

ASSESSING COAL UNIT RETIREMENT RISK

*Presentation for the US Energy Information Administration Workshop
Coal Fleet Aging*

Tom Hewson
Principal

June 14, 2016

Energy Ventures Analysis

1901 N. Moore St. Arlington, VA 22209
(703) 276 8900

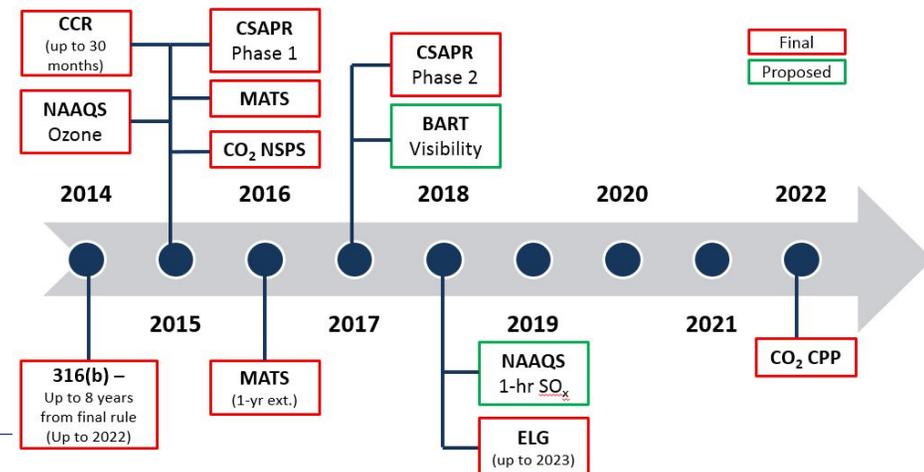


COAL CAPACITY CHALLENGES

- **Environmental Regulatory Risk**-- Compliance often requires coal units to make large capital investment in additional retrofit control measures and/or increase their cost of generation. Power providers must evaluate if they will be able to recover these compliance costs or retire units
 - Clean Power Plan (CPP) (Stayed pending litigation outcome) (October 2015)
 - Mercury & Air Toxic Standard (MATS)
 - Cross State Air Pollution Rule (CSAPR)
 - Regional Haze
 - Major modifications triggering New Source Performance Standards
 - 316 B Cooling Water Intake Structures (Aug 2014)
 - Steam Electric Effluent BACT Guidelines (Sept 2015)
 - Coal Combustion Residual Rule (December 2014)
 - Regional CO₂ Cap & Trade Programs (RGGI, California)
 - State Specific Requirements ((e.g. Colorado Clean Air-Clean Jobs , Illinois Multi-Pollutant Standard)

