EXECUTIVE SUMMARY PART II

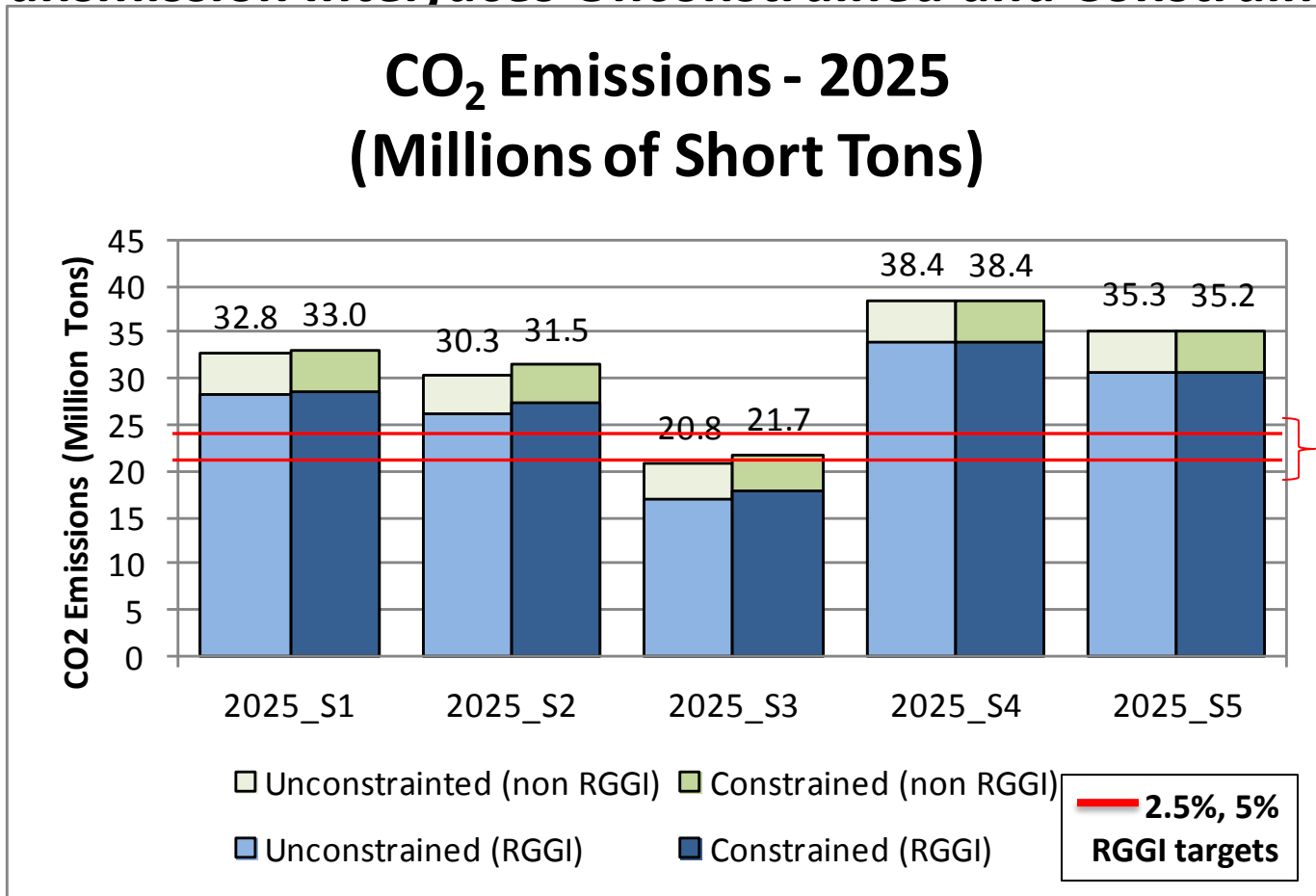
CARBON EMISSIONS



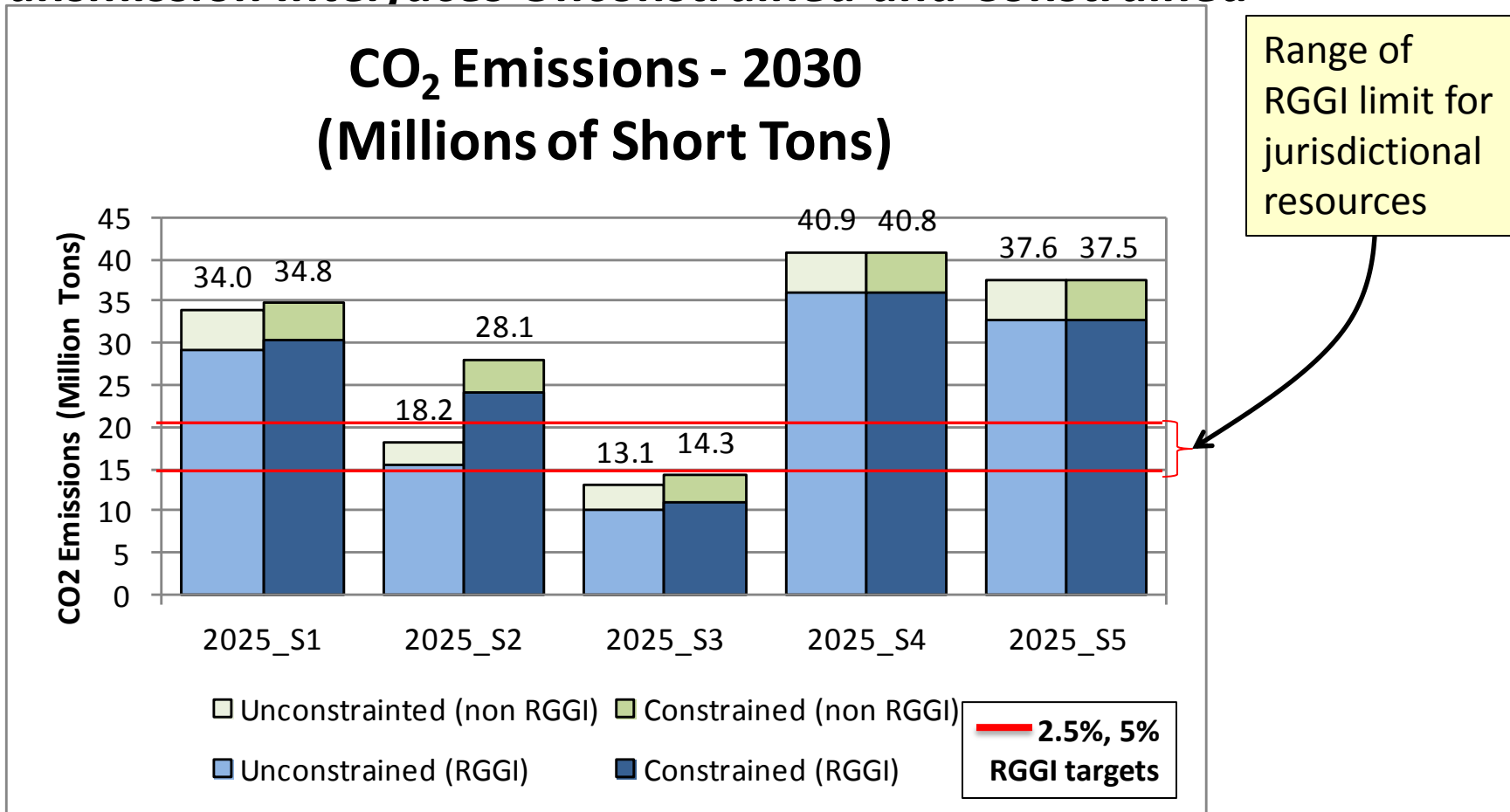
Review of Regional Greenhouse Gas Initiative

- Potential Regional Greenhouse Gas Initiative (RGGI) targets for the New England states range between approximately
 - 21.2 (5.0% reduction) and 23.9 (2.5% reduction) million short tons in 2025 (*RGGI modeling*)
 - 14.4 (5.0% reduction) and 20.5 (2.5% reduction) million short tons in 2030(*RGGI modeling*).
- RGGI currently permits the use of allowances (regardless of source or issuing State) and offsets to meet compliance obligations in any State
- Allowances may be available from primary auctions, secondary markets, banked, neighboring states, and cost containment reserves
- Offsets may be used
- RGGI excludes generators < 25 MW and municipal solid-waste units

