CPP Rate-Mass Assessment

Performed for: The Arizona Utility Group

February 2016

Contents

This report presents the findings of a gap analysis undertaken by Pace Global to assess Arizona's compliance position relative to its Clean Power Plan (CPP) goals under both a rate- and mass- based approach.

Executive Summary

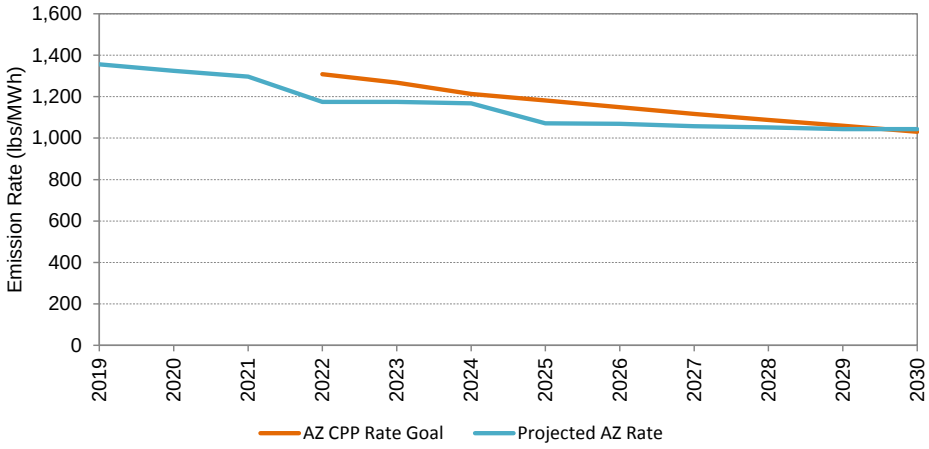
Comparing Base Case to CPP Rate and Mass Goals to Assess Compliance Gap

- The Arizona Utility Group (AUG) retained Pace Global to evaluate the preference for a rate- or mass-based approach to CPP compliance for Arizona.
- In this analysis, Pace Global modeled a base case outlook based on the known planning horizon for Arizona and the Western Interconnect and compared it to CPP goals.
  - Compliance gap for the State assessed under rate- and mass- based compliance options in the final CPP
  - Analysis does not address the individual CPP compliance position of participating utilities, or their operational (e.g. transmission) limitations
- This analysis is an initial step to assess Arizona's optimal compliance approach based on what is known or that we can reasonably project at this time – many uncertainties remain.
- The results of this analysis will inform the AUG and broader Working Group in CPP planning activities.

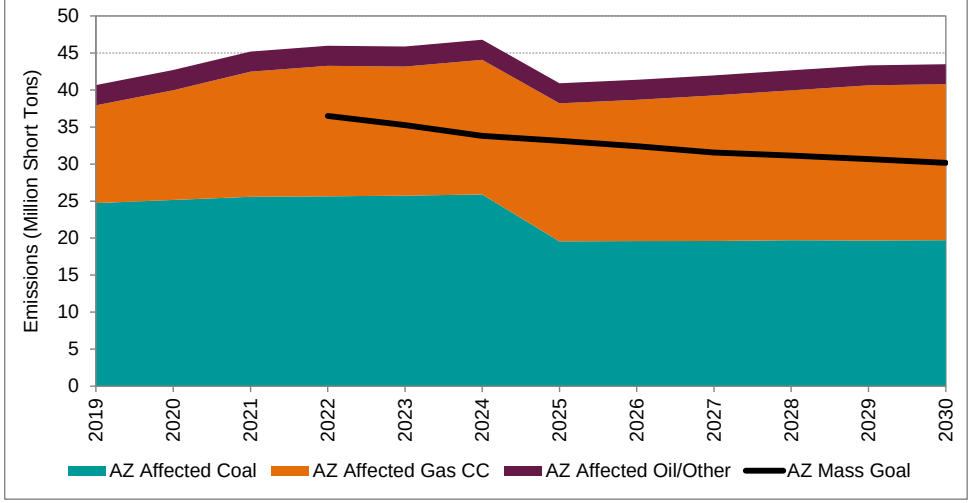
Summary of Base Case State Rate and Mass Analysis
Coal Reduction and ERCs from Renewables and Efficiency Position Arizona for Compliance Under Rate Goal

