Greenhouse Gas Regulatory Update

Environmental Advisory Group

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CLEAN POWER PLAN UPDATE

Clean Power Plan 111(d) Litigation Update

- **February 9, 2016**: Supreme Court grants stay of CPP implementation until all CPP litigation resolved, including all appeals
  - During this stay, litigation continues in the D.C. Circuit Court of Appeals, *West Virginia v. EPA* (D.C. Cir.) No. 15-1363
- **May 16, 2016**: the D.C. Circuit, acting on its own, reschedules arguments from June 2 to September 27, 2016, replacing the three judge panel with the nine of the eleven active judges

CPP Clean Energy Incentive Program
300 million allowances available Nationwide

States Allocate Allowances or Credits, EPA Matches Award

- **June 16, 2016**: EPA released prepublication version of renewables incentive program for public comment
- Eligible technologies:
  - Wind
  - Solar
  - Geothermal
  - Hydropower
- Eligible low-income community projects:
  - Demand-side energy efficiency
  - Solar
- Qualifying projects commencing operation after 2018 (low-income energy efficiency or solar) or 2020 (renewable) eligible to receive allowances or credits

Available Matching Allowances (Mass-based CCP State Plans)

	Renewable Energy Reserve	Low-Income Community Reserve
Connecticut	104,122	104,122
Maine	31,109	31,109
Massachusetts	255,705	255,705
New Hampshire	161,696	161,696
Rhode Island	53,511	53,511
Regional Total	**606,143**	**606,143**

Note: An allowance is equivalent to 1 ton of CO_2 emissions and would have monetary value in a carbon market.

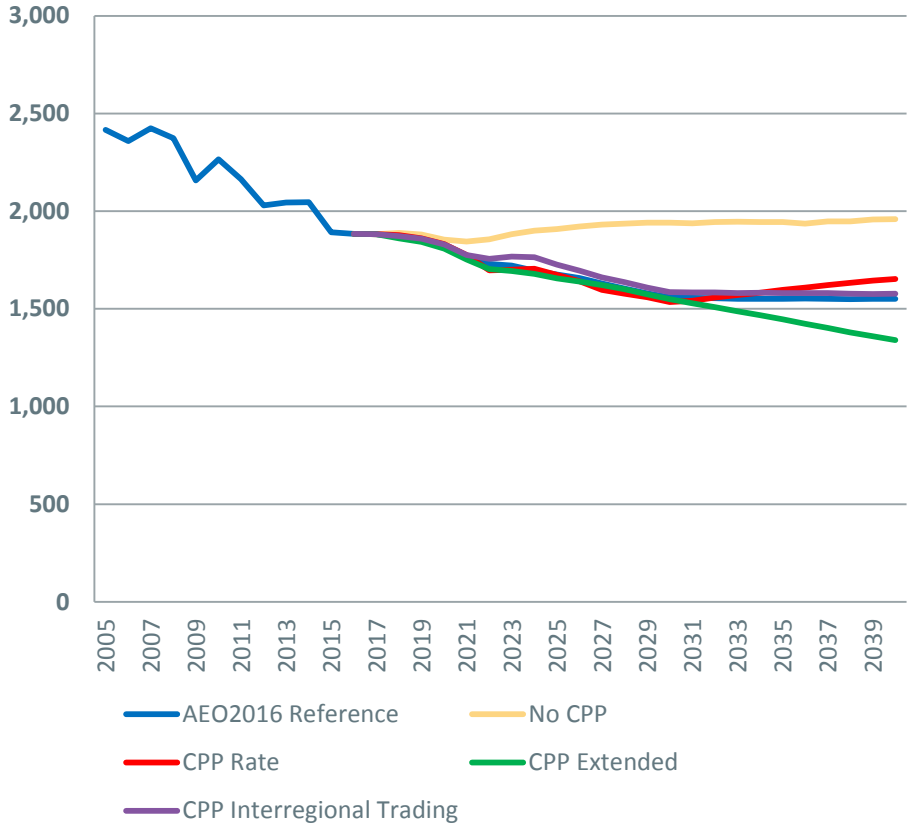
Source: EPA

EIA Annual Energy Outlook 2016 CPP Analysis

Factors in lower natural gas prices, lower capital costs for renewable resources, and renewable tax credits extension compared to AEO2015 review

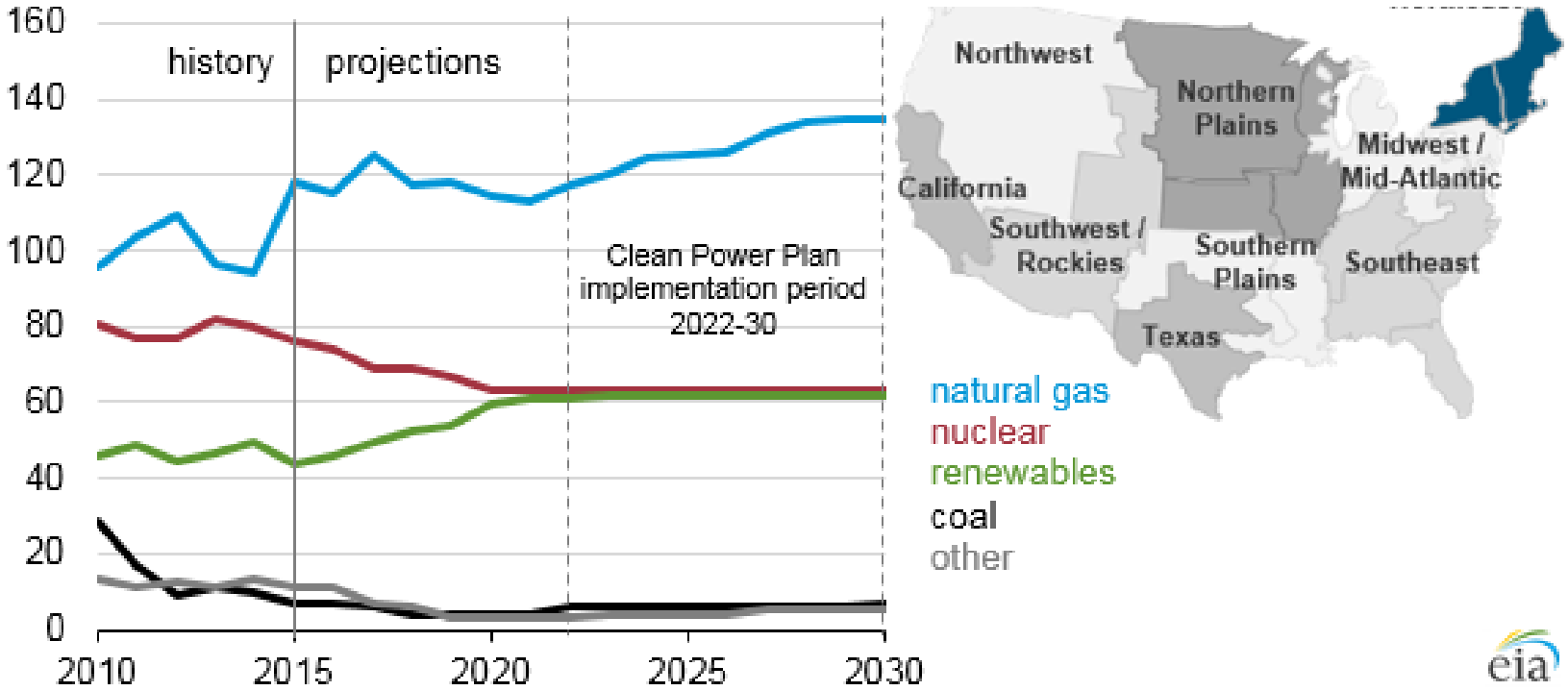
- **June 20, 2016**: EIA updated its CPP Analysis with revised cases:
  - **AEO2016 Reference case:** all states comply with CPP under mass-based program (new & existing sources)
  - **CPP Interregional Trading:** reference case with trading among regions
  - **CPP Rate**: all states comply with CPP under rate-based program
  - **No CPP:** only regional efforts continue (RGGI &California AB32)
  - **CPP Extended:** CPP emission targets continue linearly declining through 2040

EIA CPP Cases Projected National CO_2 Emissions Million Tons (Mtons)



Source: EIA

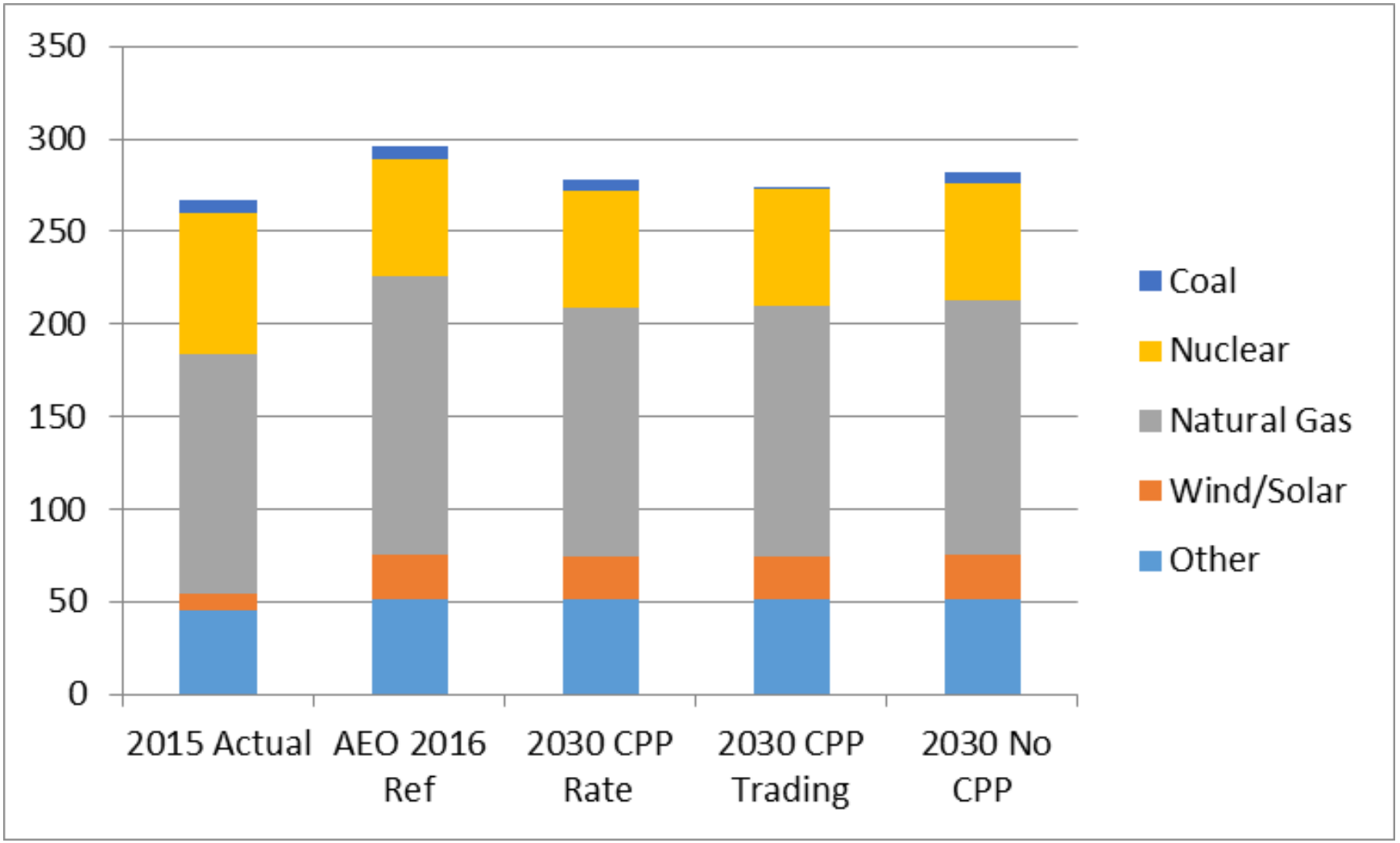
EIA 2016 CPP Analysis – Electricity Generation by Fuel Type in Northeast (Billion kWh)



