DRAFT 2016 RGGI Program Review IPM Modeling: Policy Scenarios and Sensitivity Cases

November 21, 2016

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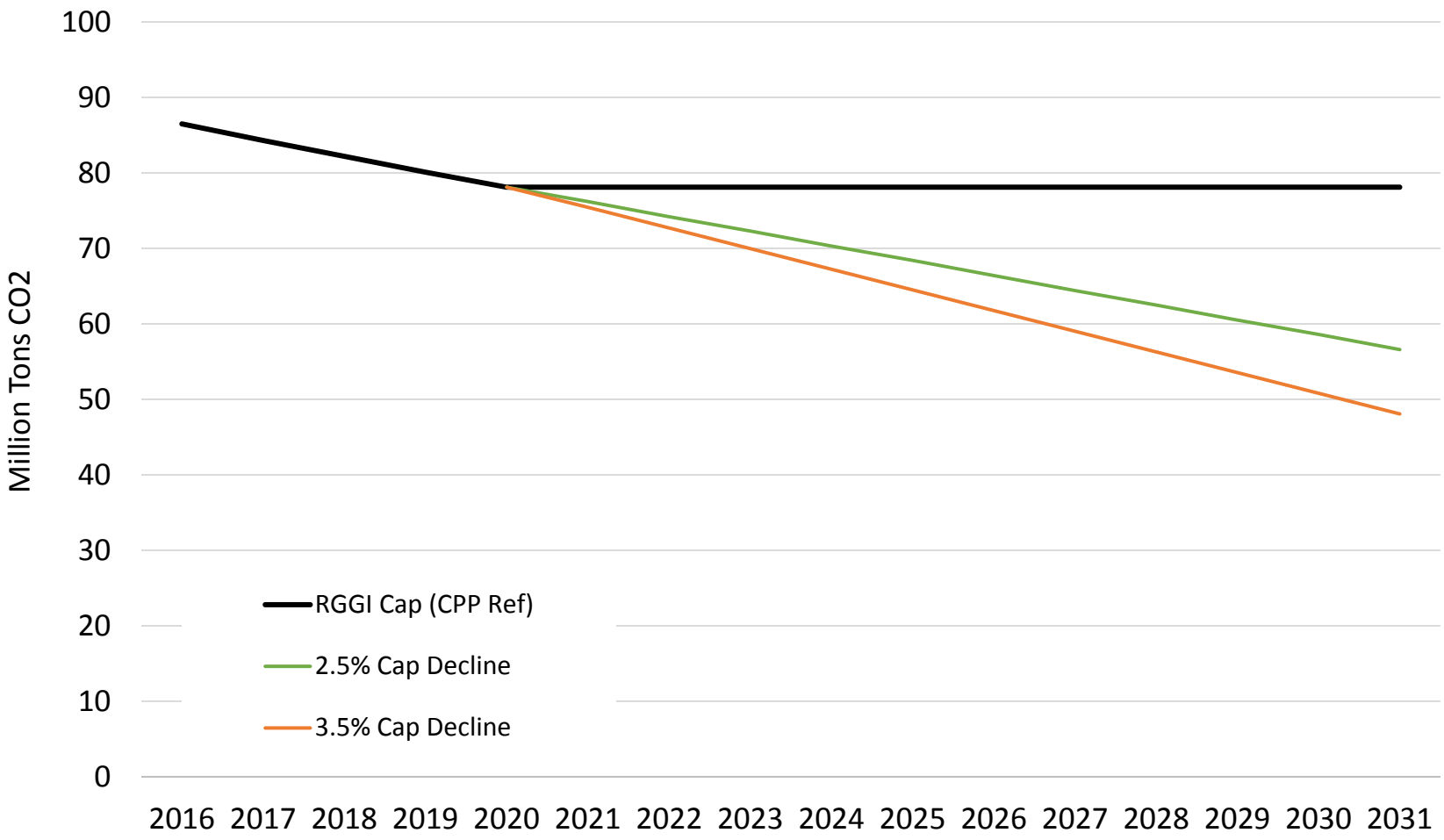
DRAFT 2016 Reference Case Assumptions Updates

- The following slides present select projections from the Clean Power Plan (CPP) Reference Case N+E and cap decline policy scenarios and sensitivities that RGGI specified for evaluation.
- These projections are based on assumptions that are draft and may change as ICF makes refinements based on review and input by the States.
- All cases assume the CPP over new and existing sources in states outside of RGGI.

DRAFT 2016 Sensitivity Case Assumptions

Assumption	CPP Reference Case N+E	High Emissions Cases	Low Emissions Cases
RGGI Cap	2020 cap held constant	2020 cap declining by 2.5% or 3.5% annually	
Cost Containment Reserve (CCR)	10 million tons available at $9 trigger price 2017-2031	No CCR available in any year	
Imports	NY Firm renewable imports from QC and ON		NY Firm renewable imports from QC and ON, and firm QC imports to NH and VT
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		
Renewable Costs	NREL 2016 Reference	NREL 2016 High Scenario	NREL 2016 Low Scenario
Gas Prices	Futures + Average of AEO 2015 High Resource Case + Reference Case	Futures + AEO 2015 Reference Case	Futures + AEO 2015 High Resource Case
Retirements	Indian Point retires 2019	Partial early nuclear retirements in New York and New England; Fewer firm coal retirements in MD	No Indian Point retirement

Assumed RGGI CO_2 Caps

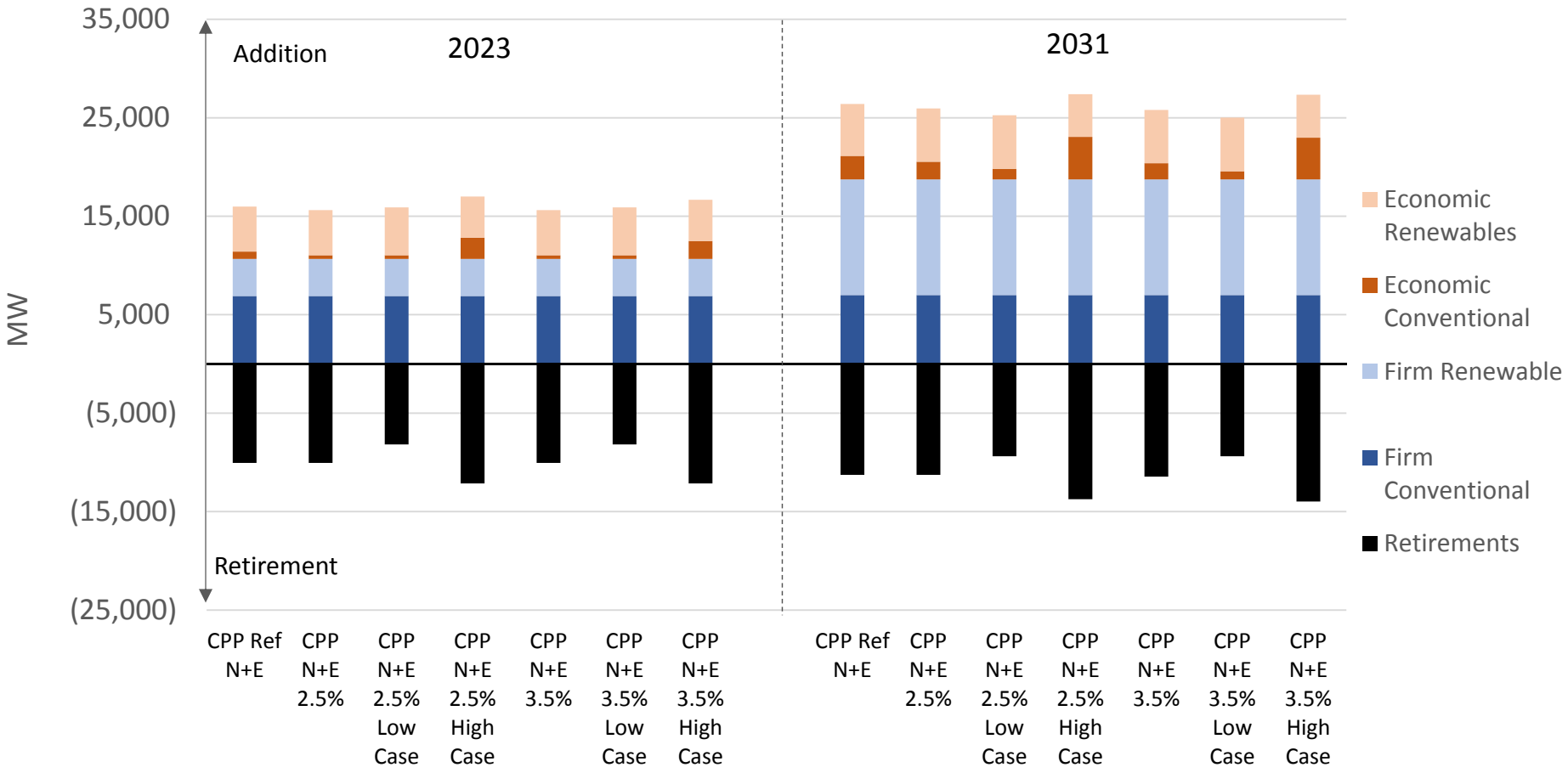


IPM Model Design

- 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 which 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.

