

Modeling of Electricity Sector Carbon Pricing in North Carolina

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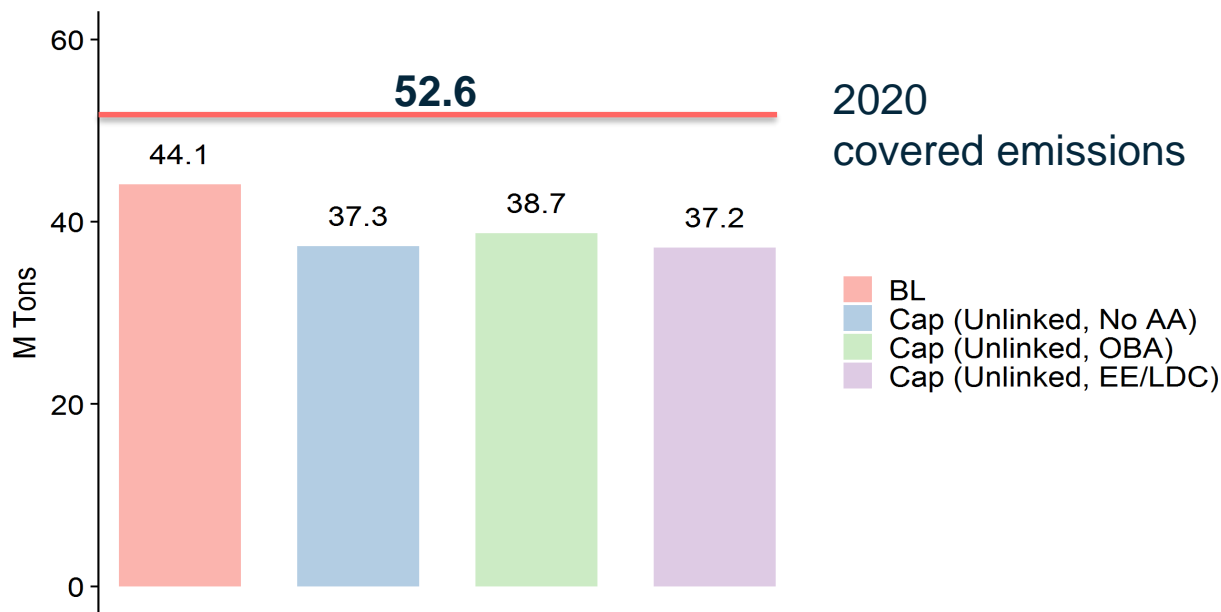
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Introduction

- We examined the opportunity to expand clean energy production in North Carolina
- We consider cap and trade in the electricity sector
 - The cap limits emissions to 30 percent below 2020 levels by 2030
 - Trading ensures emissions are achieved at least cost
- We also modeled a renewable technology standard, and its interaction with cap and trade
- Because the results for the end year 2030 depend on what is assumed to come after 2030, we focus on results for 2026