- According to EIA, the Northeast—already one of the least carbon-intensive electricity generation regions—is expected to further reduce its power sector carbon intensity from 1,037 pounds of CO_2 per megawatthour (lbs/MWh) in 2015 to 986 CO_2 lbs/MWh in 2030

Source: EIA

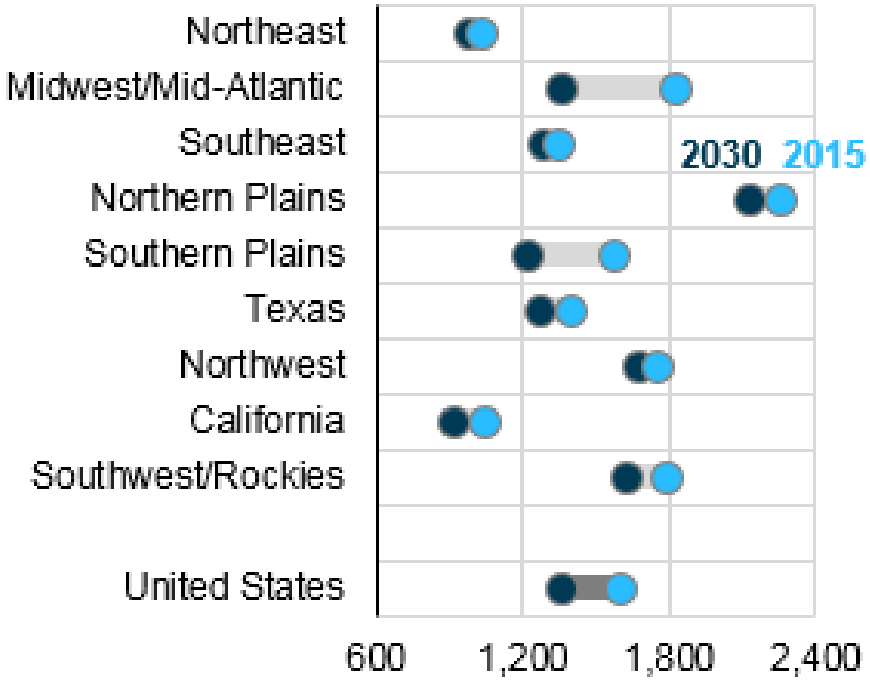
EIA CPP Analysis - Northeast Electricity Generation by Fuel Type 2015, 2030 (billion kWh)



Source: EIA

EIA 2016 CPP Analysis – Regional CO_2 Emission Rates (Reference Case AEO2016 in 2015, 2030)

Fossil generation only (lbs/MWh)



- According to EIA, the Northeast region and California meet most of their demand with natural gas generation, along with renewables generation in California and a mix of nuclear and renewables generation in the Northeast. These regions have among the lowest emission reduction requirements, and as a result are expected to register small or no change in generation mix as a result of the CPP.

Source: EIA

EIA CPP Analysis - Key Takeaways

- The reference case achieves a 35% reduction of CO_2 emissions below 2005 levels by 2030 , whereas the no CPP case achieves an 18-21% reduction in the same timeframe.
- With the mass-based case, emissions remain constant throughout 2040, but in the rate-based case, emissions increase slightly after 2030 due to increased generation.
- The CPP extended case achieves a 45% reduction of CO_2 emissions below 2005 levels by 2040.
- There is a significant reduction in coal fired generation and a significant increase in renewable generation in all cases relative to the no CPP case.
- In all cases, natural gas remains a large part of capacity and generation.

Source: EIA

REGIONAL GREENHOUSE GAS INITIATIVE

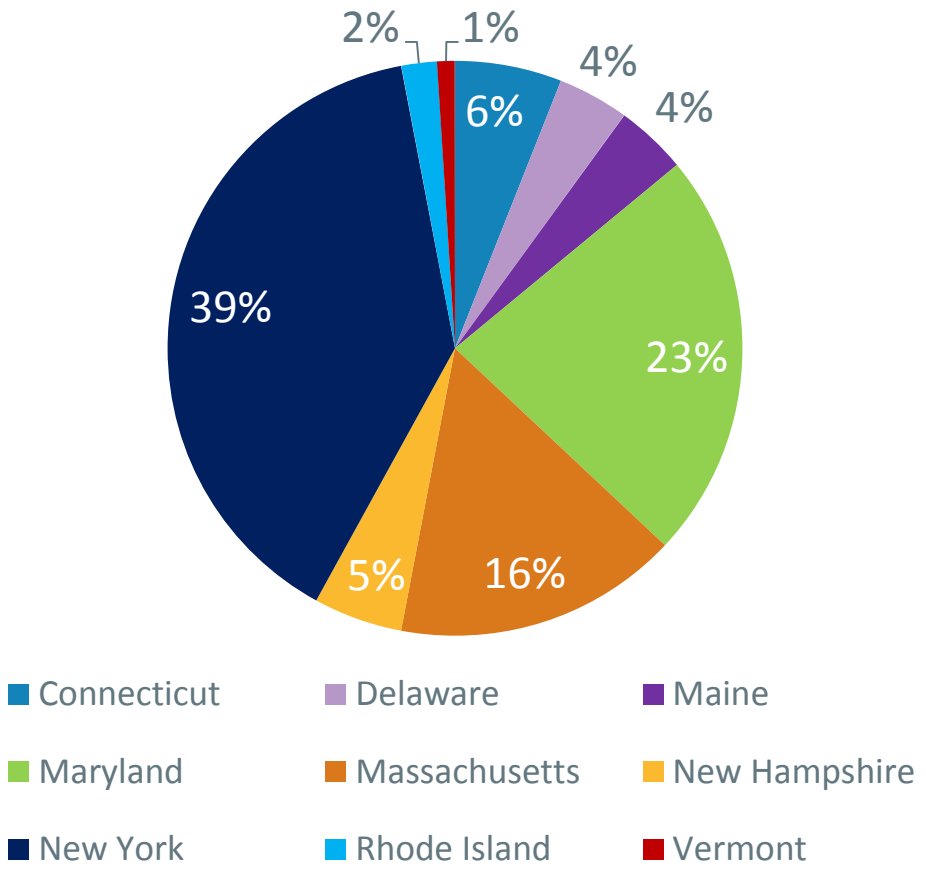
2016 Program Review and Interaction with Clean Power Plan

RGGI Program Overview
3rd Control Period (2015-2017)

Overview, Allocations & Recent Auction Results

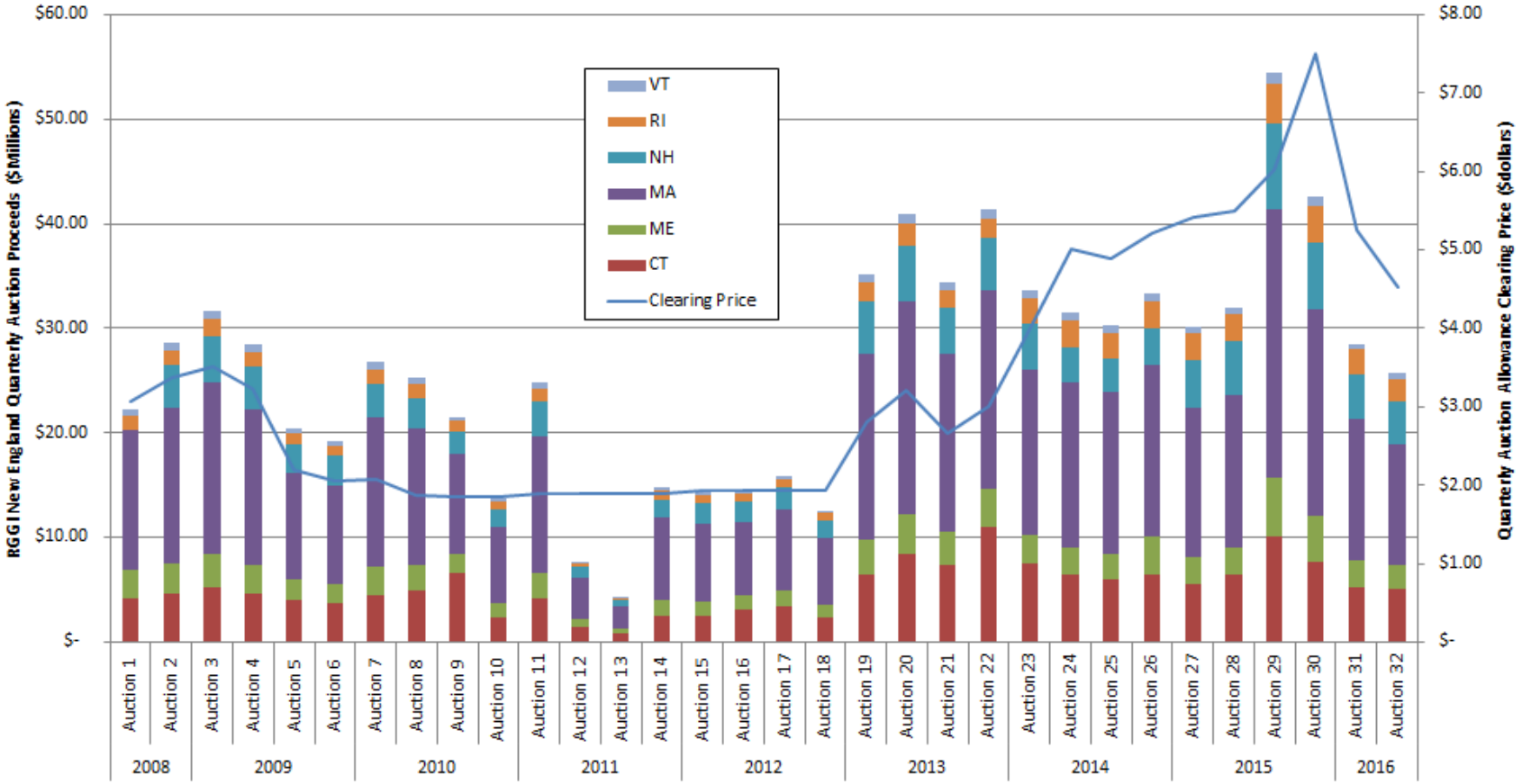
- **86.5** million short tons - RGGI 2015 cap (2014 cap was **91** M)
  - New England share **30.6** M
- **64.6** million short tons – 2016 Adjusted RGGI cap
  - New England share **21.7** M
- **130** million allowances in circulation
- **Auction 32 (June 1, 2016) results:** all 15.8 million allowances offered purchased at price of $4.53/ton, lowest clearing price since March 2014

RGGI 2016 CO_2 Allowance Allocation (State %)



Sources: RGGI, Evolution Markets

RGGI Auction Results 2009-2016YTD



Source: RGGI

2016 RGGI Program Review Update

Additional Modeling Results Released

- **June 17, 2016**: RGGI program review webinar discussed modeling scenario results, and assumptions
- The scenarios included two reference cases and five policy choices
- Reference cases
  - CPP New + Existing (N+E)
  - CPP Existing only (E)
- Policy cases
  - CPP E 2.5% 2024
  - CPP N+E 2.5% 2024
  - CPP N+E 2.5%
  - CPP N+E 5.0%
  - CPP N+E 5.0% CCR
  - All scenarios assumed mass based CPP compliance outside the RGGI region, banking allowances, and trading
  - Both reference cases had the RGGI cap stop declining after 2020 (78 Mtons) and retain the Cost Containment Reserve (CCR)
  - Policy cases had the RGGI cap declining at either 2.5% or 5%, without a CCR (to isolate impacts of the cap level) or with a two-tier modified CCR