2025 Annual System-wide CO₂ Emissions RGGI and Other Generators (Million Short Tons) *Transmission Interfaces Unconstrained and Constrained*



2030 Annual System-wide CO₂ Emissions RGGI and Other Generators (Million Short Tons) *Transmission Interfaces Unconstrained and Constrained*



CO2 Emission by Category (Million Short Tons)

Case	MSW	Other < 25 MW	Subject to RGGI	Total Emissions	MSW	Other < 25 MW	Subject to RGGI	Total Emissions
	Unconstrained				Constrained			
2025								
2025_S1	2.27	2.25	28.25	32.77	2.35	2.06	28.62	33.03
2025_S2	2.13	2.09	26.09	30.31	2.25	1.90	27.32	31.47
2025_S3	1.87	1.97	16.93	20.77	1.96	1.84	17.92	21.71
2025_S4	2.32	2.20	33.91	38.43	2.34	2.19	33.84	38.36
2025_S5	2.42	2.22	30.63	35.28	2.41	2.21	30.55	35.17
2030								
2030_S1	2.48	2.20	29.29	33.97	2.52	1.95	30.30	34.77
2030_S2	1.36	1.40	15.41	18.17	2.23	1.73	24.10	28.07
2030_S3	1.46	1.59	10.05	13.10	1.65	1.54	11.06	14.26
2030_S4	2.48	2.23	36.17	40.88	2.48	2.21	36.11	40.80
2030_S5	2.56	2.21	32.83	37.60	2.57	2.20	32.75	37.52

2025 Annual System-wide CO₂ Emissions for RGGI Generators (Million Short Tons)

Transmission Interfaces Unconstrained

- Potential RGGI emission targets for the New England states range between approximately 21.2 (5.0%) and 23.9 (2.5%) million short tons in 2025 (*RGGI modeling*).
- Annual system-wide CO₂ emissions for RGGI generators range between 16.93 (Scenario 3) and 33.91 (Scenario 4) million short tons.
- Only Scenario 3 emissions fall below the potential RGGI targets for the New England States.
- The region would need 12.71 million allowances or offsets to meet the regional share of the 5.0% RGGI target for Scenario 4 (33.91 MT).



2030 Annual System-wide CO₂ Emissions for RGGI Generators (Million Short Tons)

Transmission Interfaces Unconstrained

- Potential RGGI reduction targets for the New England states range between approximately 14.4 (5.0%) and 20.5 (2.5%) million short tons in 2030(*RGGI modeling*).
- Annual system-wide CO₂ emissions for RGGI generators range between 10.05 (Scenario 3) and 36.17 (Scenario 4) million short tons.
- Scenarios 2 (15.4 MT) and Scenario 3 (10.0 MT) fall below the 2.5% RGGI regional cap (20.5 MT), and Scenario 2 also falls below the 5.0% RGGI regional cap (14.4 MT).
- The region would need 21.77 million allowances or offsets to meet the regional share of the 5.0% RGGI target (14.4 MT) for Scenario 4 (36.17 MT).

2025 Annual System-wide CO₂ Emissions for RGGI Generators (Million Short Tons)

Transmission Interfaces Constrained

- Potential RGGI emission targets for the New England states range between approximately 21.2 (5.0%) and 23.9 (2.5%) million short tons in 2025 (*RGGI modeling*).
- Transmission constraints cause increases in regional CO₂ emissions for Scenarios 1, 2, and 3, but have little effect on Scenarios 4 and 5
- Annual system-wide CO₂ emissions range from a low of 17.92 (Scenario 3) to a high of 33.84 million short tons (Scenario 4).
- Only Scenario 3 (17.92 MT) falls below the 2025 2.5% RGGI regional cap (23.9 MT) and the 5.0% RGGI regional cap (21.2 MT).
- The region would need 12.64 million allowances or offsets to meet the regional share of the 5.0% RGGI target under Scenario 4 (33.84 MT).

