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# Insights from Modeling the Proposed Clean Power Plan

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# Outline

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- ❖ Modeling Results
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  - Compliance Cost
  - End-Use Energy Efficiency
  - Treatment of New Sources
  - Natural Gas Price/Supply
  - Implementation Policy Choices
- ❖ Appendix: Scenario Descriptions, Assumptions, etc.

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# High-Level Insights

## Key Insights

- The magnitude of impacts from the Clean Power Plan (CPP), including potential compliance costs, are dependent on EPA and state decisions yet to be made, as well as market factors, such as:
  - the availability of end-use energy efficiency (EE),
  - the price of natural gas, and
  - the future of existing nuclear plants
- This uncertainty increases the value of policy designs that inherently create the incentives for implementing least-cost solutions and allow affected companies flexibility to adapt to changing circumstances
  - Benefits of market-based trading with flexibility on where and when reductions occur

## Key Insights (Continued)

- Interconnected nature of the power system is important to consider when looking at costs and impacts of Clean Power Plan
- Benefits of multi-state collaboration and/or linked trading approaches
  - Adopting policy designs that allow access to emission reduction opportunities in other states tends to significantly lower the cost of compliance and reduce retirements
- State choice of energy efficiency policies will significantly impact the cost
  - Effective end-use energy efficiency policies are important for cost containment
  - Demand reductions dramatically reduce system cost because they both reduce the need for additional capacity & lower fuel costs due to reduced demand
- Treatment of new builds is an important policy consideration
  - Including new sources in implementation policies reduces potential market distortions and tends to lower cost
  - Different implications depending on state choice of rate- or mass-based goals

## Key Insights (Continued)

- State policy choices will impact generation mix, investments, cost, & $CO_2$ emissions
- Choice of rate- or mass-based goals and implementation policies
  - Mass-based implementation tends to lower total cost, while rate-based implementation has less impact on wholesale electricity prices
    - Despite projected wholesale electricity price increases in some states/scenarios, end-use EE may keep customer bills from increasing
  - Mass-based policies limit generation shifts and emissions leakage between states
- Rate-to-mass conversion methodology and assumptions matter
  - If each state picks the most generous conversion, more $CO_2$ will be allowed

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# Modeled Scenarios

## **Core Modeling Scenarios** (see Appendix for descriptions and assumptions)

1. Reference case
2. Emission-rate standard, individual state compliance
3. Emission-rate standard, regional compliance
4. Rate-to-Mass conversion of state goals
5. Mass-based standard, individual state compliance
6. Mass-based standard, regional compliance

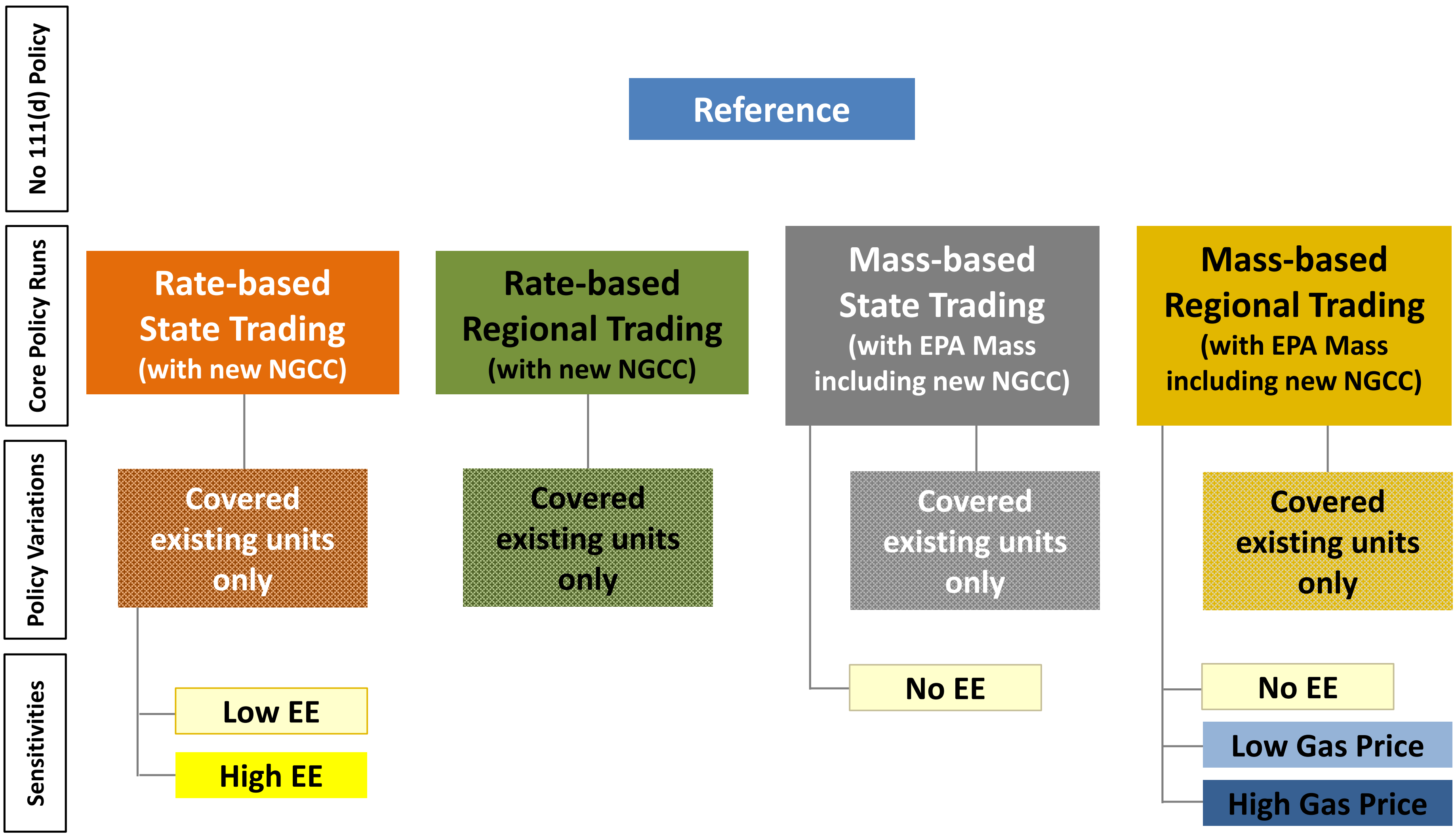
### Policy Variations

- Mass runs with projected mass goals and with EPA illustrative goals
- Most scenarios run with and without new NGCC units included

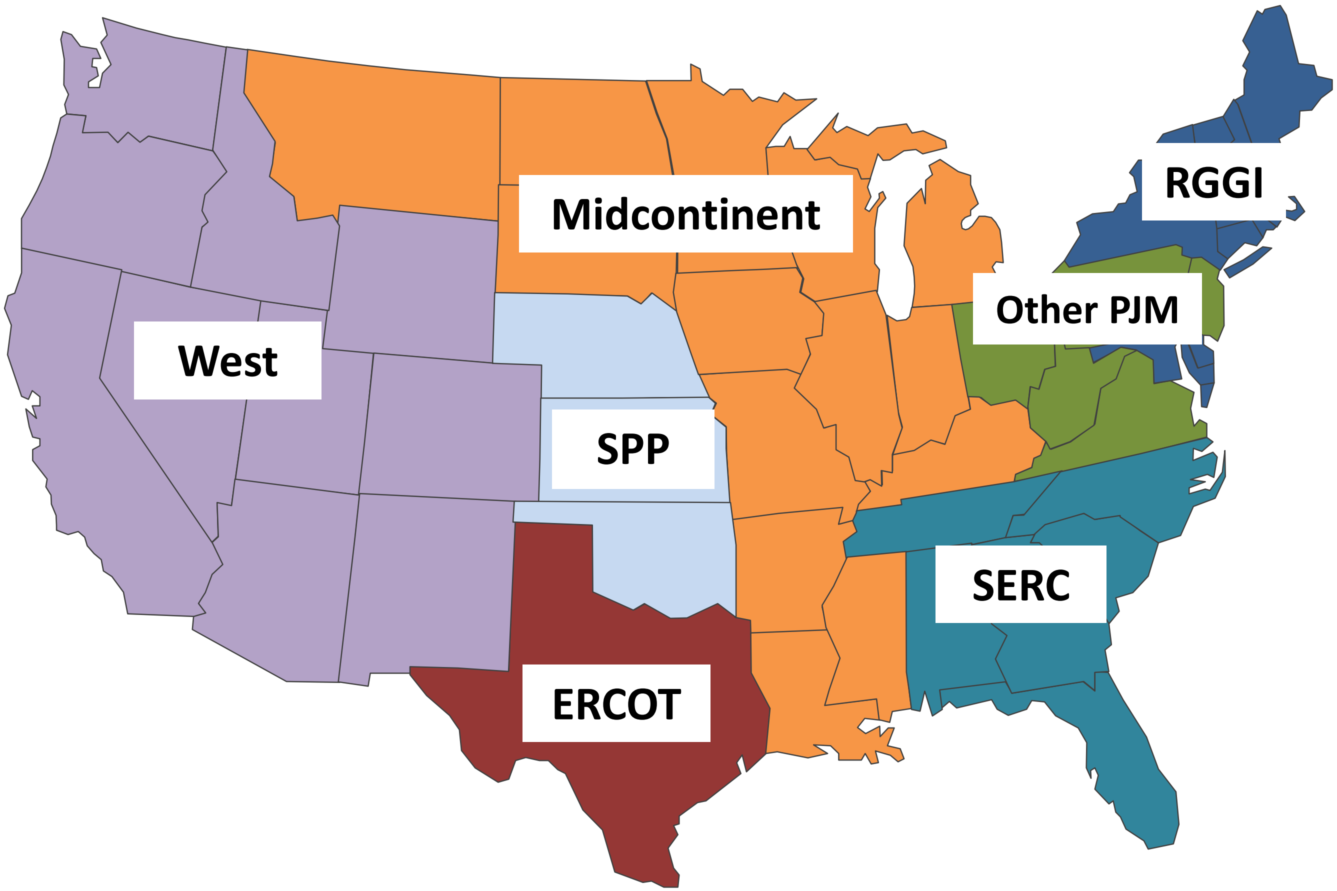
### Sensitivities

- High energy efficiency, low energy efficiency, no energy efficiency
- High and low natural gas supply

- Analysis is based on economic modeling of the power sector
  - Using the commercial version of the Integrated Planning Model (IPM) run by ICF International


No 111(d) Policy
Core Policy Runs
Policy Variations
Sensitivities
Reference
Rate-based State Trading (with new NGCC)
Rate-based Regional Trading (with new NGCC)
Mass-based State Trading (with EPA Mass including new NGCC)
Mass-based Regional Trading (with EPA Mass including new NGCC)
Covered existing units only
Covered existing units only
Covered existing units only
Covered existing units only
Low EE
High EE
No EE
No EE
Low Gas Price
High Gas Price

## Regional Scenario: Modeled Trading Regions




Note: Regional scenarios require assumptions about how states/regions are implementing the proposed Clean Power Plan. For purposes of modeling regional implementation, all EGUs in a state are grouped together in a single region as shown above for policy purposes. However, EGUs continue to be dispatched according to electricity markets with represented transmission bottlenecks.

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# Modeling Results

## Modeling Considerations

- The final rule may vary from the proposed rule in meaningful ways, such as the relative stringency of state goals
  - We intend to model the Clean Power Plan when finalized mid-summer
- In light of anticipated final rule changes, trends at the regional level that hold across a variety of scenarios/assumptions are more robust and meaningful than individual state results and individual scenario results
- The impacts in one state or region are highly influenced by the implementation approach and stringency of requirements in other states
  - Most states benefit from scenarios with increased flexibility (regional trading)
  - Scenarios which assume less flexibility, less effective approaches, or limited compliance options increase costs in some states more than others
  - Due to the nature of the building blocks, and different state circumstances, the impacts are not equally distributed across states
  - Some of the less flexible scenarios lead to generation shifts that may benefit other states. Outcomes vary with assumptions/specifications