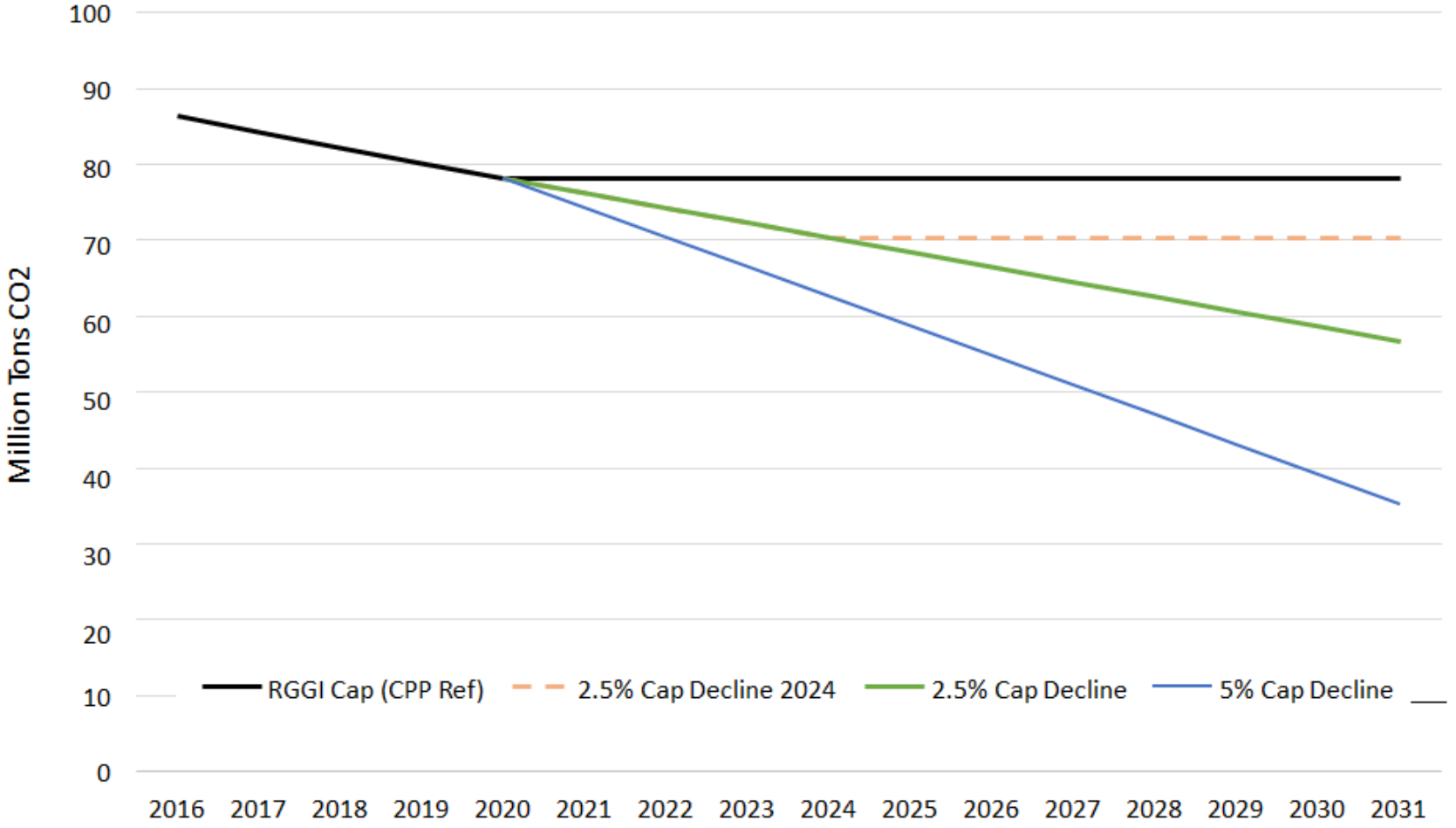
Source: RGGI

RGGI 2016 Program Review Modeling Assumptions

Assumption	CPP New + Existing (N+E)	CPP E	CPP E 2.5% 2024	CPP N+E 2.5% 2024	CPP N+E 2.5%	CPP N+E 5%	CPP N+E 5% CCR
RGGI Cap	Cap held at 2020 level (78 Mtons)		Cap declines 2.5% until 2024		Cap declines 2.5% per year	Cap declines 5% per year	
CCR Quantity	10 million tons CCR allowances available per year		No CCR allowances available				10 million tons per year through 2020, 11.7 million tons per year in two parts after 2020
CCR Trigger Price	Trigger price rising at 2.5% per year		None				1st price increases by $2 each year after 2020, 2nd price is 50% higher than 1st
Offsets	Offsets up to 3.3% of compliance		No offsets allowed				
Trading	Trading allowed within RGGI states and with non-RGGI entities						
Banking	Unlimited banking allowed						
CPP Goals	Non-RGGI entities use mass based plan on new and existing sources	Non-RGGI entities use mass based plan on existing sources with leakage set aside	Non-RGGI entities use mass based plan on new and existing sources				

Source: RGGI

RGGI 2016 Program Review Modeled Reduction Scenarios (2016-2031)



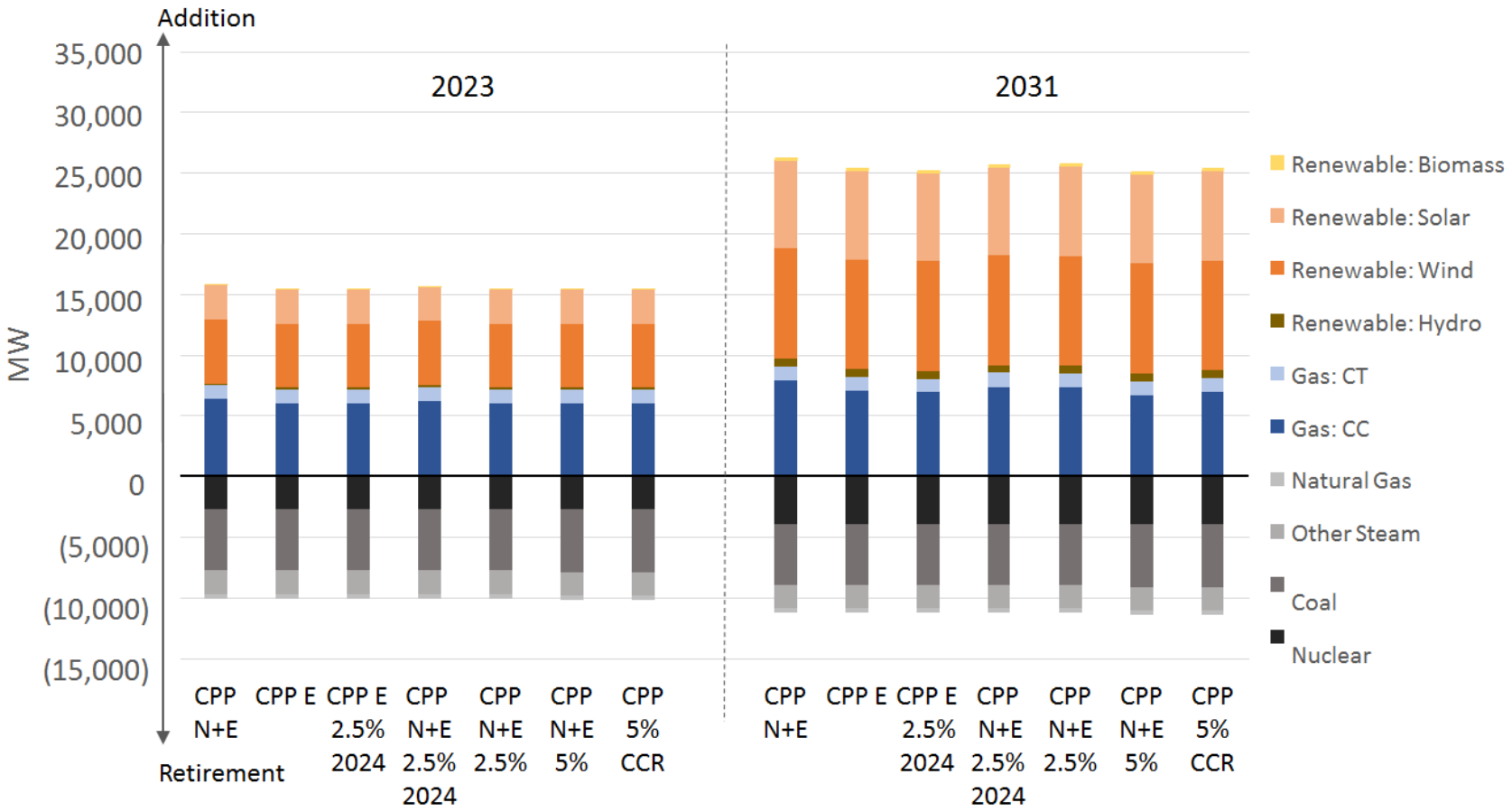
Source: RGGI

RGGI Model Results - Scenario Results

- CO_2 emissions decrease in every scenario, and in all but one case (CPP reference New + Existing (N+E) in 2030-31) the aggregate emissions of RGGI states remain below CPP goals
- RGGI allowance prices and electricity prices rise in all scenarios, but to varying degrees
- In all scenarios, capacity and generation shift away from coal, nuclear, and steam, to natural gas and renewables.
  - Capacity additions and retirements are either classified as firm (already expected by RGGI) or economic (determined by the model as necessary)

Source: RGGI

RGGI Model Results - Capacity Changes

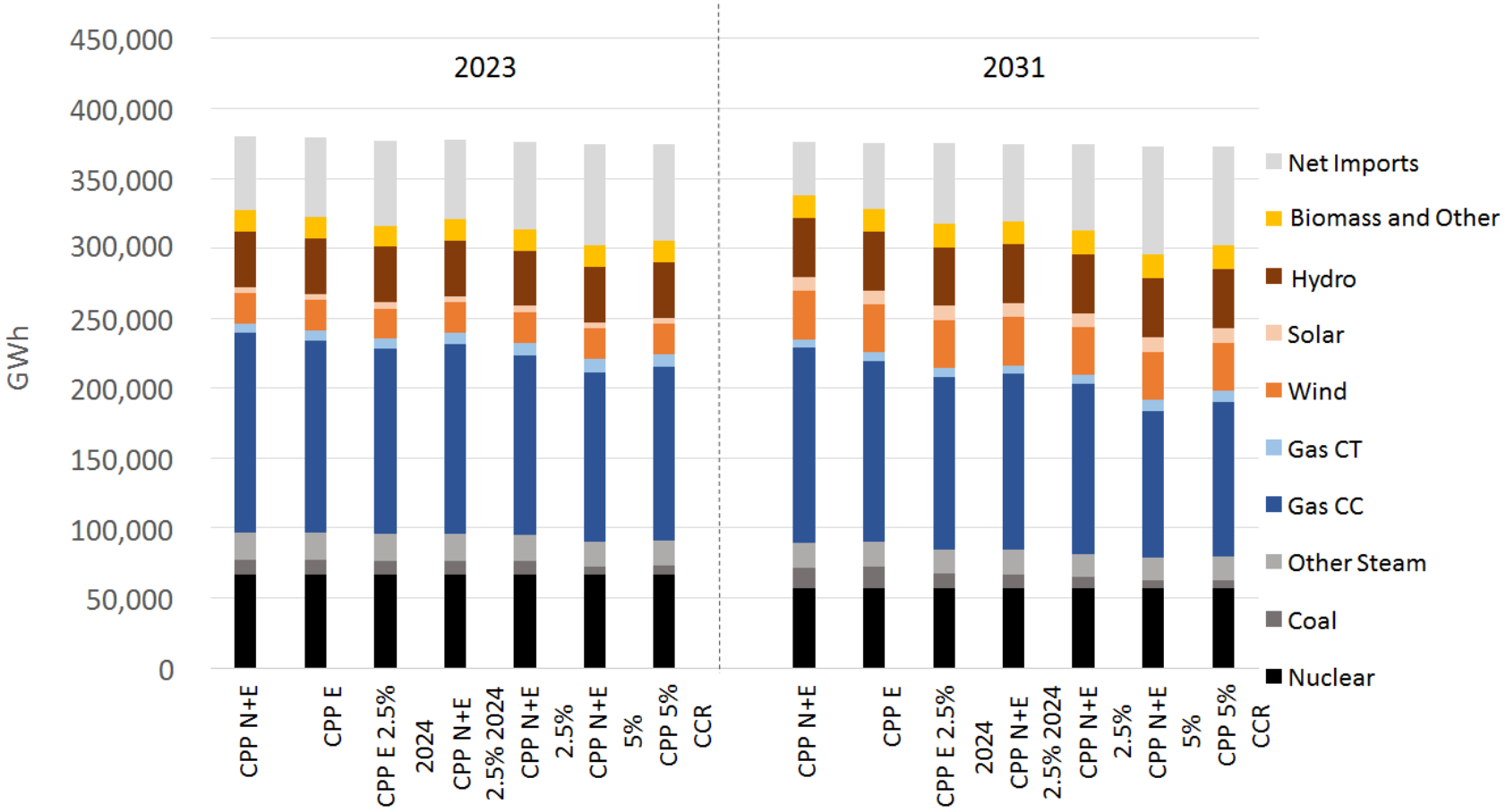


Under all scenarios significant coal, nuclear, and steam thermal retirements assumed and new capacity additions are made primarily through renewables, CC and CT natural gas.