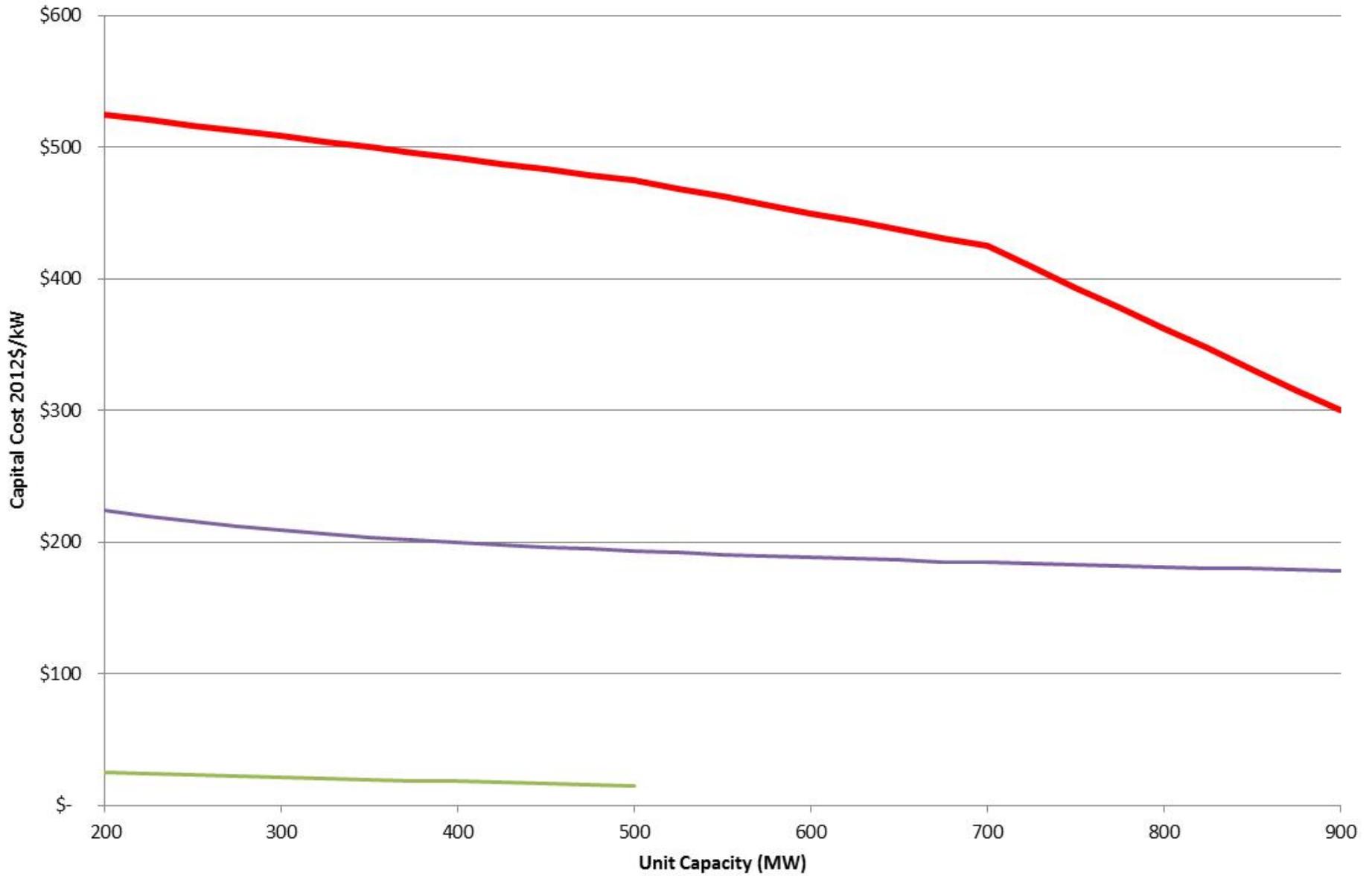
Future

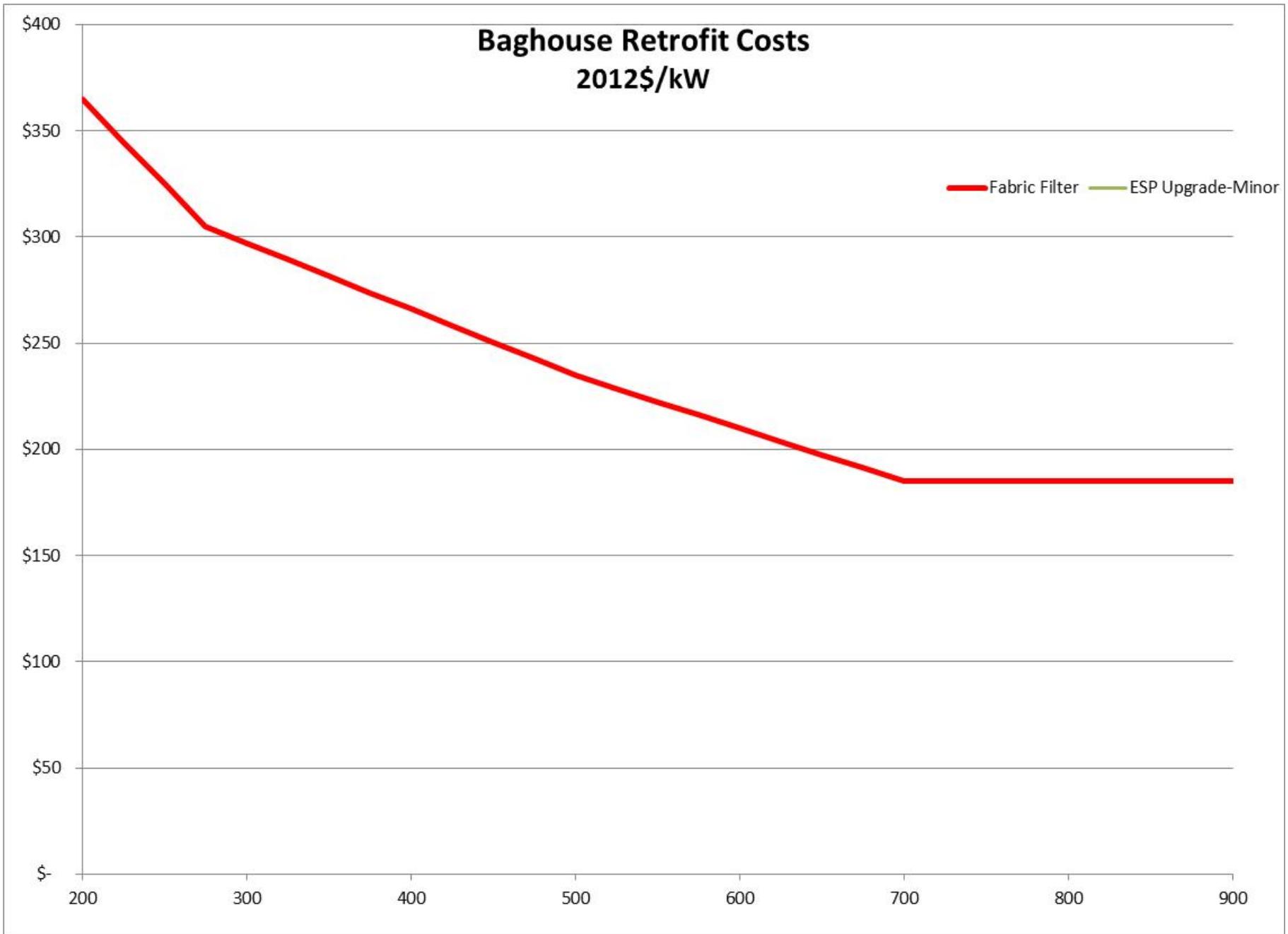
- 2010 short-term SO₂ NAAQS (75 ppb)
- 2015 Ozone NAAQS (70 ppb)
- Regional Haze- Reasonable Forward Progress
- Risk of Future Regulatory programs



Retrofit NOx Control Costs

EVA-SCR SNCR EPA-SCR





COAL CAPACITY CHALLENGES

■ Financial Risk

- Cost of Capital varies— Independent Power Producer, Investor Owned Regulated Utility, Rural Electric Coop, and Public Owned Utility
- Remaining unit lifetime- Steam-electric 65-70 years, NGCC 45 years

■ Operation Issues- Ramping, seasonal dispatch (??), age, environmental penalties,

■ Unit Competition

- Unit Delivered Fuel Prices

- Coal versus natural gas (Commodity price outlook changes depending upon regulatory outlook, productivity/extraction costs, fuel demand (including outside power market demand), regional coal quality, etc...

- Nuclear

- Future Relicensing requirements

- Renewable

- Production Tax Credit/Investment Tax Credit- recently extended
- State RPS Standards- REC values
- Clean Power Plan- renewable set-aside incentives to address leakage
- Other renewable financial incentives
- Curtailments (Wind) and Transmission issues