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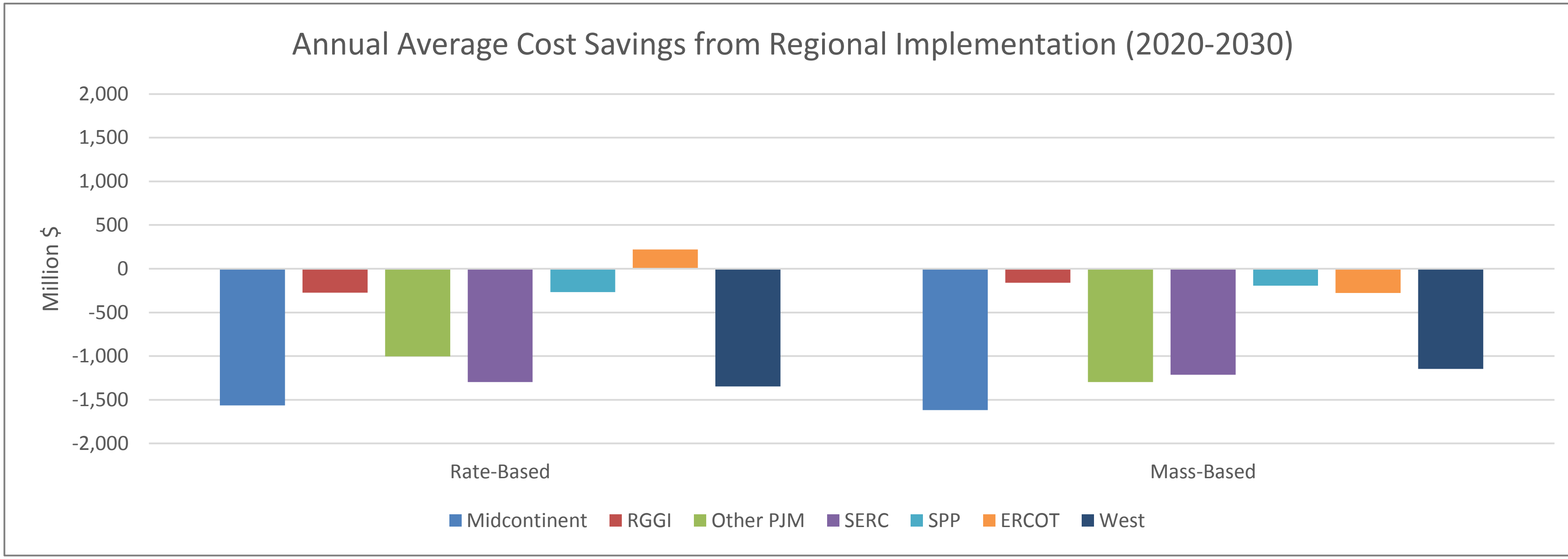
# Multi-State Collaboration

# Regional cost savings from multi-state collaboration

- Across all regions and with both rate-based and mass-based policies, moving to regional implementation has lower cost than single state implementation
- However, individual state results vary

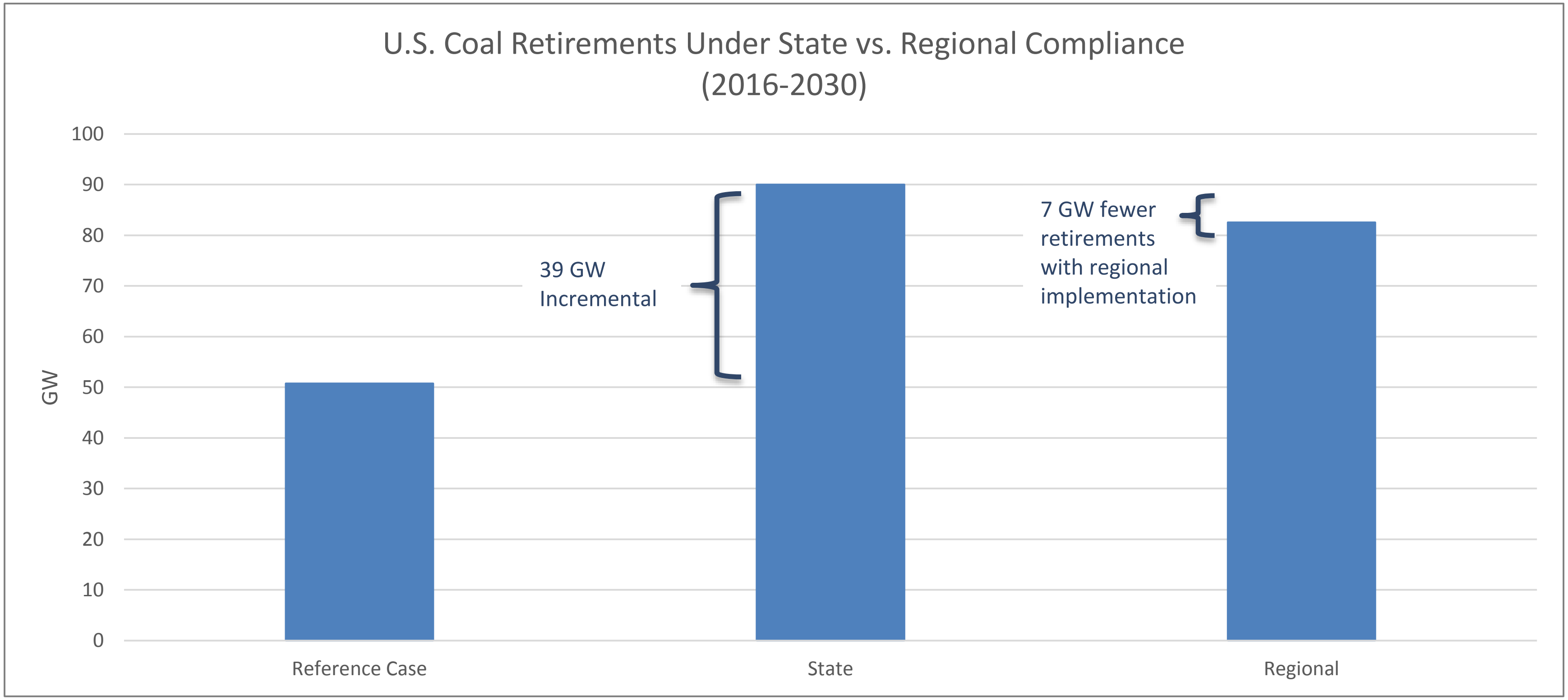



Rate- and mass-based scenarios shown above include new NGCC. Mass-based scenarios uses EPA illustrative mass goals.

- In the rate-based run above, ERCOT is an outlier with higher costs under the regional scenario; but ERCOT (Texas) is the only state not assumed to collaborate with others in the regional implementation scenario. Thus, ERCOT's policy is consistent across state and regional runs, while costs vary as a result of other states' policy choices

# Access to Out-of-State Reductions Limits Retirements

- Implementing the Clean Power Plan as a region as opposed to individual states prevents about 7 GW of U.S. coal capacity from retiring during 2016-2030.




State and Regional scenarios shown above are mass-based scenarios that use EPA illustrative mass goals with new NGCC included.

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# Compliance Cost

## Interpreting Modeling Results on Cost

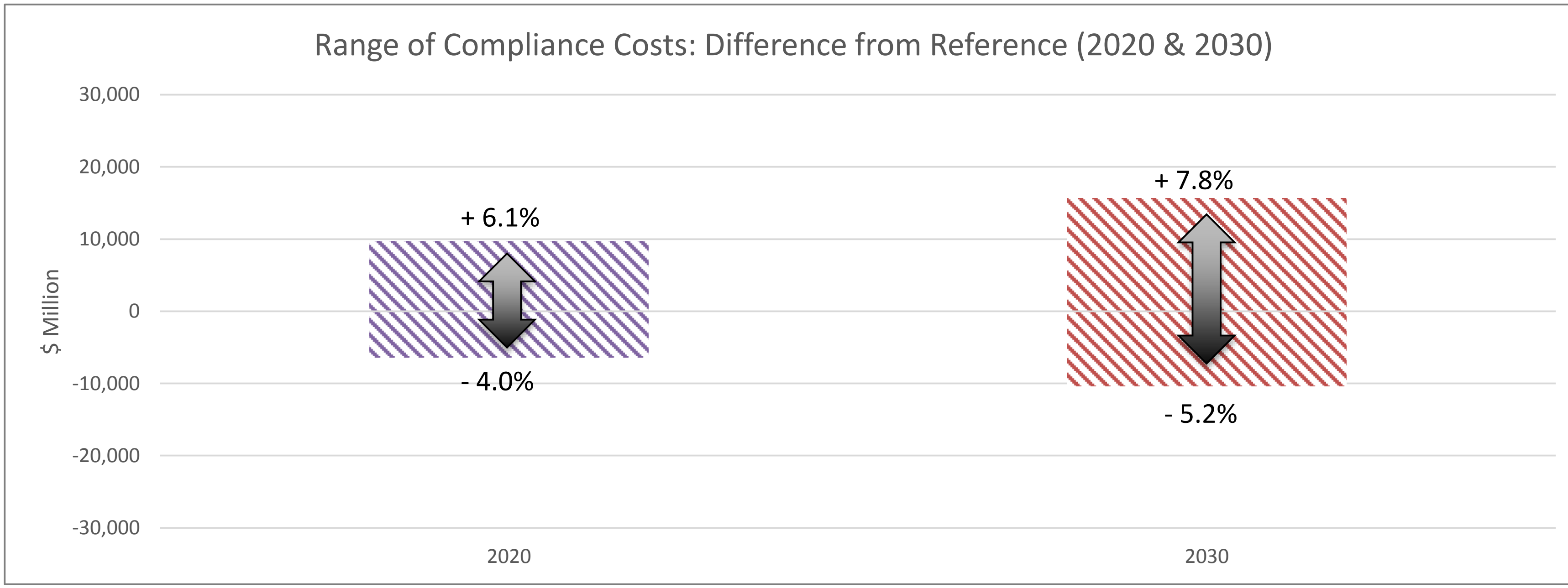
❖ Components of Total Adjusted Cost:

- Total System Cost (TSC): Includes all costs associated with generation, such as new capacity, fuel, and other operating & maintenance costs, as well as compliance costs such as the utility portion of end-use energy efficiency. For a state, this includes in-state generation only.
- EE Participant costs: We assume 55% of the total resource cost of an end-use energy efficiency measure is born by the utility and 45% of the cost is paid by the consumer/participant. While the utility portion is included in TSC, and thus impacts wholesale electricity costs, the participant portion is a separate line item.
- Import/export adjustment: Some scenarios result in generation shifts between states/regions so that the cost of in-state generation may go down, while the cost of importing power goes up (or vice versa). To better account for total costs to deliver energy, this adjustment estimates the cost associated with changes in net electricity imports/exports. Because IPM uses regional (rather than state-level) electricity demand, state-level imports are estimated compared to the reference case.

$$\text{Compliance cost} = (\text{Total Adjusted Cost})_{\text{Reference Case}} - (\text{Total Adjusted Cost})_{\text{Policy Case}}$$

# Total Compliance Cost Cumulative for U.S.*

- Projected compliance cost in policy scenario *without end-use energy efficiency*:
  - **$9.7 Billion in 2020** and **$15.7 Billion in 2030** annually
- Wide range of costs predicted across scenarios depending on assumptions
  - With some negative costs depending on the treatment of end-use energy efficiency **

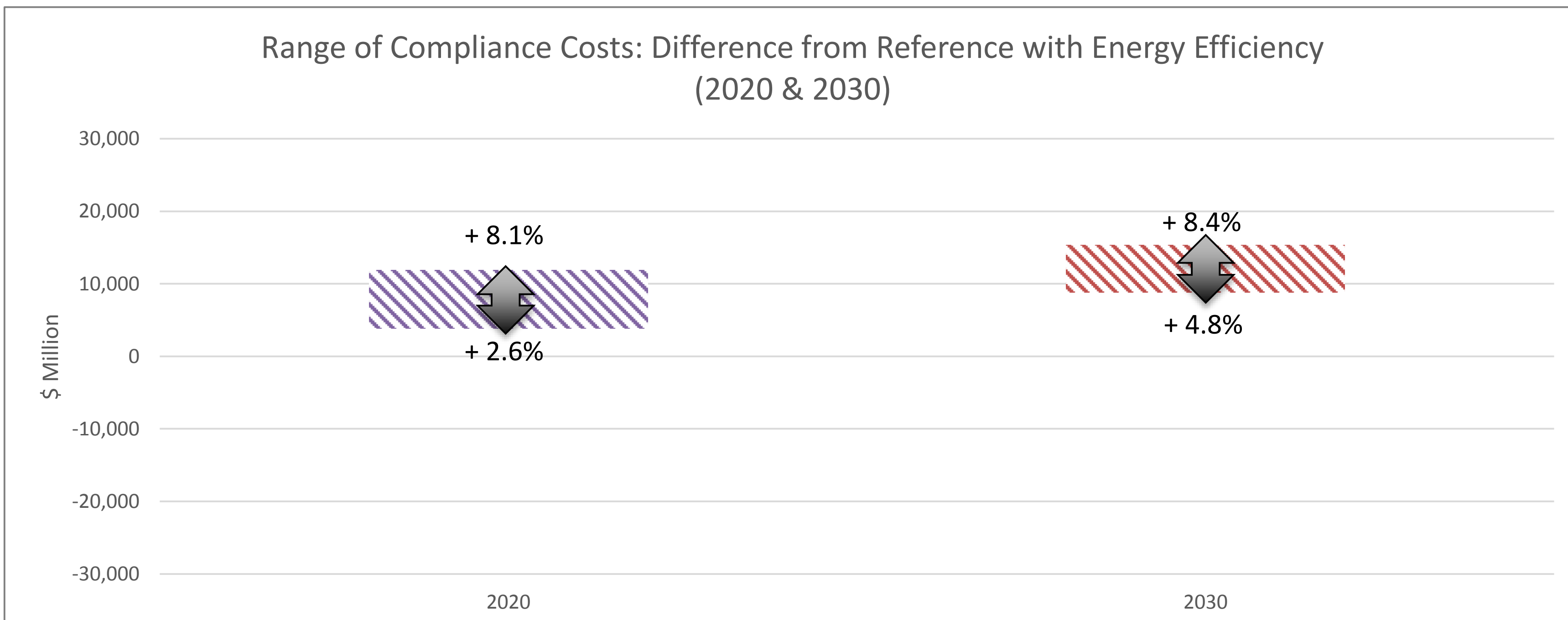



* IPM includes the continental U.S.; costs noted in the graph do not include Alaska and Hawaii

**Negative costs shown above represent lower costs to deliver energy services under a policy scenario compared to the business-as-usual reference case. In this study, we do not attempt to quantify health or climate benefits of the proposed Clean Power Plan. In the proposal, EPA estimated annual costs of $7.3 billion to $8.8 billion compared to public health and climate benefits worth an estimated $55 Billion to $93 Billion per year in 2030.