Note: Reference cases - CPP New + Existing (N+E), CPP Existing only (E).

Source: RGGI

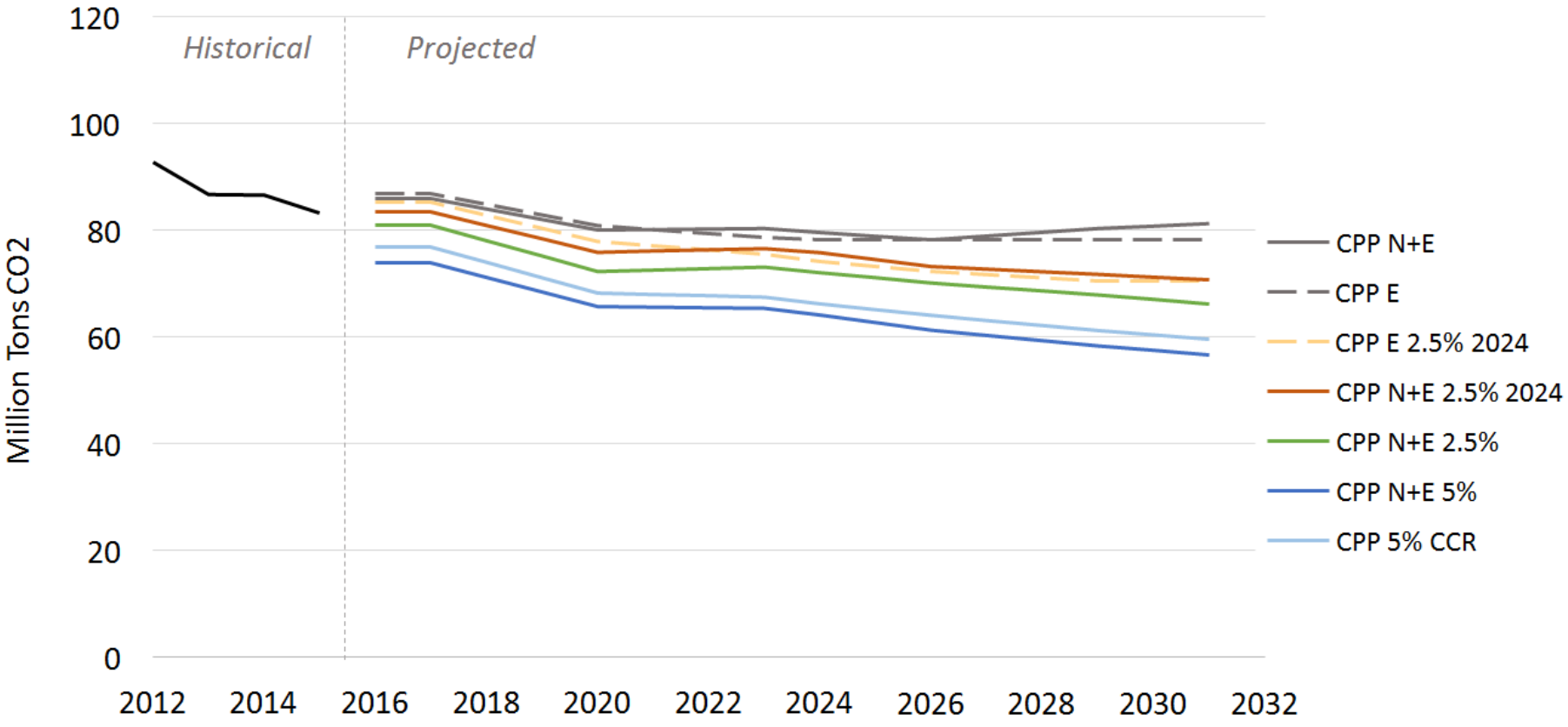
RGGI Model Results - Generation Mix



By 2031, coal, nuclear, and steam plants continue to generate around a quarter of electricity within the RGGI jurisdiction, but renewables generate around a quarter as well, with the difference being made up with varying amounts of natural gas and imports.

Source: RGGI

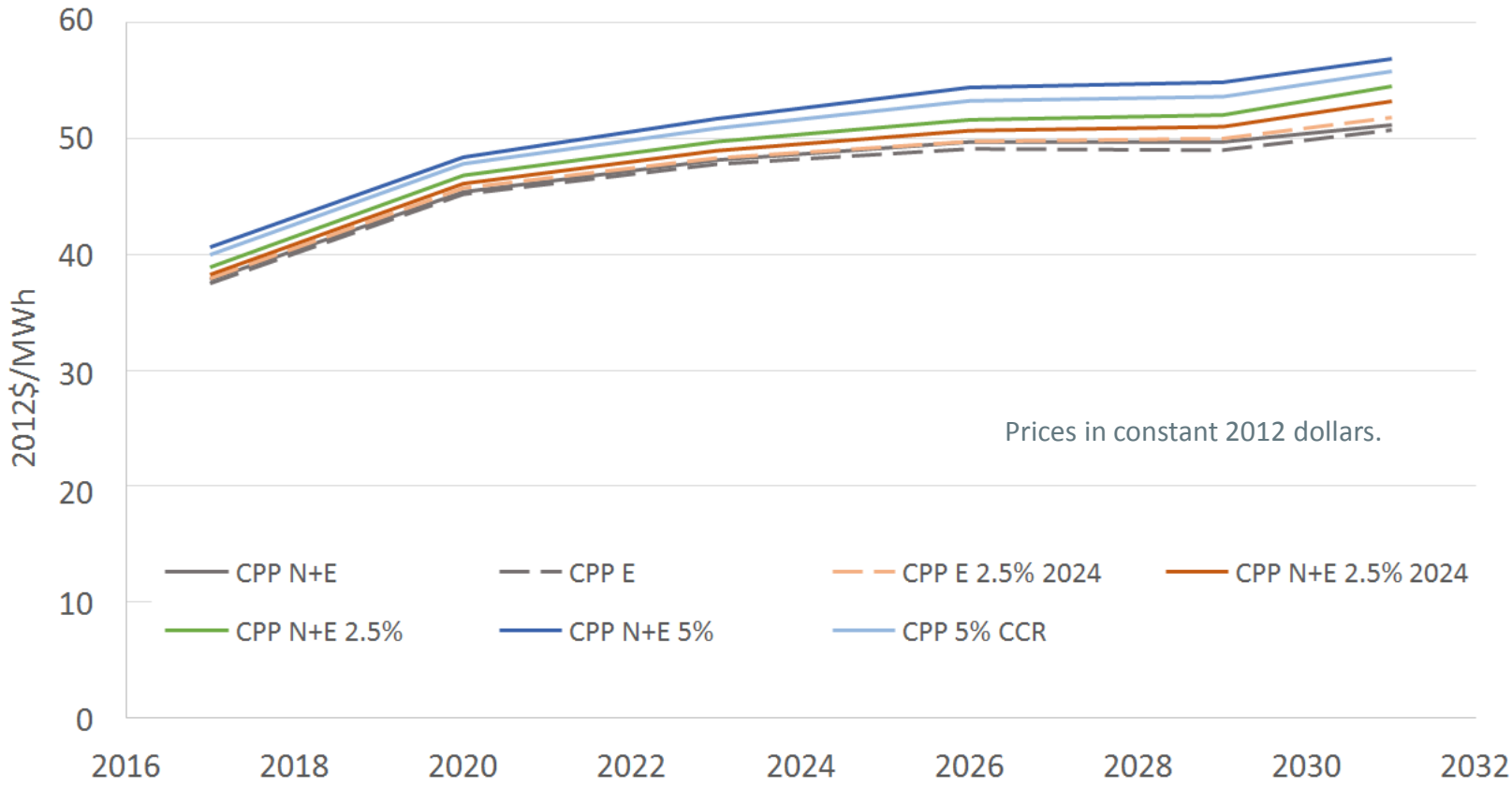
RGGI Model Results - CO_2 Emissions



Aggregate RGGI CO_2 emissions in 2031 range from just over 80 million tons/year in the reference cases (CPP N+E; CPP E), to just under 60 million tons/year in the 5% declining cap case (CPP N+E 5%)

Source: RGGI

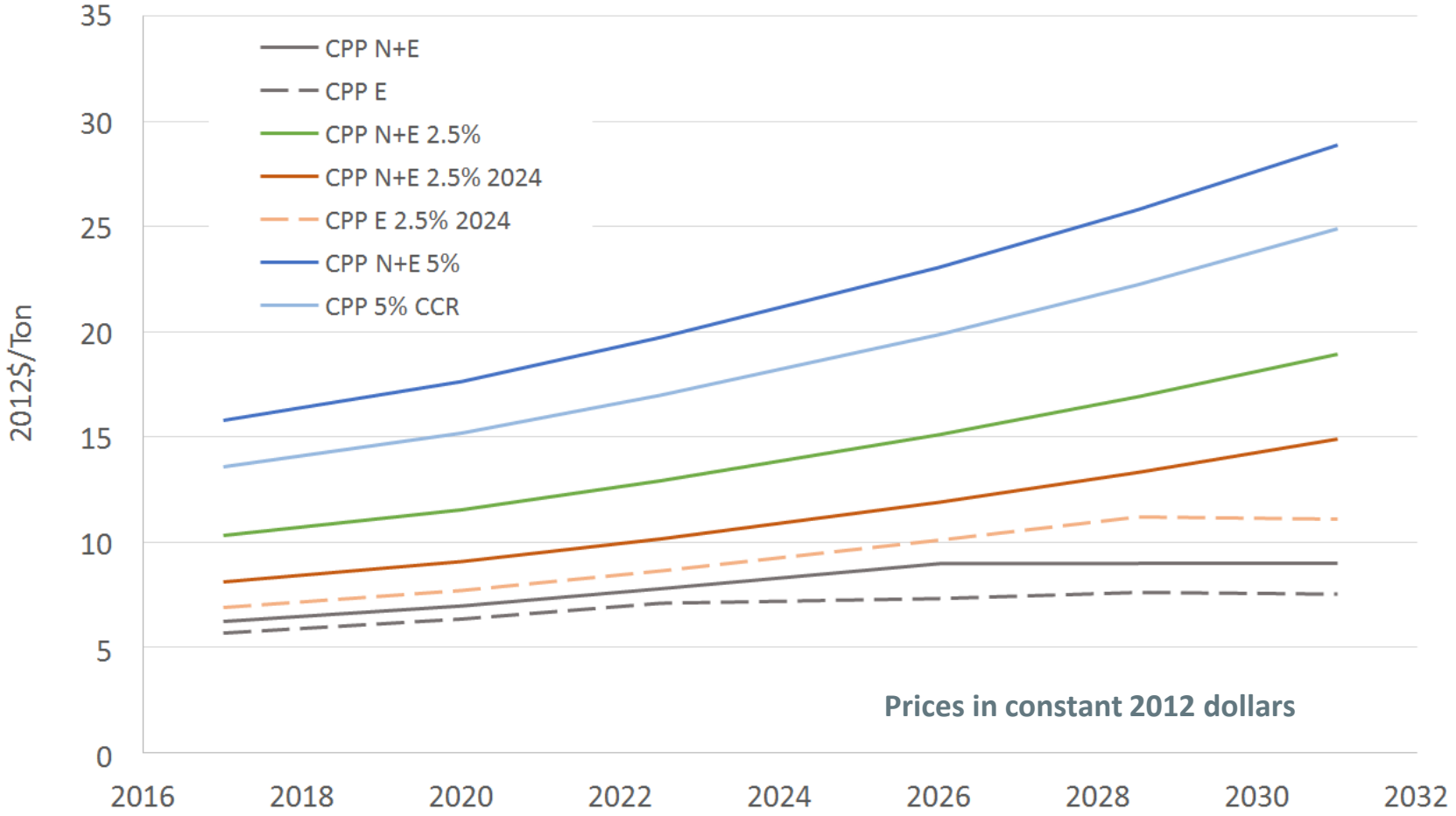
RGGI Model Results – Electricity Prices



Average electricity prices in the RGGI jurisdiction during 2031 range from around $50/MWh in the reference cases, to around $57/MWh in the 5% declining cap case.