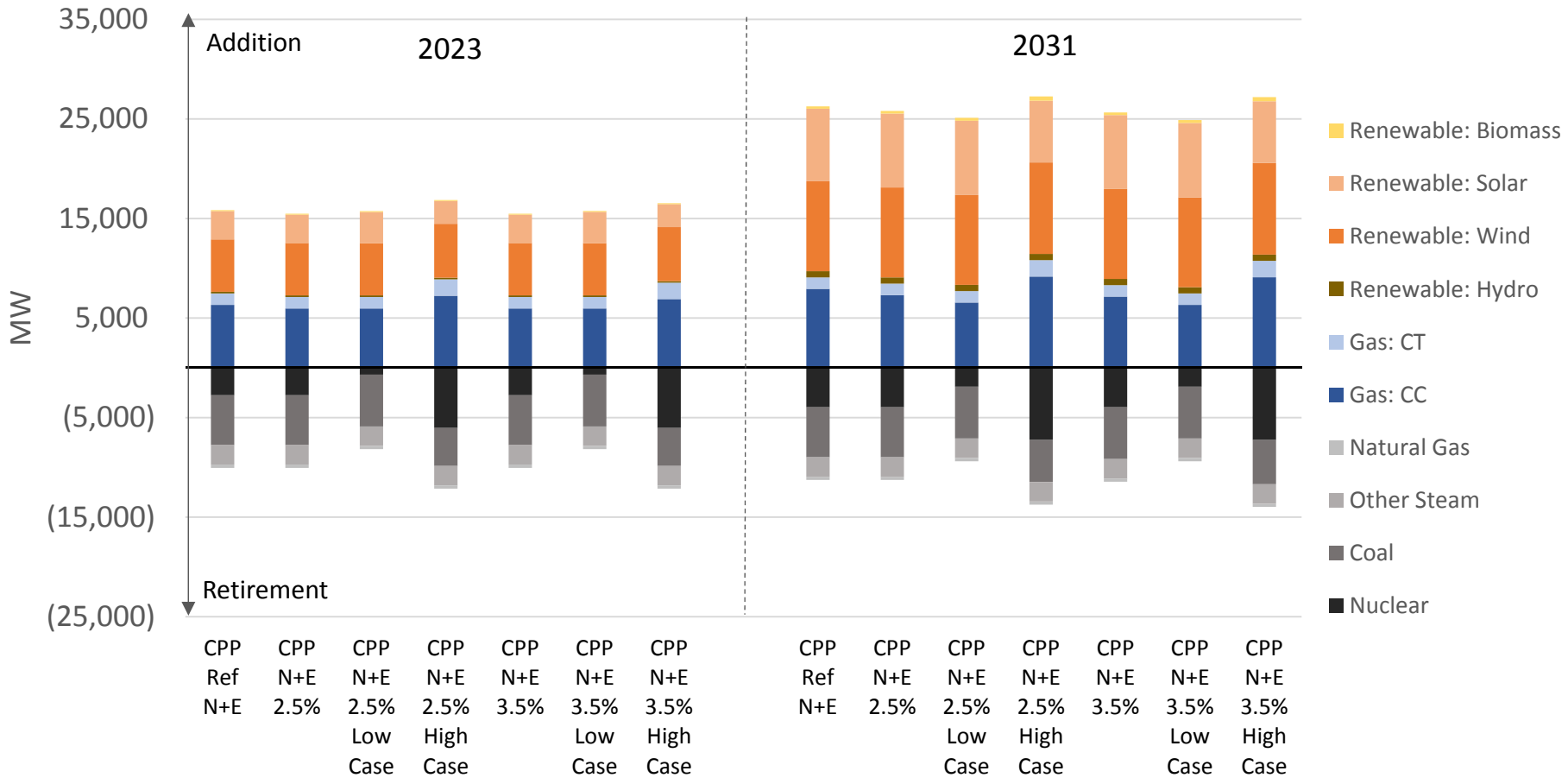
RGGI Cumulative Capacity Additions

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



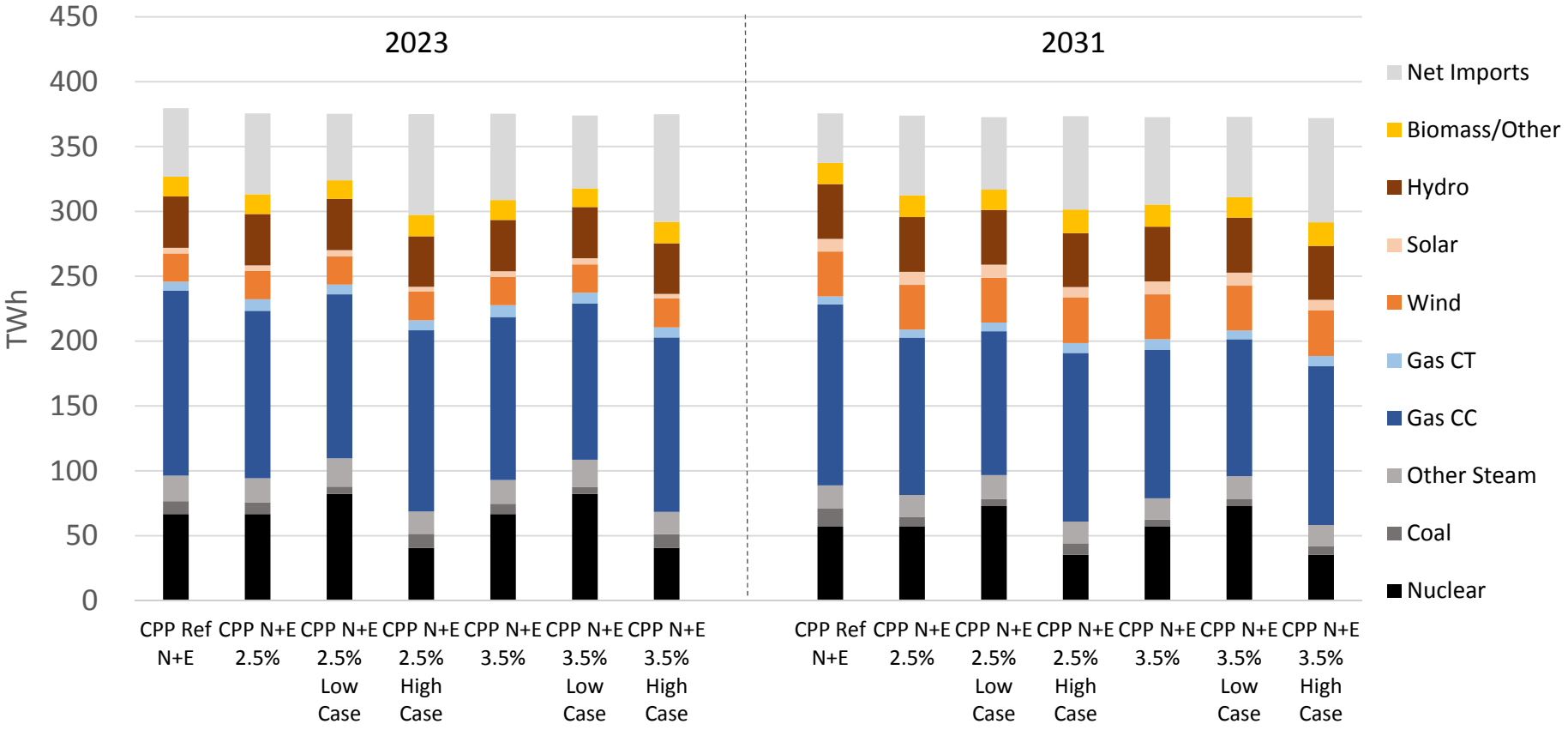
RGGI Cumulative Capacity Additions (2)