2030 Annual Systemwide CO₂ Emissions for RGGI Generators (Million Short Tons)

Transmission Interfaces Constrained

- Potential RGGI reduction targets for the New England states range between approximately 14.4 (5.0%) and 20.5 (2.5%) million short tons (*RGGI modeling*).
- Annual system-wide CO₂ emissions for generators larger than 25 MW range between a low of 11.06 (Scenario 3) and to a high of 36.11 (Scenario 4) million short tons.
- Only Scenario 3 emissions (11.06 MT) would fall below the 2030 2.5% RGGI regional cap (20.5 MT) and 5.0% RGGI regional cap (14.4 MT).
- The region would need 21.71 million allowances or offsets to meet the regional share of the 5.0% RGGI target for Scenario 4 (36.11 MT).



Energy Contribution by Resource Technology 2025 (TWh and Percent), Transmission Interfaces Constrained

Scenario	2025_S1		2025_S2		2025_S3**		2025_S4		2025_S5	
Coal	0.19	0.12%	0.13	0.09%	0.11	0.07%	5.06	3.36%	0.18	0.12%
NG	54.65	36.25%	52.29	34.70%	31.04	19.59%	53.55	35.53%	58.33	38.70%
Oil	0.00	0.002%	0.01	0.006%	0.00	0.000%	0.01	0.004%	0.00	0.000%
Wood	4.54	3.01%	4.24	2.81%	4.26	2.69%	4.93	3.27%	4.94	3.27%
EE/DR	24.58	16.31%	24.58	16.31%	37.21	23.48%	24.58	16.31%	24.58	16.31%
Nuc	27.26	18.08%	27.26	18.09%	27.26	17.20%	27.26	18.08%	27.26	18.08%
PV	4.59	3.05%	5.26	3.49%	10.70	6.75%	4.59	3.05%	4.59	3.05%
Misc.*	3.12	2.07%	2.99	1.99%	2.67	1.68%	3.13	2.07%	3.21	2.13%
Wind	11.72	7.78%	14.82	9.83%	17.56	11.08%	6.49	4.31%	6.49	4.31%
Hydro/ES	3.92	2.60%	3.68	2.44%	3.87	2.44%	3.98	2.64%	3.98	2.64%
Import	16.15	10.71%	15.45	10.25%	23.81	15.03%	17.16	11.39%	17.17	11.39%
Total TWh	150.73	100.00%	150.71	100.00%	158.48	100.00%	150.74	100.00%	150.74	100.00%

* Includes old tire fuel, municipal solid waste, land fill gas, wood waste, etc.

** Plug-in Electric Vehicles charging increased the total energy consumed in S3.

Energy Contribution by Resource Technology 2030 (TWh and Percent), Transmission Interfaces Constrained

Scenario	2030_S1		2030_S2		2030_S3**		2030_S4		2030_S5	
Coal	0.15	0.09%	0.04	0.02%	0.05	0.03%	5.23	3.31%	0.15	0.09%
NG	58.73	37.16%	46.86	29.67%	17.04	9.96%	58.32	36.91%	63.33	40.07%
Oil	0.00	0.000%	0.00	0.002%	0.00	0.000%	0.01	0.009%	0.00	0.000%
Wood	4.48	2.83%	3.64	2.30%	3.50	2.05%	4.93	3.12%	4.94	3.13%
EE/DR	25.86	16.36%	25.86	16.37%	54.08	31.60%	25.86	16.36%	25.86	16.36%
Nuc	27.26	17.25%	27.26	17.26%	27.24	15.92%	27.26	17.25%	27.26	17.25%
PV	5.49	3.47%	8.32	5.27%	16.03	9.37%	5.49	3.47%	5.49	3.47%
Misc.*	3.29	2.08%	2.95	1.87%	2.26	1.32%	3.30	2.09%	3.37	2.13%
Wind	13.19	8.34%	25.73	16.29%	22.43	13.11%	6.49	4.11%	6.49	4.11%
Hydro/ES	3.89	2.46%	3.34	2.11%	3.68	2.15%	3.98	2.52%	3.98	2.52%
Import	15.72	9.95%	13.94	8.83%	24.83	14.51%	17.16	10.86%	17.17	10.86%
Total TWh	158.05	100.00%	157.94	100.00%	171.15	100.00%	158.04	100.00%	158.04	100.00%

* Includes old tire fuel, municipal solid waste, land fill gas, wood waste, etc.

** Plug-in Electric Vehicles charging increased the total energy consumed in S3.