Source: RGGI

RGGI Model Results - Allowance Prices



By 2031, RGGI allowance prices range from around $7 in constant 2012 dollars for the reference cases (CPP N+E, CPP E), to around $28 in the 5% declining cap scenario (CPP N+E 5%).

Source: RGGI

Next Steps

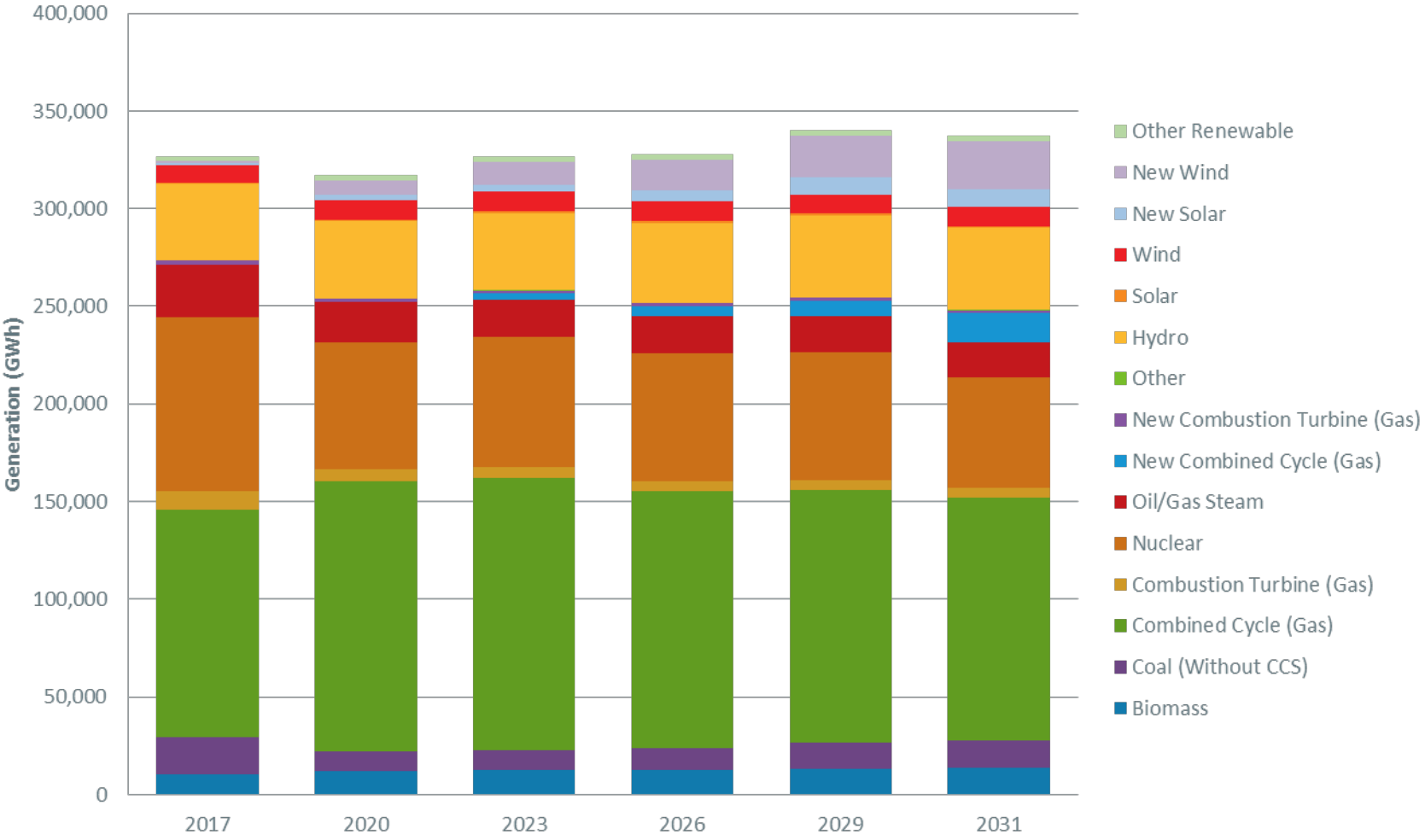
- During the meeting, RGGI state representatives emphasized that the presented scenarios and underlying assumptions do not indicate any specific policy preferences or program design revisions
- Public stakeholder comments seem to lean toward:
  - a 5% declining cap
  - modifying or removing the CCR
  - being trade-ready
- Additional meeting dates and modeling results are expected in the coming months, no specific schedule was announced
- Additional details on the project review can be found at http://www.rggi.org/design/2016-program-review

APPENDIX

Selected Analysis Using 2016 RGGI Program Review Data

RGGI Program Review Results

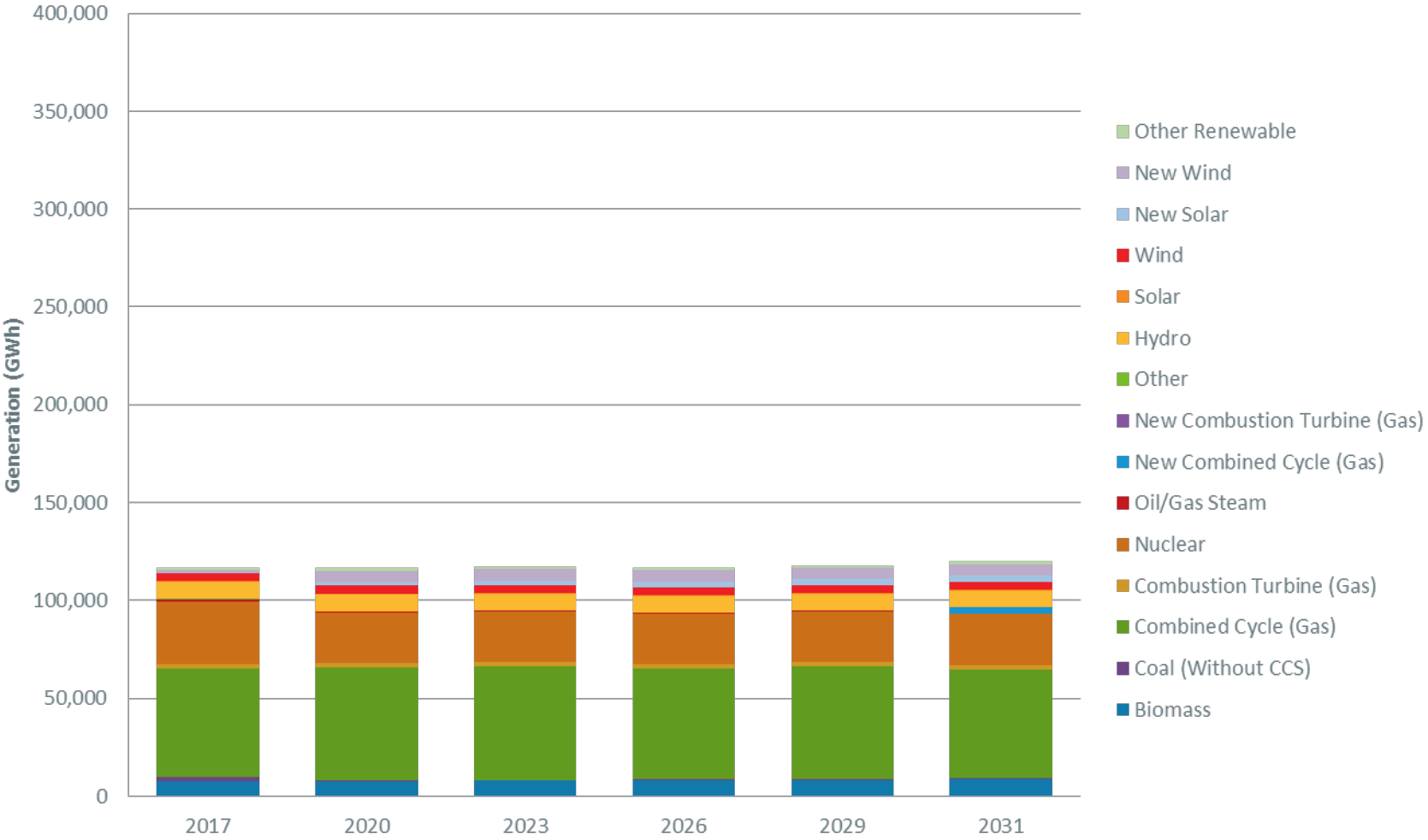
Reference Case 9-States Generation (GWh) (CPP ref N+E)



Source: RGGI

RGGI Program Review Results *(CPP ref N+E)*

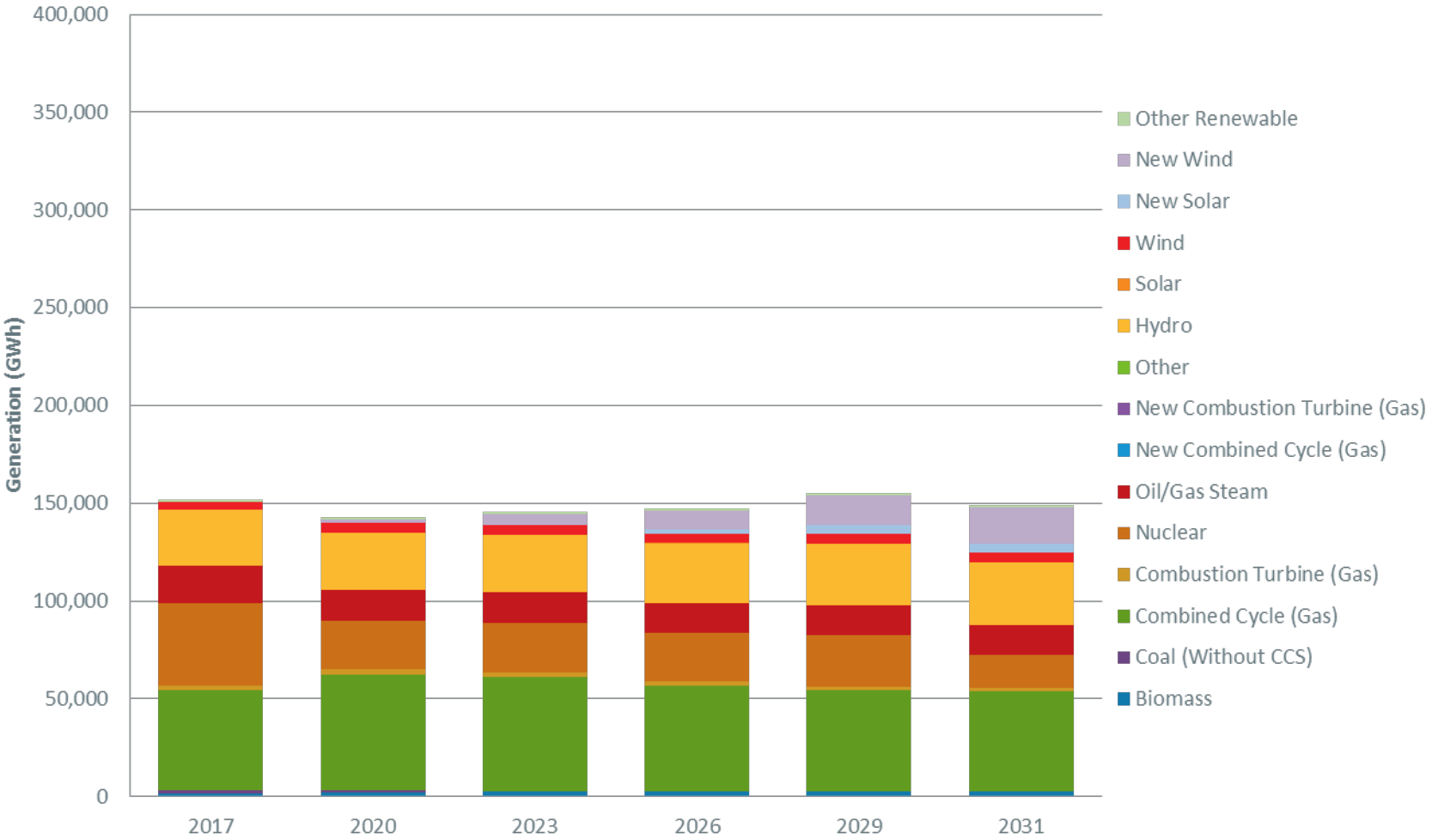
Reference Case New England Generation (GWh)



