DRAFT 2016 RGGI Program Review: CPP Reference Cases & Modeling Scenarios

June 17, 2016

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DRAFT 2016 CPP Reference Cases Assumptions Updates

- The following slides present select projections from two Clean Power Plan (CPP) Reference Cases and five cap decline policy scenarios that RGGI specified for evaluation.
- Projections are based on assumptions in place as of May 27, 2016.
- These projections are draft and may change as ICF makes refinements based on review and input by the States.
- Both CPP Reference Cases assume the CPP in states outside of RGGI.
- CPP Reference Case New and Existing (CPP N+E) places mass-based goals in non-RGGI states for existing sources and the new sources complement.
- CPP Reference Case Existing (CPP E) places CPP mass-based goals in non-RGGI states for existing sources and proposed EPA leakage set-aside.

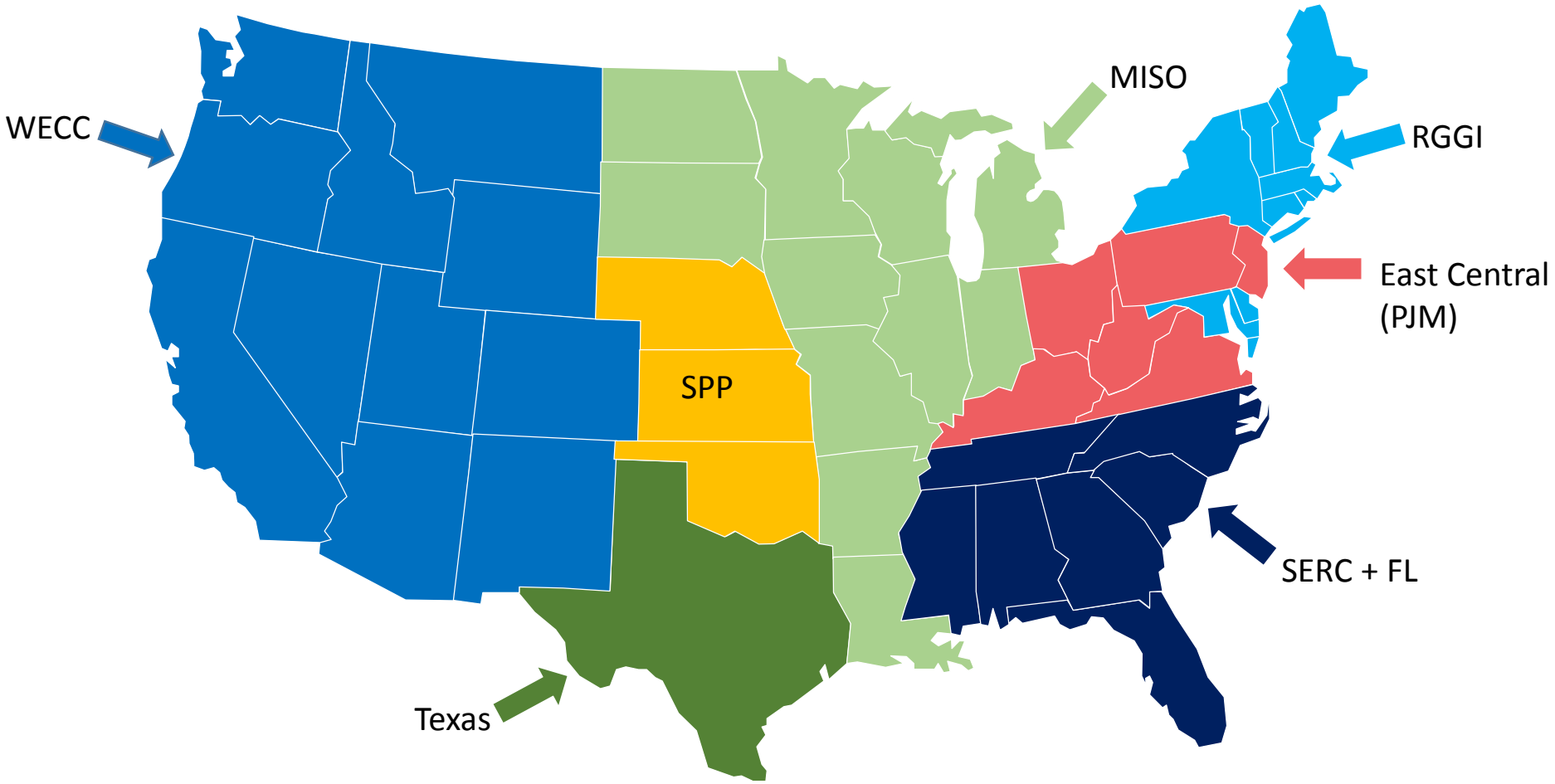
DRAFT 2016 CPP Reference Cases Assumption Updates

Assumption	CPP New and Existing (N+E)	CPP Existing (E)
RGGI Cap	2020 cap extended through end of modeling horizon	
Cost Containment Reserve (CCR)	10 million tons available in each year through end of modeling horizon	
CCR Trigger Price	Trigger price rising at 2.5% annually through end of modeling horizon	
Offsets	Offsets allowed up to 3.3% of compliance through end of modeling subject to minimum allowance price availability assumption	
RGGI Trading	Trading of RGGI allowances among RGGI states	
Banking	Unlimited banking across the modeling horizon	
CPP Goals	States outside of RGGI subject to mass based goals covering existing and new sources	States outside of RGGI subject to mass based goals covering existing sources and proposed leakage set-aside
CPP Trading	Trading zones outside RGGI	

DRAFT 2016 CPP Reference Cases Assumption Updates

- Rest of the assumptions for both cases are the same as those previously presented and discussed with stakeholders with the following exceptions:
  - Offsets available at CO_2 allowances price of $13 in 2017 and rising to $22.60 in 2021 and $25 in 2022. After 2022 the prices increases 2.5% per year thereafter.
  - NY CES implementation updated for consistency with the Clean Energy Standard Cost Study Base Case.
  - NY 2015-2018 firm renewable capacity updated.
  - Addition of NY firm renewable imports from Ontario and Quebec.
  - Costs for new wind and solar updated to NREL 2016.
  - Biomass fuel costs updated to NREL 2016 average value.
  - CPP representation shifted to zone approach (see next slide).

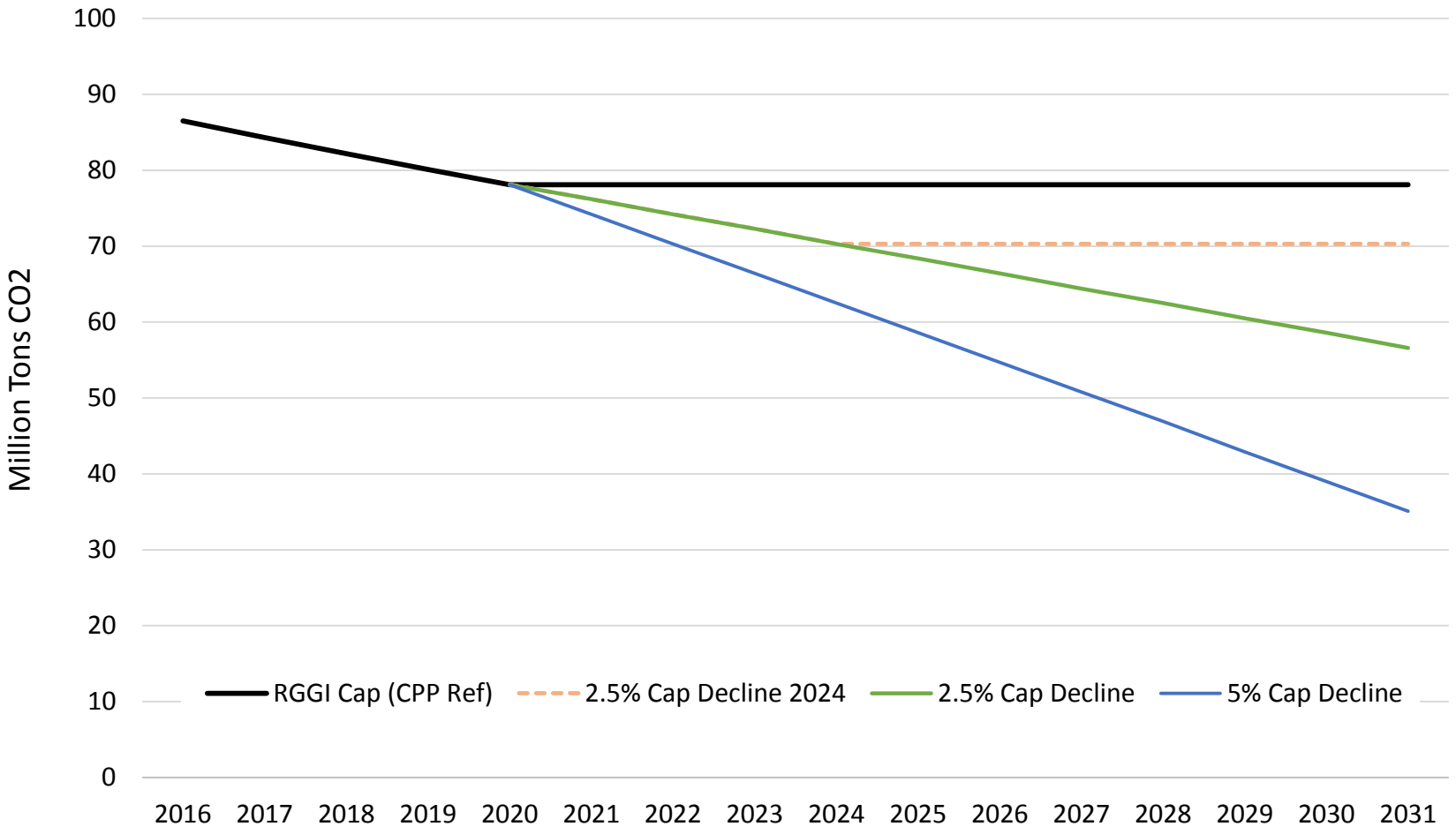
DRAFT 2016 CPP Reference Cases Assumption Updates-Trading Zones