1. Emissions reductions can be achieved at very low cost

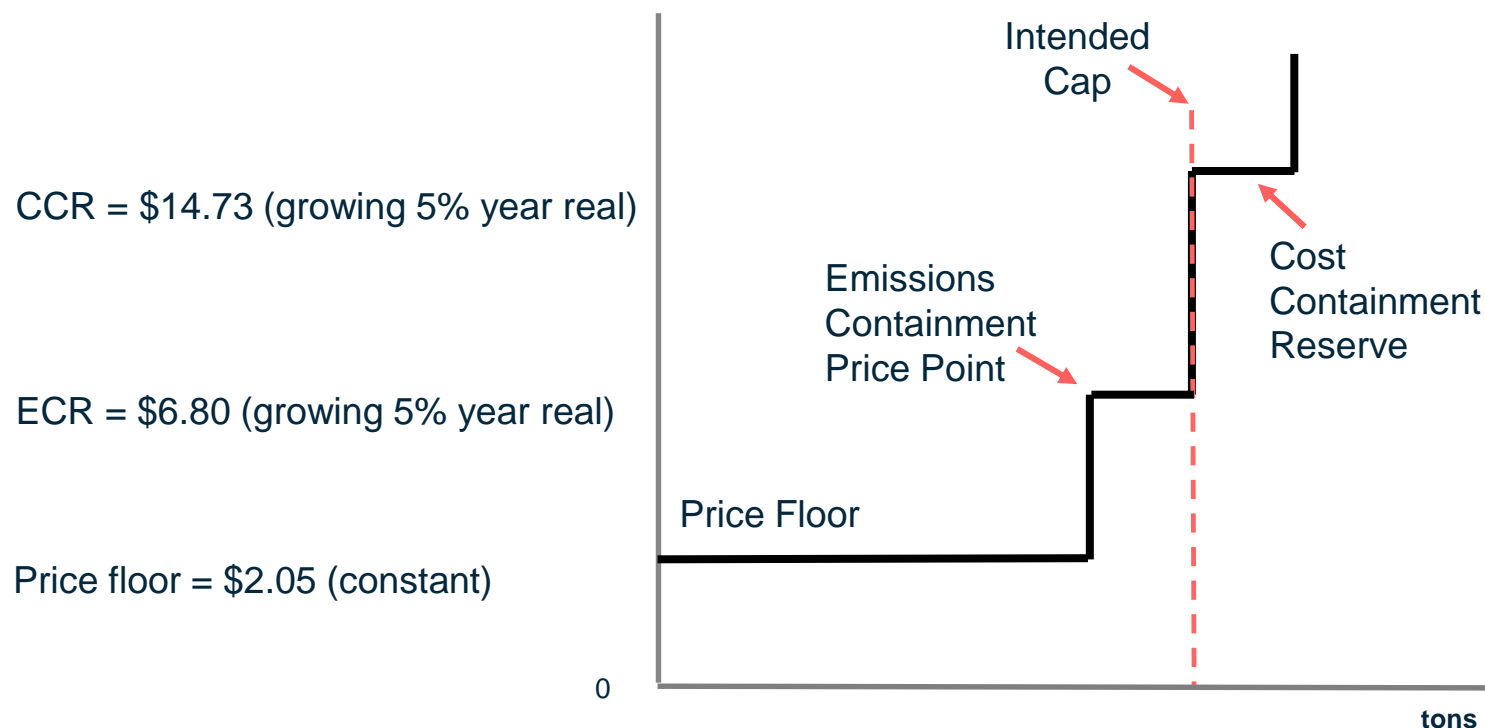


Emissions outcomes in 2026 under various cap-and-trade scenarios

- Baseline emissions fall almost to the level of the cap
- Cap and trade yields additional emissions reductions due to cost management features of the program (next slide)

Background: Cap and Trade Program Design

(2026 prices in 2015\$)



- The model borrows the RGGI program design
- Low allowance prices yield additional reductions
- Note the role of consignment auctions with free allocation

2. Low allowance prices accelerate emissions reductions

- Low prices result in an additional 4% annual emissions reductions in 2030
- Low prices result in 10.4% further cumulative reductions over the decade compared to 2020 levels
- Cumulative reductions from 2020 levels by 2030 are 150 million tons
- Annual allowance value is \$76-79 million in 2026 (2015\$)