- This analysis suggests that Arizona is well positioned for rate approach based on the Base Case outlook due to increased reliance on gas expected and significant energy efficiency and new renewables.
- Arizona meets CPP interim goal under a rate-based approach – falls slightly short of meeting final goal.
  - ERCs banked during interim period could be used to meet compliance with final goal.
- On a mass basis, Pace Global projects a net annual allowance deficit that would equate to retiring another ~1,900 MW of coal to comply by 2030.

AZ Rate v. CPP Rate Goal



AZ Emissions v. CPP Mass Goal



Base Case Analysis Indicates Rate Approach May be Advantageous, However, Other Factors and Portfolios Need to be Considered

- Trading opportunities and implications were not considered in this analysis.
- This analysis presents just one outlook of future supply.
  - Market conditions, technology developments, and / or additional regulations could change this mid to long-term outlook.
  - Additional scenarios should be considered to gauge the preference for a rate-based approach under alternate future states.
- The ultimate definition of what qualifies as an ERC in the final rate federal model rule will be important; Arizona will want to incorporate ERCs from qualified and verified energy efficiency and distributed renewables in state plan under a rate-based approach.
- Significant additional coal retirements or generation constraints beyond those assumed in the base case outlook would be required for mass-based compliance.
  - Mass-based approach may provide broader trading opportunities enabling compliance with moderate additional fossil retirements.

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Arizona Rate v. Mass Analysis Overview & Results

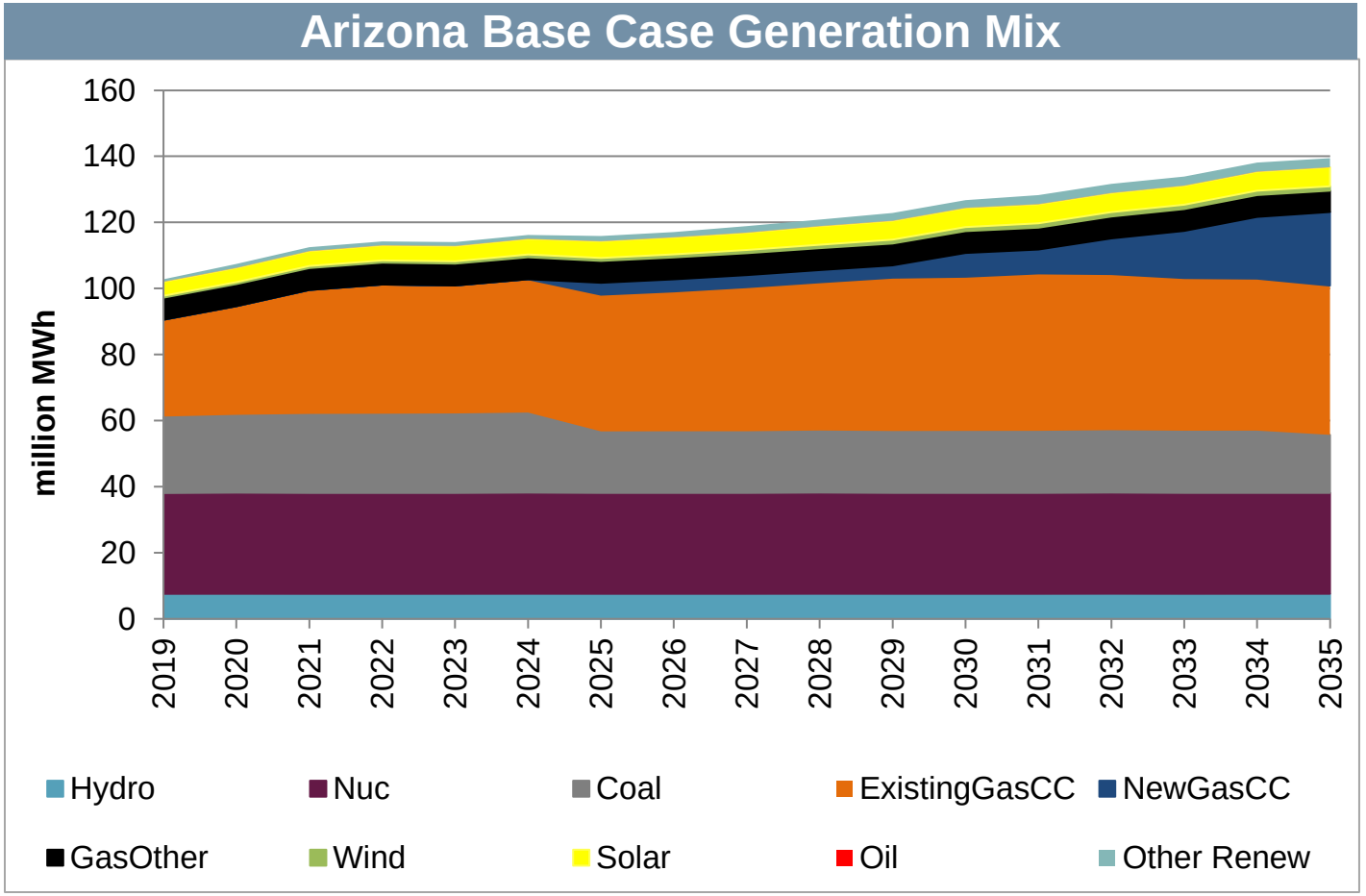
Dispatch Modeling Used to Determine Base Case Generation and Emissions Trajectory Through 2035