Source: RGGI

RGGI Program Review Results *(CPP ref N+E)*

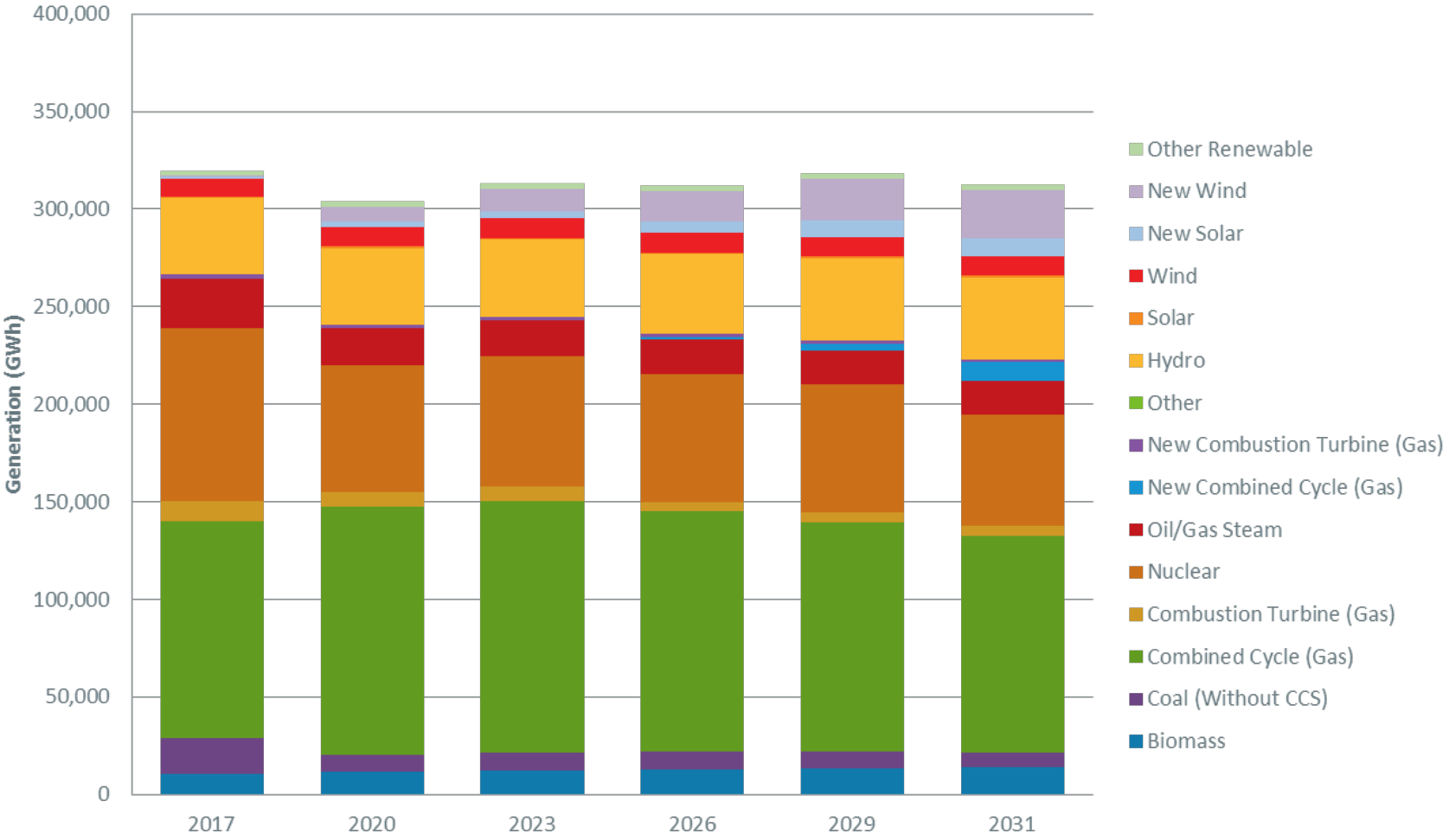
Reference Case New York Generation (GWh)



Source: RGGI

RGGI Program Review Results (CPP 2.5% N+E)

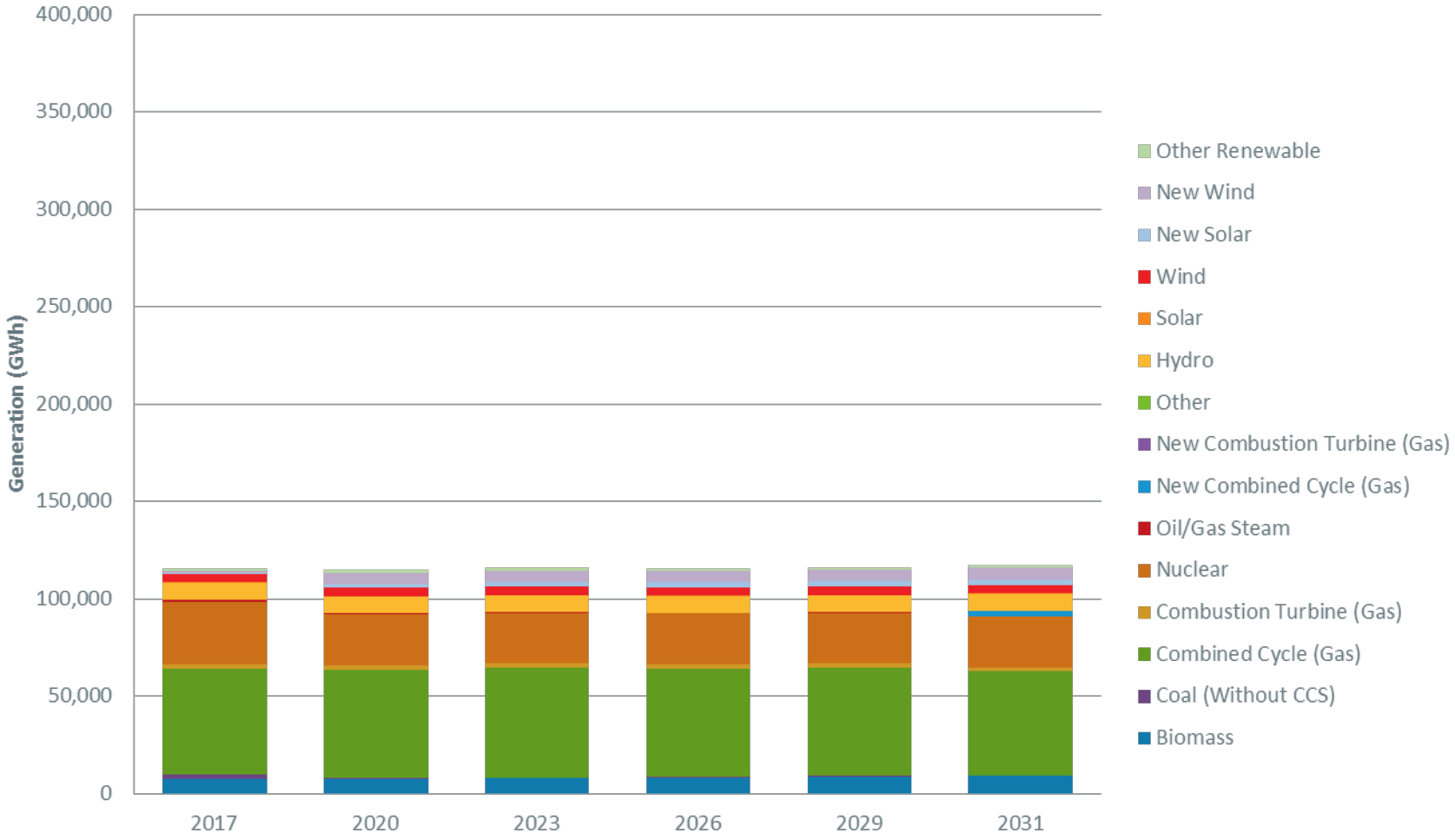
Business-As-Usual 9-States Generation (GWh)



Source: RGGI

RGGI Program Review Results (CPP 2.5% N+E)

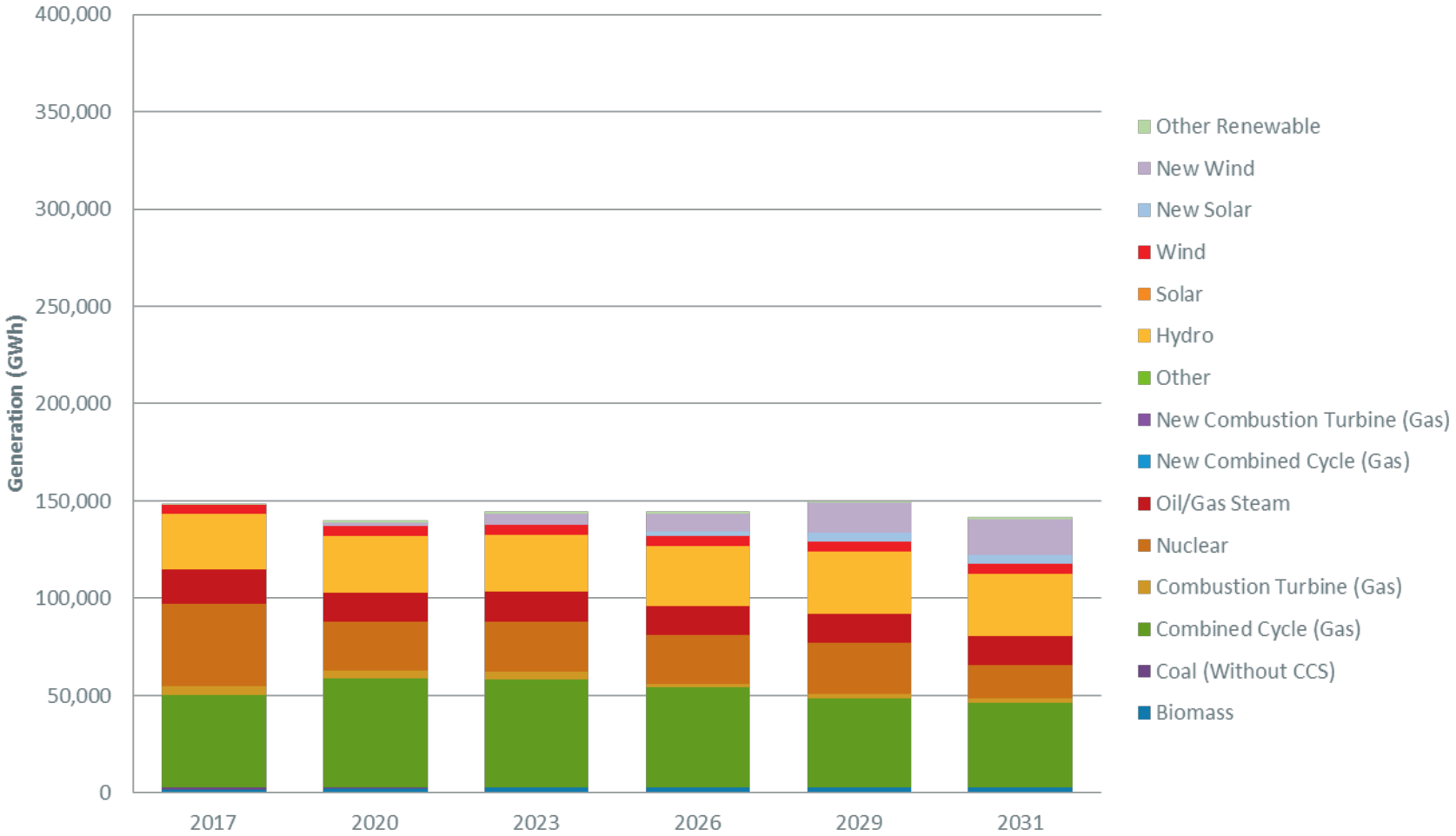
BAU Case New England Generation



Source: RGGI

RGGI Program Review Results (CPP 2.5% N+E)