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



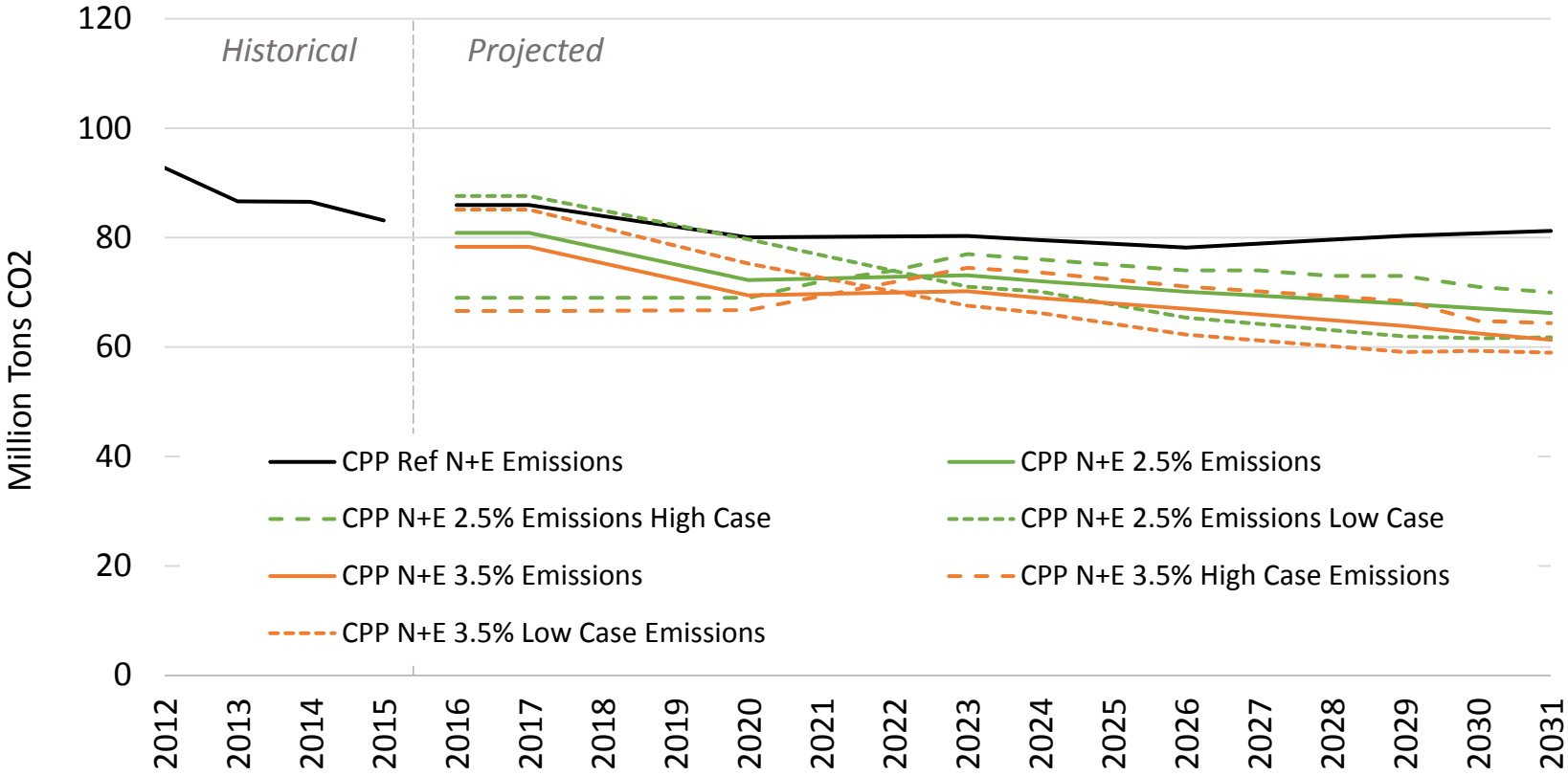
RGGI Generation Mix

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



RGGI CO_2 Emissions

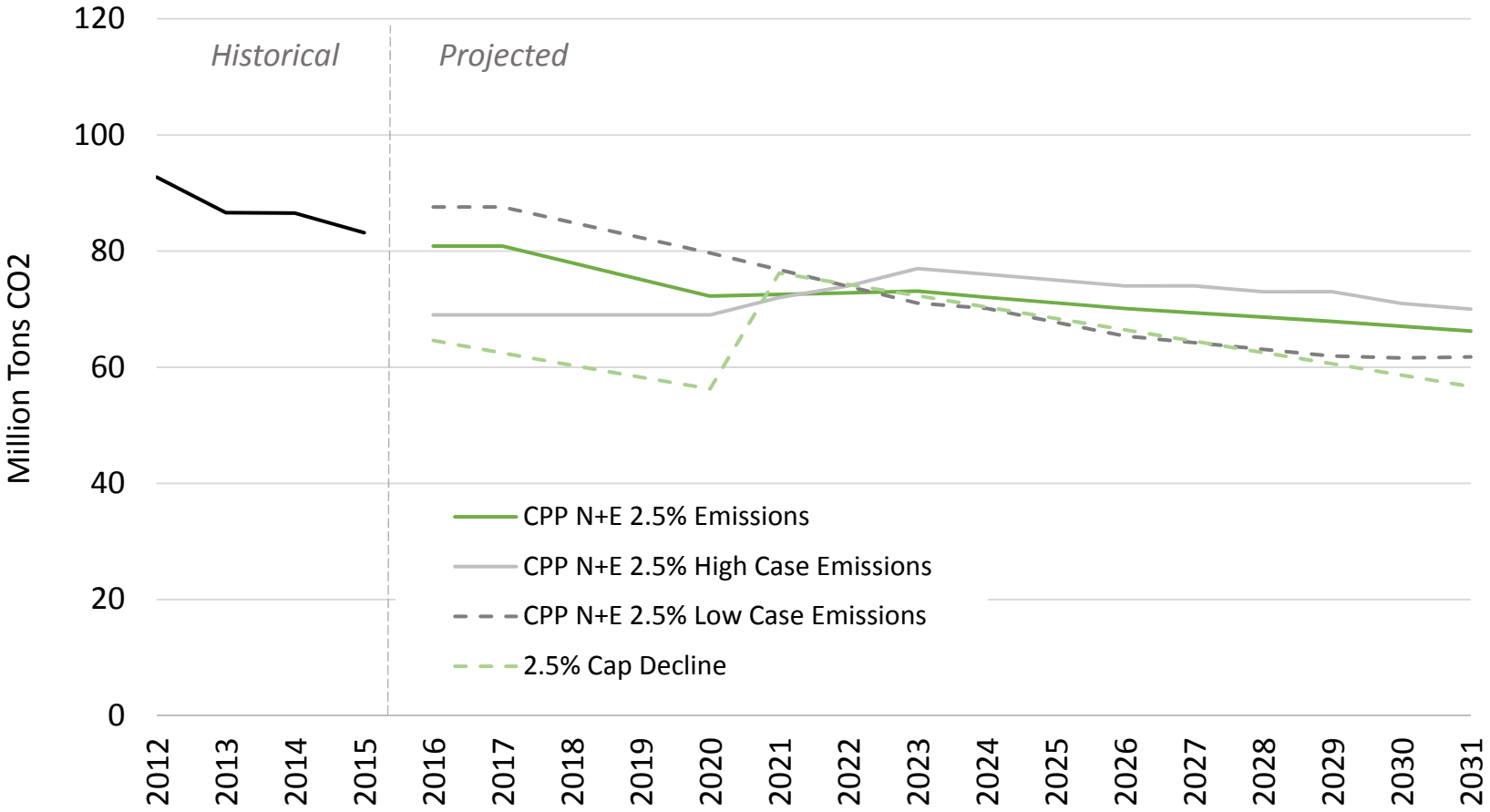
- The chart shows projected CO_2 emissions from RGGI-affected sources.
- Emissions exceed the RGGI Cap when allowances are withdrawn from the bank or purchased at the CCR trigger price.



Note: Model assumes that any allowance bank is fully exhausted in 2031 and in 2032, emissions would immediately drop to cap levels shown on slide #4.

RGGI CO_2 Emissions
2.5% Cap Case and Sensitivity Cases

- The chart shows projected CO_2 emissions from RGGI-affected sources.



Note: Model assumes that any allowance bank is fully exhausted in 2031 and in 2032, emissions would immediately drop to cap levels shown on slide #4.