- Pace Global deployed Aurora, an hourly chronological dispatch model, to simulate the economic dispatch of power plants within a competitive framework across the western interconnect for the base case outlook.
- Generation supply and load outlook was provided individually by the participating utilities for the known planning horizon. Assumptions were aggregated by Pace Global and integrated into base case modeling to best reflect the future generation position of the state in absence of carbon regulation based on what is know at this time.
- For fuel and other market assumptions, the analysis largely relied on Pace Global assumptions for a business as usual outlook, without emission constraints of the CPP or other national carbon regime.

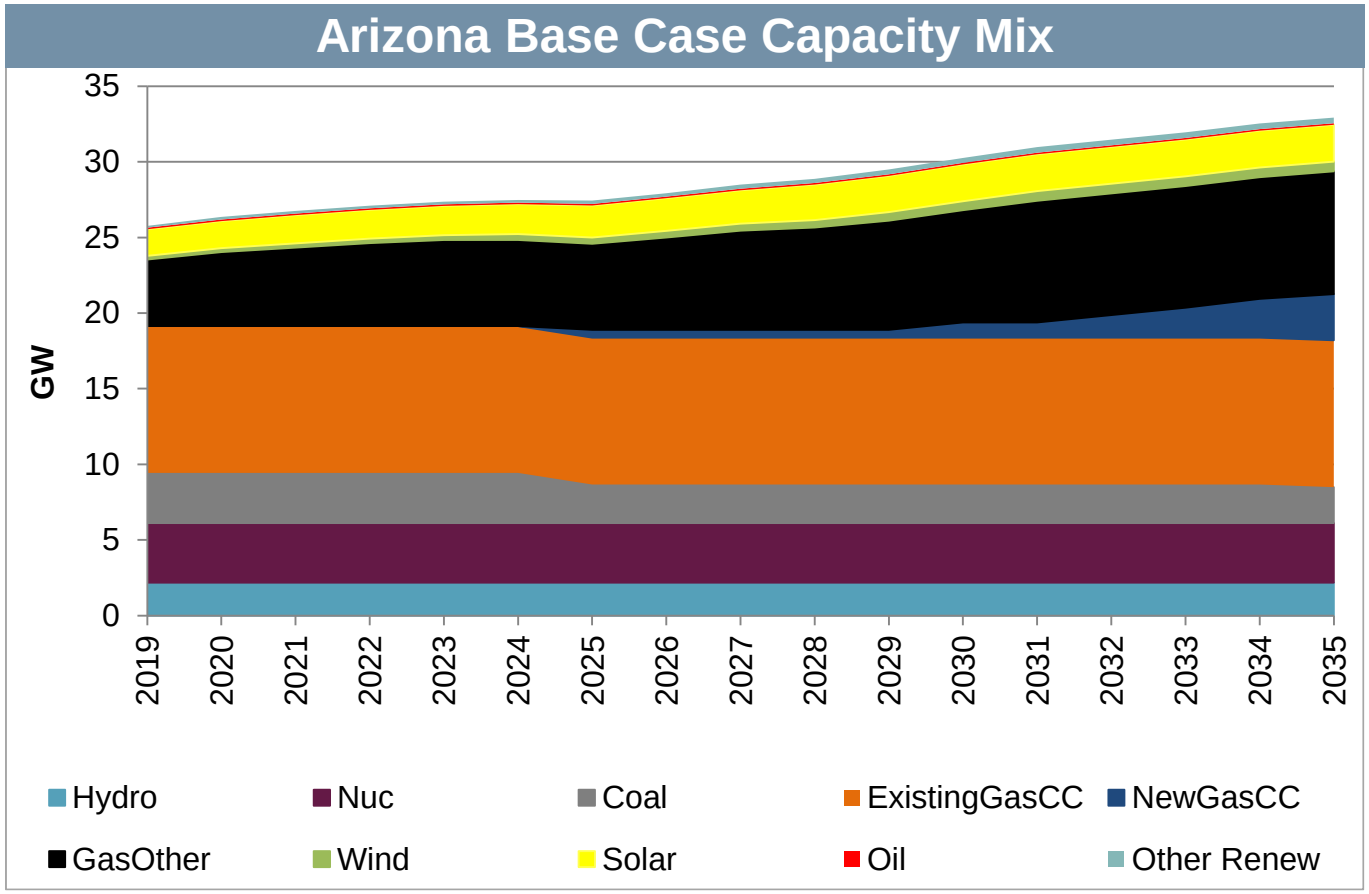
Base Case Represents Economic or Expected Future Generation Mix Based on No CPP or Other National Carbon Constraint

- Includes announced fossil and gas unit retirements and conversions
- Firm new builds based on announced projects that are under construction
- Existing RPS and state carbon policies only (i.e. price on carbon applicable to California generation)
- Arizona utilities provided outlook for owned and contracted generation as well as projected load
- Economic new builds beyond the “known” future to maintain reserve margins
- Hourly economic dispatch analysis – aggregated annually to compare to CPP goals

