BIPARTISAN POLICY CENTER

The Administration's Clean Energy Standard Proposal

An Initial Analysis

Bipartisan Policy Center Staff Paper

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1. Introduction*

In his 2011 State of the Union address, President Obama announced the goal of producing 80 percent of electricity from "clean" energy sources by 2035. Following the address, the White House released some general principles for a proposal for a Clean Energy Standard (CES).[1] Most recently, President Obama reiterated this call for a CES in a March 30, 2011 speech on energy policy.

Since the President's announcement and White House release, few details have emerged as to how the Administration would design a CES. While there continues to be debate over the merits of the President's proposal, there exists very little analysis to inform this debate. The President's CES proposal differs from existing proposals in that in includes generation from natural gas as a qualifying resource. This expansion of a CES to cover natural gas has been met with some controversy, particularly by renewable energy advocates who believe it would unfairly favor natural gas at the expense of renewable electricity sources.

This paper is intended to contribute to discussion of the President's proposal, highlighting important analytical and design questions. The CES represented in this analysis is one possible interpretation of the President's proposal, and is not intended to be a definitive representation of the Administration's intentions. BPC is continuing to analyze the impacts of a range of CES policy scenarios.

Key findings from this analysis include the following:

- No single technology dominates the generation mix under the CES. While there has been concern that inclusion of natural gas under the CES would lead to displacement of future nuclear and renewable generation capacity, BPC's analysis suggests that both nuclear and renewable generation could see significant growth under a CES that is consistent with the President's targets. Less stringent targets, or the inclusion of a price ceiling, would likely shift generation away from nuclear and renewable generation in favor of natural gas. Finally, while the CES increases generation from natural gas in the near term, its longer term (2025 and beyond) implications for natural gas are less clear, and depend on assumptions about gas prices, EPA regulation, and the cost of alternative technologies.

- President Obama's CES targets appear to be more costly than what earlier CES proposals have found acceptable. BPC's analysis projects that a CES based on the targets announced

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* Prepared by Meghan McGuinness, Associate Director for Energy and Environment, Bipartisan Policy Center

[1] The White House. "President Obama's Plan to Win the Future by Producing More Electricity through Clean Energy." January, 2011.

by President Obama would result in a credit price that is projected to reach 7 cents per KWh by 2030. Earlier CES proposals have included effective price ceilings of 3.5 to 5 cents per KWh. Thus far, the Administration has not specified whether the CES would include a price ceiling. BPC's analysis confirms that the omission of such a ceiling could be expensive.

- A CES that credits only new and incremental generation will not ensure achievement of an overall clean energy goal. The CES analyzed by BPC credits existing renewable generation, but excludes the current quantity of generation from existing nuclear and natural gas combined cycle (NGCC) units, crediting only incremental generation from these units. Without credit for existing generation, generation from existing NGCC units is projected to decline under the CES, and total clean energy is projected to be less than the President's target.

- Including forthcoming EPA regulations in the baseline reduces the cost of the CES. Because forthcoming EPA regulations for air pollution, cooling water intake systems, and coal ash residuals are projected to result in the retirement of older and less efficient coal-fired power plants in the near term, these regulations encourage increased generation from sources that qualify for the CES. CES credit prices are projected to be about 0.6 to 0.9 cents per KWh lower under the first decade of the CES when EPA regulations are taken into account.[2]

- Regional disparities may be difficult to avoid under a CES. BPC's analysis suggests that a CES consistent with the President's target – if designed as assumed in this analysis – would lead to wealth transfers from coal-intensive regions to regions with cleaner generation portfolios. Retail electricity price impacts are also projected to be greater in coal-intensive regions, while retail rates could decline in some regions with surplus credits.

Going forward, there are a few key questions that warrant further analysis. These include:

- How sensitive is the observed generation mix to assumptions about technology costs and availability?

- How would a price ceiling affect costs, regional impacts, the generation mix and the ability to meet the President's 80 percent clean energy goal?

- Could alternative policy designs better encourage increased utilization of existing NGCCs?

- Could alternative policy designs, such as varying the percentage CES requirement across regions, or adjusting the treatment of existing clean energy generation, reduce regional disparities in cost impacts?

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[2] Of course, these environmental regulations are not without cost. For example, EPA estimates that its proposed Utility MACT regulations will $10.9 billion per year, with benefits of between $59 and $160 billion per year.

- How would the inclusion of energy efficiency resources in a CES affect the costs of the program and the feasibility of implementation?

The paper proceeds as follows. Section 2 provides an overview of the concept of a CES and a summary of the Administration's proposal. Section 3 discusses the assumptions and design decisions BPC made in developing a detailed CES based on the proposal. Section 4 provides a summary of modeling assumptions and the scenarios analyzed, and Section 5 provides a summary of key results.