# Implications of Modeled Energy Efficiency on Compliance Cost

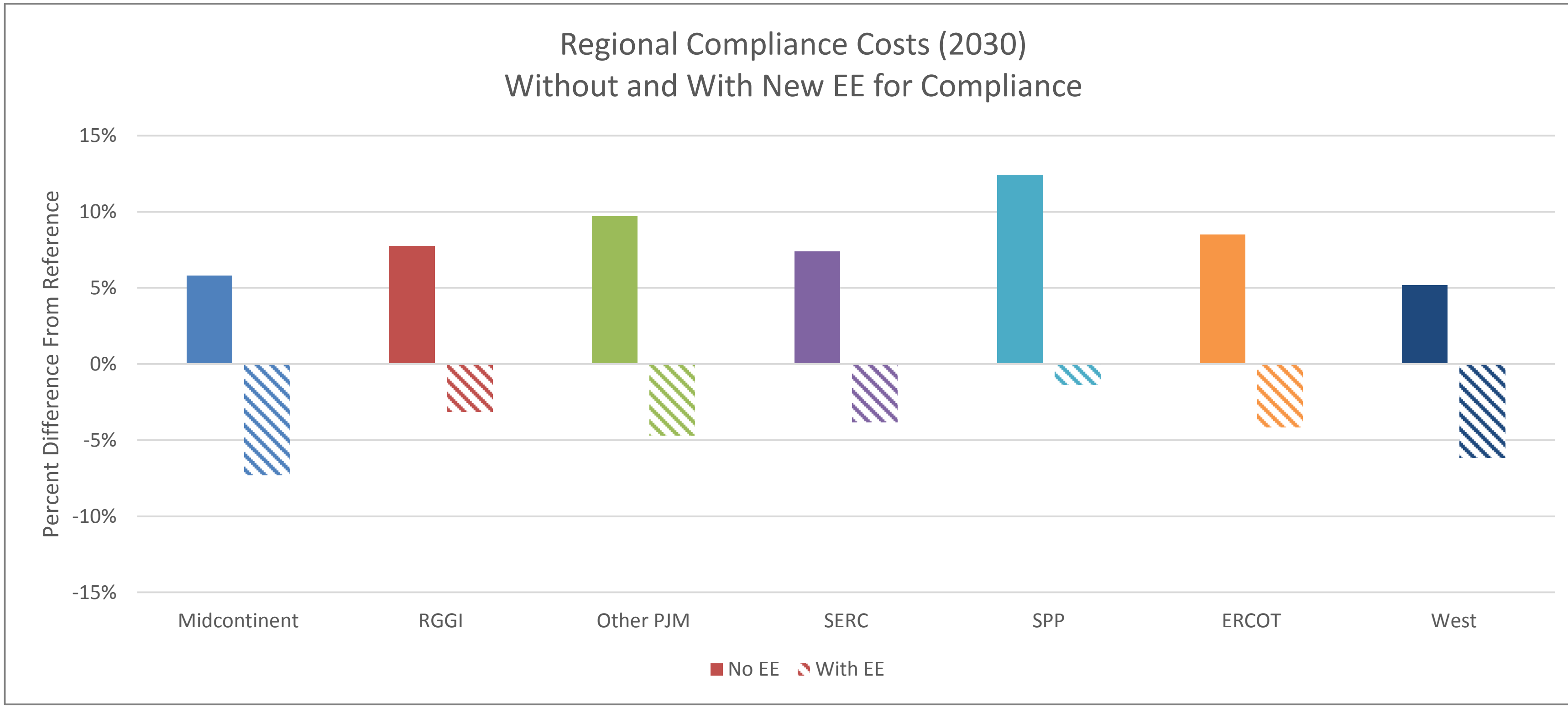
- Reference case electricity demand (AEO2014) assumes existing state EE programs, building codes, and federal efficiency standards, but does not offer new additional EE
- Policy cases assume additional policies to implement CPP are capable of incentivizing new end-use EE at assumed cost/supply to compete on cost basis with generation
- B/c new EE is assumed cost-competitive, policy runs with EE have lower costs than reference
- However, policy costs would exceed baseline costs if new EE were offered in reference case
  - Policy costs in 2030 are up to **$15.4 Billion** when using a reference case that assumes the removal of existing market barriers to EE investments (e.g., high transaction costs, split incentives) would occur in a business-as-usual case.



# Energy Efficiency

# Impact of Energy Efficiency on Regional Compliance Cost

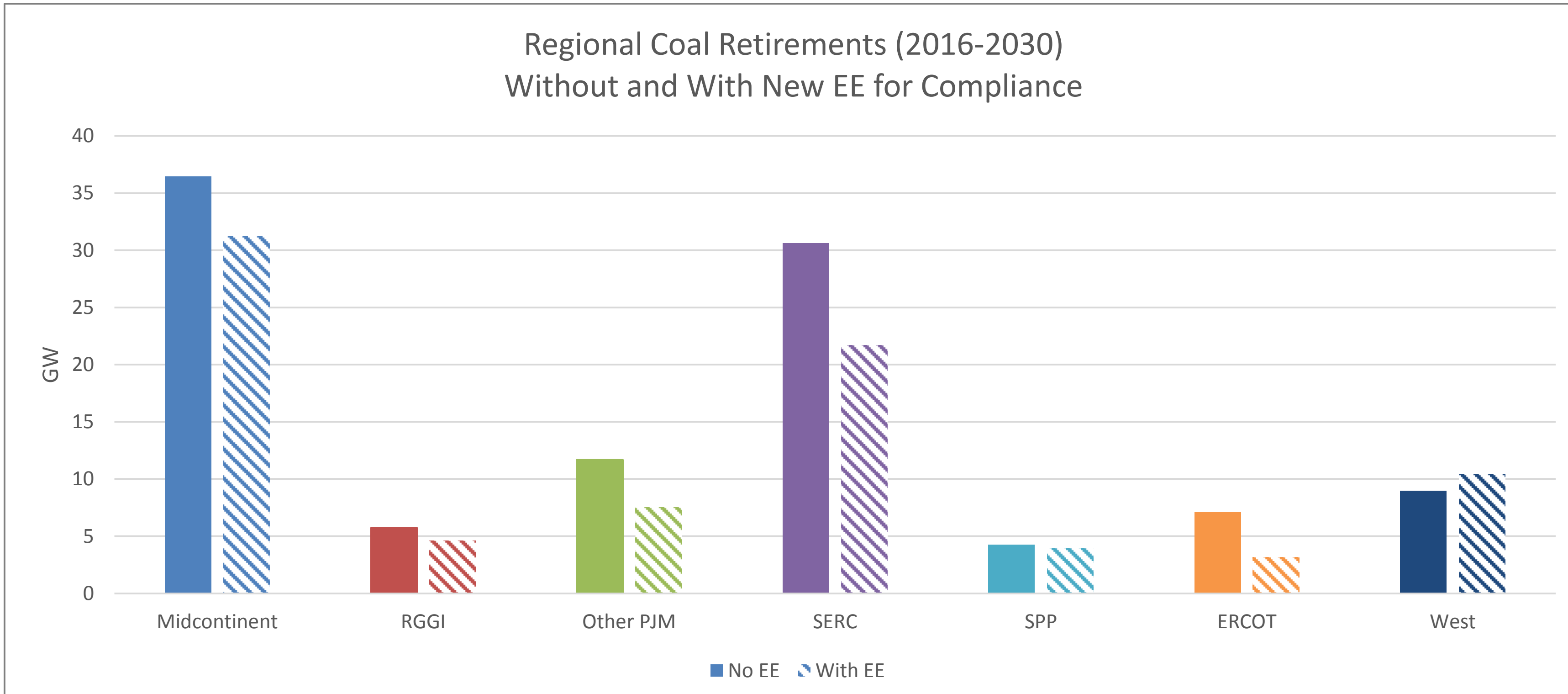
- Given availability/cost assumptions, policies that incentivize additional end-use energy efficiency are projected to lead to dramatic cost savings in all regions




Scenarios shown above use regional mass-based goal and include new NGCC.

## Impact of EE on Coal Retirements

- Given availability/cost assumptions, policies that incentivize additional end-use energy efficiency are projected to lead to fewer coal retirements in most regions.

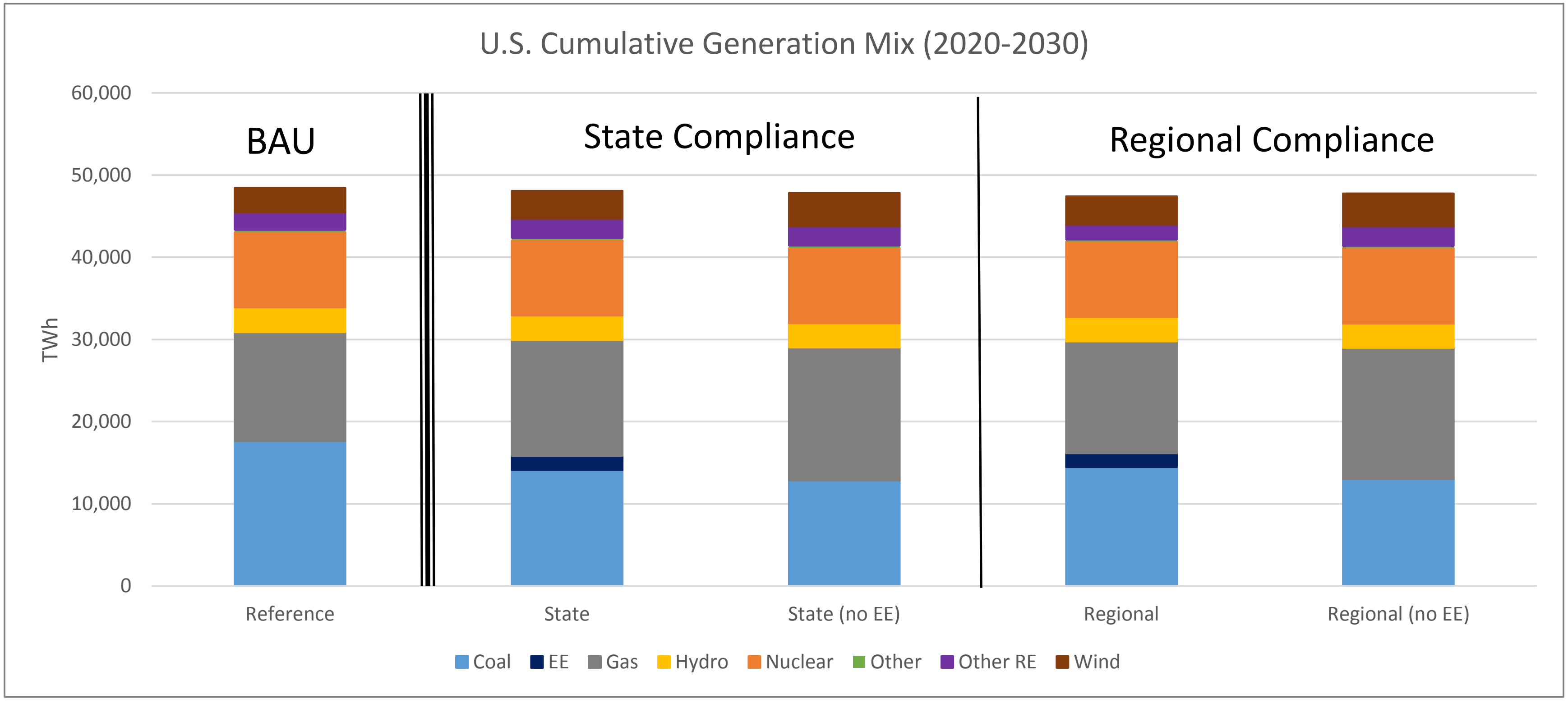



Scenarios shown above use regional mass-based goal and include new NGCC.