Base Case Supply Outlook Summary - Generation



Base Case Supply Outlook Summary - Capacity



Prominent Changes Over Forecast Period

Retirement/Repower

1,100MW coal

- Sundt 4 (repower)
- Apache ST2 (repower)
- Cholla

New Builds

3,050MW new NGCC

400MW new wind

800MW new solar

330MW geothermal

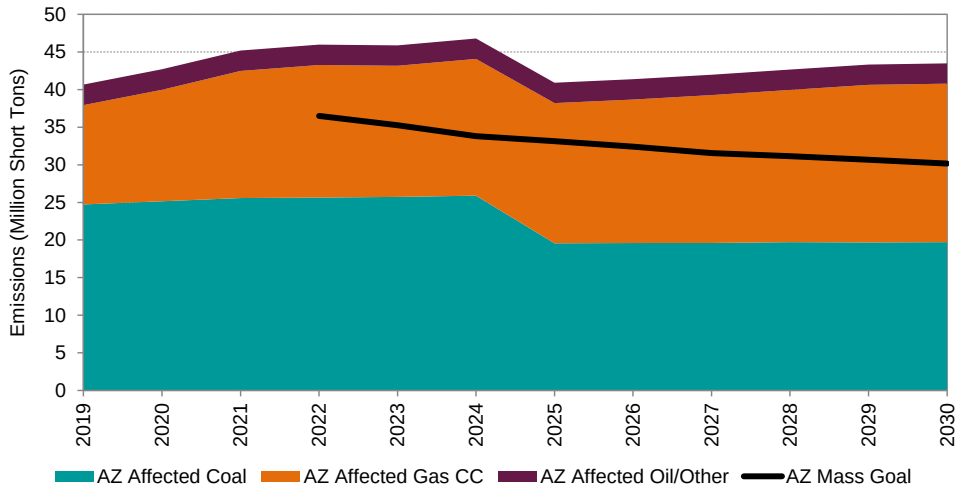
Mass and Rate Positions Determined Based on Parameters of Final CPP and Proposed Federal Model Rules

Mass-Based Position Determination	Rate-Based Position Determination
1. Mass-based goal – Quantified emissions from all affected units in the state (tons CO2) – Compared to state mass goal for each year of the CPP (tons CO2) **2. Mass-based goal including New Source Complements*** – Quantified emissions from all affected units as well as emissions from base case new natural gas combined cycle units – Compared to state mass including New Source Complements for each year of the CPP	**1. Rate-based goal – State Rate Approach** – Numerator - quantified emissions from all affected units in a state (lbs CO2) – Denominator – quantified generation from all affected units in a state plus ERCs from new utility-scale renewables and nuclear (online post 2012) and energy efficiency – Compared to state rate-based goal for each year of the CPP (lbs CO2/MWh)

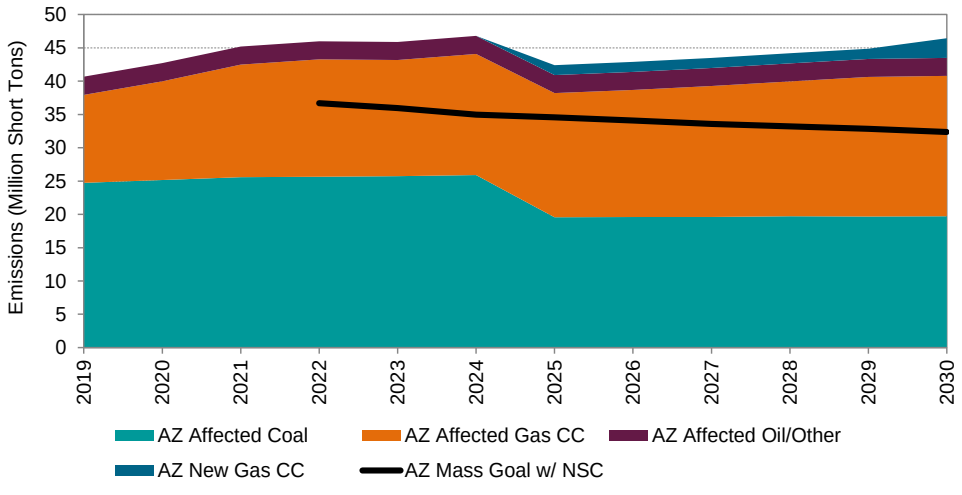
* New Source Complements represent the EPA's estimated new source emissions needed to satisfy incremental demand beyond 2012. Assumed as incremental to mass-based goal, they can be adopted and compared against emissions from affected units and that of new sources to address leakage under a mass-based approach.