DRAFT 2016 CPP Cap Decline Scenario Assumptions Summary

Assumption	2.5% 2024 (E)	2.5% 2024 (N+E)	2.5% Cap	5% Cap	5% Cap CCR
RGGI Cap	Cap declines 2.5% from 2021-2024	Cap declines 2.5% from 2021-2024	Cap declines 2.5% post-2020	Cap declines 5% post-2020	Cap declines 5% post 2020, Post-2020 cap adjusted for 50 million (50 M) CCR allowances
CCR Quantity	No CCR allowances available throughout modeling horizon				10 million (10 M) available each year through 2020; two CCR quantities available each year post-2020
CCR Trigger Price	N/A				Two CCR prices 1st CCR price increases by $2.00 each year; 2nd CCR price is 50% higher than 1st
Offsets	No offsets available throughout the modeling horizon				
RGGI Trading	Trading of RGGI allowances among RGGI states				
Banking	Unlimited banking across the modeling horizon				

Assumed RGGI CO_2 Caps



DRAFT 2016 Scenario Policy 5% Cap CCR: CCR Assumptions

- 10 million (10M) CCR allowances available each year from 2016-2020
- Two quantities of CCR are available post-2020:
  - 1st CCR trigger price is $8 in 2016 & increases $2 each year (nominal $)
  - Quantity available at 1st trigger price approx. 1/3 less than current 10 M CCR*
  - 2nd CCR trigger price is 50% higher than 1st CCR trigger
  - A maximum of 11.7M total CCR allowances available each year

	Quantity 1	Quantity 2	Trigger 1 (Nominal $)	Trigger 2 (Nominal$)	Trigger 1 (Constant) ($2012)	Trigger 2 (Constant) ($2012)
2016-2020	10M per year	N/A	$8 rising to $16	N/A	$7.4 rising to $13.4	N/A
2021-2031	7M per year	4.7 M per year	$18 rising to $38	$27 rising to $57	$14.7 rising to $24.2	$22 rising to $36.3

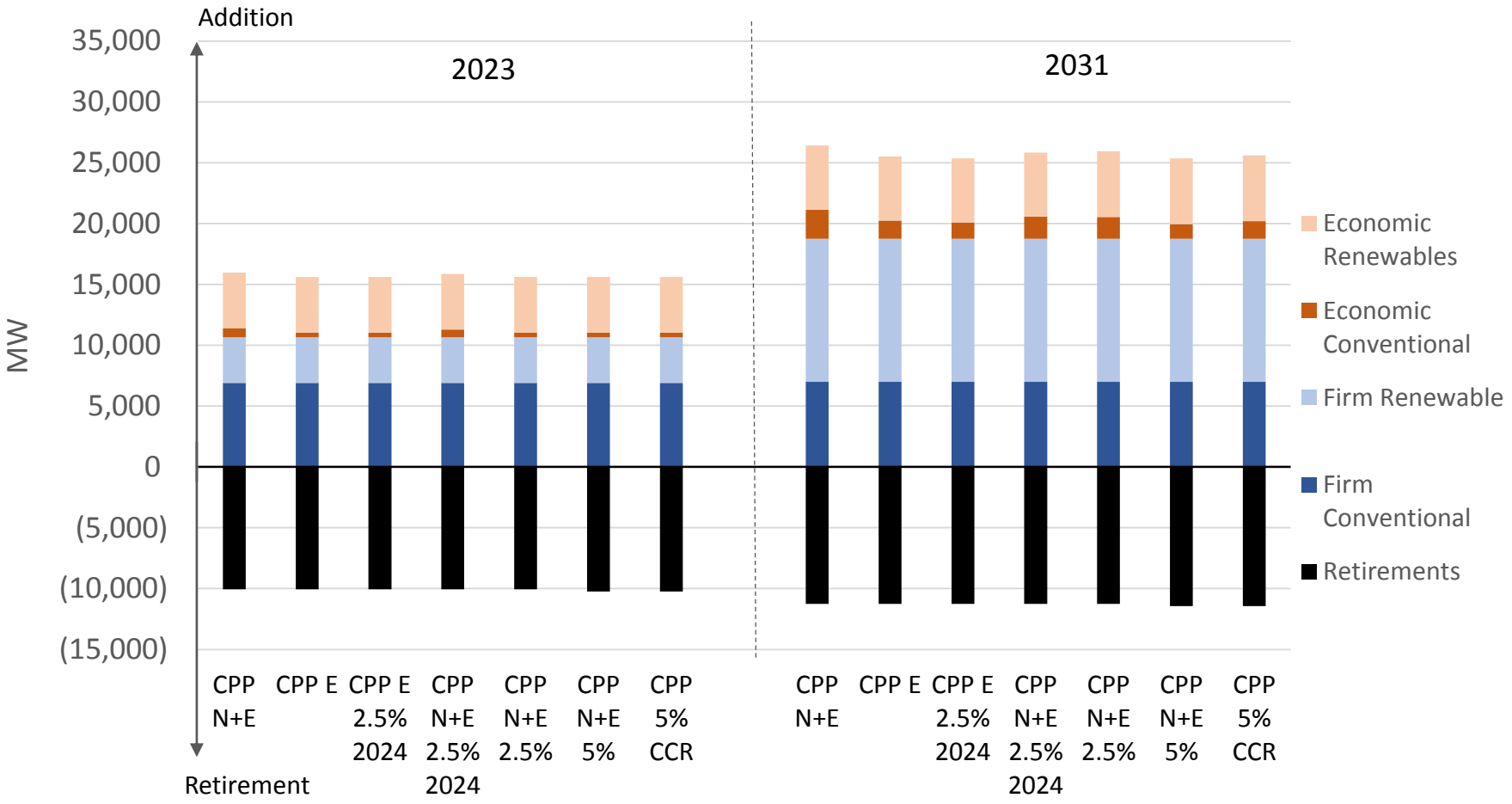
*Bullet updated 6/23/2016 to correct inconsistency with chart value (7M), originally said "Quantity available at 1st trigger price is 1/3 of current 10M CCR."

IPM Model Design

- The following projections were developed using the Integrated Planning Model (IPM), the same model used by EPA in analyzing power sector impacts of environmental regulation.
- Models are schematic representations that are used to project trends.
- Model design features will impact projected results.
- One key feature of IPM is that it optimizes across the time horizon of the analysis, so it will act in the near-term in response to long-term requirements and costs.
- This optimization has two implications for the projections:
  - The projections assume that any allowance bank is exhausted within the timeframe of the analysis.
  - Projections in the near term including generation, emissions, and allowance pricing, can be a function of projections in later years of the analysis.