## Cumulative Generation Mix

❖ In policy scenarios, coal and gas generation remain a key part of the generation mix

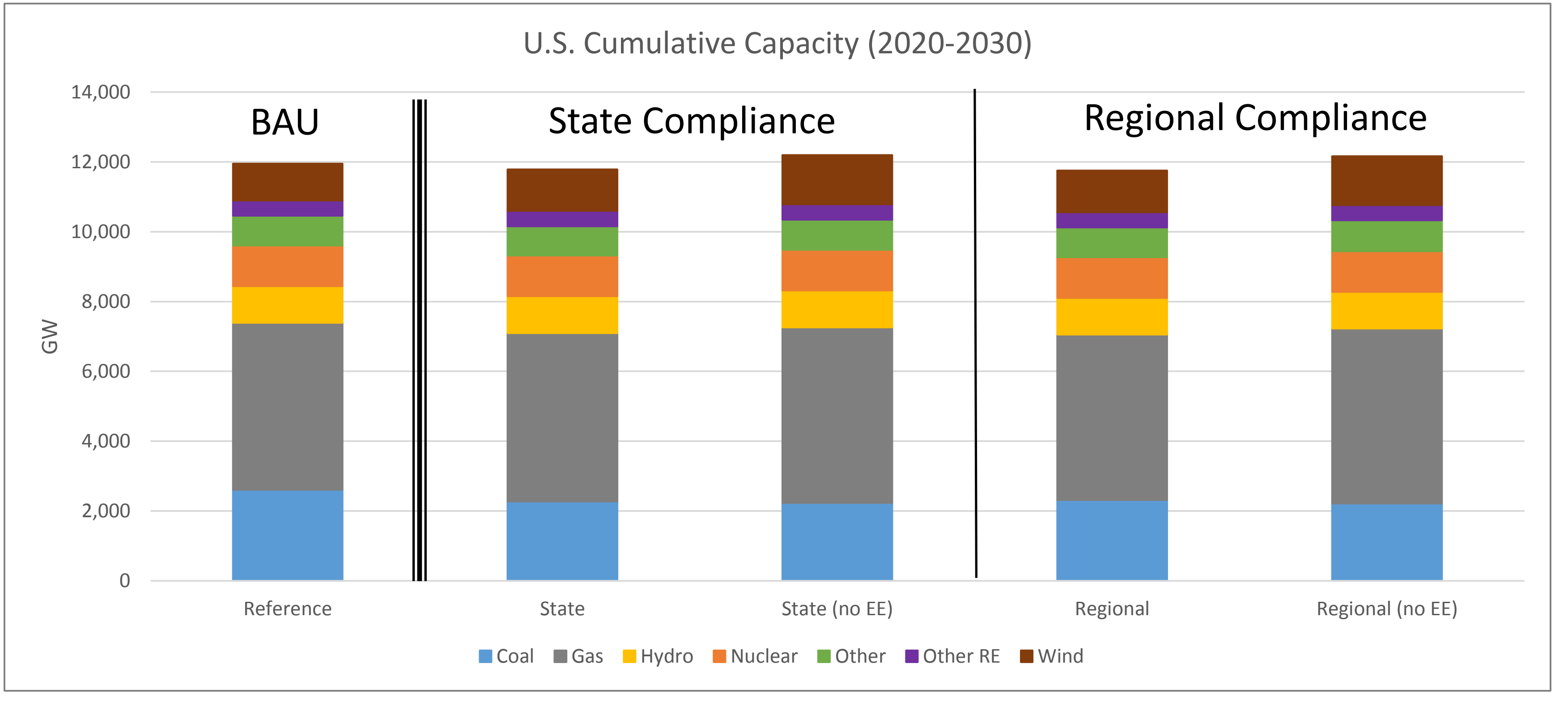
- While coal-fired generation in all policy cases is lower than reference case levels, more coal-fired generation occurs in scenarios that allow for additional end-use EE
- More gas generation occurs in scenarios that restrict investment in additional end-use EE
- Due to increased gas demand, in 2030, gas prices are 8%-10% higher in runs without end-use EE, as compared to runs with end-use EE.




State and Regional scenarios shown above are mass-based scenarios that use EPA illustrative mass goals with new NGCC included.

## Cumulative Capacity Mix

- Capacity trends mirror trends in generation
- When end-use EE investments are offered, capacity needs are reduced
- There is slightly more coal capacity, less gas capacity, and less wind capacity in scenarios that allow for additional investment in end-use EE




State and Regional scenarios shown above are mass-based scenarios that use EPA illustrative mass goals with new NGCC included.

## Assumption: Energy Efficiency Cost

- In policy scenarios, end-use EE is available to serve electricity demand using an assumed three-step supply curve with cost increasing as the supply available at each step is exhausted. In 2020, costs are: 2.3, 2.6, and 3.2 cents/KWh. Costs in each block increase by .3 cents/KWh starting in 2021. An assumed participant portion (45% of the total resource cost of EE) is added separately to the compliance cost.

| 2020 EE Cost | Units = Cents/KWh | | | Units = $/MWh | | |
|---|---|---|---|---|---|---|
| | Step 1 | Step 2 | Step 3 | Step 1 | Step 2 | Step 3 |
| Utility Portion | 2.3 | 2.6 | 3.2 | 23 | 26 | 32 |
| Participant Portion | 1.9 | 2.1 | 2.6 | 19 | 21 | 26 |
| Total Resource Cost | 4.2 | 4.7 | 5.8 | 42 | 47 | 58 |

## Modeling End-Use Energy Efficiency: Costs

- EE availability and cost varies across states and model representation of end-use efficiency is over-simplified
- BPC cost assumption for policy scenarios: rising annually from 2020 cost of
  - Program cost: 2.3 - 3.2 cents/KWh
  - Total resource cost: 4.2 - 5.8 cents/KWh
- Estimates of the cost of end-use energy efficiency vary
  - LBNL, March 2014: 2.1 cents/KWh (range: <1 – 5 cents/KWh)
  - ACEEE, April 2014: 1.7-3.2 cents/KWh
  - Synapse (2011): 2.6 cents/KWh
  - Michigan Public Service Commission and Michigan Economic Development Corporation (2013): 2 cents/KWh
  - ACCCE based on Alcott and Greenstone (2012): 11 cents/KWh
  - Studies vary in methodology. Most estimates include only program costs. Some, such as ACCCE, include total resource costs.

LBNL: Lawrence Berkeley National Laboratory
ACEEE: American Council for an Energy-Efficient Economy
ACCCE: American Coalition for Clean Coal Electricity

# Assumption: Energy Efficiency Supply

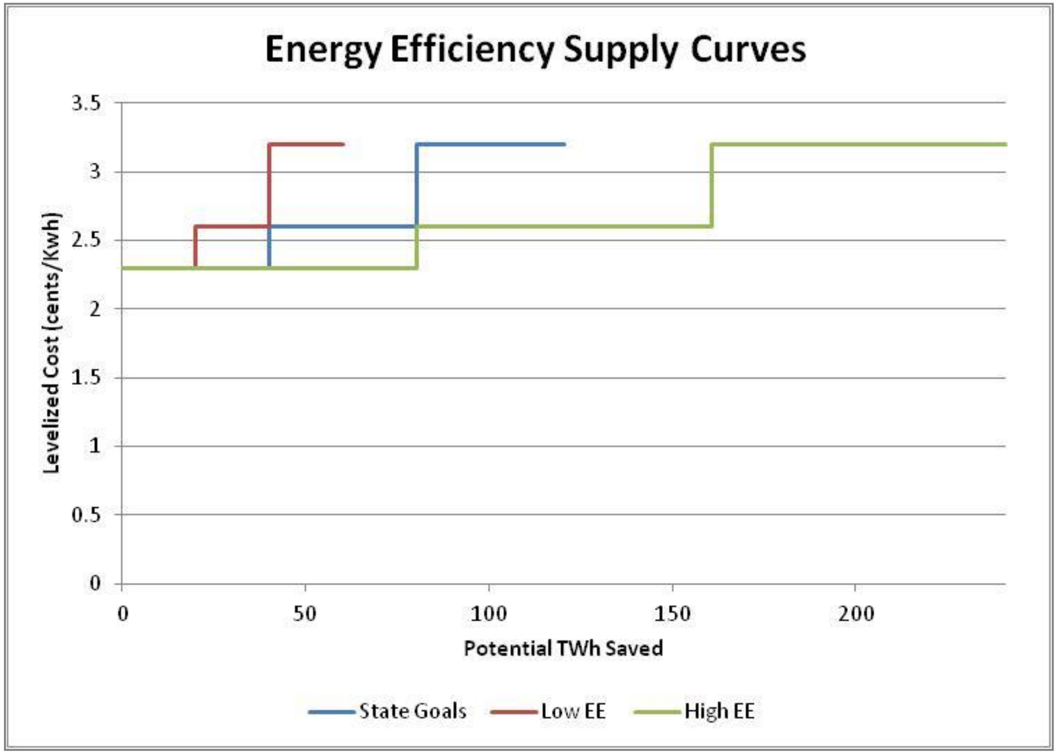
- BPC sensitivities vary the supply of end-use energy efficiency

**Core Runs (state goals)**: assume three equally-sized cost blocks shown in blue with 1/4 the available supply estimated by Synapse (2011).

**High EE**: same as above except the supply in each cost block shown in green is double the supply in the core runs (1/2 the supply estimated by Synapse).

**Low EE**: supply in each cost block shown in red is ¼ supply in the core runs (1/8 of the supply estimated by Synapse).

**No EE:** no end-use EE or heat rate improvements are available



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# Treatment of New Sources

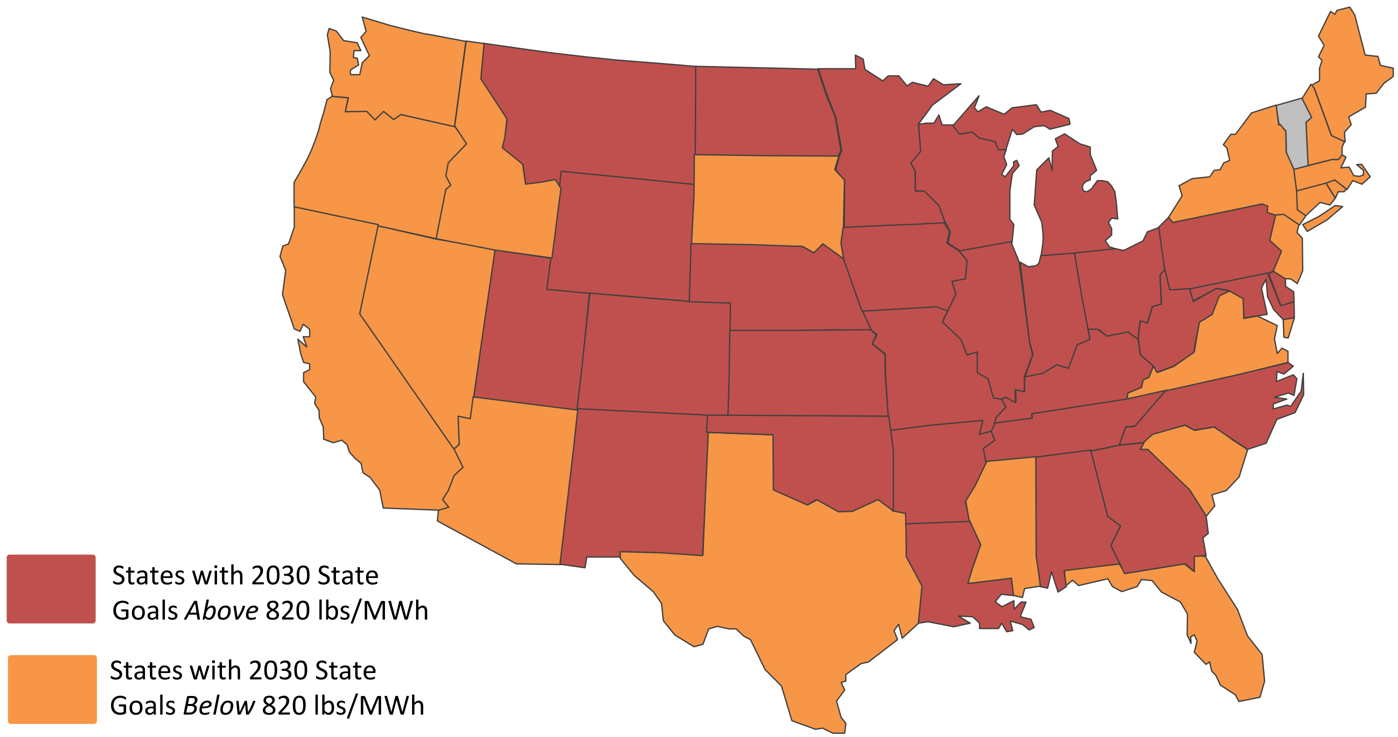
## Treatment of New Sources in $CO_2$ Implementation Policy

- New sources are covered by a separate 111(b) new source performance standard
- Proposed Clean Power Plan, section 111(d), applies to covered existing units
- States could choose to include new sources (NGCC) under implementing policy
- **Including new NGCC units in §111(d) implementing policy may lower cost, reduce market distortions, and limit stranded assets of existing natural gas generators**
  - Individual state results vary; looking at cumulative results for entire U.S.:
  - Rate-based implementation: allowing new NGCC units whose emission rate is below the state goal to generate compliance credits tends to lower costs
    - Excluding new NGCC ignores the compliance benefits of new NGCC generation in rate-based policy implementation
    - However, a policy that credits new NGCC produces fewer $CO_2$ reductions, b/c credits for any new NGCC that would have been built anyways (BAU) would offset required reductions from existing sources
  - Mass-based implementation: choosing to include new NGCC units under the mass goal tends to result in lower costs (using EPA's illustrative mass with growth)
    - In mass-based programs, excluding new NGCCs favors new NGCCs over existing

# Assumption: Treatment of New Sources

For rate-based implementation w/NGCC scenarios, states/regions (in red below) whose goals are above the emission rate of new NGCC units (assumed 820 lbs $CO_2$/MWh*) were assumed to allow new NGCC units to generate compliance credits and result in a lower average emission rate for compliance with state goals. In states colored yellow below, new NGCC were assumed not covered by the policy.