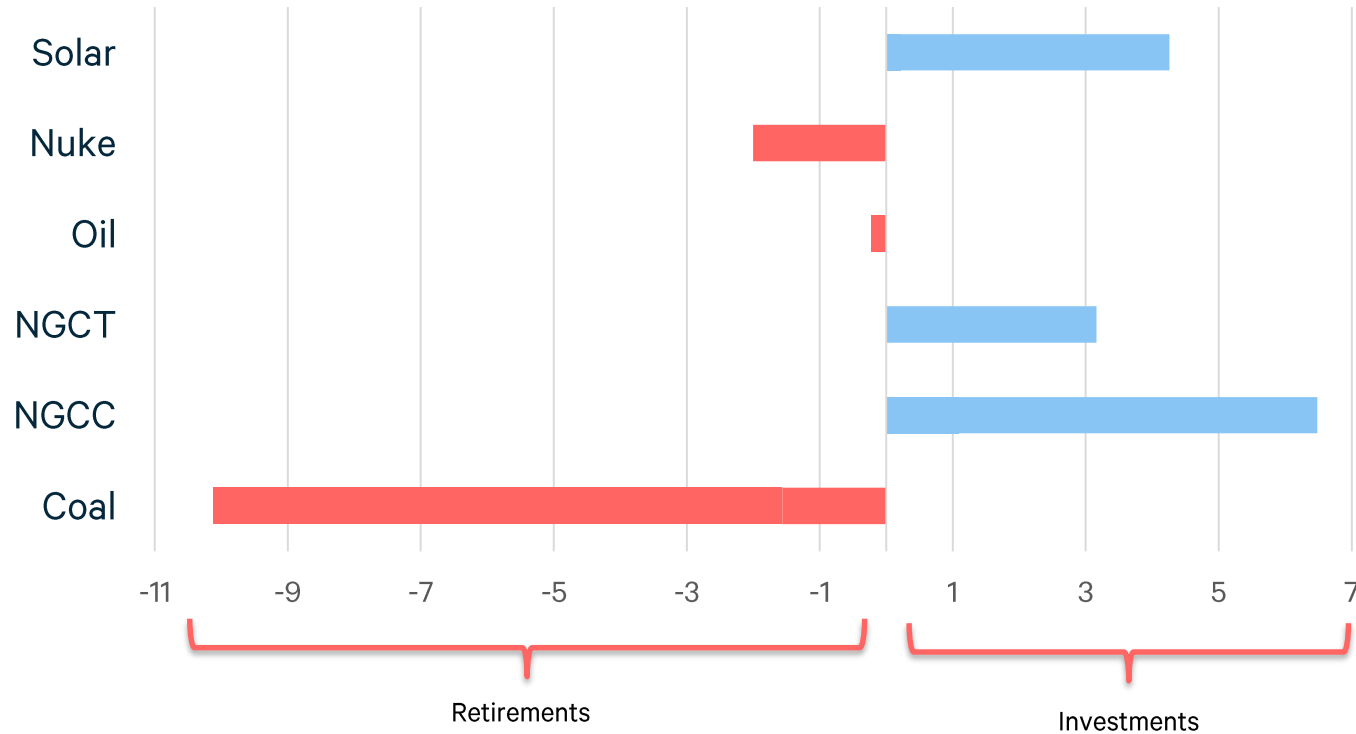
3. North Carolina's baseline is getting cleaner

Model assumptions:

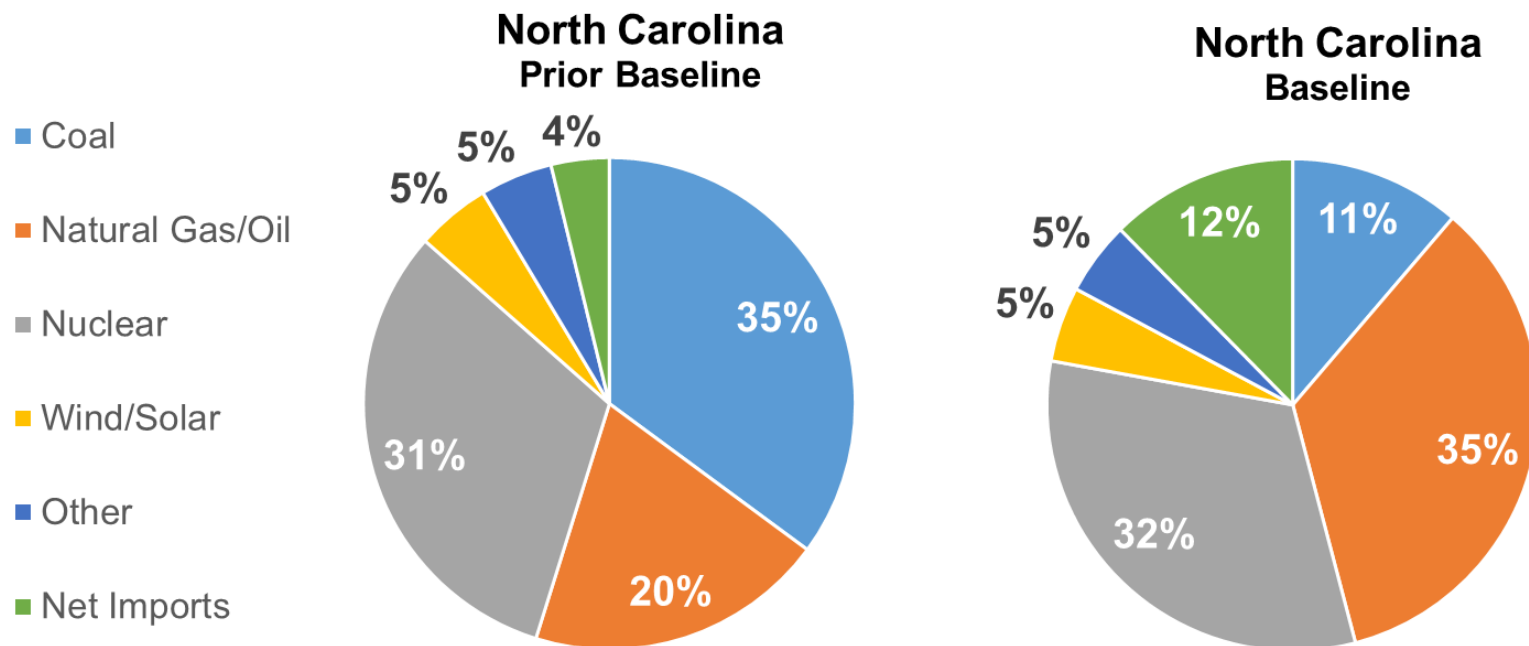
- Energy efficiency spending is assumed to reduce demand proportionately across all time blocks
 - 1.1% reduction from AEO 2016 levels by 2025
 - 1.6% reduction by 2030
- Demand side management is assumed to represent dispatchable capacity and reduces the (15%) capacity reserve requirement by:
 - 2% reduction in 2017
 - 3% reduction in 2025 and thereafter
- Retirements and Investments.....