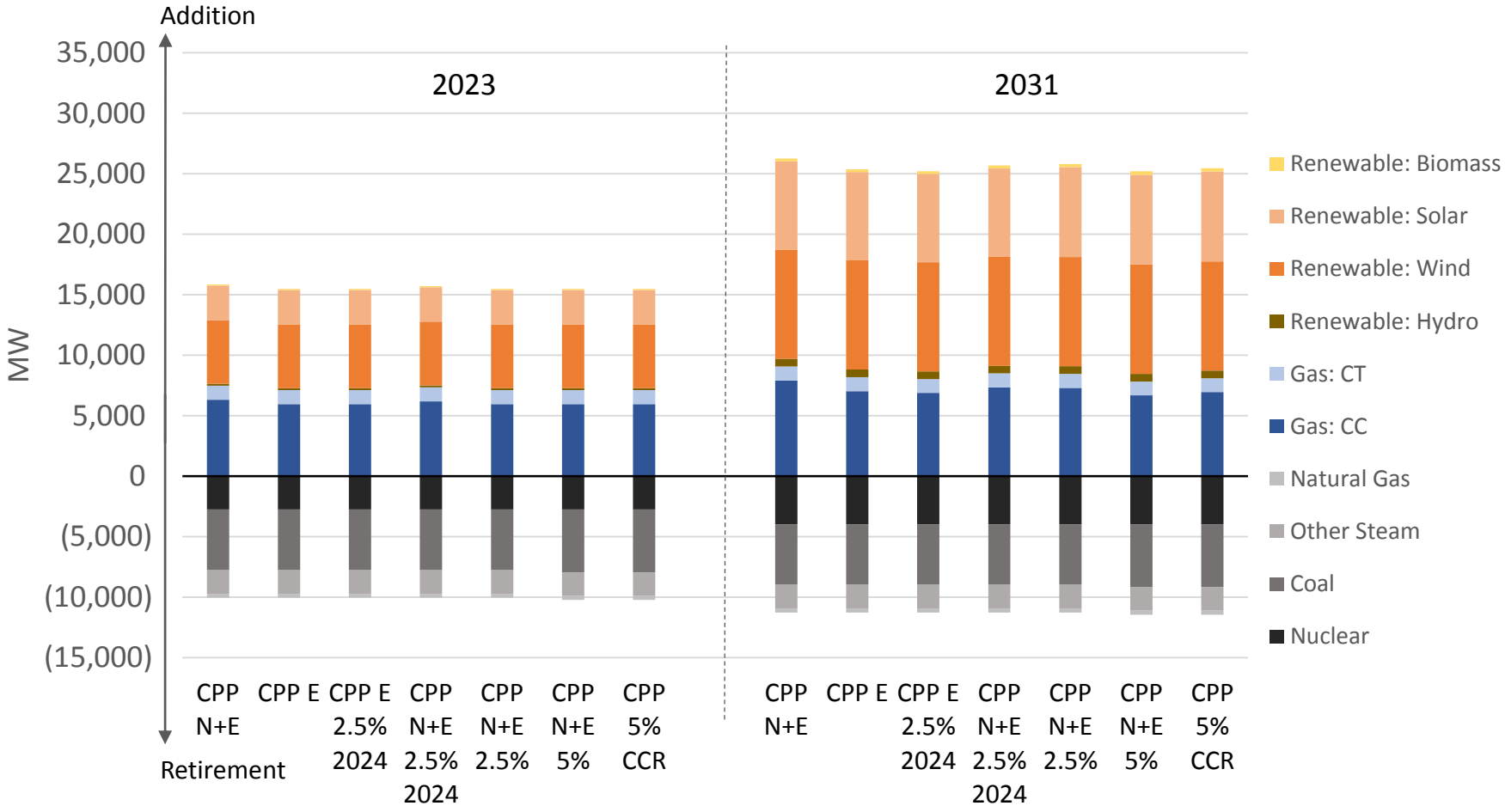
RGGI Cumulative Capacity Additions

- The chart shows the distribution of capacity additions and retirements across firmly planned ("Firm") and model-projected ("Economic") types.



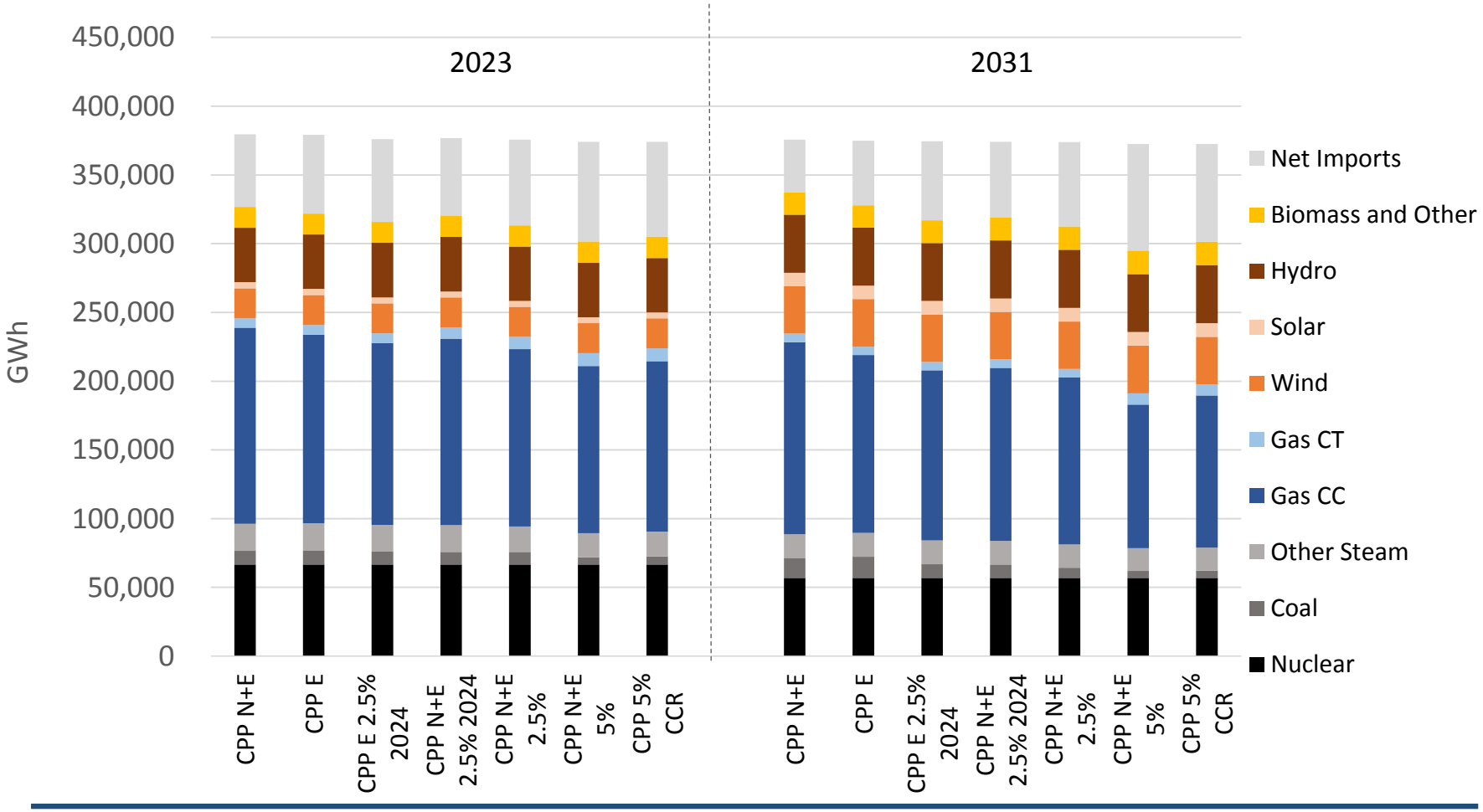
RGGI Cumulative Capacity Additions (2)

- The chart shows the distribution of capacity additions and retirements by capacity type.



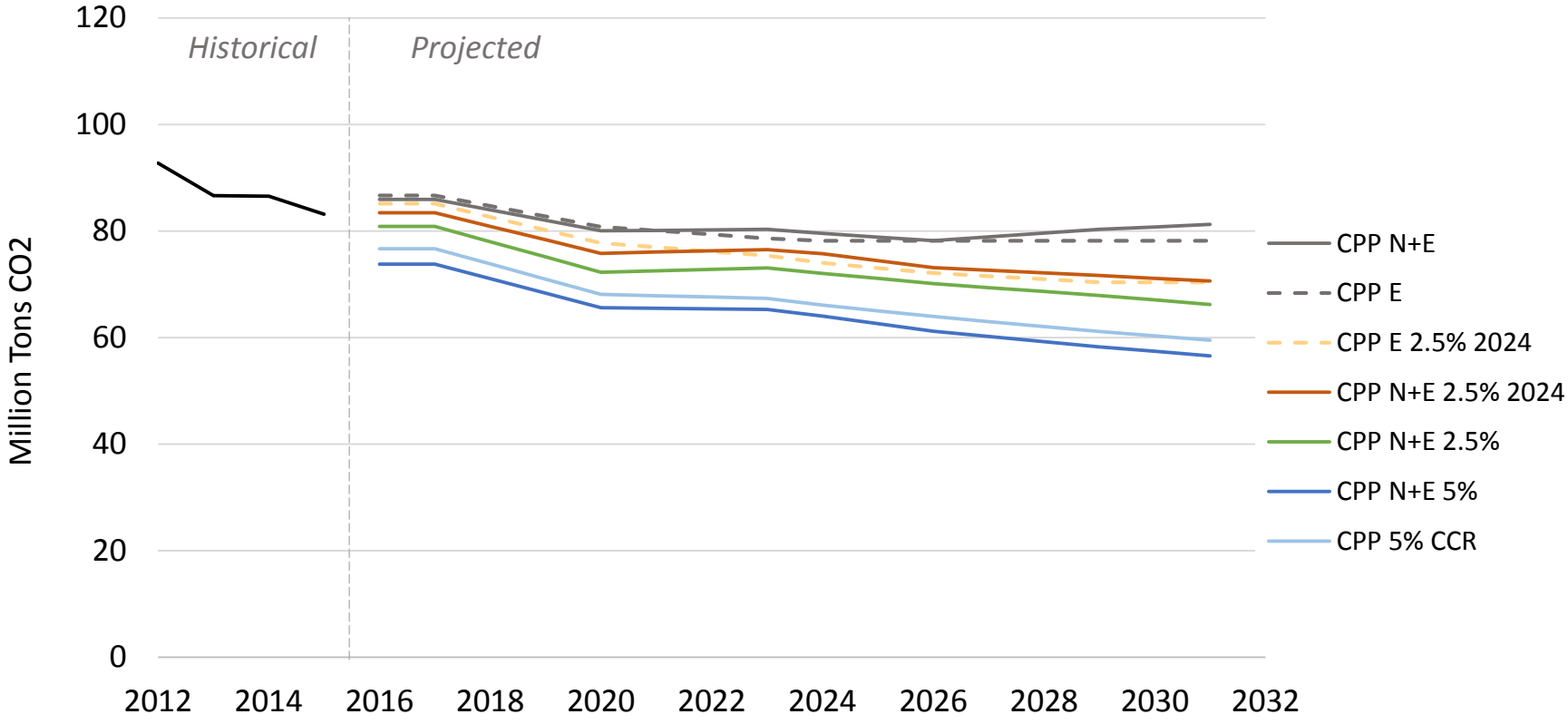
RGGI Generation Mix

- The chart shows generation by type and net imports for the RGGI states.



RGGI CO_2 Emissions

- The chart shows projected CO_2 emissions from RGGI-affected sources.
- Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.



Note: Model assumes that any allowance bank is fully exhausted in 2031.