## States (Red) Assumed to Include New Sources for Rate-based w/NGCC




*IPM emission rates of new NGCCs range from 740-820 lbs $CO_2$/MWh, depending on start year

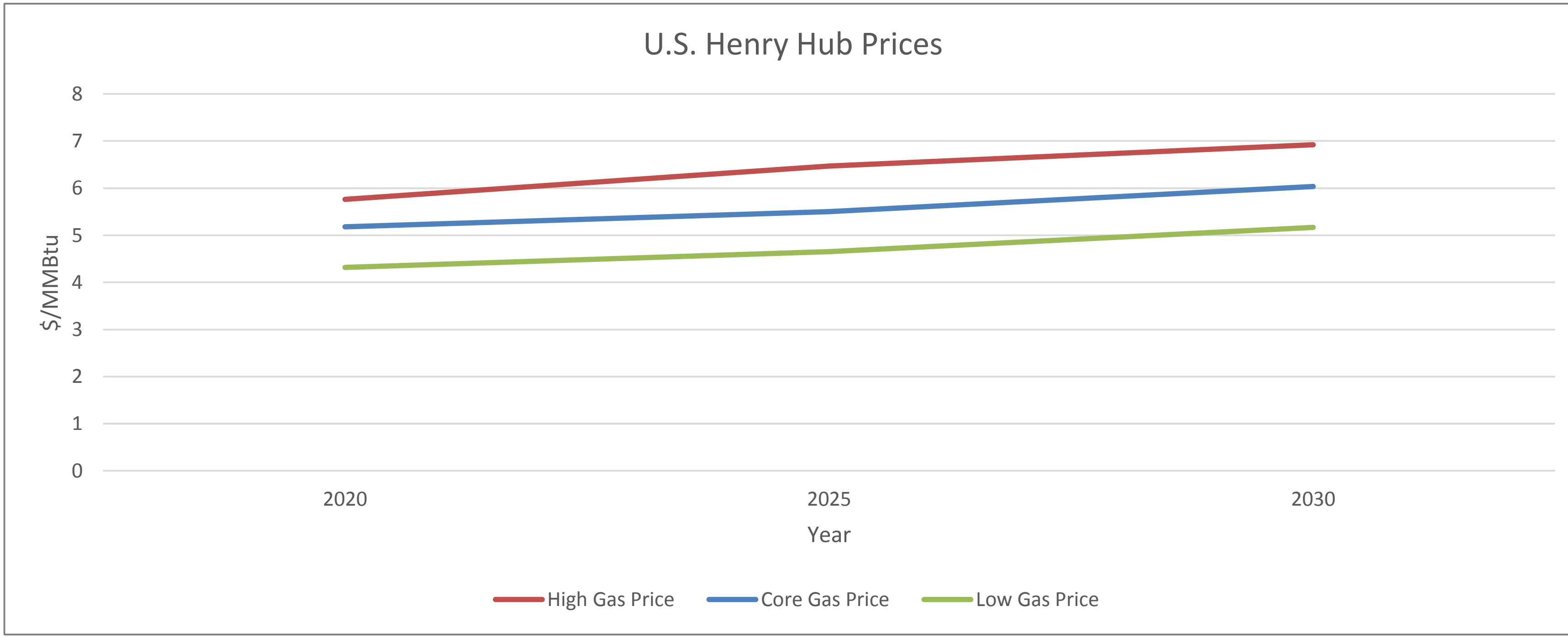
# Natural Gas Supply/Price Uncertainty

## Assumption: Natural Gas Supply

- The Integrated Gas Module is an analytic tool focused on the natural gas market that is fully integrated into IPM
- Resource cost curves and information about gas pipeline networks and storage facilities are inputs into the Integrated Gas Module, with demand and prices being determined endogenously
- Core natural gas assumptions align with EPA's Clean Power Plan assumptions
- Resource cost curves were adjusted for the low and high gas price sensitivities

# Assumption: Natural Gas Supply/Price Sensitivities

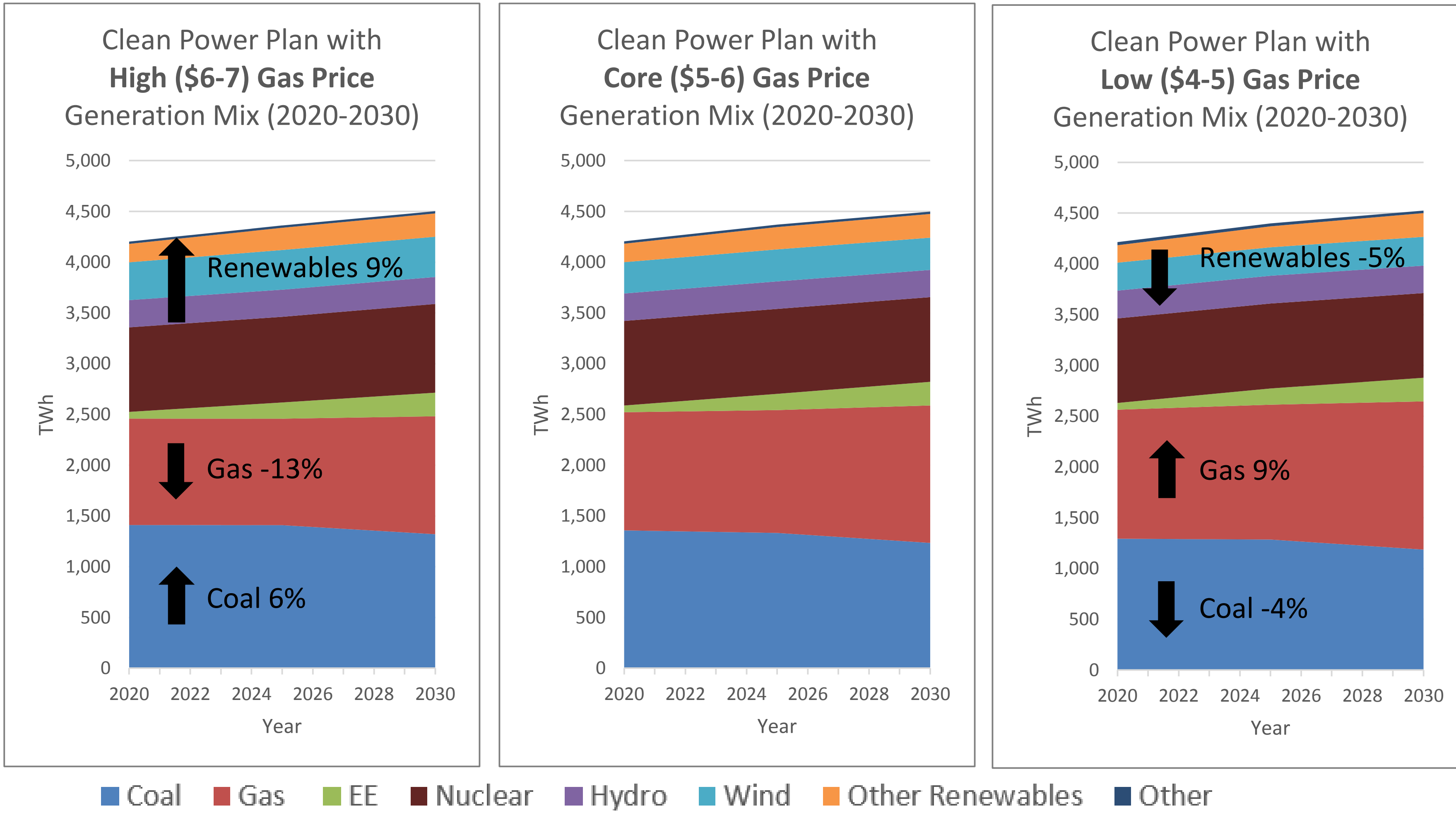
- In the High Gas Price scenario, U.S. Henry Hub prices are 11% higher than in the Regional Mass scenario (titled Core Gas Price in the chart below) in 2020 and 15% higher in 2030.
- In the Low Gas Price scenario, U.S. Henry Hub prices are 17% lower than in the Regional Mass scenario in 2020 and 14% lower in 2030.




The High, Core, and Low Gas Price scenarios assume states implement the Clean Power Plan with regional cooperation using a mass-based trading system that includes growth and new sources.

# Impacts Of Gas Price On Generation Mix

- Impacts on nation-wide generation mix compared to the policy with core gas prices (center):




The High, Core and Low Gas Price scenarios assume states implement the Clean Power Plan with regional cooperation using a mass-based trading system that includes growth and new sources.
The percentage labels in the above graphs represent differences in cumulative 2020-2030 generation as compared to the core gas price case. The "Renewables" percentage includes hydro, wind, and other renewables.

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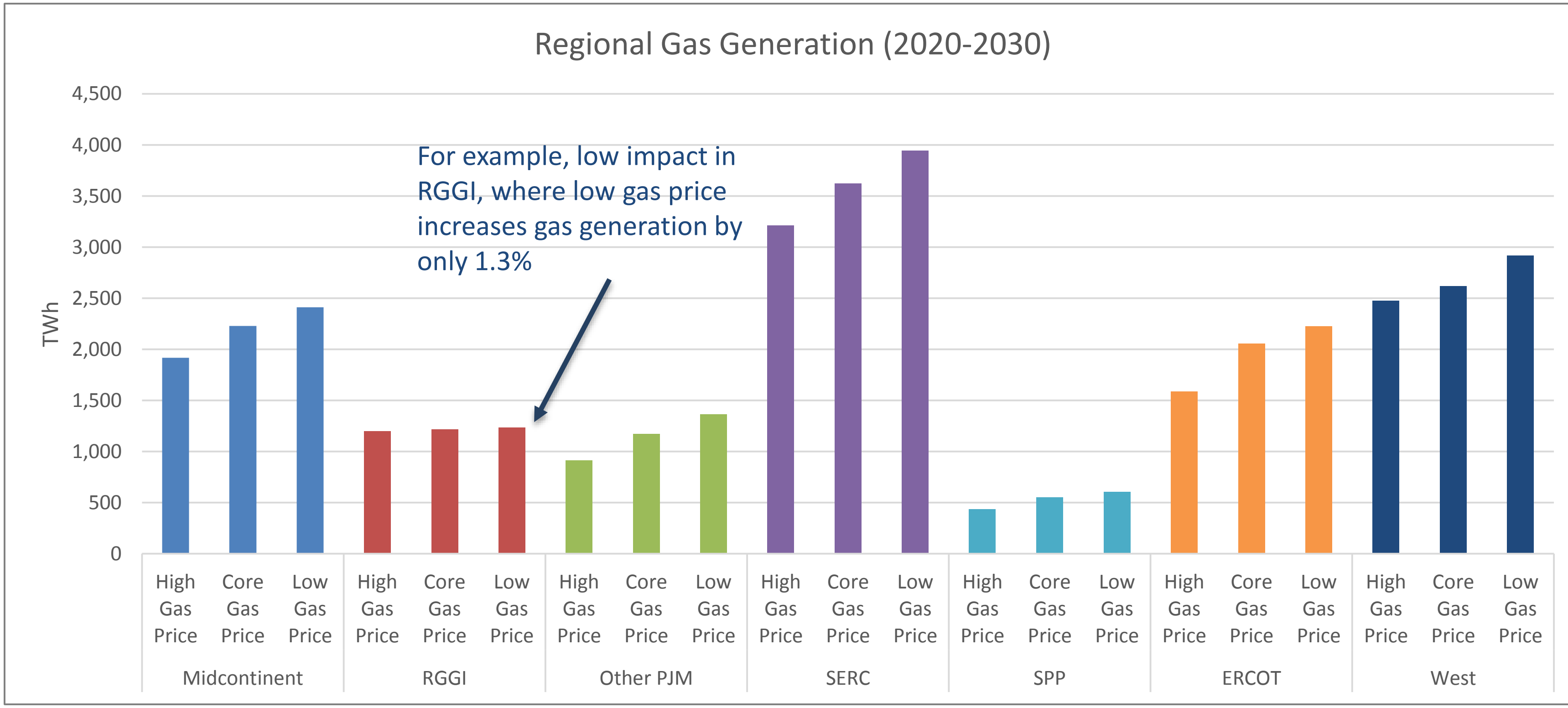
# Regional Detail: Impact of Gas Price on 111(d) Implementation

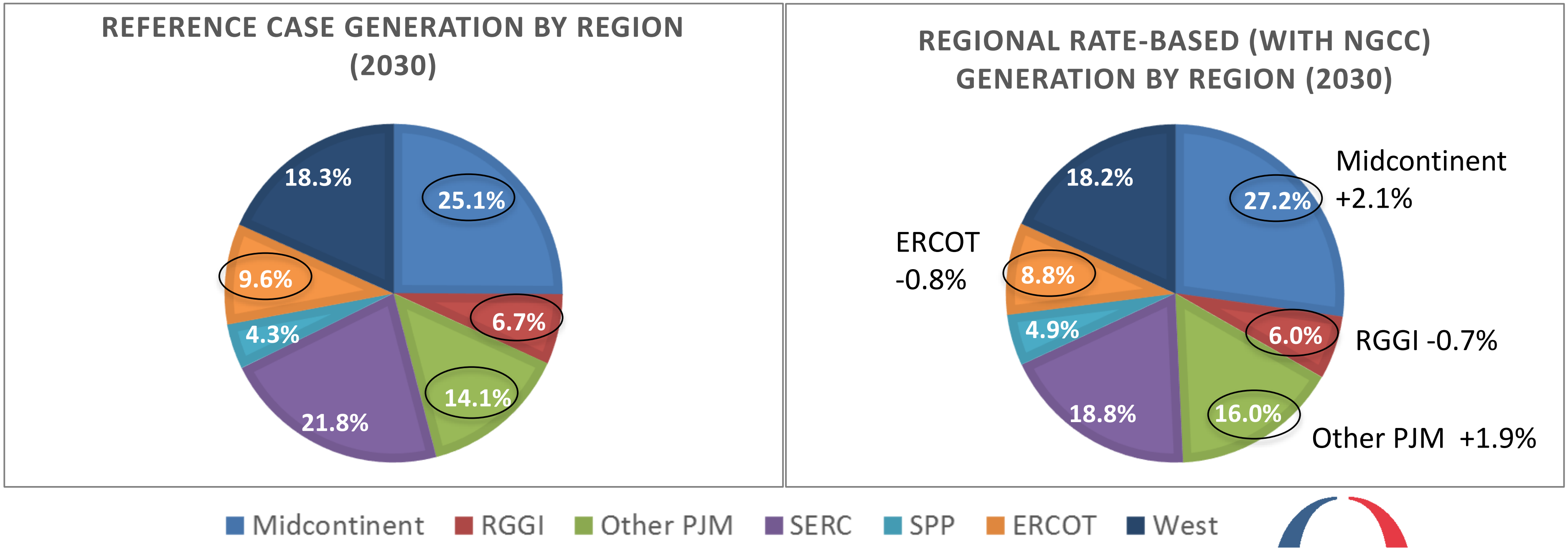
- High gas price decreases gas generation 13% from the core case, while low gas price increases gas generation 9%, on average; due to regional differences, impacts vary by region




The High, Core, and Low Gas Price scenarios assume states implement the Clean Power Plan with regional cooperation using a mass-based trading system that includes growth and new sources.