Baseline Capacity Assumptions

Planned Retirements and Investments in NC after 2018 [GW]



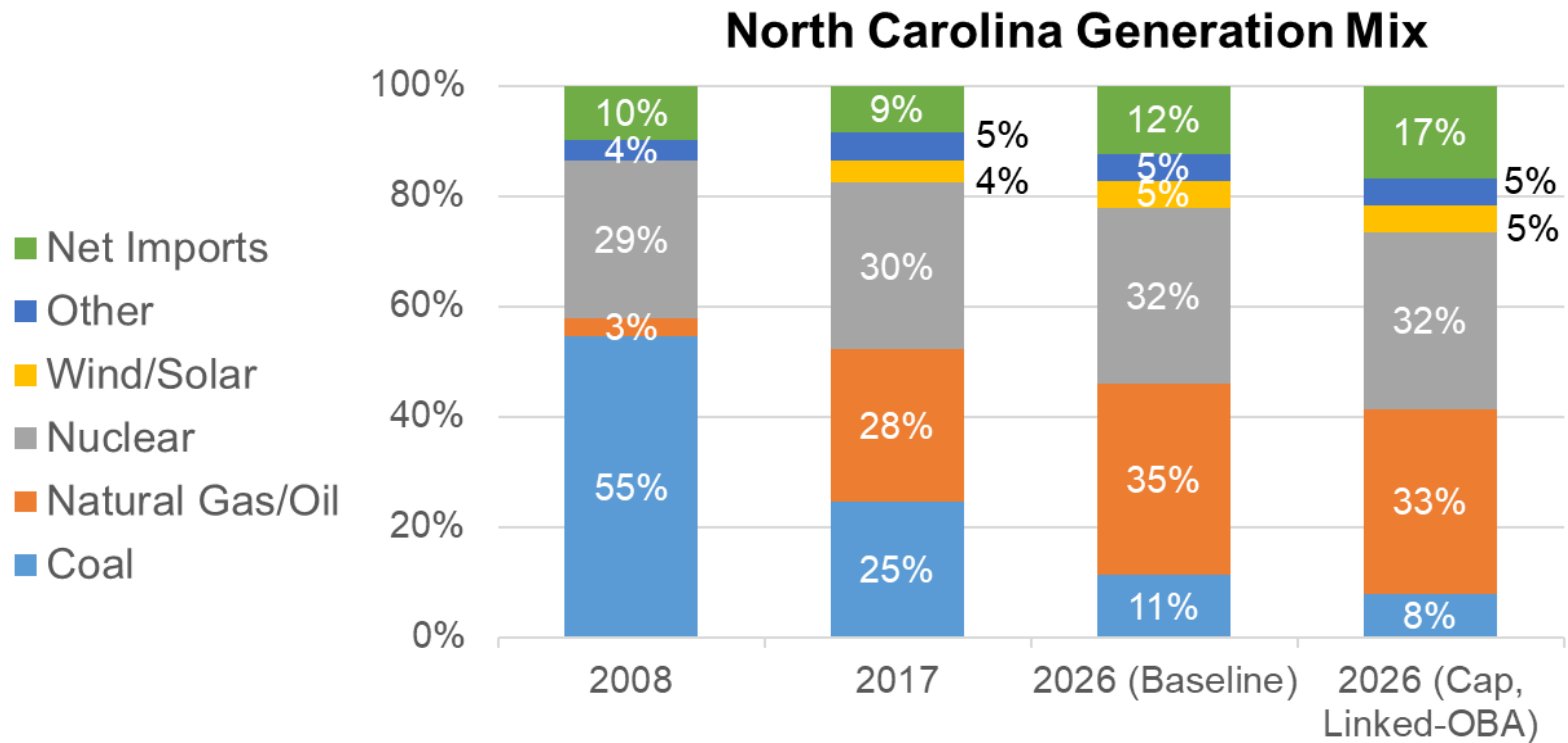
Baseline generation mix in 2026



We updated information from EIA baseline assumptions drawing on EPA modeling and utility integrated resource plans