RGGI CO_2 Emissions
2.5% 2024 Cases

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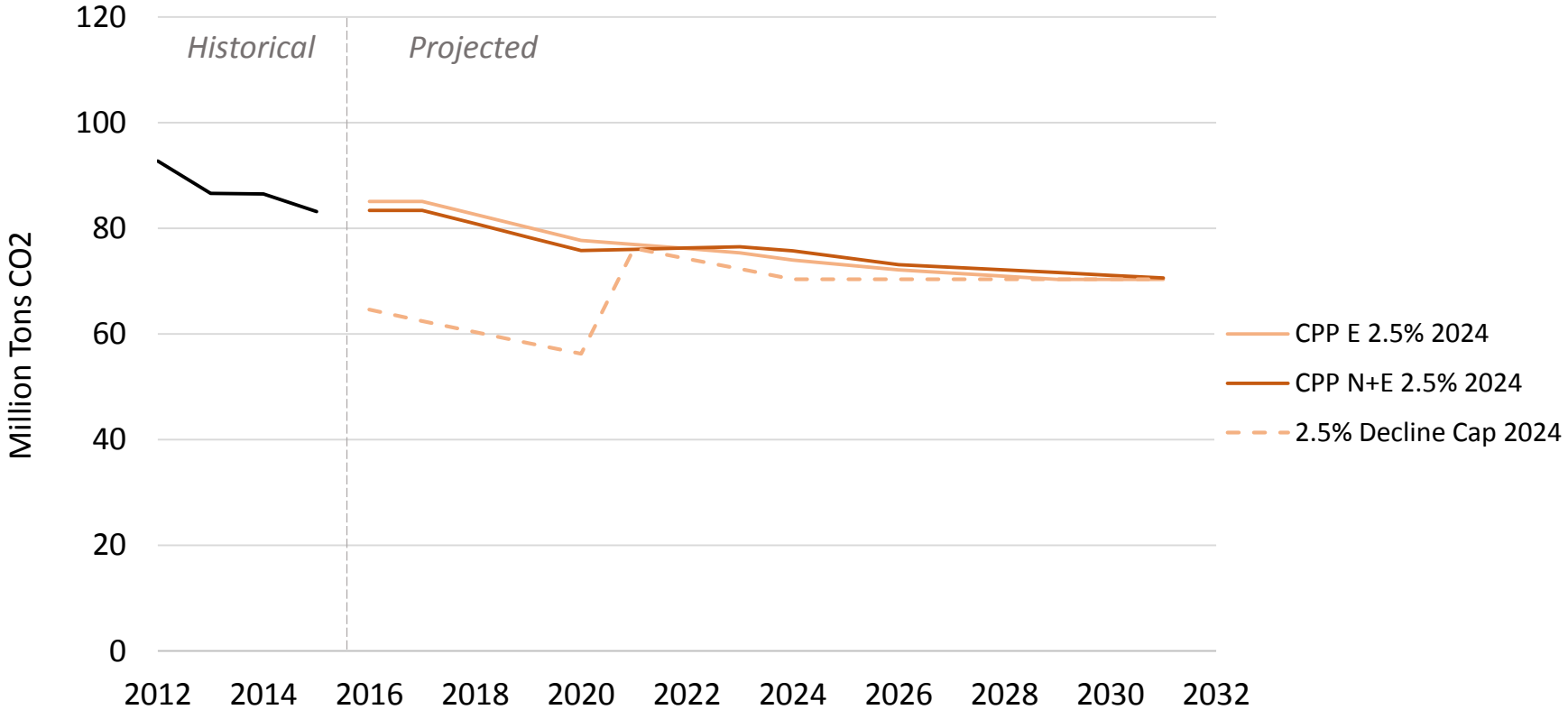

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RGGI CO_2 Emissions
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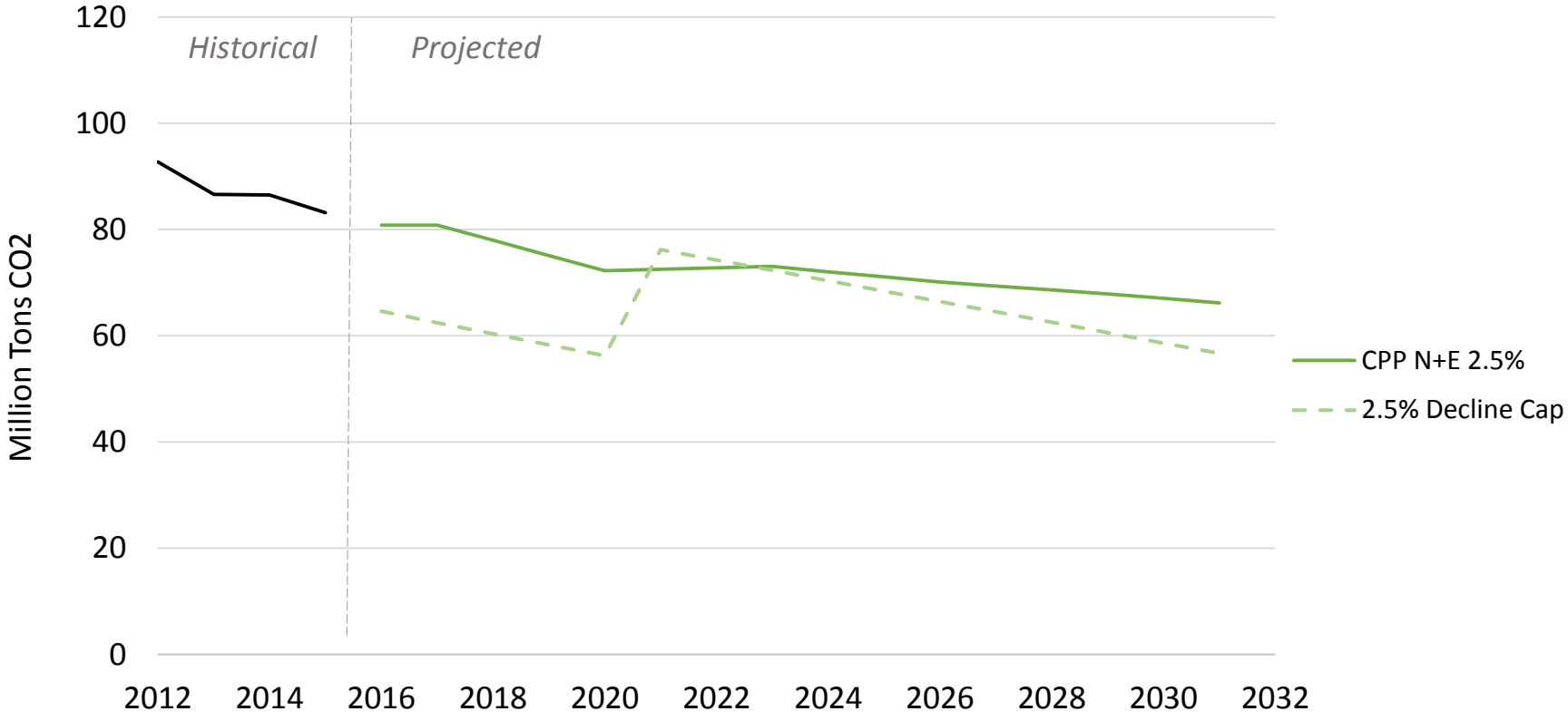

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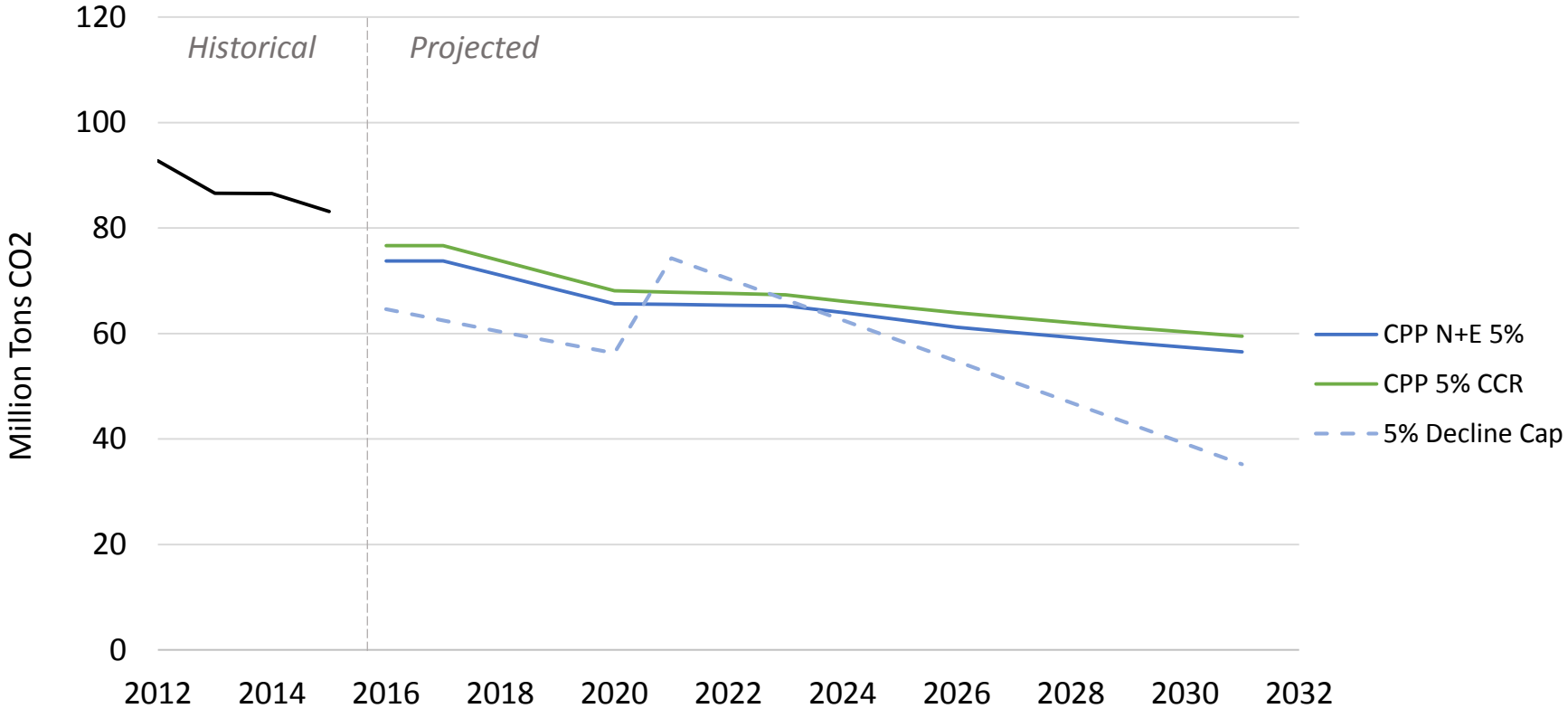
RGGI CO_2 Emissions
5% Cap Cases