RGGI CO_2 Emissions
3.5% Cap Case and Sensitivity Cases

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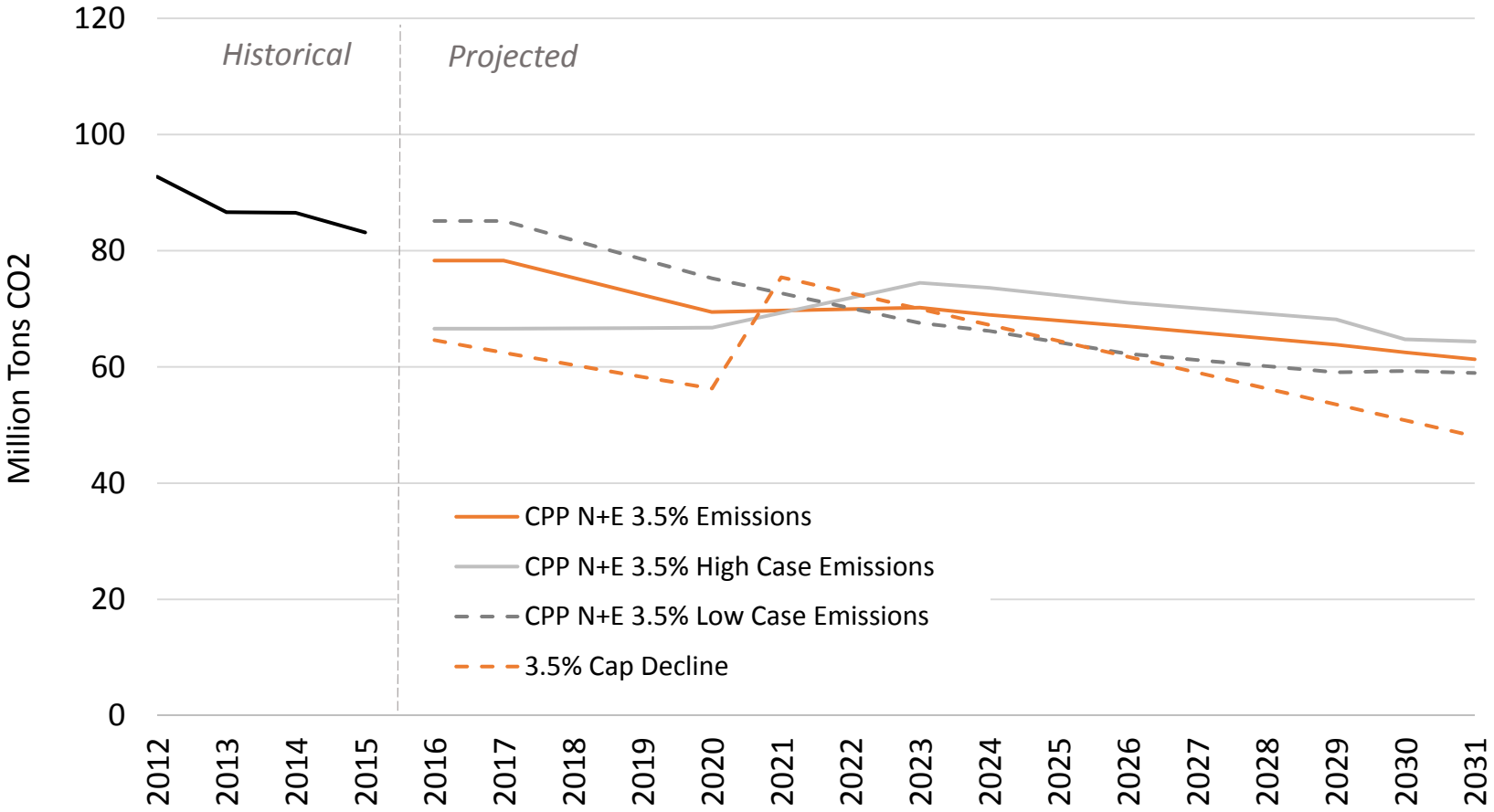


Note: Model assumes that any allowance bank is fully exhausted in 2031 and in 2032, emissions would immediately drop to cap levels shown on slide #4.

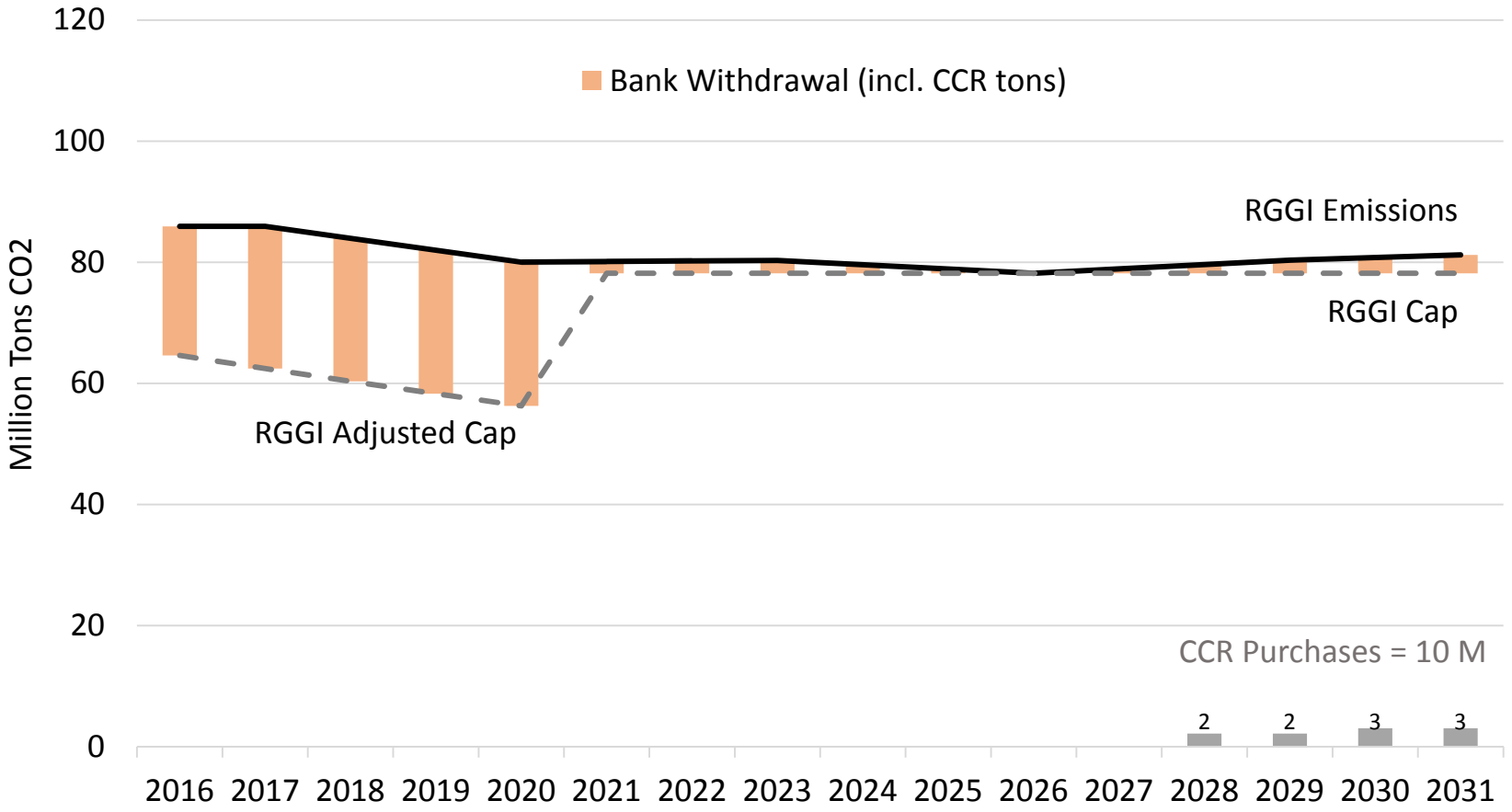
RGGI Emissions (Million of Tons)

Case	Average Emissions, 2016-2031	2031 Projected Emissions	2032 Cap*
CPP Ref N+E	81	81	78
CPP N+E 2.5%	72	66	55
CPP N+E 2.5% Low Case	72	62	55
CPP N+E 2.5% High Case	72	70	55
CPP N+E 3.5%	69	61	45
CPP N+E 3.5% Low Case	68	59	45
CPP N+E 3.5% High Case	69	64	45

* The time horizon of this analysis is 2017 through 2031. As discussed in slide 5, IPM will optimize use of allowance banking over that time period and carry no bank beyond 2031. What would be the 2032 cap value in an analysis with a longer time horizon can be compared to the 2031 emissions to illustrate the impact of the banking behavior on long-term emissions.