- Anticipated consumption falls by almost 1%

4. The cap accelerates emissions reductions



- The emissions cap leads to a reduction in coal and natural gas generation

5. Allocation has a modest effect on generation

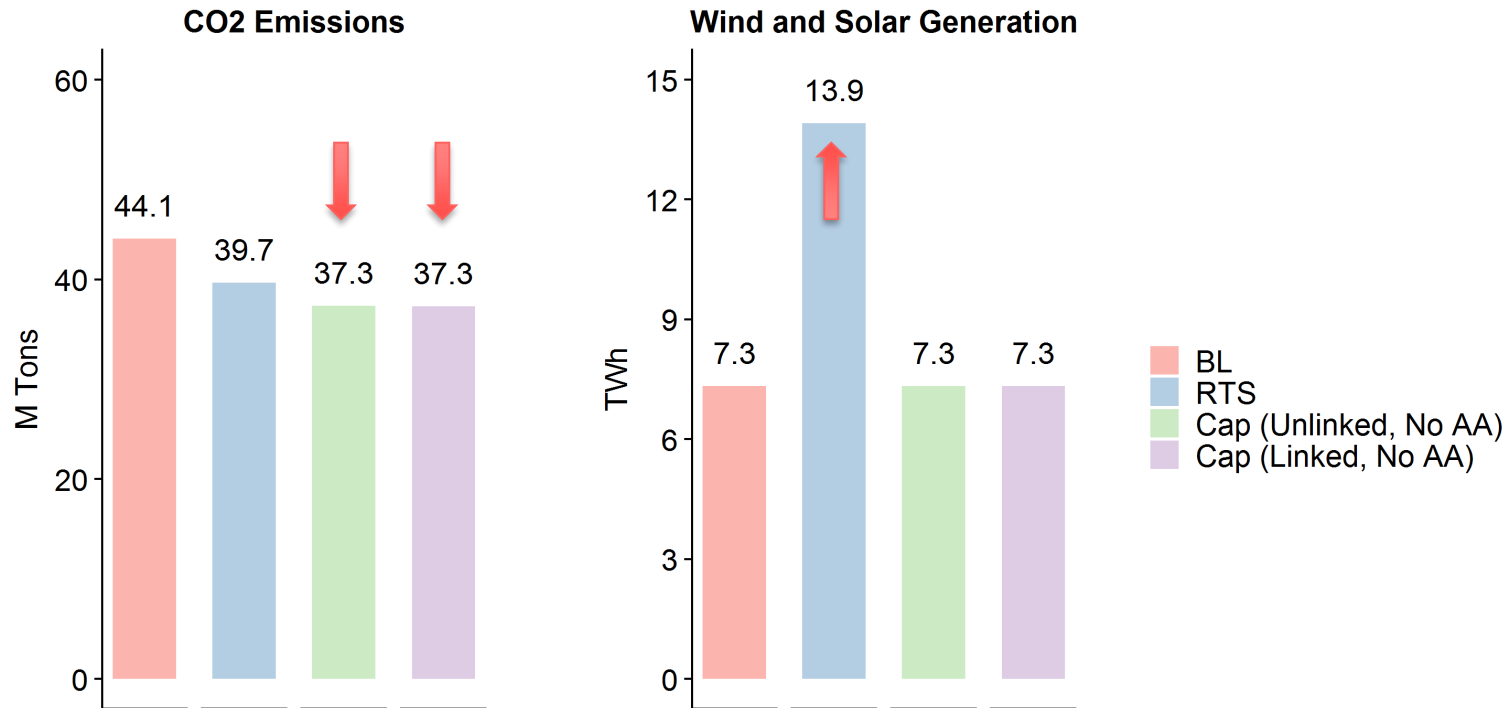
Cap and trade “allocation” (use of allowance proceeds):