- The chart shows projected CO_2 emissions from RGGI-affected sources.
- Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.



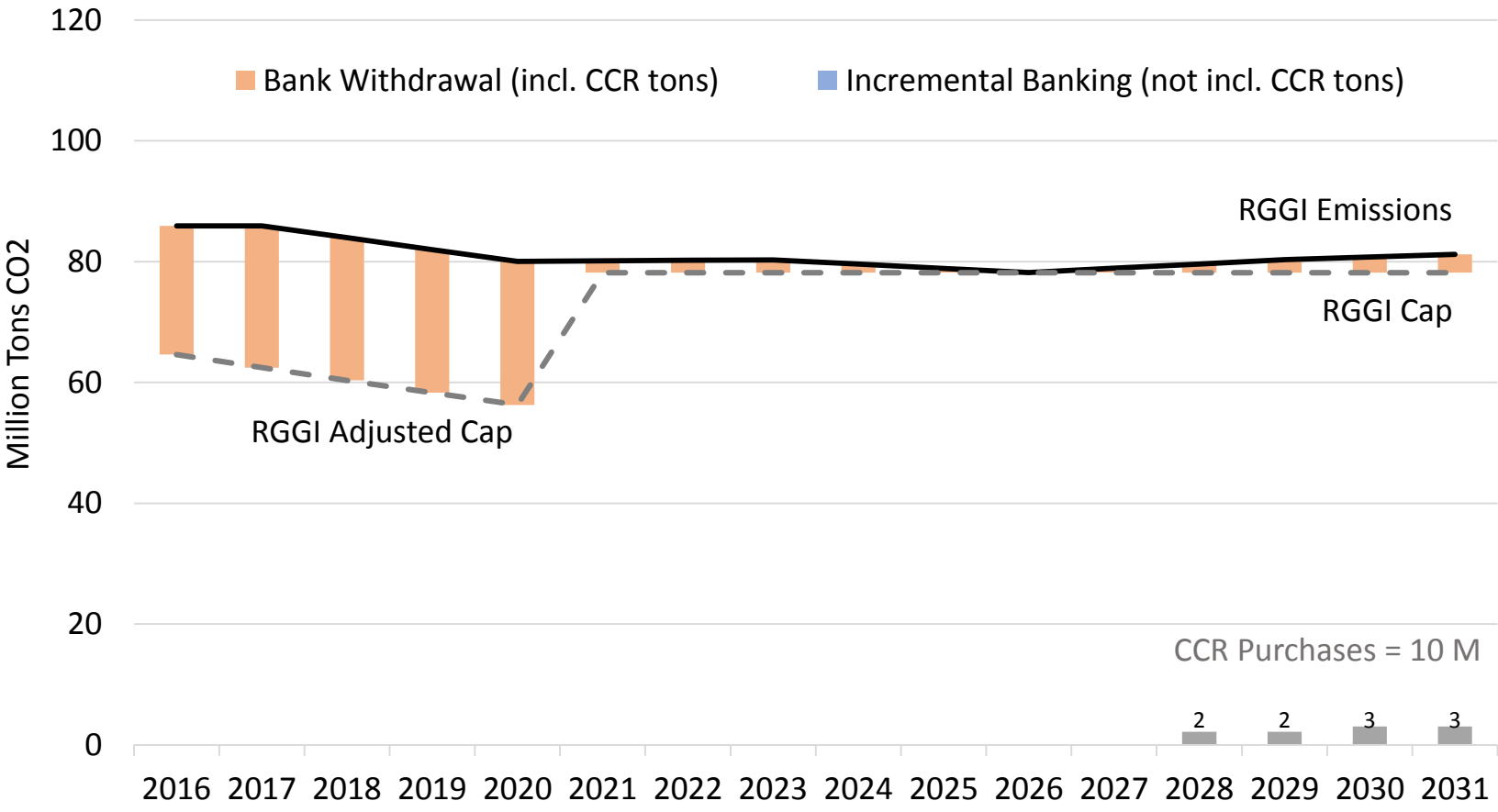
Note: Model assumes that any allowance bank is fully exhausted in 2031.

RGGI Emissions (Million of Tons)

Case	Cumulative Emissions				Average Emissions, 2016-2031
	2016-2021	2022-2031	2022-2029	2030-2031	
CPP Ref N+E	498	797	635	162	81
CPP Ref E	506	783	626	156	81
2.5% 2024 (E)	488	723	582	141	76
2.5% 2024 (N+E)	478	733	591	142	76
2.5% Cap (N+E)	460	698	564	133	72
5% Cap (N+E)	418	609	495	114	64
5% Cap CCR (N+E)	434	635	515	120	67
CPP Goals (Aggregate for RGGI States)		*850*	*690*	*160*	

CO_2 Emission Reductions
CPP Ref (E+N)

- The chart shows the projected CO_2 emissions relative to the cap and the use of banked allowances and CCR allowances used for compliance.



CO_2 Emission Reductions
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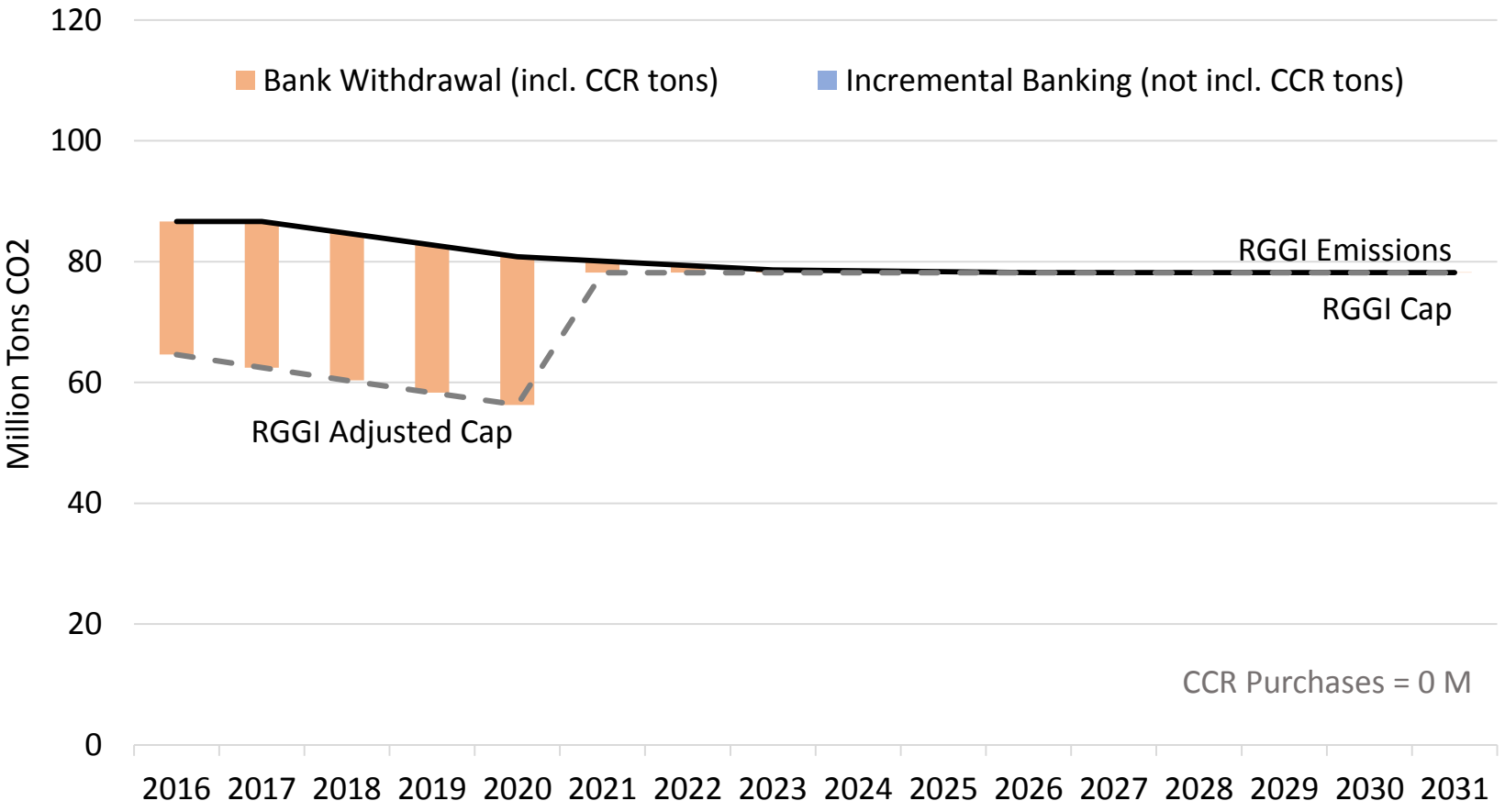