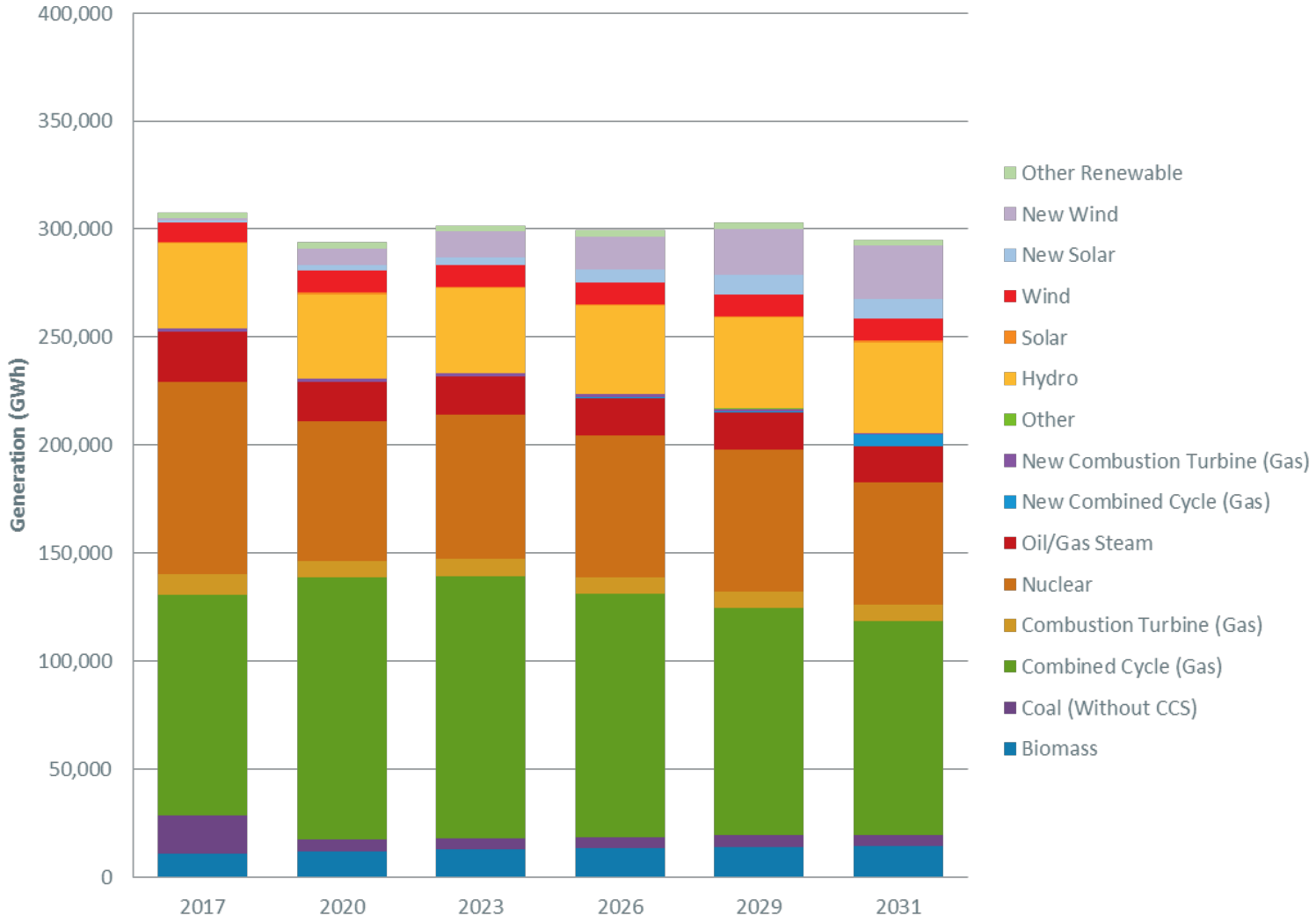
BAU Case New York Generation



Source: RGGI

RGGI Program Review Results (CPP 5% N+E)

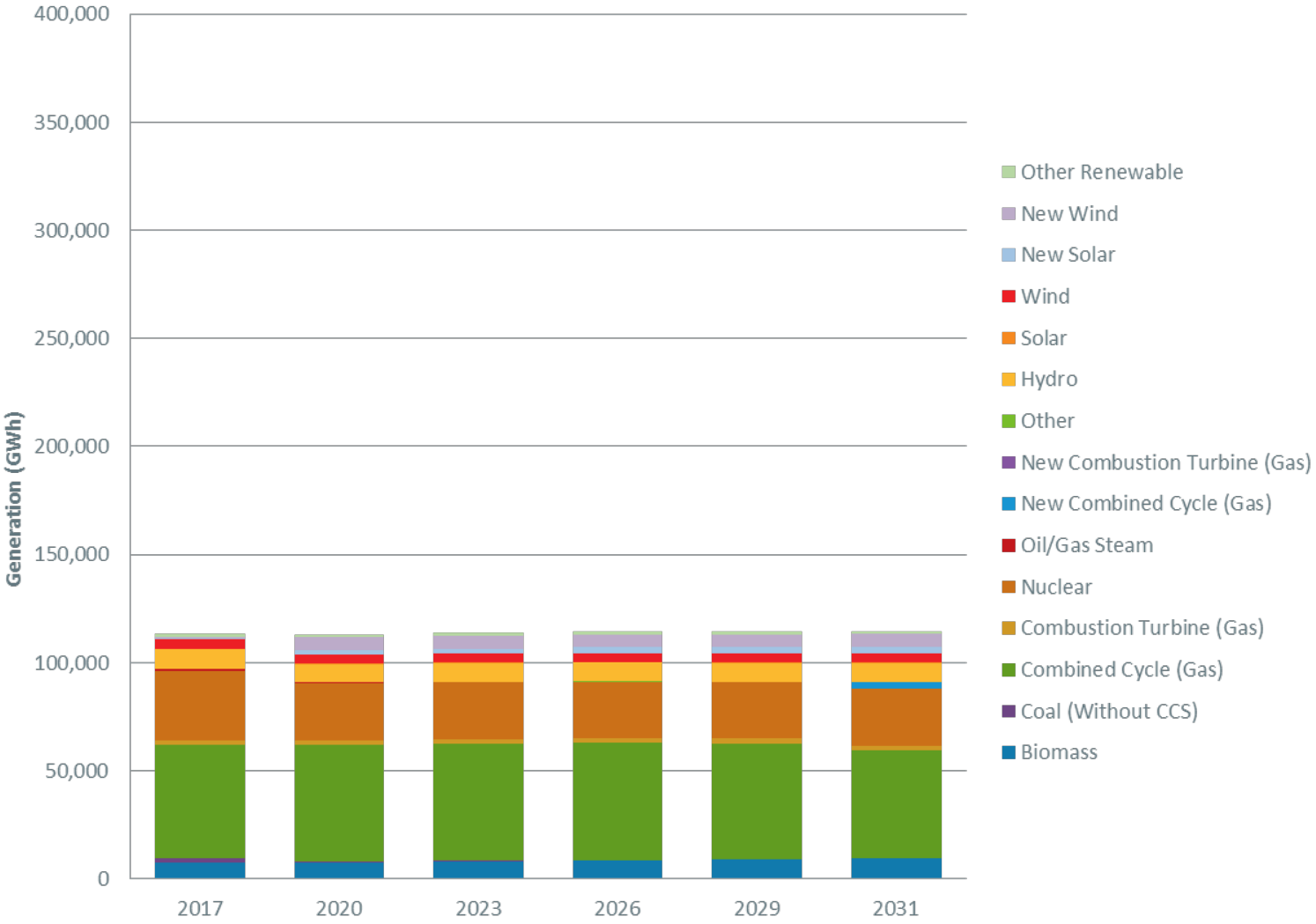
5% Declining Cap Case 9-States Generation



Source: RGGI

RGGI Program Review Results (CPP 5% N+E)

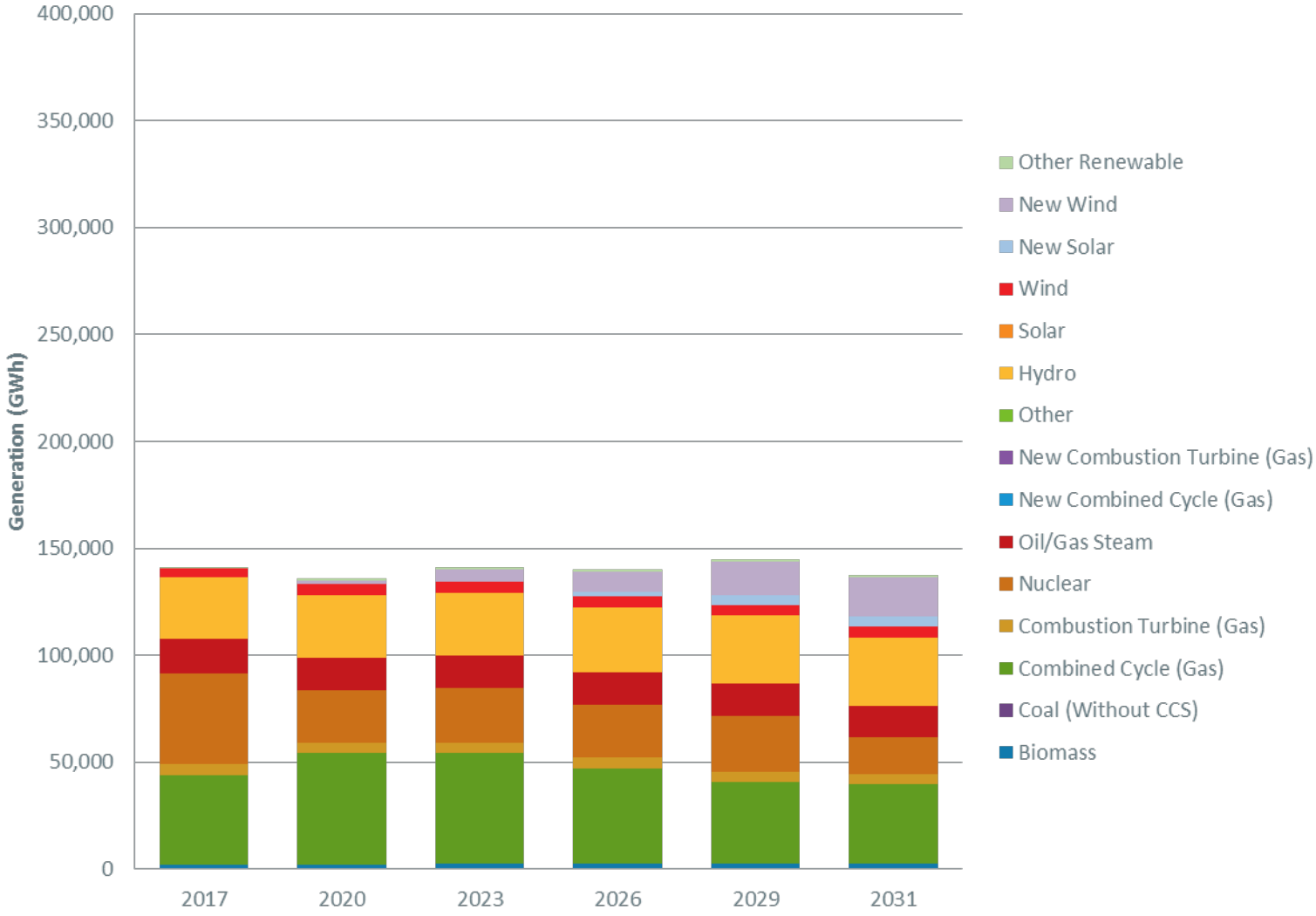
5% Declining Cap Case New England Generation