- (NoAA): No allocation within the electricity sector; auction proceeds go to the general fund
 - (EE): Investments in energy efficiency
 - (LDC): Value returned to local distribution companies for rate relief
 - (OBA): Output based allocation to producers based on electricity generation (“output”) from all sources except coal, hydro & existing renewables
- Variations in allocation have predictable effects
- Energy efficiency spending lowers consumption
 - Output-based allocation reduces power imports

Renewable Technology Standard

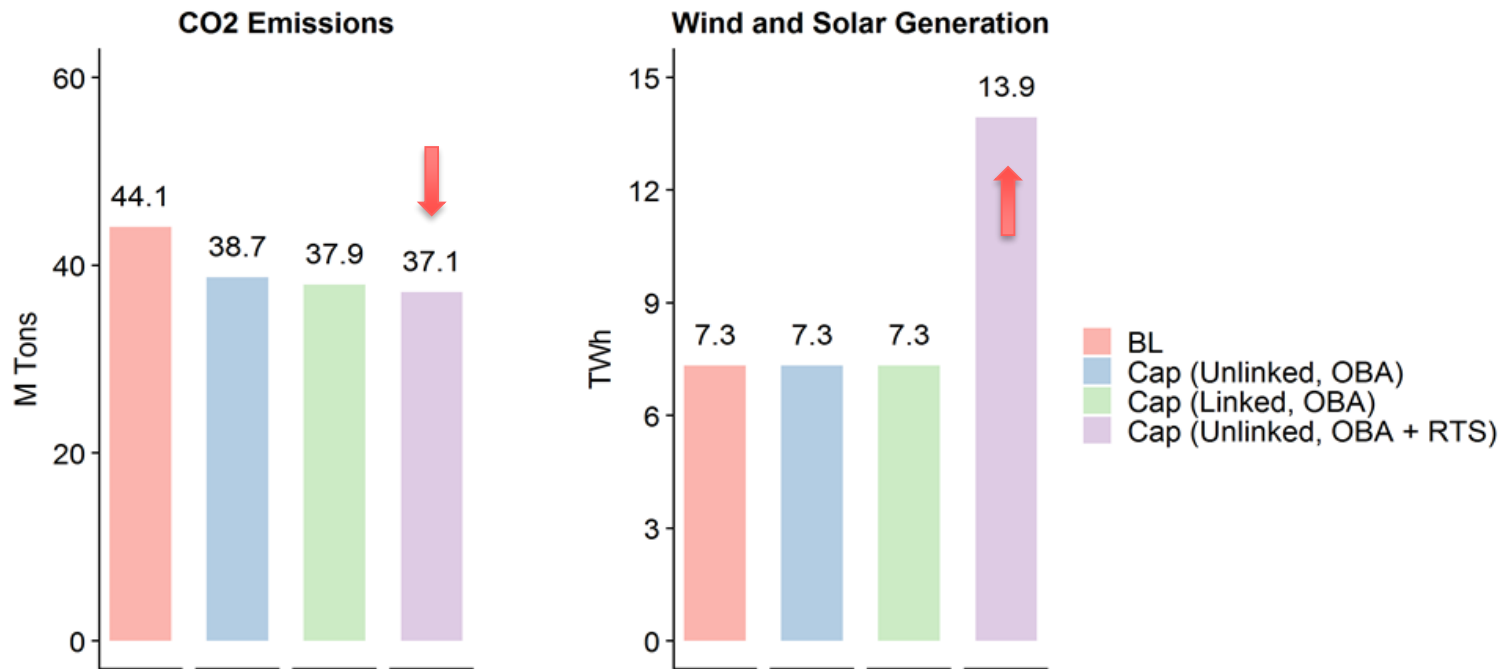
- We model a requirement for in-state wind and solar generation to grow by 1% of consumption per year
- We model this separately and in combination with cap and trade