CO_2 Emission Reductions
CPP Reference N+E

- 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
CPP N+E 2.5% Cap Decline

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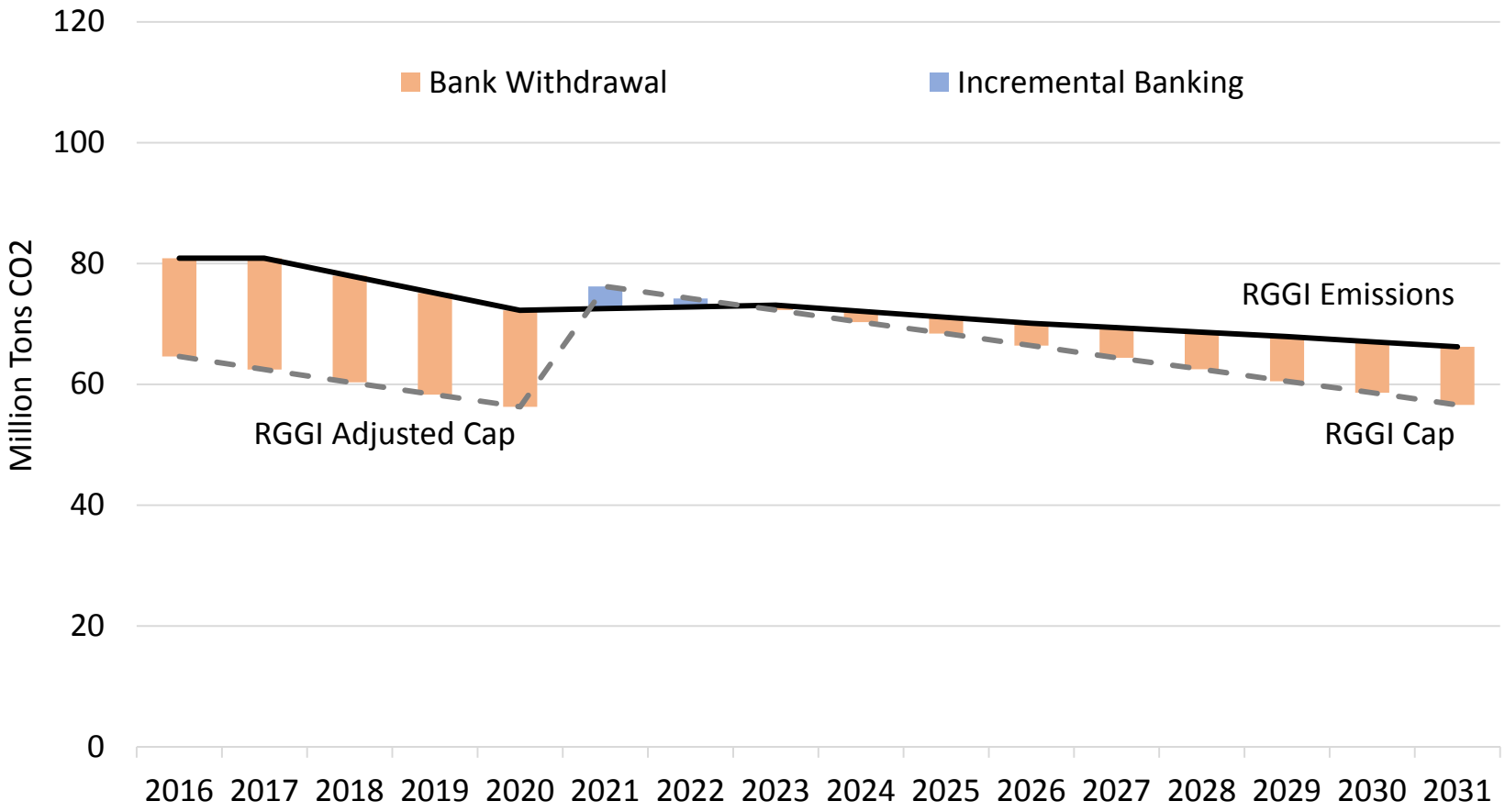

CO_2 Emission Reductions
CPP N+E 2.5% Cap Decline Low Emissions Sensitivity

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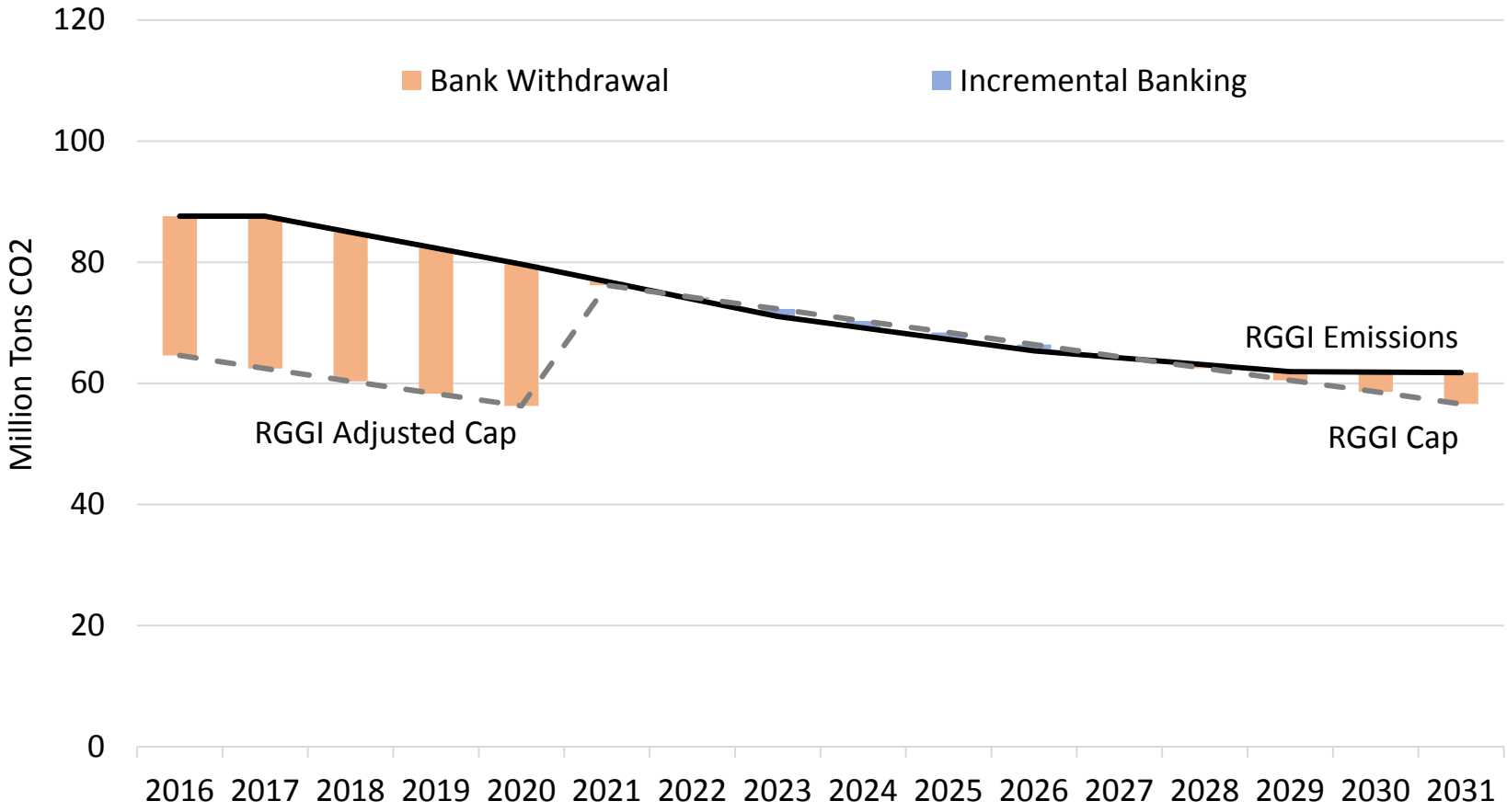