# States are Influenced by Choice and Impacts of Policies in Other States

- For example, a rate-based scenario where some regions include new NGCC units for compliance (Midcontinent, Other PJM, SERC, SPP) and others do not (RGGI, West, ERCOT) results in generation shifts between regions, with Midcontinent and Other PJM increasing share and RGGI and ERCOT reducing share of generation compared to the reference case
- Note: SERC sees a decrease in generation relative to the reference case, despite having a regional rate goal slightly above the new NGCC rate. Because the goal and NGCC rate are very similar, new gas generation does not earn many credits, unlike in surrounding regions where the rate differential is greater.



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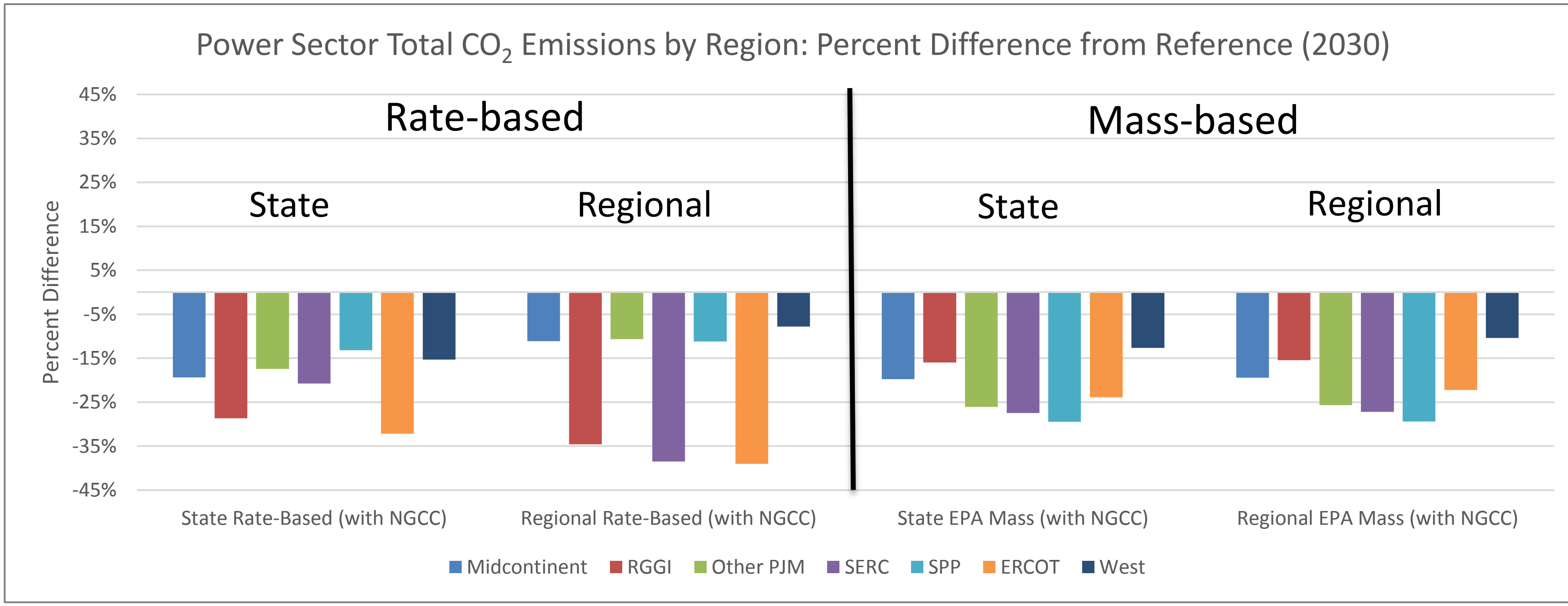
# Implementation Policy Choices

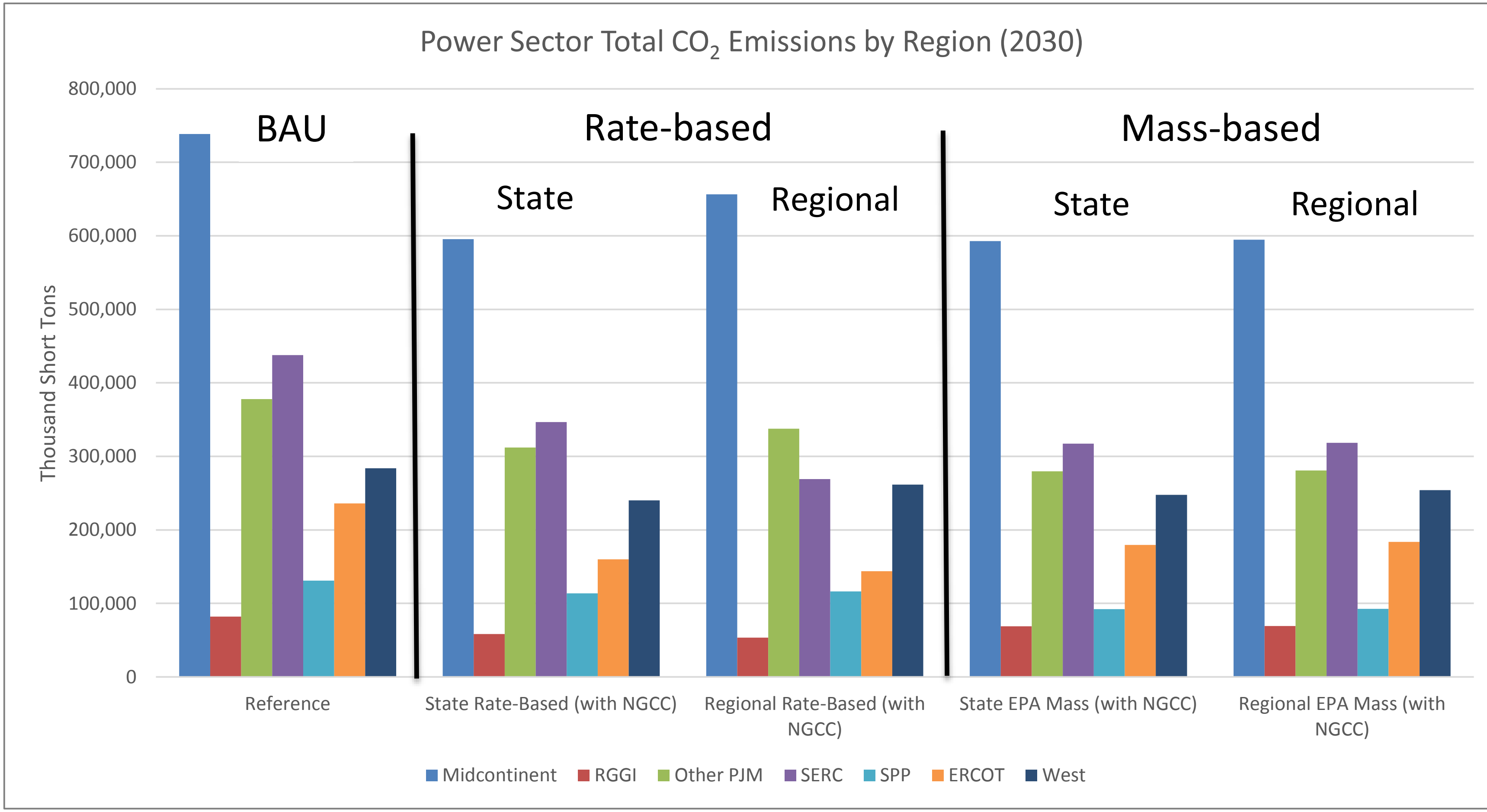
## $CO_2$ Impact Varies by Region and by Policy Choice

- Rate-based implementation results in more regional differentiation in total $CO_2$ reduction levels than mass-based implementation approaches
- Regional rate-based implementation (with new NGCC) leads to more significant generation shifts and the greatest difference in where total $CO_2$ reductions occur, as well as the highest total $CO_2$ emissions



## $CO_2$ Emissions by Region

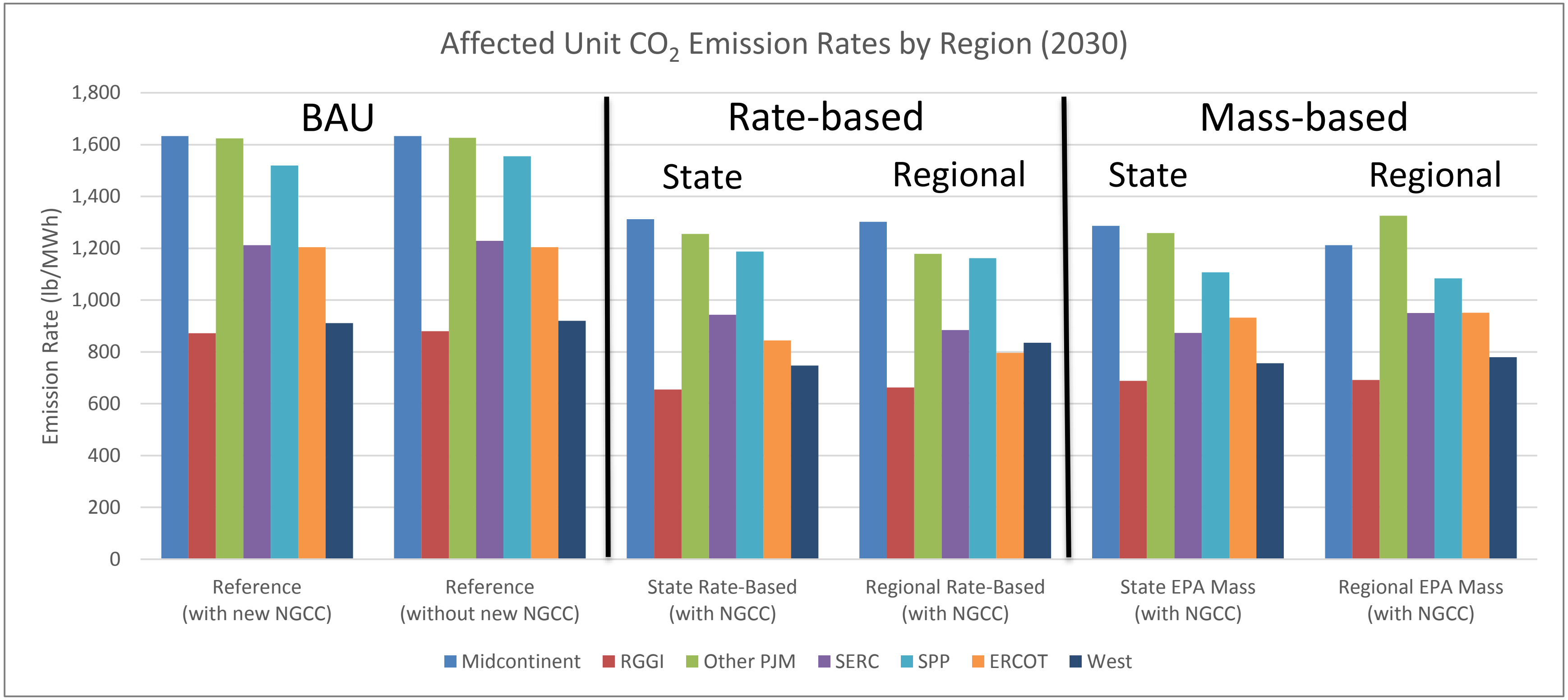
- Below shows tons of $CO_2$ emissions for all power plants in each region




BAU = Business-as-usual projection (reference case)