CO_2 Emission Reductions
2.5% 2024 Cap Decline(E)

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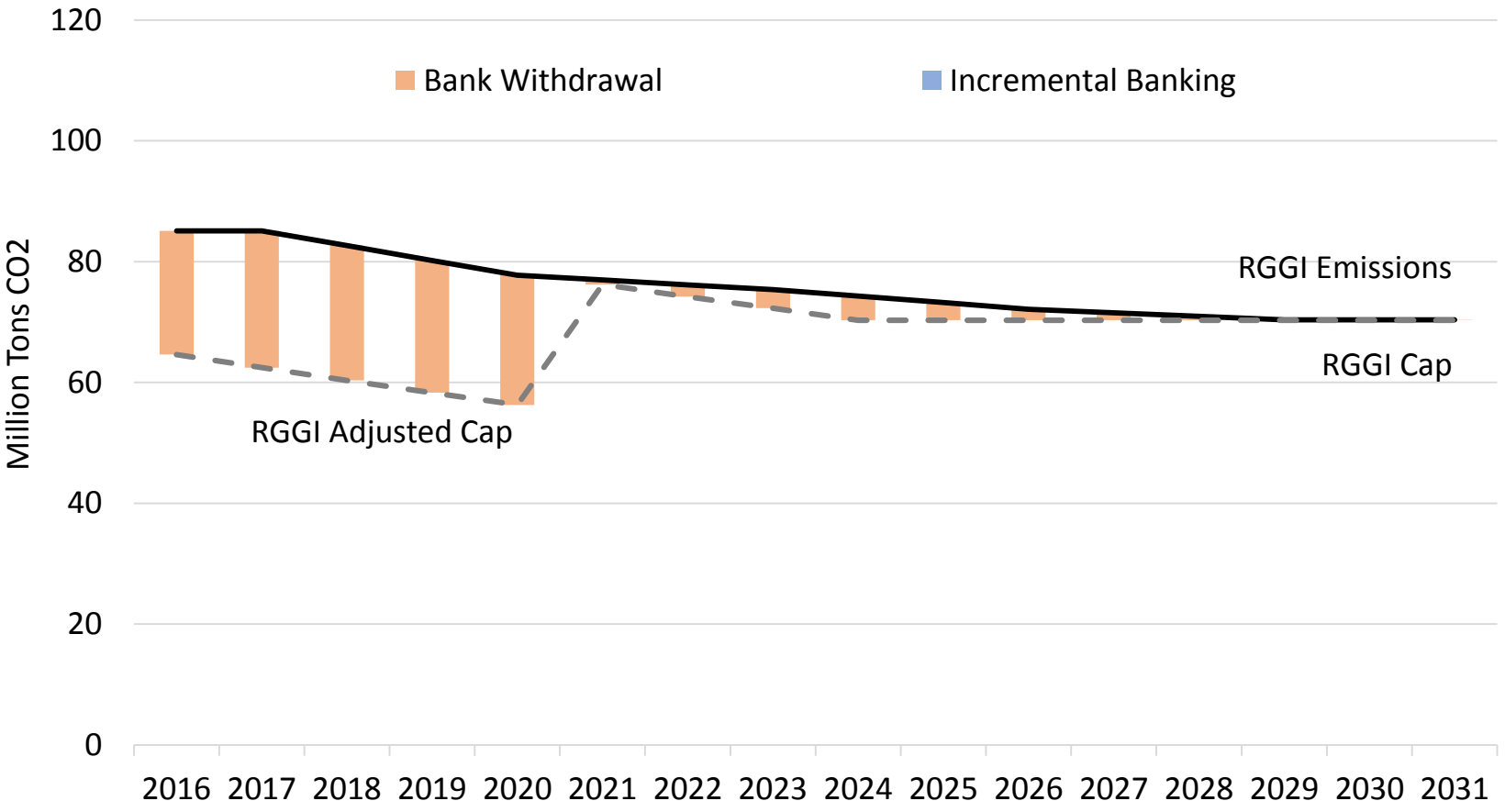
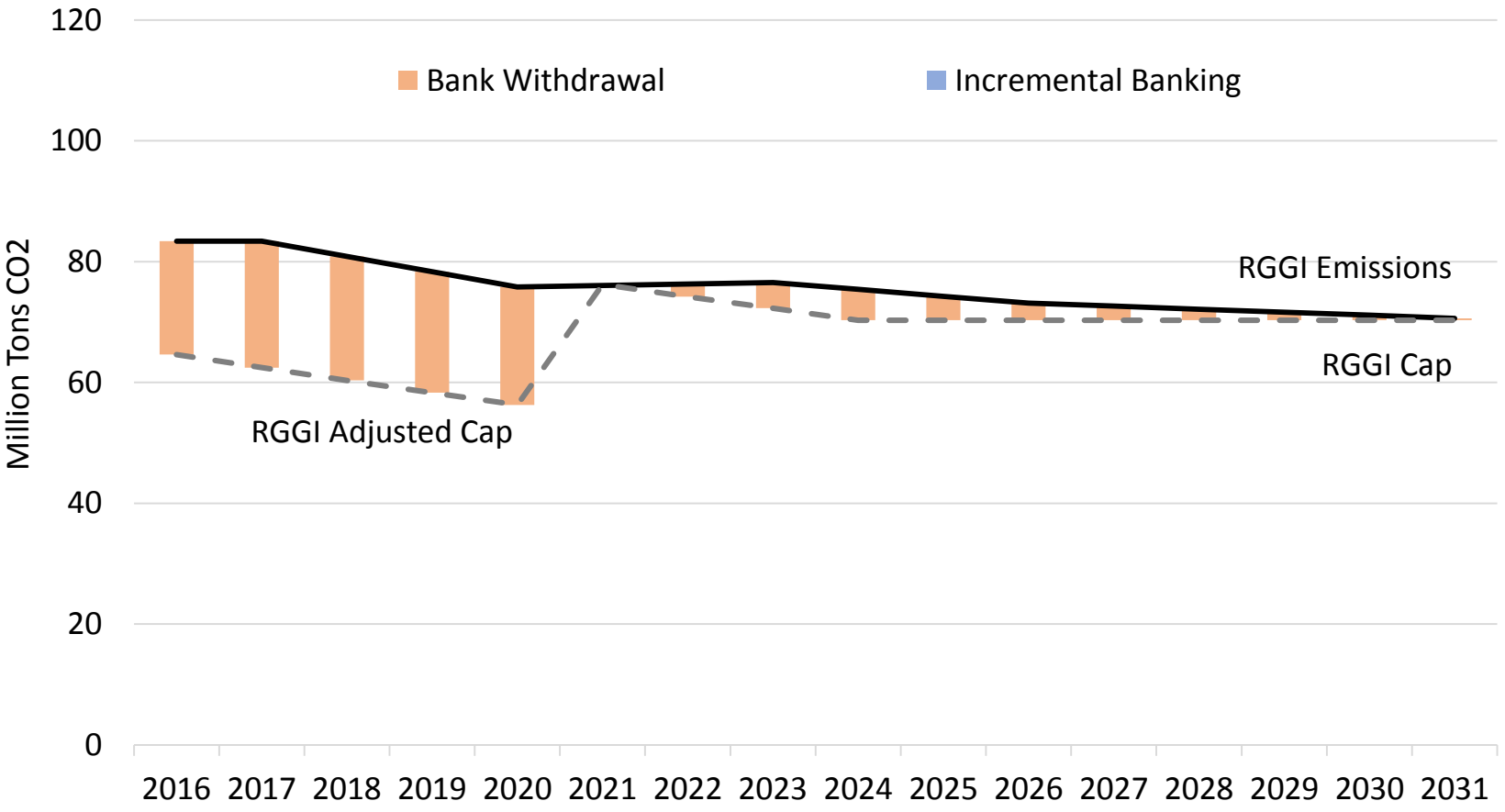


CO_2 Emission Reductions
2.5% 2024 Cap Decline (E+N)

- The chart shows the projected CO_2 emissions relative to the cap and the use of banked allowances for compliance.