Source: RGGI

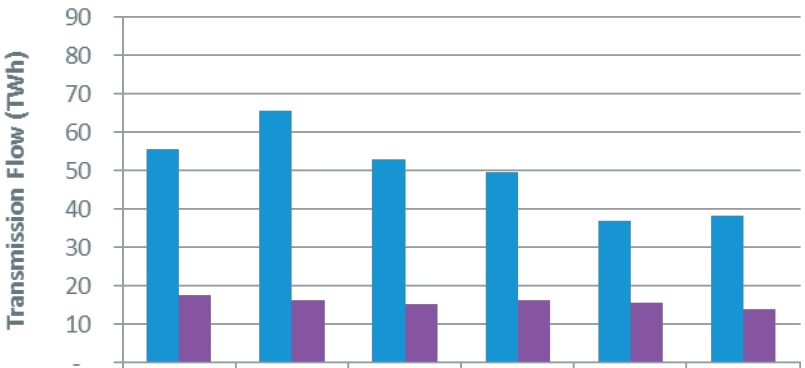
RGGI Program Review Results (CPP 5% N+E)

5% Declining Cap Case New York Generation



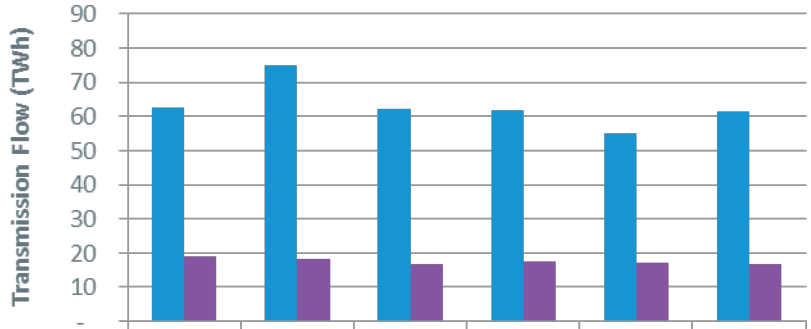
Source: RGGI

RGGI Reference Case Net Imports (CPP ref N+E)



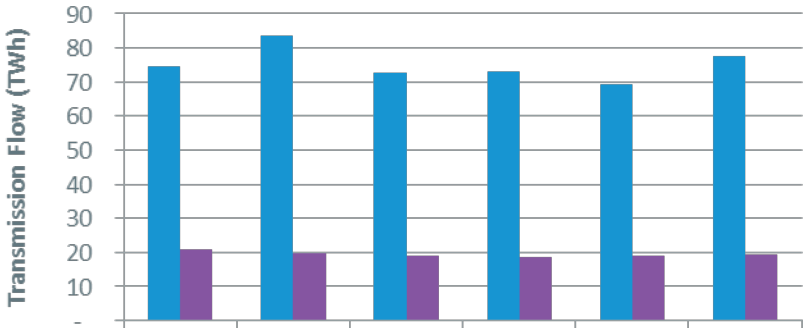
	2017	2020	2023	2026	2029	2031
RGGI	55	65	53	50	37	38
ISO-NE	18	16	15	16	15	14

RGGI BAU Case Net Imports (CPP 2.5% N+E)



	2017	2020	2023	2026	2029	2031
RGGI	62	75	62	62	55	61
ISO-NE	19	18	17	17	17	17

RGGI 5% Declining Cap Case Net Imports (CPP 5% N+E)

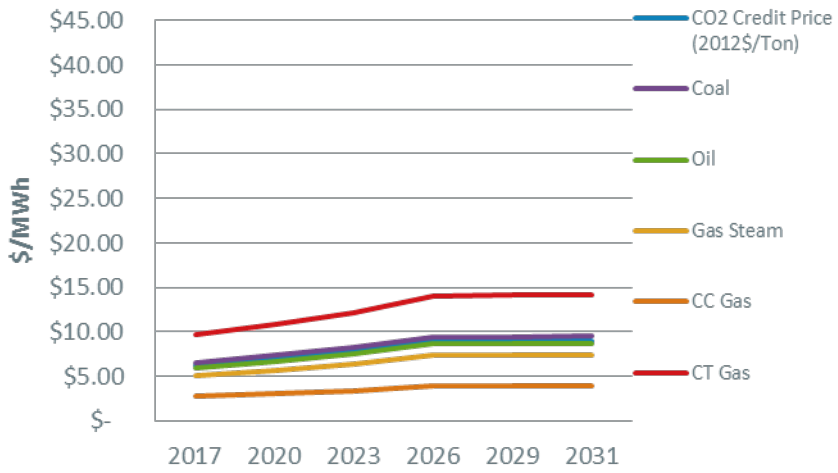


	2017	2020	2023	2026	2029	2031
RGGI	75	84	73	73	69	78
ISO-NE	21	20	19	19	19	19

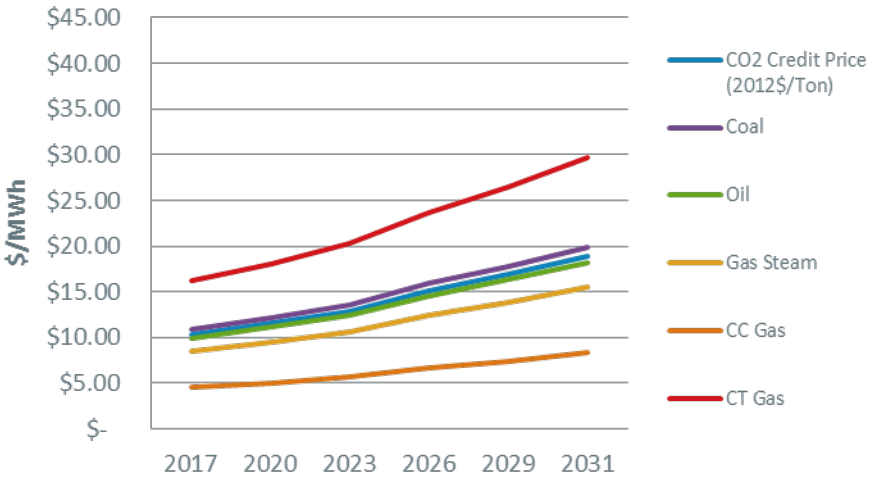
Source: RGGI, Inc.

Source: RGGI

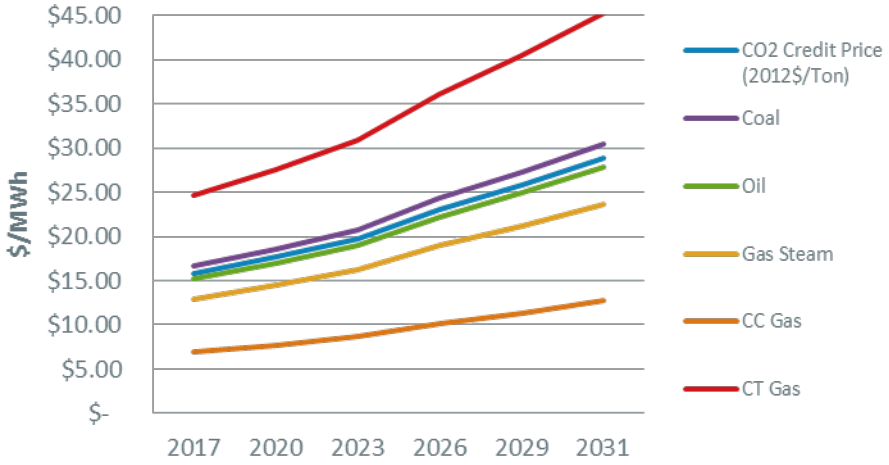
Cost of Electricity by Technology in RGGI Reference Case (CPP ref N+E)



Cost of Electricity by Technology in RGGI BAU Case (CPP 2.5% N+E)



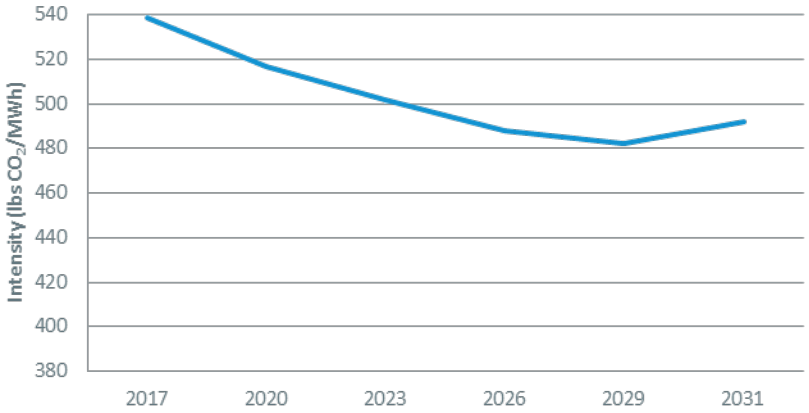
Cost of Electricity by Technology in RGGI 5% Declining Cap Case (CPP 5% N+E)



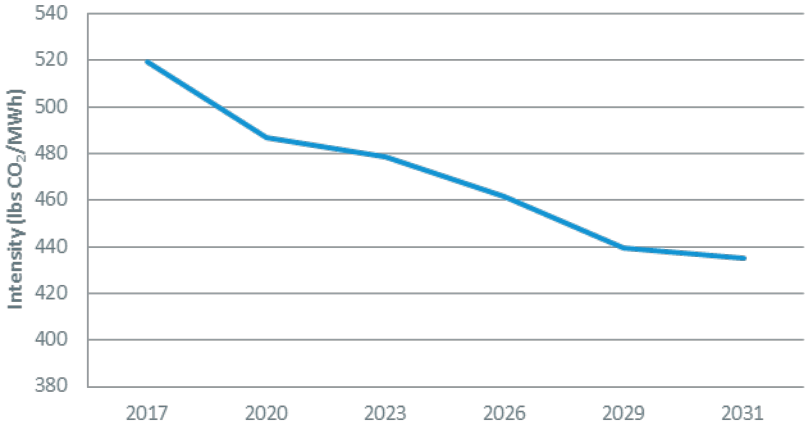
Source: RGGI, Inc.

Source: RGGI

Carbon Intensity of Electricity Generation in RGGI Reference Case (CPP ref N+E)

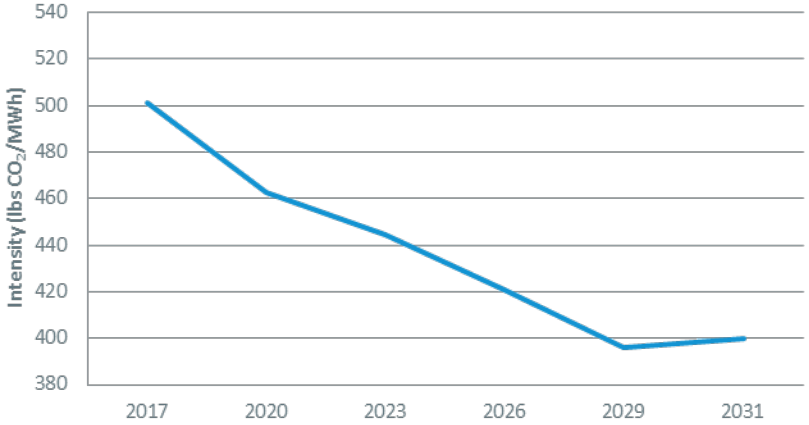


Carbon Intensity of Electricity Generation in RGGI BAU Case (CPP 2.5% N+E)



Source: RGGI

Carbon Intensity of Electricity Generation in RGGI 5% Declining Cap Case (CPP 5% N+E)



Source: RGGI, Inc.