## Affected Unit $CO_2$ Emission Rates by Region

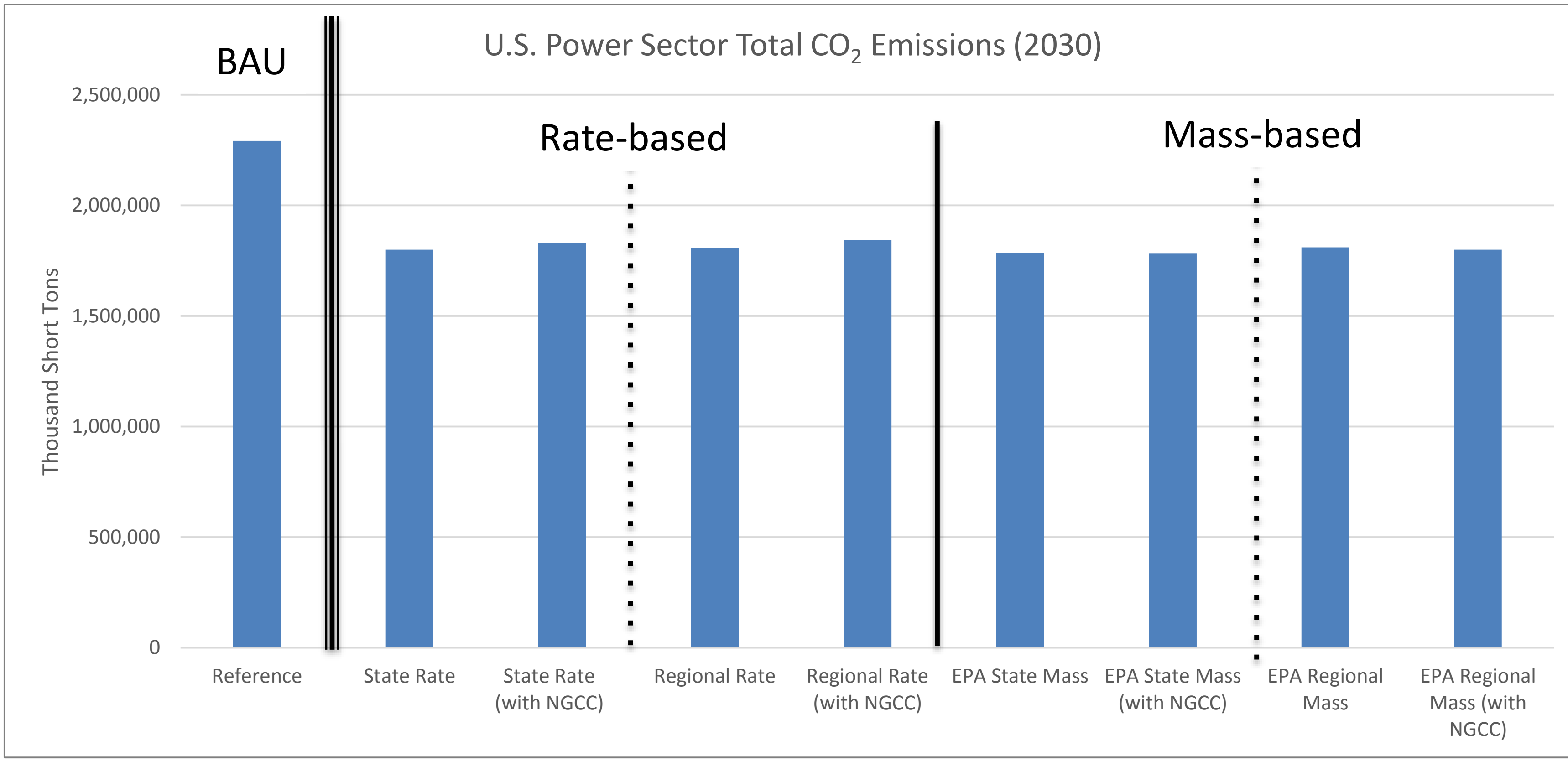
- All $CO_2$ emission rates in the policy runs are lower than in the reference case. But, regions vary in whether they have lower rates under state versus regional and mass versus rate.




BAU = Business-as-usual projection (reference case).
Reference (with new NGCC) includes new NGCC units in the rate calculation, while Reference (without new NGCC) does not. All policy cases include new NGCC units in the rate calculations for regions where the 2030 emission rate goal is greater than 820 lbs/MWh.

# At U.S. level, some variation in total power sector $CO_2$ levels across scenarios

- Similar $CO_2$ levels between rate- and (EPA) mass-based goals
- Including new NGCC units for rate-based slightly increases total $CO_2$




BAU = Business-as-usual projection (reference case)

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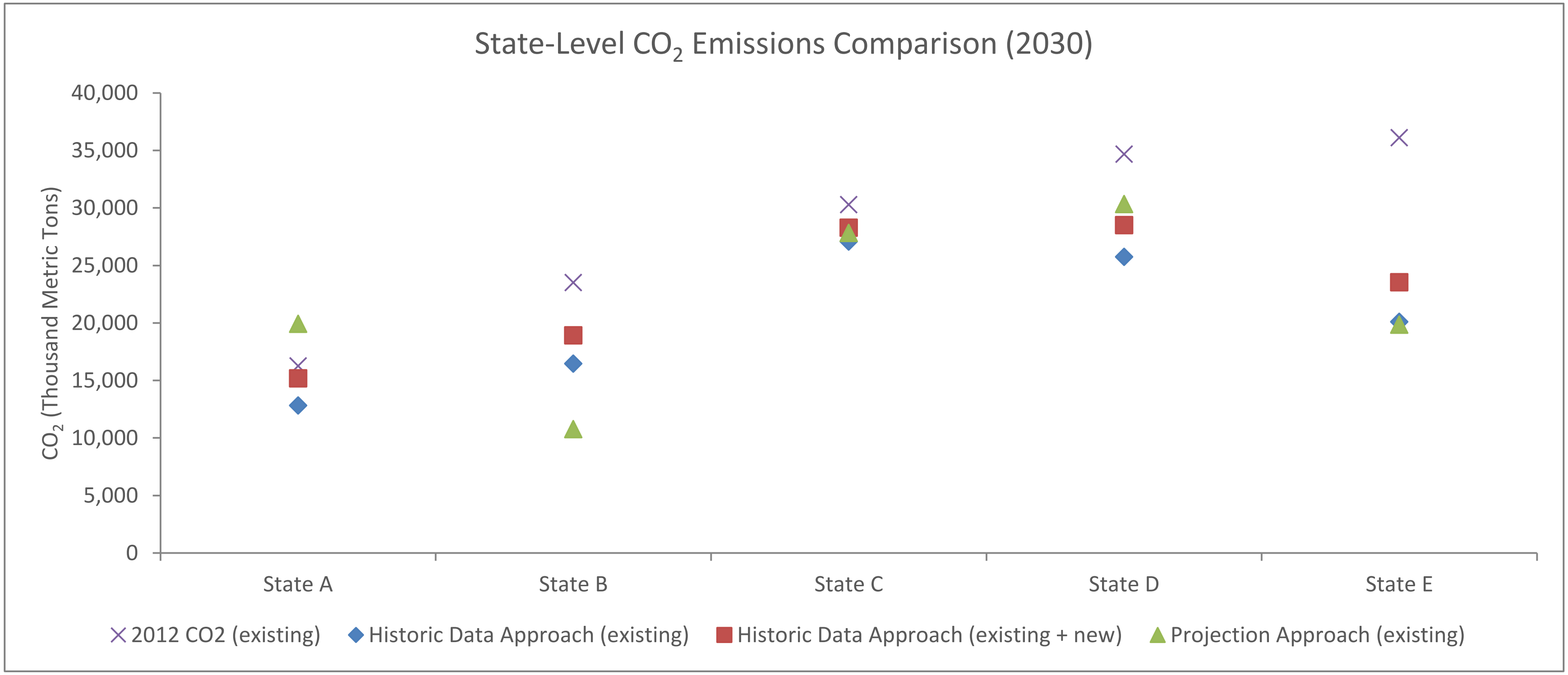
# Rate-to-Mass Conversion

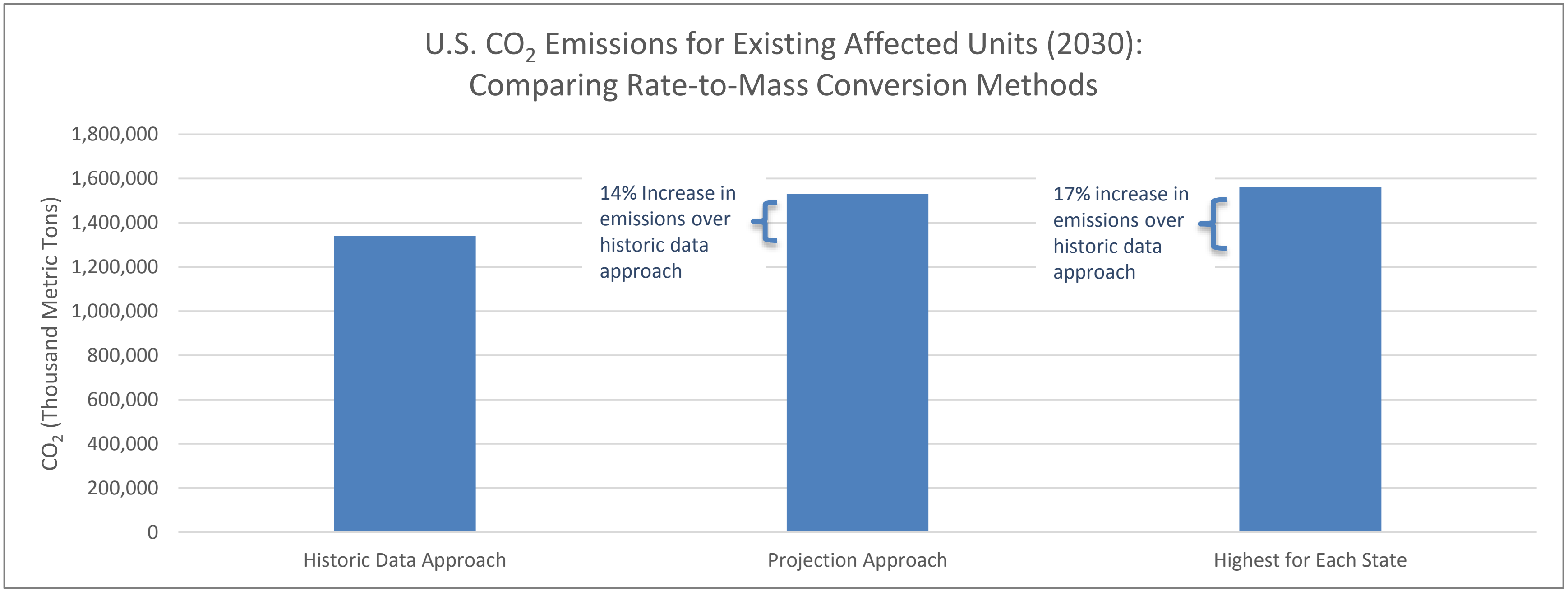
# Rate-to-Mass Conversion Methods and Assumptions

- For some states, different methodologies lead to significantly different allowable emissions
  - For some states (e.g., A, D), the *projection* approach led to a higher mass goal
  - For others (e.g., B), the EPA *historic data* approach led to a higher mass goal
  - For still others (e.g., C, E), the methodology made little difference
- In addition to incorporating BSER into goals, a *projection* approach with an economic dispatch model tends to lock in further generation shifts between states that could result from disparate impacts of implementing rate-based state goals with varying stringency between states



# Rate-to-Mass Conversion Methods

- Conversion methodology and assumptions matter
  - Different methodologies lead to different allowable emission levels
  - If each state selects its most generous conversion, more $CO_2$ will be allowed




Each bar sums the state-level $CO_2$ emissions for the continental U.S. that would be allowed from existing affected units under final 2030 mass goals. "Historic Data Approach" is based on the EPA mass-based illustrative final goals for existing sources only from the November 2014 NODA. The "Projection Approach" bar shows the 2030 final goals for existing affected units based on a BPC state goal rate-to-mass based conversion scenario run through IPM. "Highest for Each State" selects the largest mass goal for each state between the "Historic Data Approach" and "Projection Approach."