6. The renewable standard achieves slightly fewer reductions but doubles renewable capacity compared to cap and trade



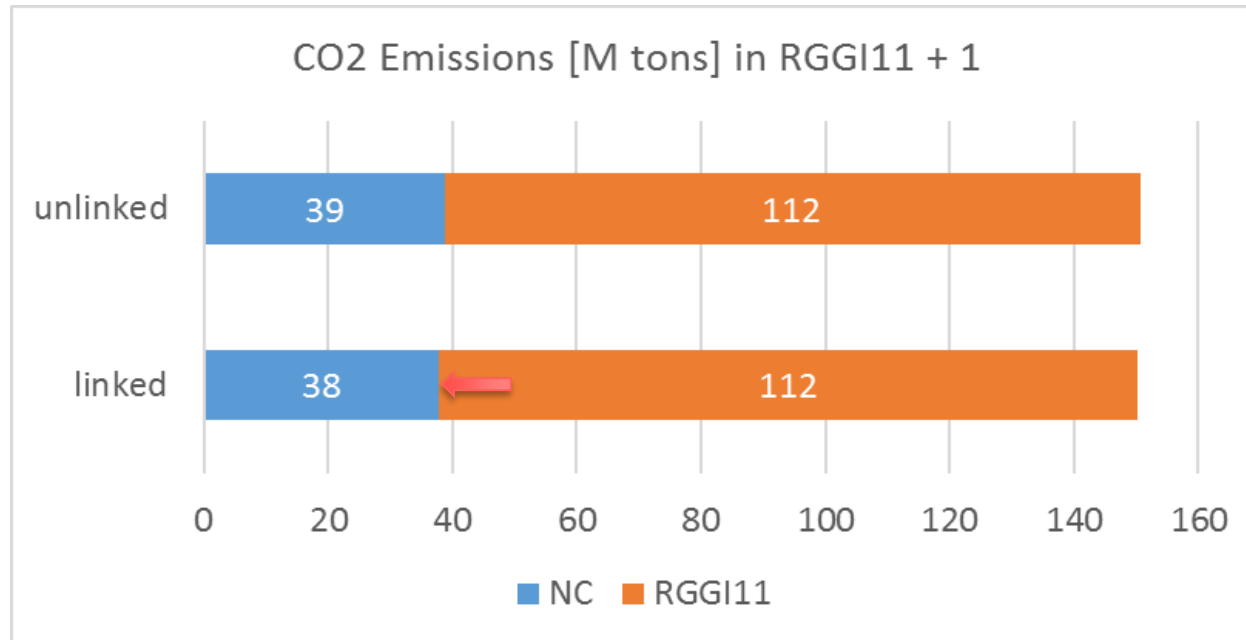
- The renewable standard has greater upfront costs
- It provides important new infrastructure that puts the state in a better position for future emissions reductions

7. A combination of cap and trade and a renewable standard is an option used by many states



- Output based allocation brings more generation into the state and reduces leakage
- Emissions are lowest when the cap is combined with a technology standard

8. Linking cap and trade has little effect on emissions or prices, and strengthens the program in other ways



- Allowance prices are similar in NC and RGGI
- The 'trading ready design' makes linking seamless
- Linking reduces emissions in NC and reduces emissions in the combined regions

Reflections on Linking

- Linking would lower the cost in NC whether the state is a buyer or seller of allowances
- Given uncertain market trends and fuel prices, linking is expected to reduce the variability of allowance prices on average
- Linking benefits electricity markets by enabling coordination of investments
- Linking enables greater ambition and policy influence at the national level

Summary

- We attempt to reflect NC resource plans and climate policy goals
- The baseline is trending toward cleaner energy, and policy can accelerate that trend
- Emissions cap and trade achieves reductions at a low price
- Renewable technology standards have greater upfront costs, but position the state to achieve additional reductions in the future
- Cap and trade and renewable standards can be pursued together
- Linking can strengthen the cap-and-trade program
- This analysis is independent and was not solicited by advocacy or industry groups or state government



Thank you!

Acknowledgements

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