CO_2 Emission Reductions
2.5% Cap Decline (E+N)

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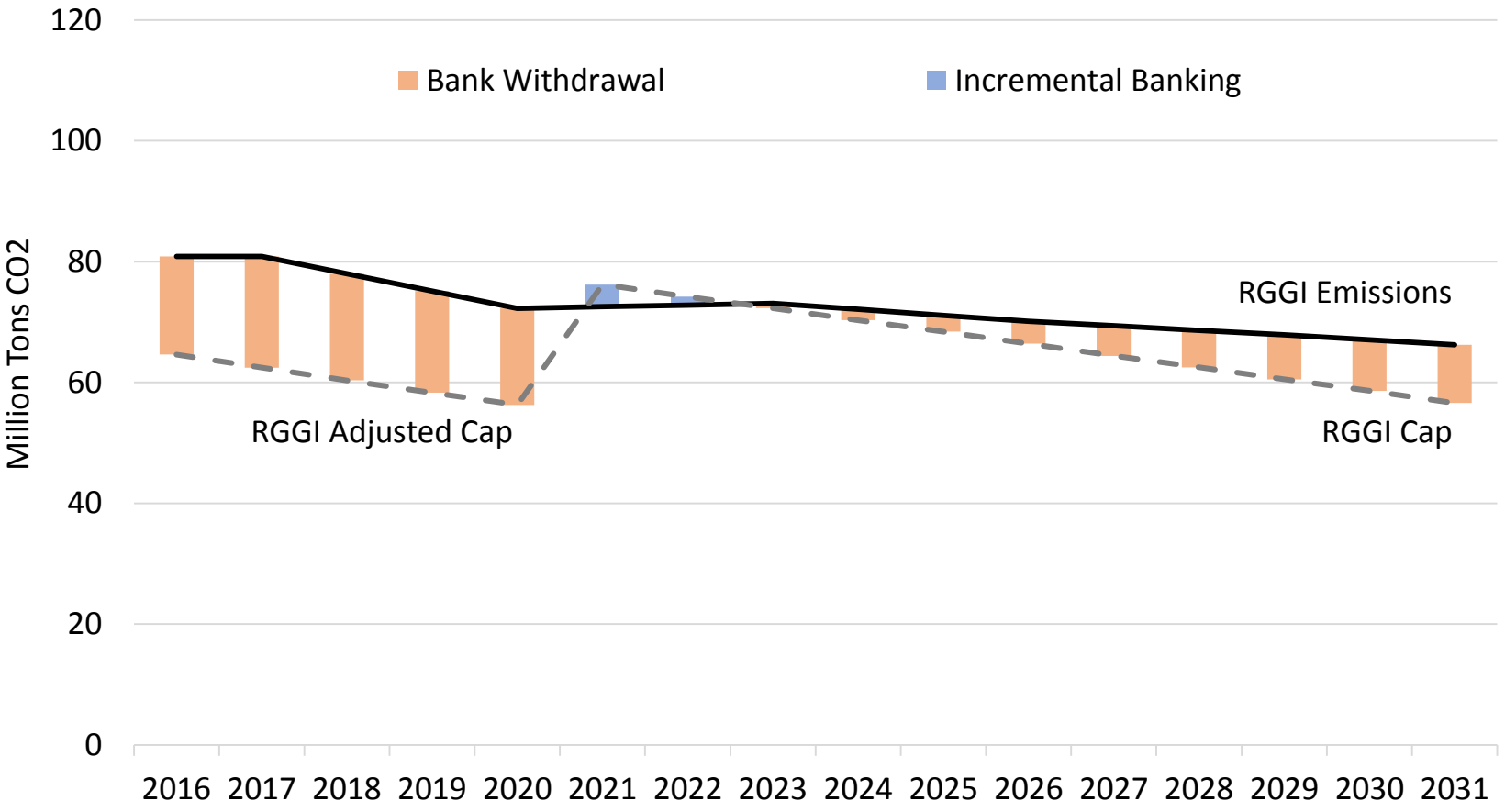
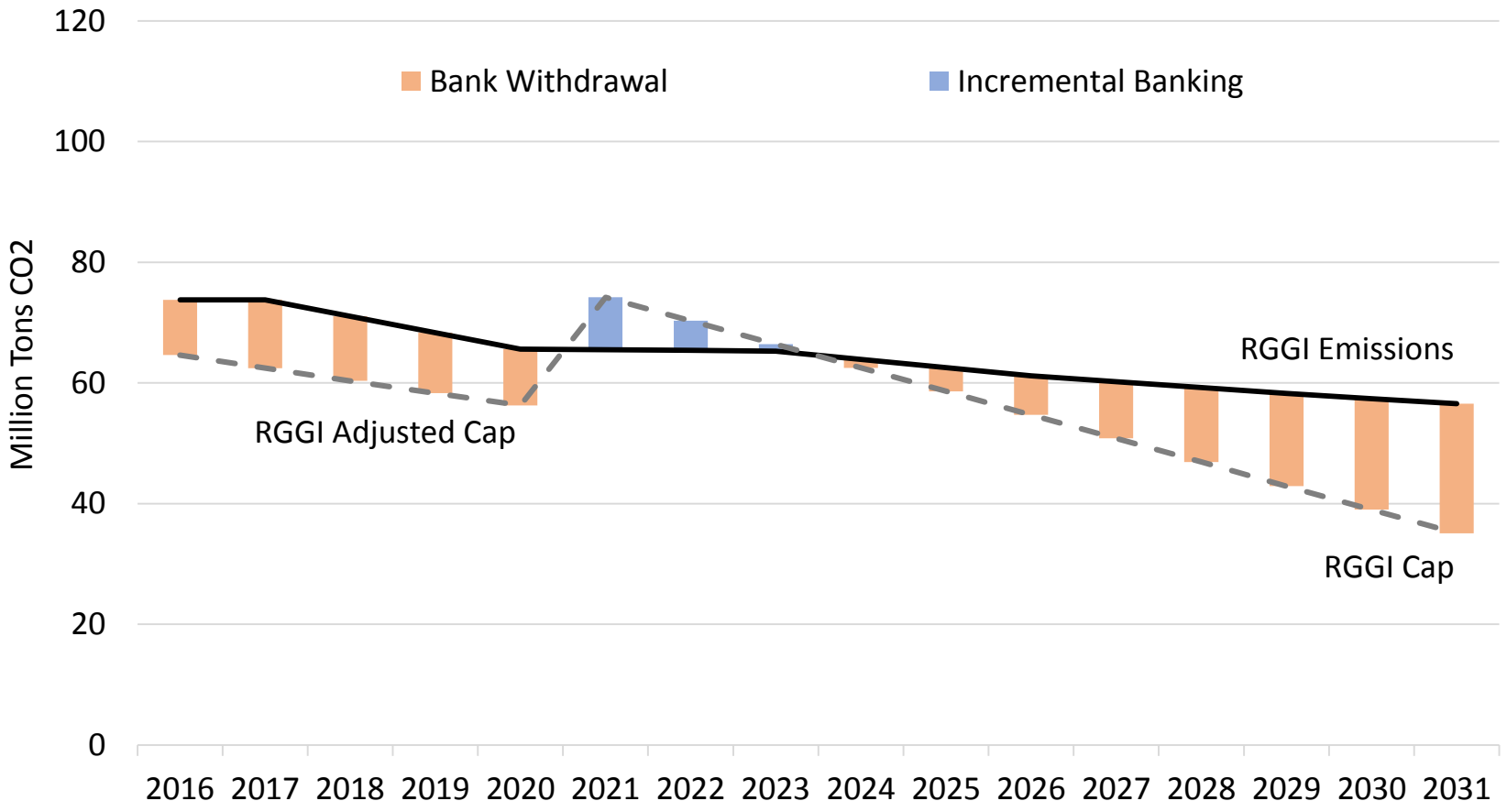


CO_2 Emission Reductions
5% Cap Decline (E+N)

- The chart shows the projected CO_2 emissions relative to the cap and the use of banked allowances for compliance.



CO_2 Emission Reductions
5% Cap Decline CCR (E+N)