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# Appendix:
# Scenario Descriptions, Assumptions, etc.

| Scenario | Description |
|---|---|
| Rate-based State Trading | Each state must comply with the state rate-based targets included in EPA's Clean Power Plan proposal. Trading is permitted among sources within the state. Banking of credits is allowed through 2030. EE, RE, and nuclear are credited at EPA's state goal rate. The core run includes existing and new EGUs in the policy and a variation includes only existing covered EGUs. |
| Rate-based Regional Trading | Each designated region must comply with a regional rate-based target, calculated using a fossil generation-weighted average of EPA's proposed state targets. Fossil generation data is from 2012, from EPA's Goal Calculation TSD, Appendix 1. Trading is permitted within each region, and banking of credits is allowed. All EGUs in a state are grouped in the same region and states are grouped into regions for regional cooperation. EE, RE, and nuclear are credited at the calculated regional goal rate. The core run includes existing and new EGUs in the policy and a variation includes only existing covered EGUs. |
| Mass-based State Trading | Each state must comply with the state mass-based target. The mass-based targets are based on EPA's illustrative mass goals, with variations using the mass goal for existing plus new units and the mass goal for existing units only. Trading is permitted among sources within the state and banking is allowed between 2020 and 2029. Because this is a mass-based target, no additional credits are created for EE, RE, and nuclear. |
| Mass-based Regional Trading | Each state is assigned the same target as the mass-based state trading scenarios. Trading is permitted among all sources in a given region and banking is allowed between 2020 and 2029. Because this is a mass-based target, no additional credits are created for EE, RE, and nuclear. |
| Treatment of new sources | For rate-based implementation w/NGCC scenarios, states/regions whose 2030 goal is above the emission rate of new NGCC units (assumed 820 lbs $CO_2$/MWh*) were assumed to allow new NGCC units to generate compliance credits and result in a lower average emission rate for compliance with state goals. |

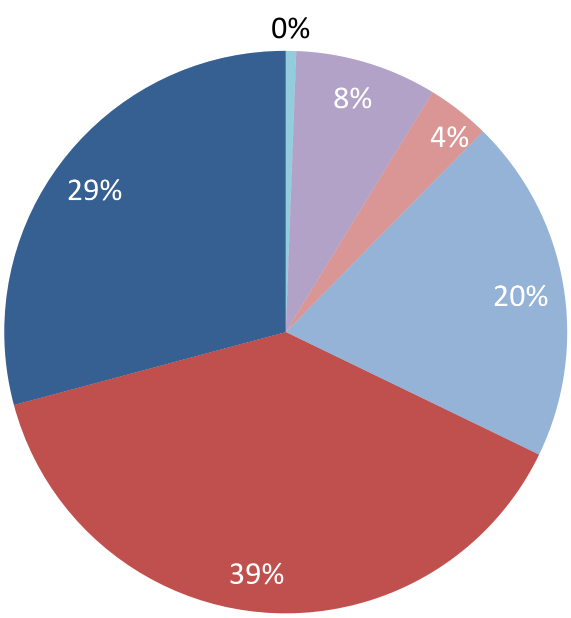
| Scenario | Description |
|---|---|
| High EE | The High EE sensitivity is identical to the rate-based state trading scenario (existing units only), except for end-use energy efficiency supply is twice as large. |
| Low EE | The Low EE sensitivity is identical to the rate-based state trading scenario (existing units only), except for end-use energy efficiency supply is half as large. |
| No EE | Identical to the mass-based state and regional scenarios (with EPA mass including new NGCC), except no additional end-use energy efficiency or plant heat rate improvements are available. |
| High Gas | Identical to the mass-based regional scenario (with EPA mass including new NGCC), except a 20% cost adder is applied to each step of the cost curve within ICF International's Integrated Gas Module. |
| Low Gas | Identical to the mass-based regional trading scenario (with EPA mass including new NGCC), except a 20% cost reduction is applied to each step of the cost curve within ICF International's the Integrated Gas Module. |

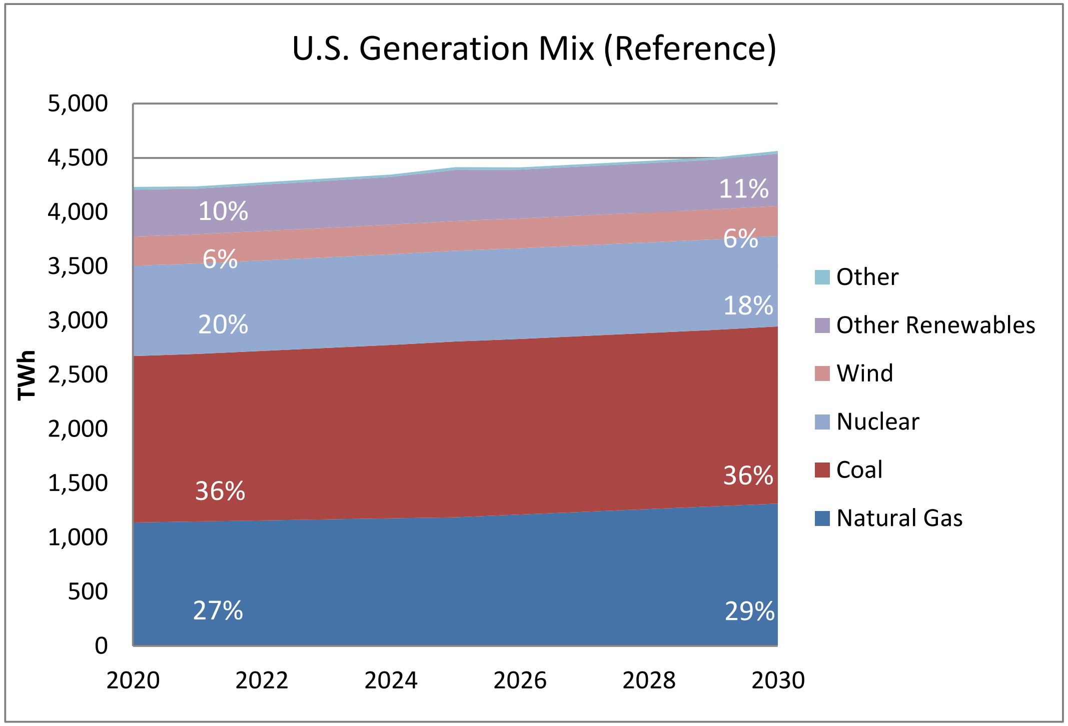
| Assumption | Sources | Description |
|---|---|---|
| Electric and Peak Demand Growth | AEO 2014 | |
| Capacity Build Costs | AEO 2014 & LBNL | Costs for all technologies come from AEO 2014, except on-shore wind capacity costs come from Lawrence Berkeley National Laboratory's (LBNL) 2012 Wind Technologies Market Report. |
| Natural Gas Price | IPM Integrated Gas Module | EPA assumptions of resource estimates |
| Coal Supply/Prices | AEO 2014 | ICF coal supply is calibrated to AEO 2014 average minemouth prices. |
| Air Pollution Control Costs | EPA, EIA, AEO 2014, & AEO 2013 Early Release | Retrofit costs for most pollution control technologies come from EPA. DSI costs come from EIA. CCS retrofit costs for coal and gas come from AEO 2014 and AEO 2013 Early Release. |
| Nuclear Power Licensing/Operation | AEO 2014 & BPC | Reference case retirements come from AEO 2014. Plants are able to relicense at 60 years. |
| Firm Builds and Retirements | Research by ICF using NEEDS and other data sources, and state (IN, IL) input. | |

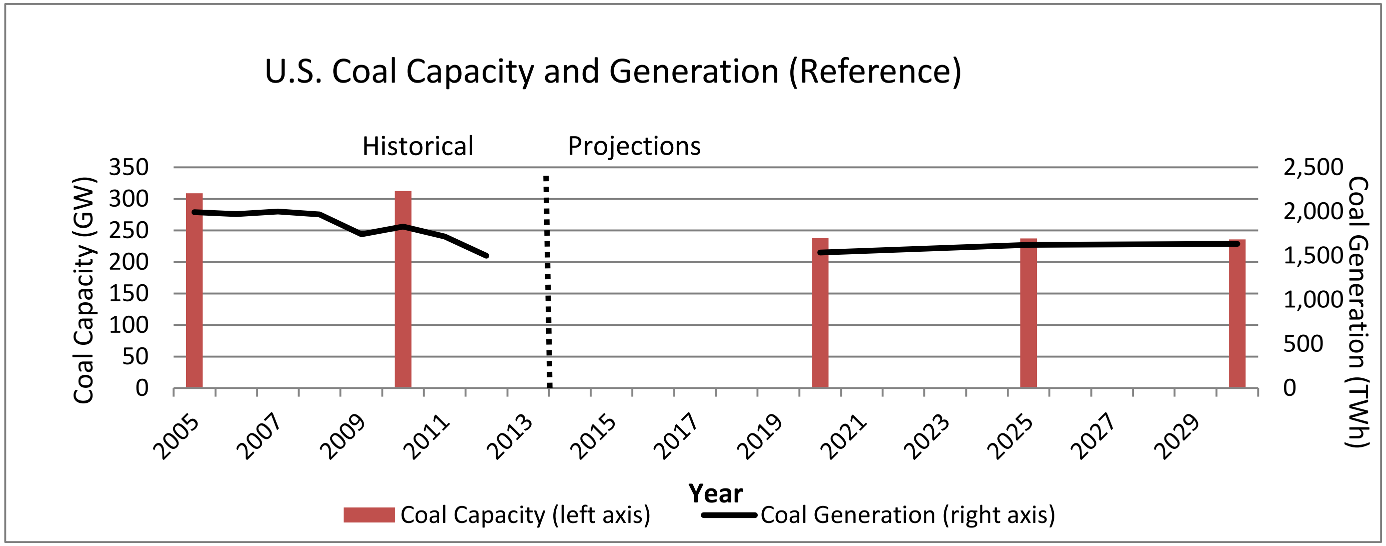
| Assumption | Sources | Description |
|---|---|---|
| Biomass Co-firing | EIA, AEO 2014, & BPC | Costs are based on EIA biomass cost curves and AEO 2014 co-firing cost assumptions. Coal units can co-fire up to 15%. Existing subcritical coal units that are 300MW or smaller can repower/retrofit to burn 100% biomass. |
| Natural Gas Co-firing | EPA & BPC | Coal units that use gas on site can co-fire up to 15% without additional pipeline costs or efficiency degradation penalties. Units that are within 10 miles of a gas pipeline can fully convert to gas. These units incur a pipeline cost and a 5% heat rate penalty. |
| End-Use Energy Efficiency | Synapse Energy Economics and BPC | Energy efficiency assumptions vary across scenarios from 0, 1/8, 1/4, and 1/2 of the supply estimates based on work by Synapse Energy Economics. EE is available to utilities based on a three-step cost curve that ranges from 2.3 - 3.2 cents/KWh. The cost at each step increases by 0.3 cents/KWh beginning in 2021. The utility portion is assumed to be 55% of the total cost; the remaining participant portion of the cost is included in the total cost, but not electricity cost impacts |
| Heat Rate Improvement | BPC | Coal units can select between two levels of efficiency upgrades based on the unit's capacity, fuel type, steam cycle, and boiler type to close 25% or 40% of the gap between the unit heat rate and the "best in class" heat rate. |
| Coal with CCS | BPC | Assumes both the Kemper plant and the Texas Clean Energy Project will be built as coal-fired generation with CCS. Other CCS generation can come online if it is deemed economical. |
| Coal without CCS | EPA | In all policy cases, §111(b) policy requires CCS for any new coal builds |

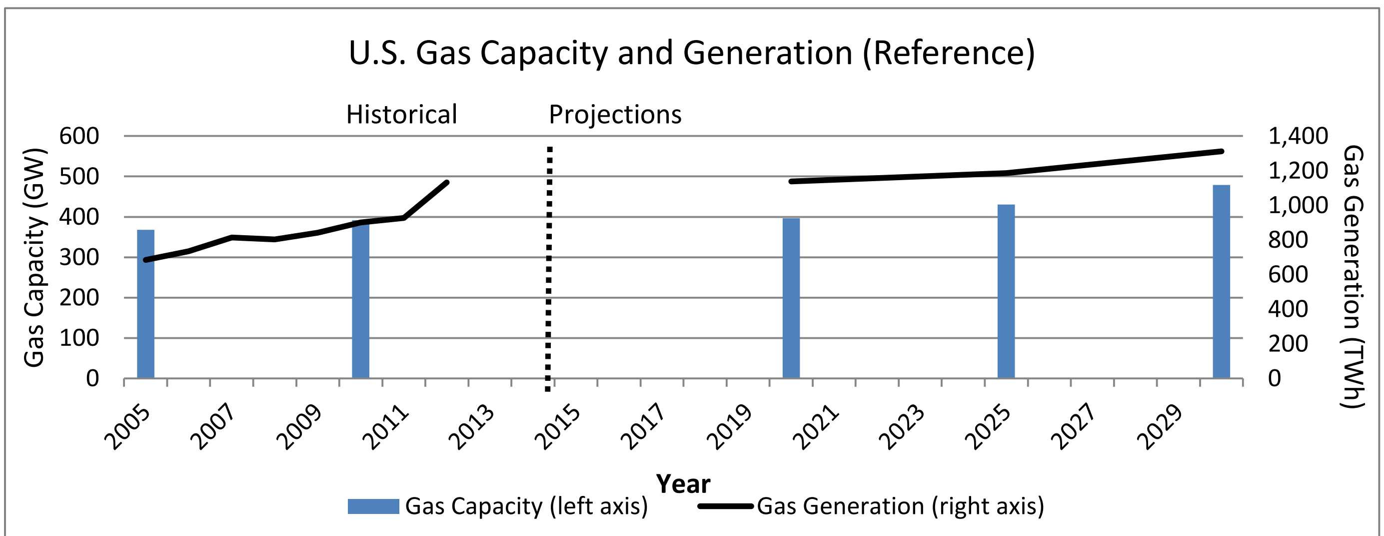
## ❖ Reference case largely based on Energy Information Administration's Annual Energy Outlook 2014

- No 111(d) policy assumed
- Percent contribution from each generation type remains fairly consistent
- Modest growth in total generation to accommodate modest load growth
- Coal remains dominant generation fuel






**Reference (no 111(d) policy)**

- **Even with significant coal retirements by 2020, coal generation holds steady**
- **Low electricity demand growth helps to dampens need for new capacity investment, even with significant retirements underway**



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