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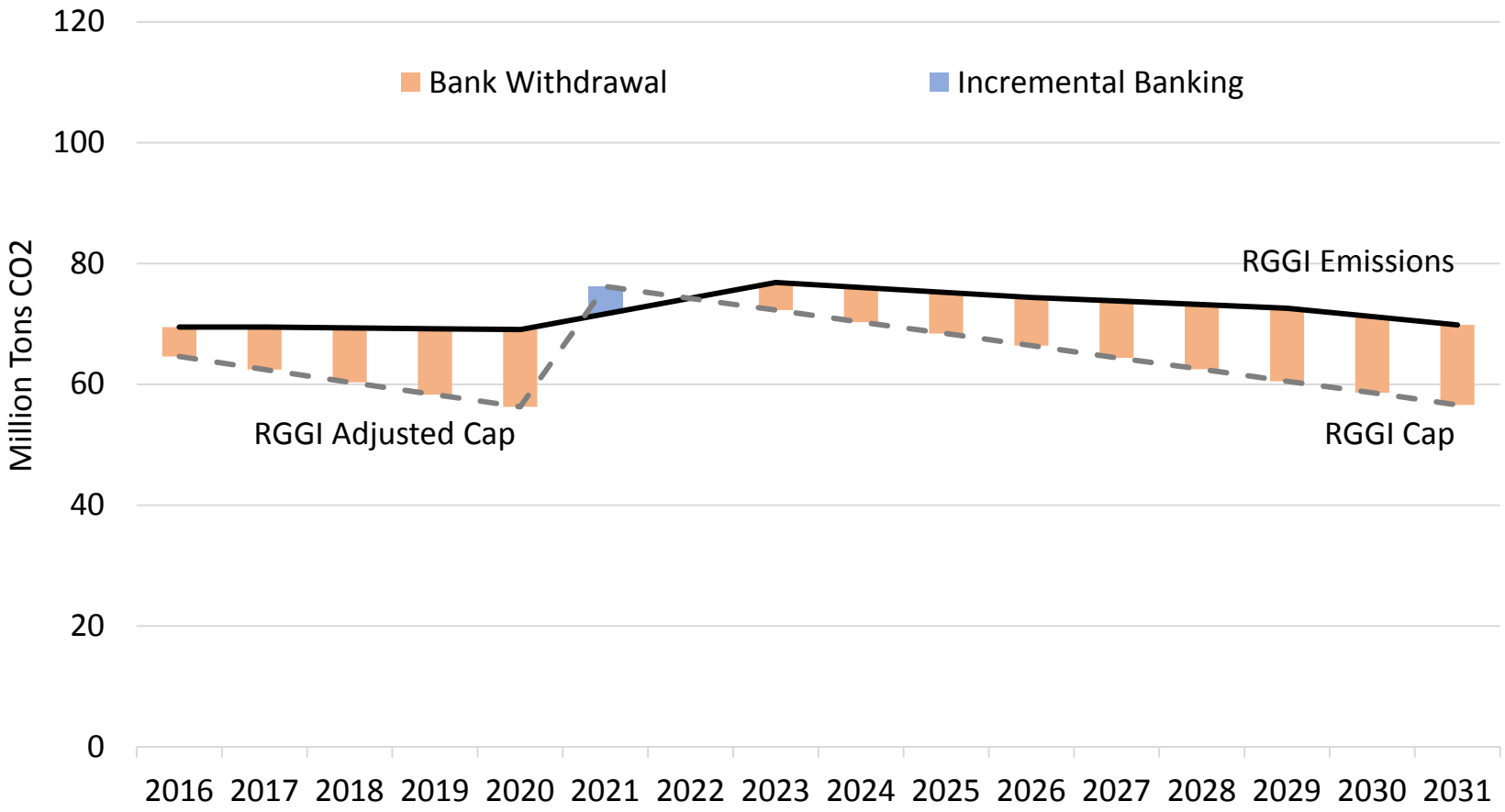

CO_2 Emission Reductions
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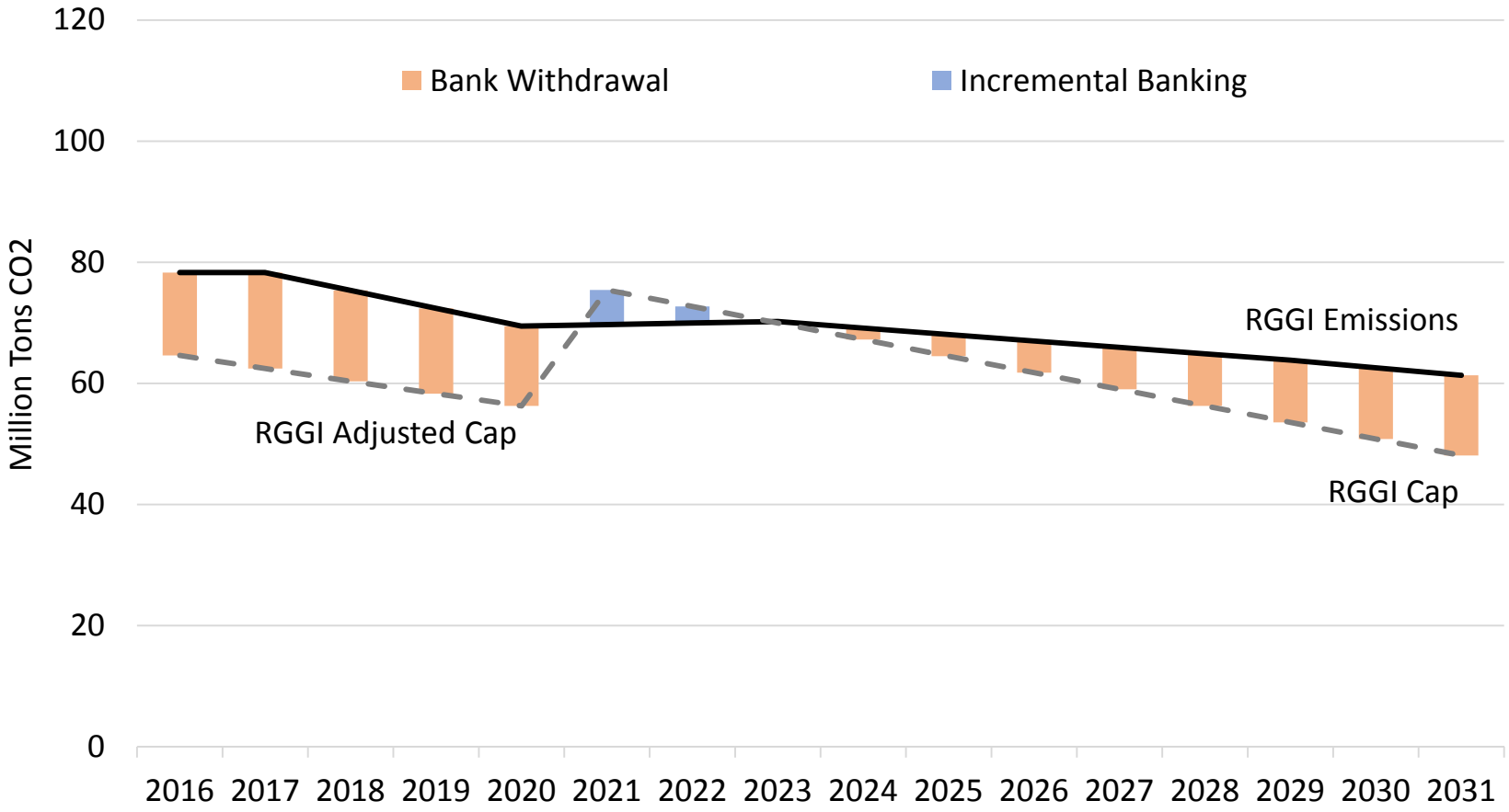

CO_2 Emission Reductions
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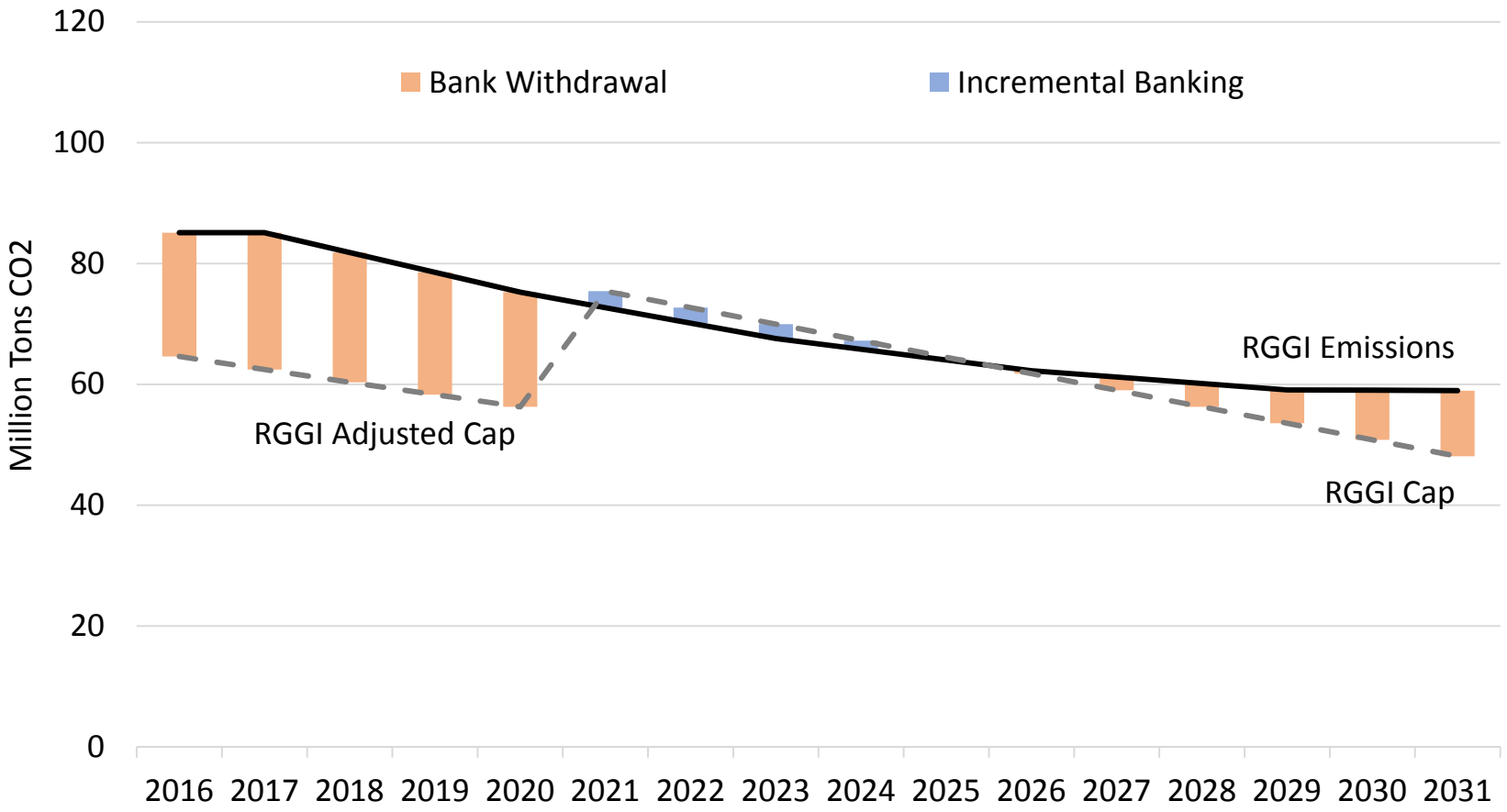