Base Case Mass-based Emissions v. CPP Goals

AZ CO_2 Emissions Affected v. Mass Goal

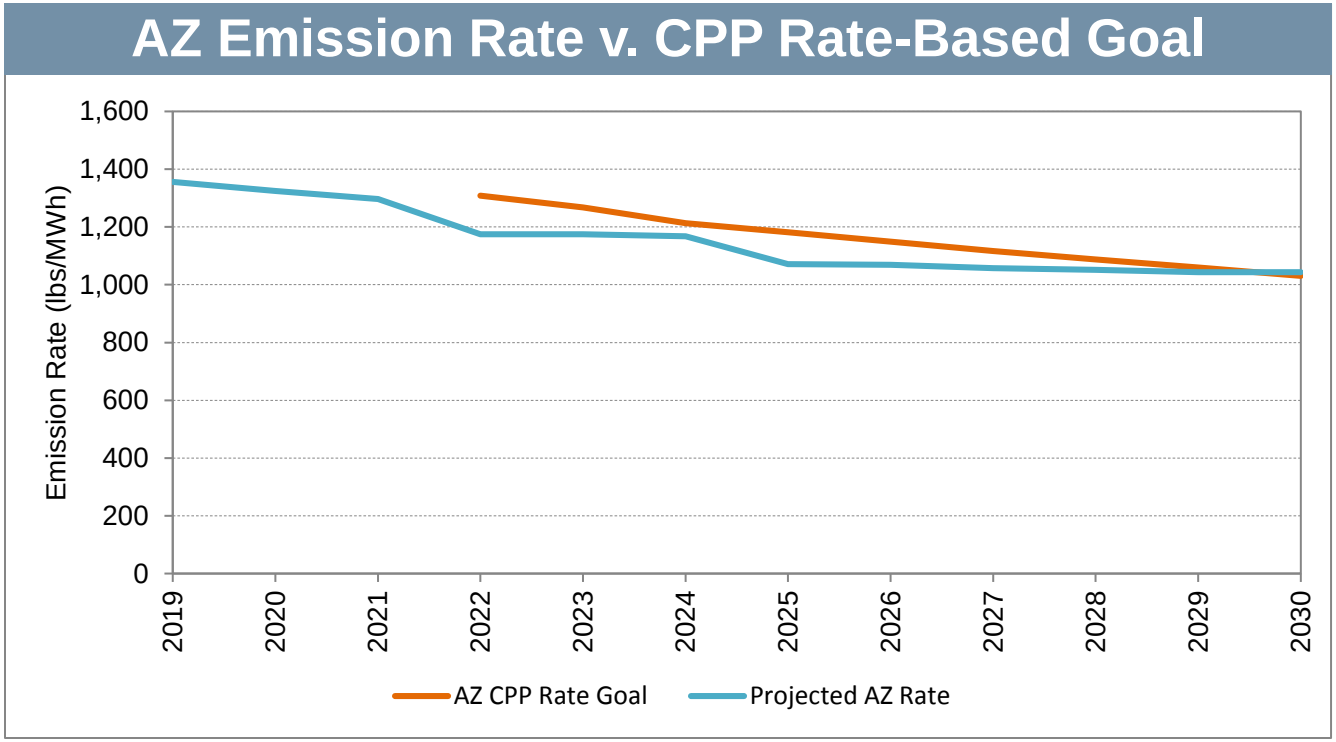


AZ CO_2 Emissions Affected & New v. NSC Goal



	Base Case (MTons CO2)	CPP Goal (MTons CO2)	Allowances Needed (MTons CO2)
Emissions from Affected Units v. Mass-based Goal			
2022	46.0	36.5	9.5
2025	40.9	33.1	7.8
2029	43.3	30.7	12.6
2030	43.5	30.2	13.3
Emissions from Affected Units and New NGCC v. Mass-based Goal w/ New Source Complements			
2022	46.0	36.7	9.3
2025	42.4	34.6	7.8
2029	44.9	32.9	12.0
2030	46.4	32.4	14.0

Calculated Base Case Emission Rate v. CPP Goal



	Base Case Rate (lbCO2/ MWh)	State Goal (lbCO2/ MWh)	ERCs Position (million MWh)	Comments
Interim (2022-2029)	1,101	1,173	+38.6	Significant ERCs accumulated during interim period, to be banked or sold
Final (2030)	1,044	1,031	-1.0	net short position in 2030 and beyond could be covered by ERCs banked in interim period

Questions & Discussion