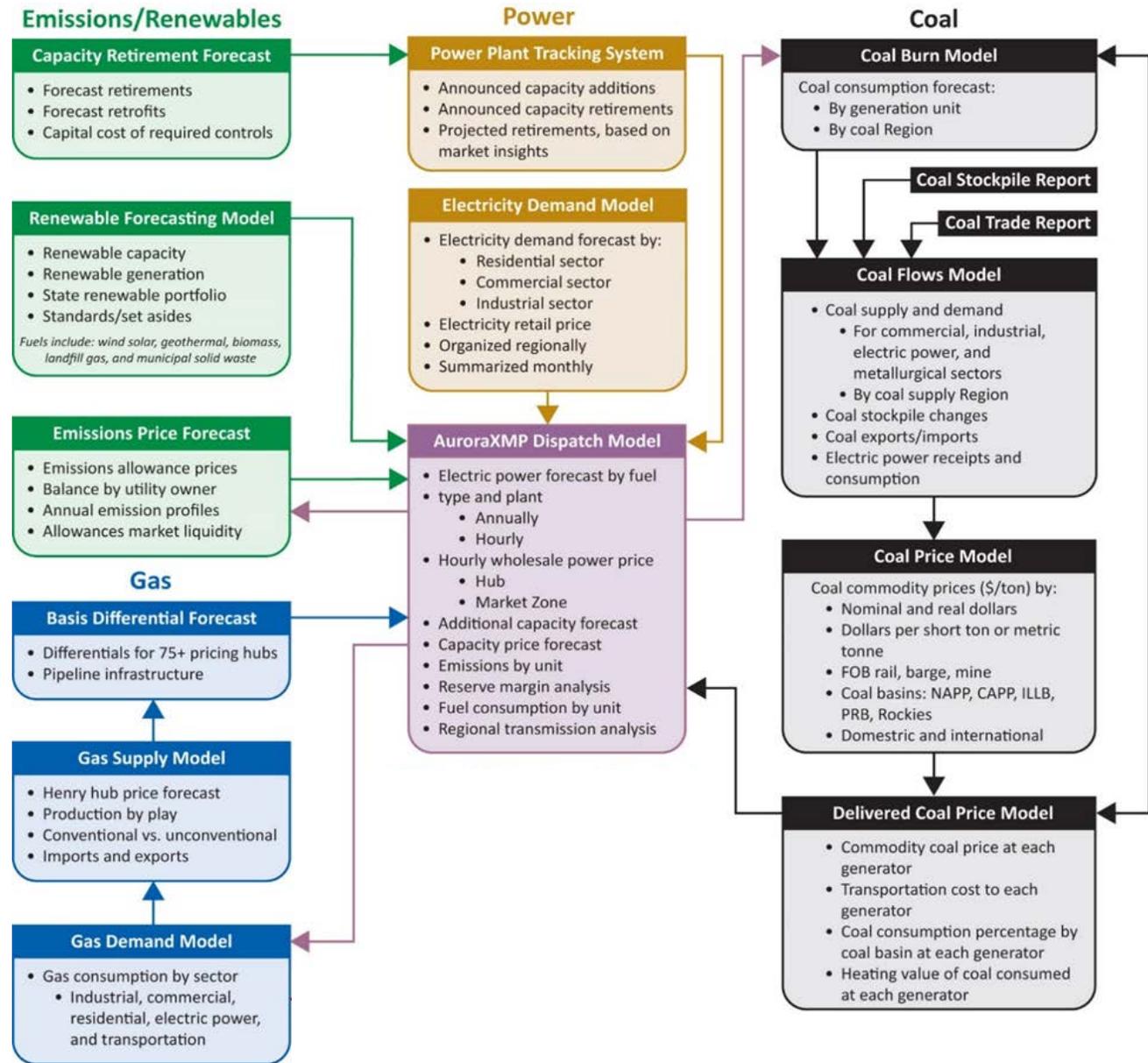
ANNOUNCED COAL UNIT RETIREMENTS – CUMULATED BY NERC REGION

- An additional 36.86 GW of announced coal unit retirements during period 2016-2025
 - 9.51 GW in RFC (26%)
 - 8.78 GW in SERC (24%)
 - 8.33 GW in WECC (23%)