CO_2 Emission Reductions
CPP N+E 3.5% Cap Decline High Emissions Sensitivity

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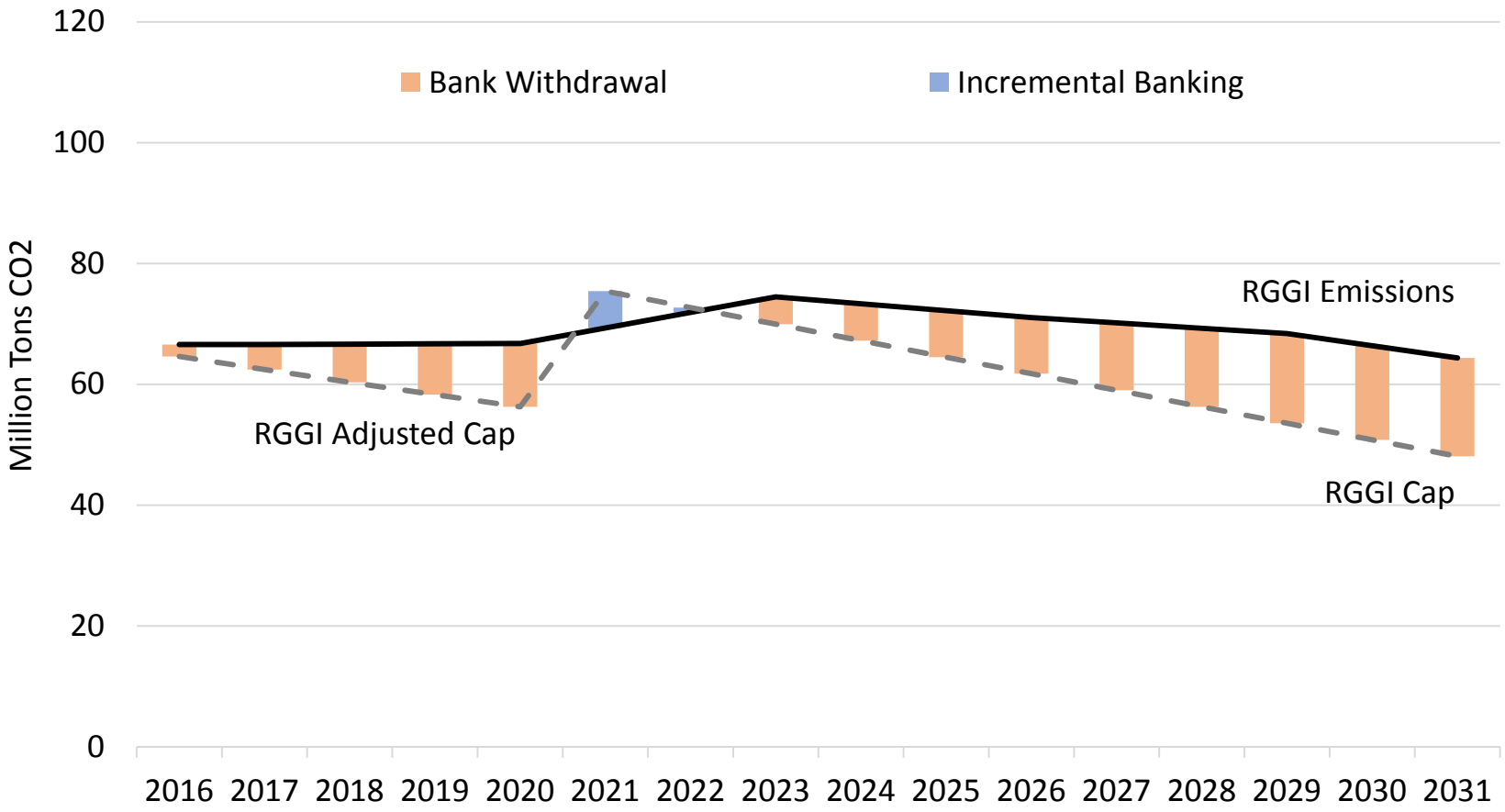
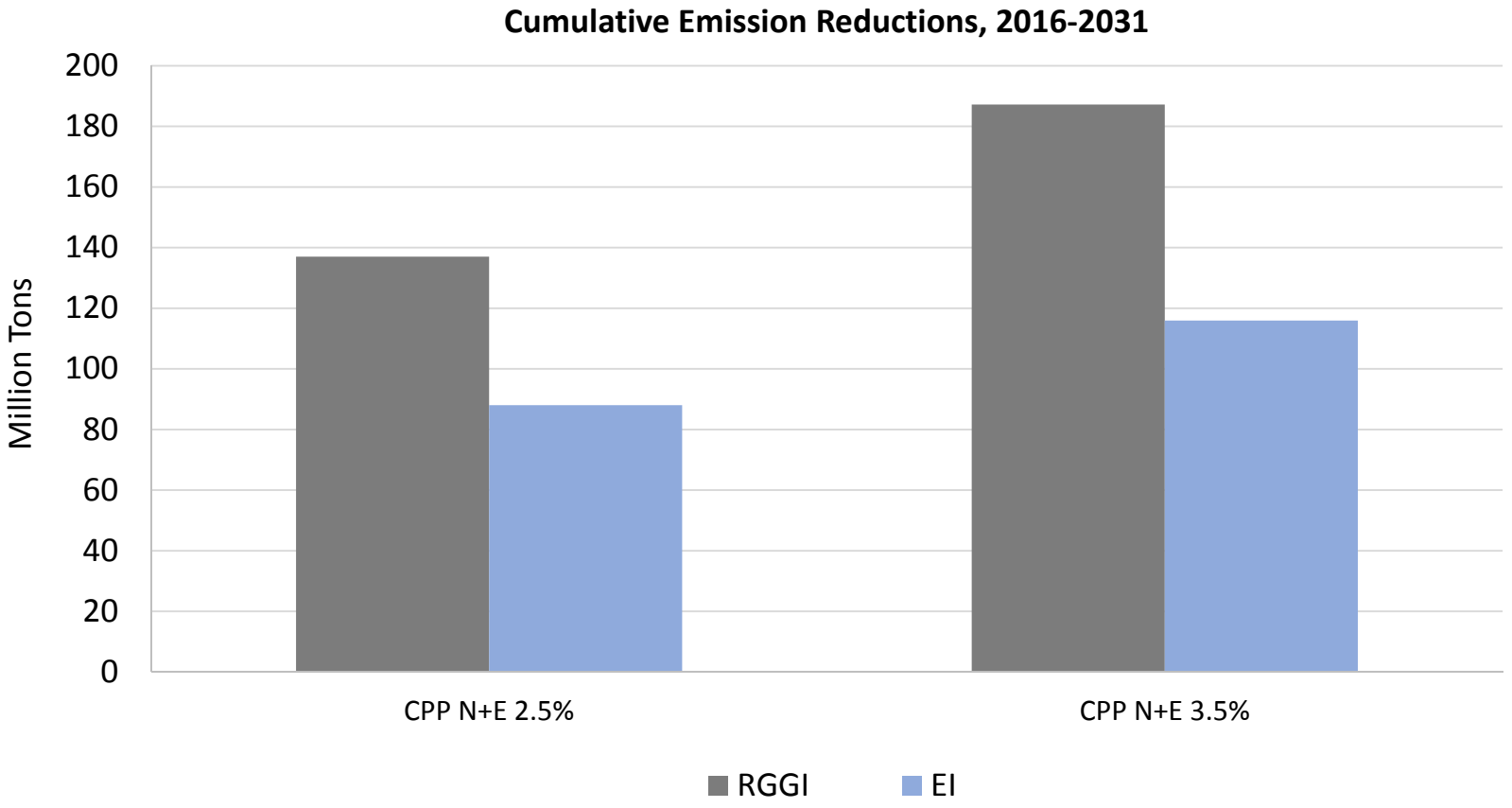