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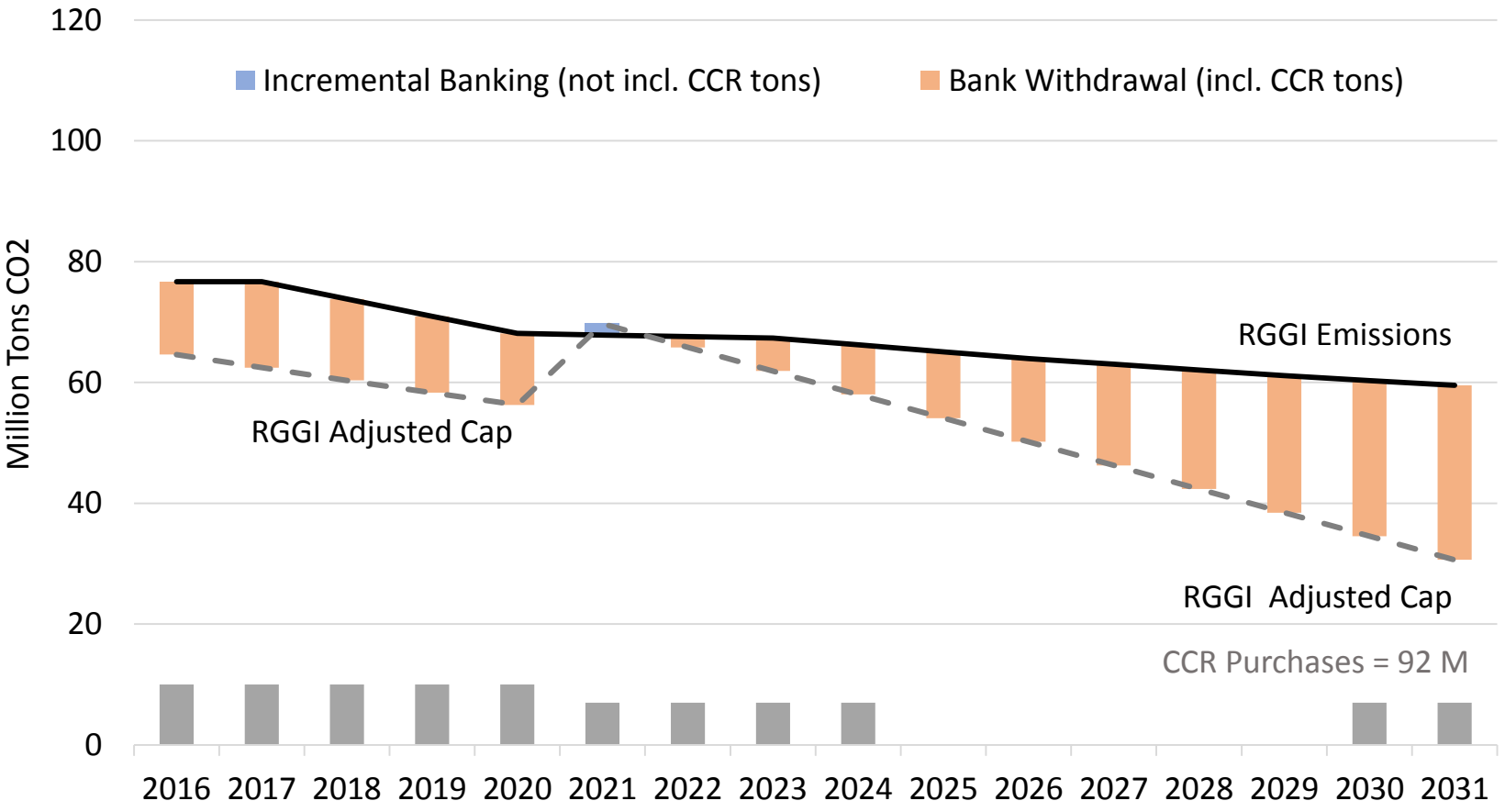
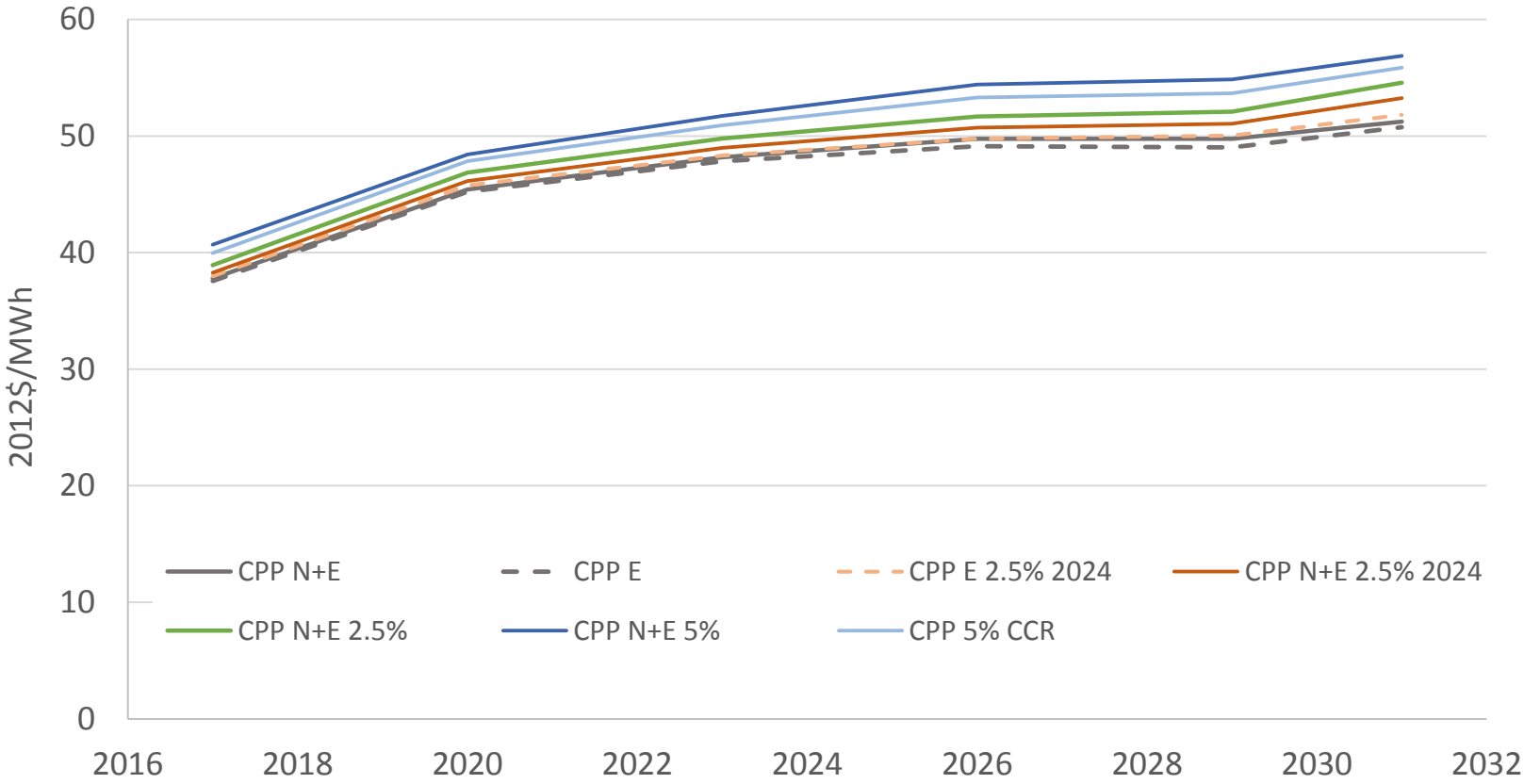


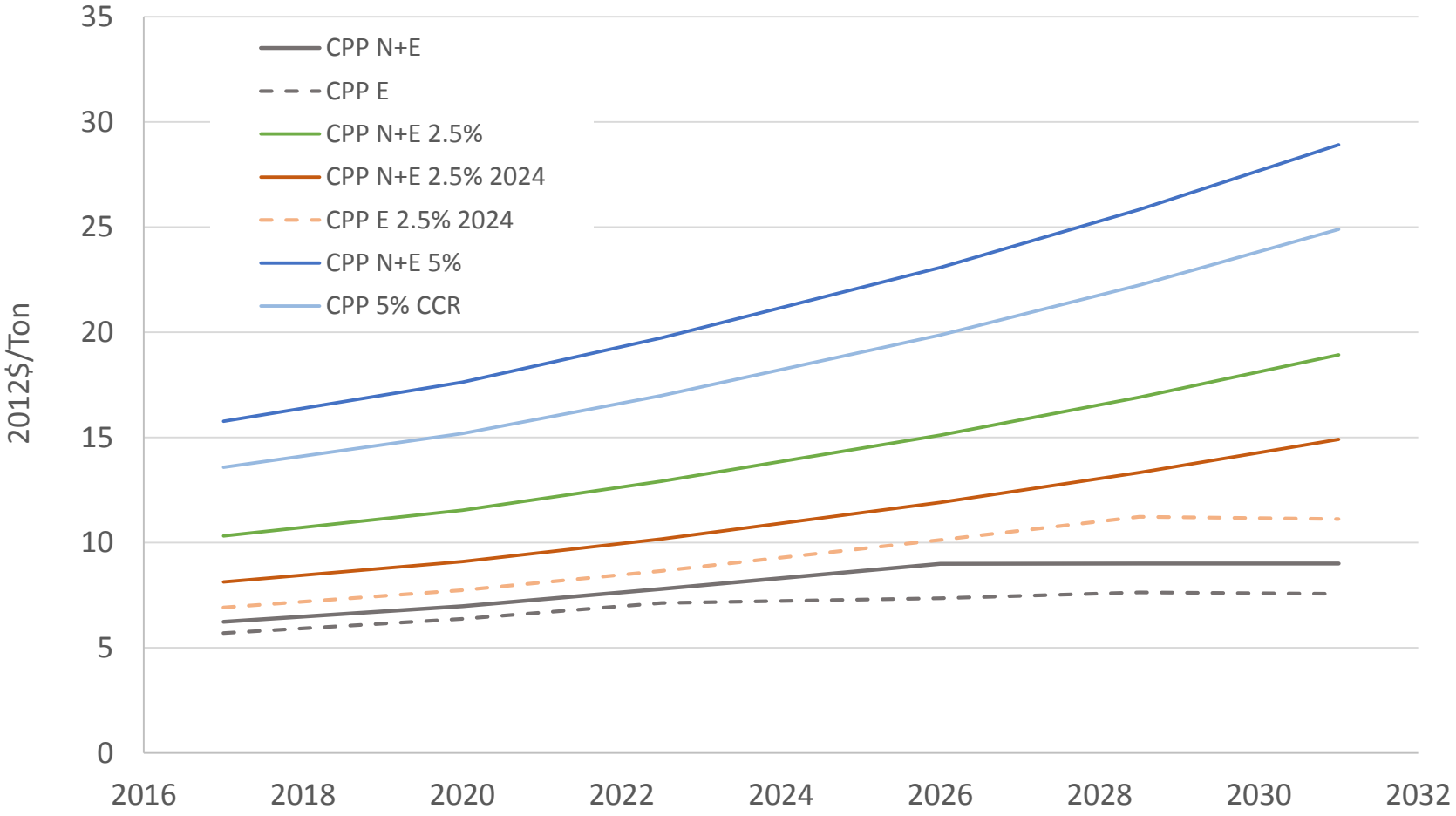
RGGI Firm Power Prices

- The chart shows the projected RGGI average annual firm (energy + capacity) prices in constant 2012 dollars.



RGGI Allowance Prices

- The chart shows the projected RGGI allowance prices in constant 2012 dollars.



CO_2 Allowance and Trigger Prices
5% Cap Decline CCR (E+N)

- The chart shows the allowance prices and CCR trigger prices in the 5% Cap CCR case.