	NPCC	RFC	SERC	FRCC	MRO	SPP	TRE	WECC	Total
2011	439	372	346	0	64	0	0	4	1,224
2012	1,000	7,094	3,789	135	262	92	0	413	12,785
2013	1,524	9,912	7,520	135	381	92	0	608	20,172
2014	1,817	11,773	8,961	135	588	110	138	1,700	25,222
2015	1,892	20,578	16,543	135	2,253	712	138	2,181	44,431
2016	2,328	24,964	20,036	135	2,983	2,094	138	2,593	55,271
2017	3,730	24,964	22,888	385	3,106	2,584	138	4,744	62,539
2018	3,730	26,678	23,629	1,258	3,414	3,588	1,009	4,744	68,050
2019	3,730	26,977	23,629	1,258	3,414	3,686	1,009	5,494	69,197
2020	3,730	27,911	24,005	1,258	3,704	3,686	1,009	6,749	72,052
2021	4,113	27,911	24,142	1,258	3,896	4,026	1,009	7,003	73,359
2022	4,113	28,191	24,737	1,258	4,239	4,026	1,009	7,003	74,577
2023	4,113	30,089	24,737	1,258	4,919	4,026	1,009	7,003	77,155
2024	4,113	30,089	25,322	1,258	4,919	4,026	1,009	7,770	78,507
2025	4,113	30,089	25,322	1,258	4,966	4,026	1,009	10,508	81,292

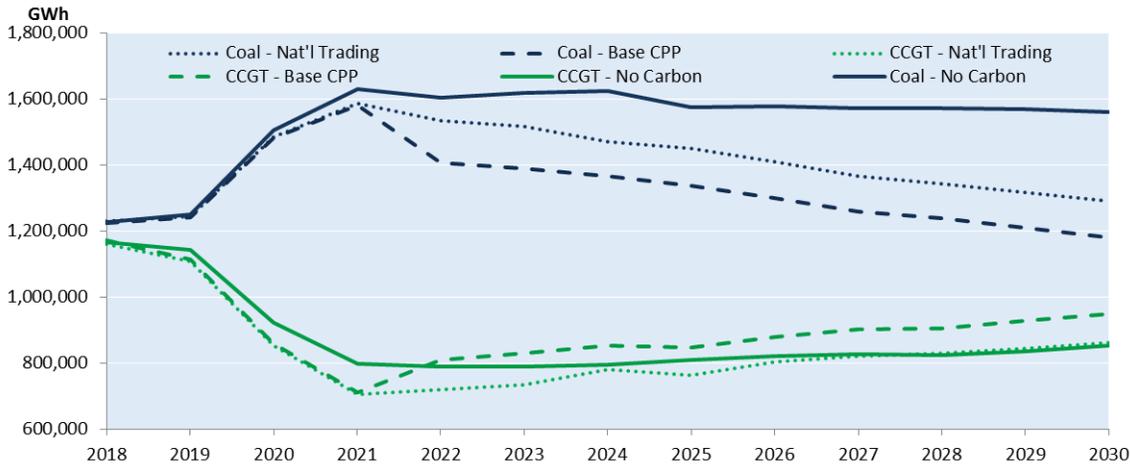
OVERVIEW OF EVA'S INTEGRATED BUSINESS PROCESS

- EVA possesses a suite of databases, models, and market insight that feeds its integrated business process
- EVA's commodity and power prices are seamless and provide an internally consistent outlook
- EVA utilizes the AURORA_{XMP} hourly dispatch model to represent the North American electric power sector