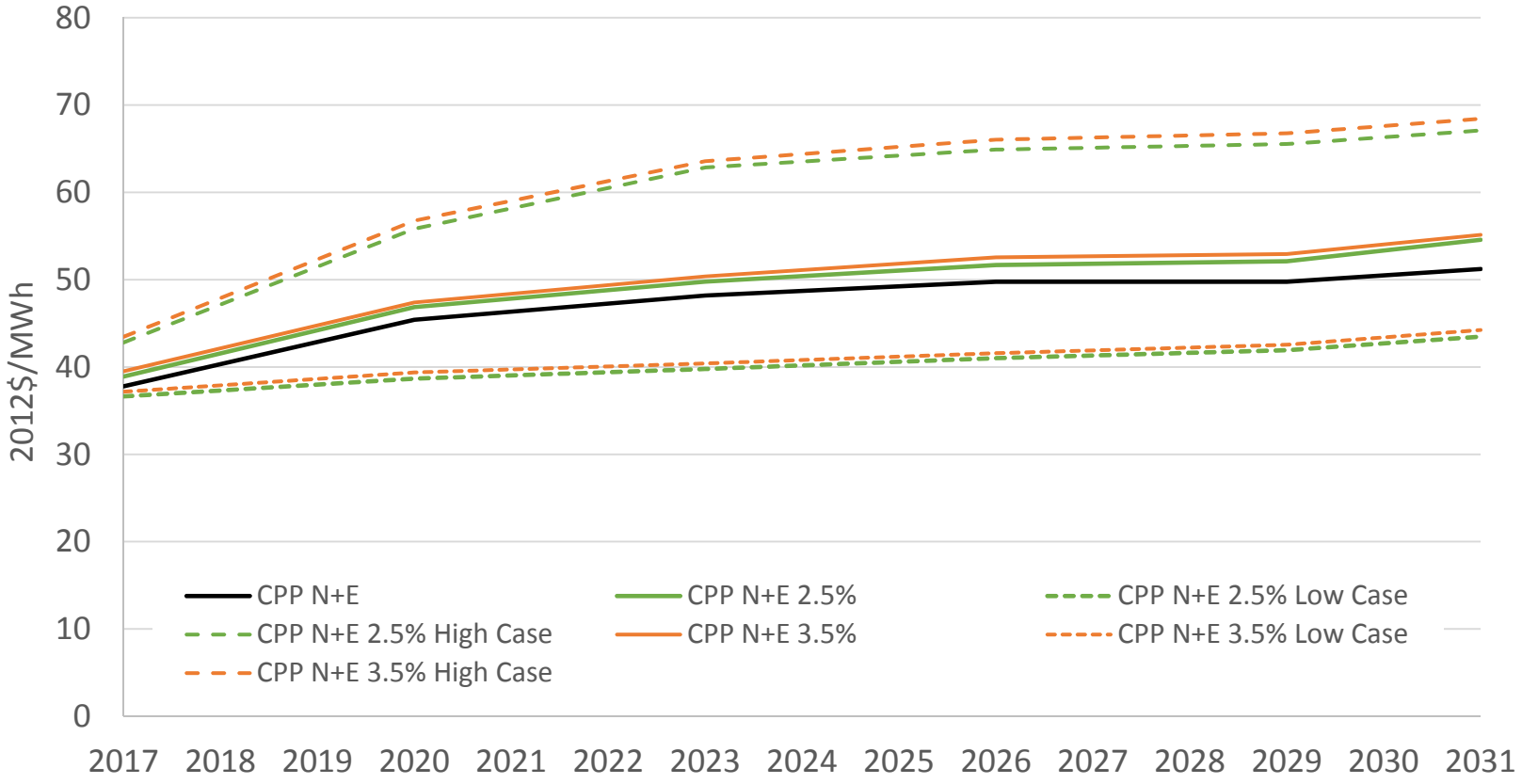
Eastern Interconnect and RGGI Cumulative Emission Reductions

- The chart shows cumulative CO2 emission reductions in RGGI and for the entire Eastern Interconnect, including RGGI, for the 2016-2031 period.



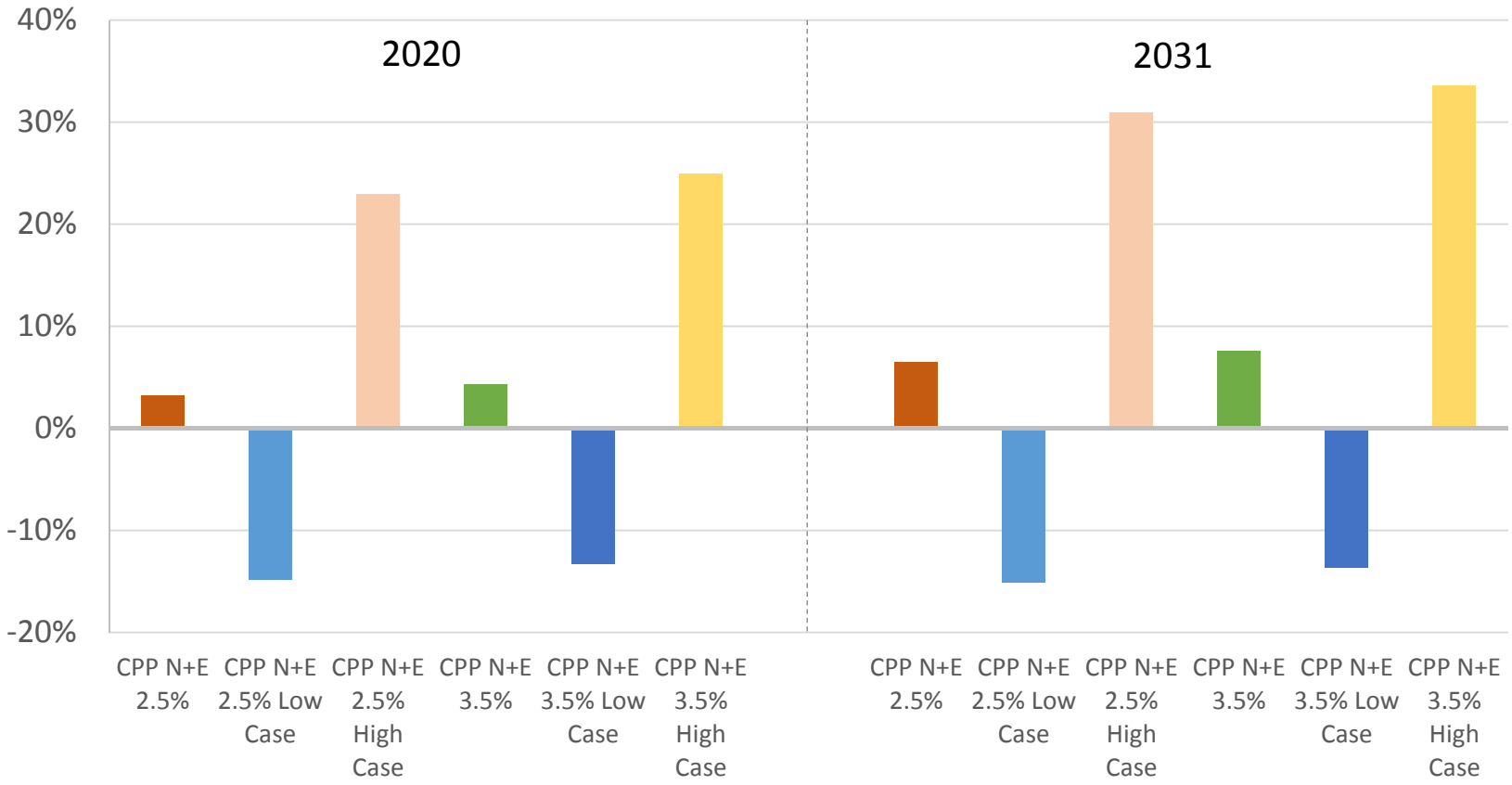
RGGI Firm Power Prices

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



Change in RGGI Firm Power Prices

- The charts show the percentage change in RGGI average firm power prices (real 2012$) in the scenarios relative to their respective CPP reference case in 2020 and 2031.



RGGI Allowance Prices

- The charts show the projected RGGI allowance prices in constant 2012 dollars.