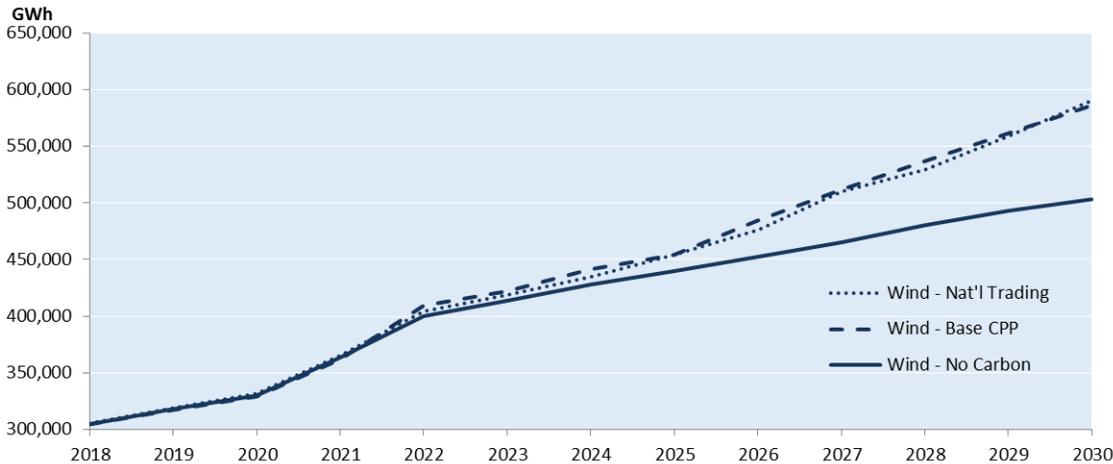
COAL GENERATION IS REPLACED BY INCREASING RENEWABLES AND EE

FOSSIL GENERATION BETWEEN NO CARBON, CONSTRAINED AND NAT'L TRADING



- With the Clean Power Plan limiting the carbon emissions from fossil units, the coal generation in constrained CPP and national trading CPP case declines compared to the no carbon case
- CCGT generation increases in the constrained trading case to replace the lost coal generation

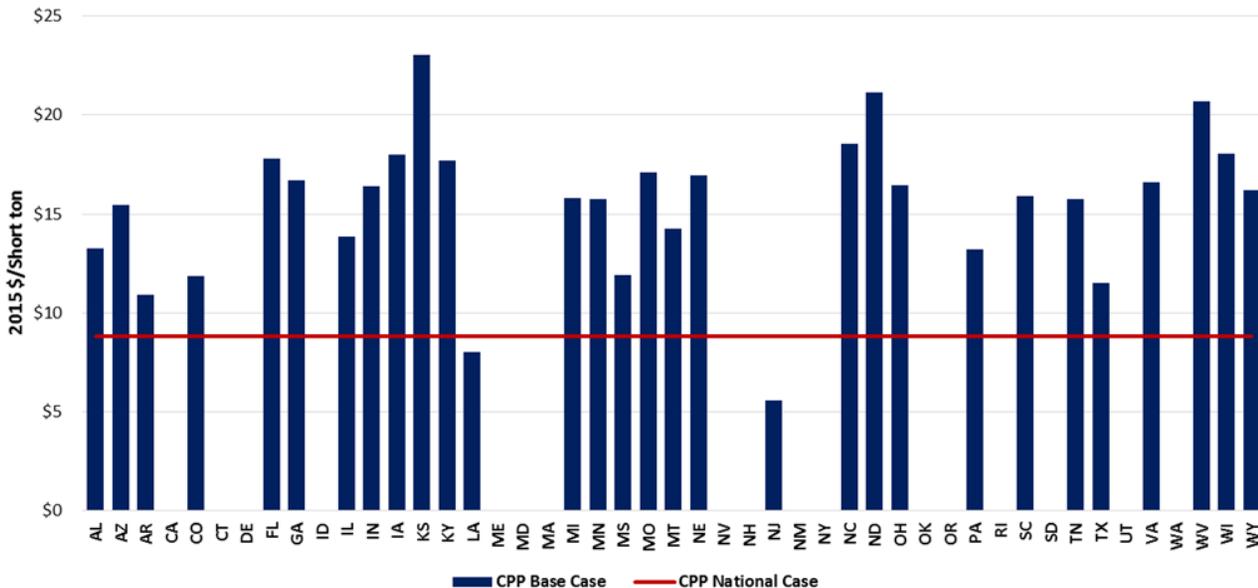
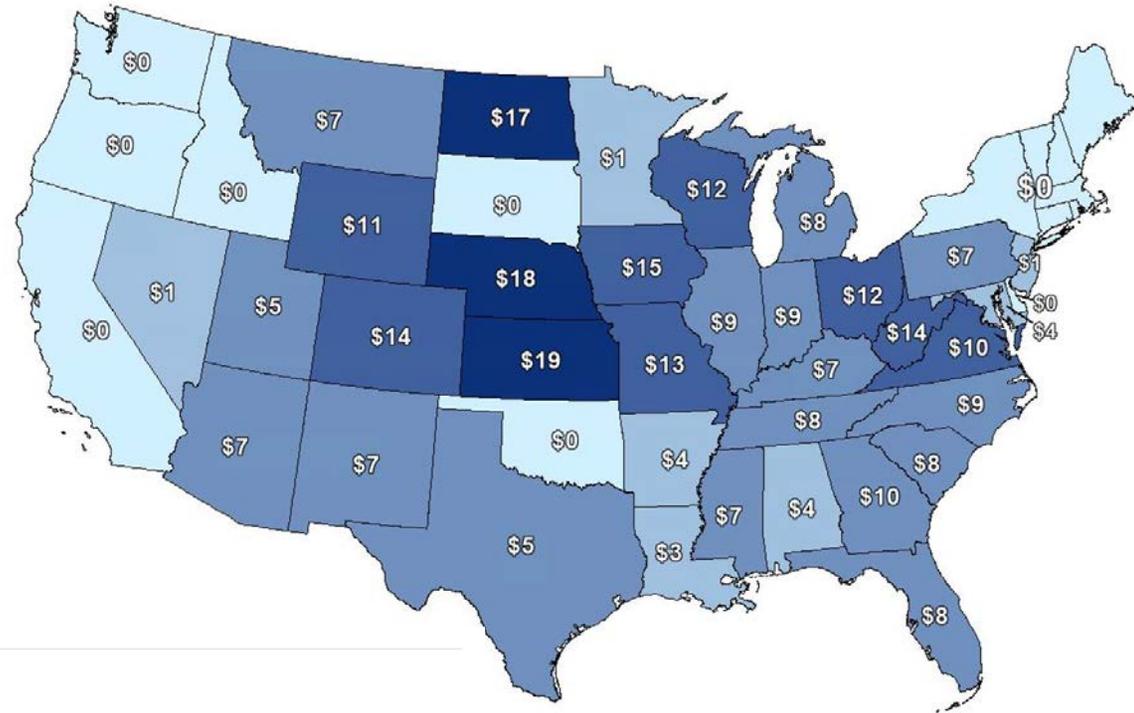
WIND GENERATION BETWEEN NO CARBON, CONSTRAINED AND NAT'L TRADING



- Renewable generation goes up by ~85 TWh in the constrained CPP case and by ~95 TWh in the national trading case to replace the lost coal generation

CPP COMPLIANCE COST CAN VARY SIGNIFICANTLY BY REGION

- 2022-2030 average state carbon penalty (\$2015/ton) in CPP mass-based scenario with intra-state trading only
 - States with highest reduction requirements (e.g. ND, NE, KS) have highest carbon penalties
 - Already established CO2 allowance markets (RGGI, CA AB32) see no additional cost for CO2 due to the stringency of their programs



- 2030 state carbon penalties compared to national carbon penalty
- In national trading scenario, compliance cost for states with no or low CO₂ reduction requirement could increase

OUTLINE

ABOUT EVA

ABOUT ENERGY VENTURES ANALYSIS

EVA, Inc. is an energy consulting firm located in Arlington, VA. EVA is focused on economic, financial, and risk analysis for the electric power, coal, natural gas, petroleum, renewable, and emissions sectors.

Since 1981, EVA has been publishing supply, demand, and price forecasts as part of its FUELCAST subscription service for these energy sectors.

EVA performs various analyses for an array of clients that include:

- power utilities
- fuel producers
- fuel transporters
- commodity traders
- regulators
- financial institutions



ENVIRONMENTAL CONSULTING AREAS

- Assessment of future environmental policies, for example:
 - Mercury & Air Toxic Standard (MATS)
 - 316 B Cooling Tower Intake Structures
 - Coal Combustion Residual Rule
 - Cross State Air Pollution Rule/Clean Air Interstate Rule
 - Regional CO₂ Programs (RGGI, California AB32)
 - Regional Haze
 - State legislation (e.g. Colorado Clean Air-Clean Jobs , Illinois Multi-Pollutant Standard)
 - State Renewable Portfolio Standards
- Emission allowance forecasts
 - SO₂ (Acid rain, CAIR, CATR, CSAPR), NO_x (annual, ozone season), CO₂ (RGGI, CA AB32, Clean Power Plan)
- GHG emission offset supply, demand, price balance
- Technology control market studies
- Economic and employment impacts of environmental policies
- Environmental control reagent market forecasts
- Public utility commission audits
- Expert testimony