2. Overview of a CES and the Administration's Proposal

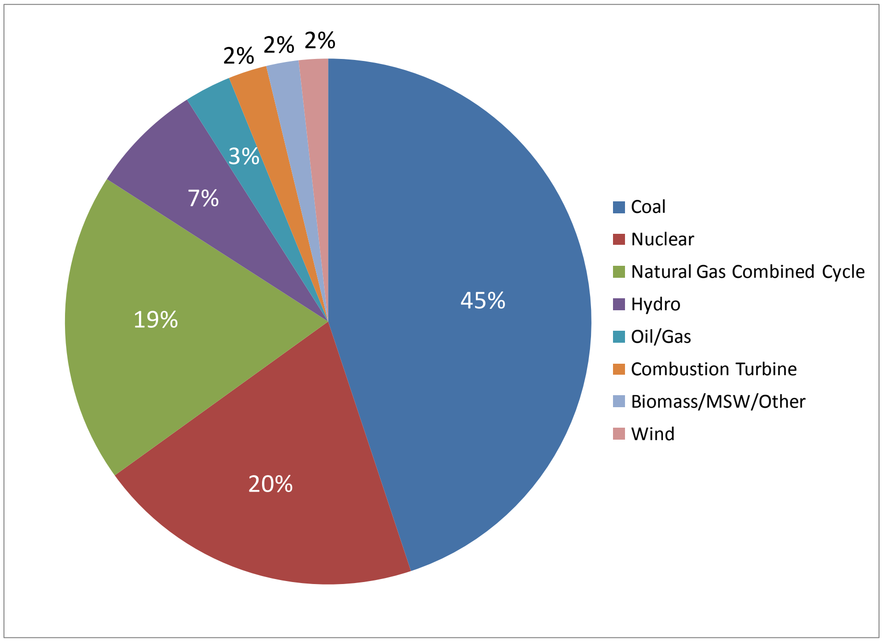
A CES requires that a specified percentage of electricity delivered by electricity retailers, or load distribution companies (LDCs), be generated by qualifying clean energy resources. Companies that produce qualifying electricity are awarded clean energy credits that can be submitted for compliance or sold to other companies.[3] The design of a CES is similar to a renewable energy standard, except that a broader set of resources, such as nuclear, coal with carbon capture and storage (CCS), and potentially, NGCC, is considered to be "qualifying." Two CES proposals were introduced during the last Senate. Senator Richard Lugar (R-IN) introduced a "Diverse Energy Standard" as part of a larger energy bill, and Senator Lindsay Graham (R-SC) introduced a stand-alone CES.[4] The CES targets and qualifying resources were similar under both bills, and included existing and incremental non-hydro renewable energy sources, as well as incremental nuclear, hydro, and fossil fuel fired generation with CCS. The Administration's proposal differs from these two earlier bills in that it incorporates "efficient natural gas," interpreted to mean NGCC, as a qualifying resource.

The Administration estimates that about 40 percent of today's electricity generation is produced by "clean" energy sources, which includes renewable energy sources, nuclear, and NGCC plants. Figure 1 displays the composition of our current electricity generation mix. Based on 2009 EIA data, generation from these sources comprises about 50 percent of total electricity generation. The Administration's 40 percent estimate suggests that only half of NGCC generation was included in that calculation.

[3] In restructured markets, generators and LDCs are typically separate entities. Generators, which would not face a compliance obligation, would sell credits to LDCs, which would have to hold enough credits to meet the CES target. In regulated markets, LDCs are often utilities that own generation resources, such that the entity that earns the credit for qualifying generation would be the same entity facing a compliance obligation.

[4] See S.3464, Practical Energy and Climate Plan Act of 2010, available at http://www.gpo.gov/fdsys/pkg/BILLS-111s3464is/pdf/BILLS-111s3464is.pdf, and S. 20, Clean Energy Act of 2010, available at http://www.gpo.gov/fdsys/pkg/BILLS-111s20is/pdf/BILLS-111s20is.pdf.

Figure 1. Share of Current Electricity Generation by Source



Source: EIA Form 906 data.

The Administration's plan provides very limited information as to how the President's target would be translated into the specifics of a CES. It does, however, offer some general principles, including:

- *Provide credit to a broad set of electricity sources*. The CES would credit renewable and nuclear power, while providing partial credit to clean coal with CCS and efficient natural gas.

- *Use complementary policies to increase energy efficiency.* The Administration suggests that investment in energy efficiency could not be used to comply with the CES. It notes that the CES should be paired with measures such as appliance efficiency standards and tax credits for energy efficiency investments, as well as provisions to help manufacturers invest in technologies that improve efficiency.

- *Protect consumers.* Energy efficiency is proposed as the primary vehicle for reducing consumer impacts. The Administration's plan does not address whether the CES should include an upper limit on CES credit prices.

- *Ensure regional fairness.* The CES would attempt to limit inequities among regions based on disparities in clean energy resources. The Administration's plan does not specify how this would be achieved.

- *Promote development and deployment of new technologies*. The CES would include provisions to promote deployment of new and emerging clean energy technologies, such as coal with CCS.

3. Representing a Clean Energy Standard Consistent with the President's Targets

The specific design of a CES will have implications for the overall cost and effectiveness of the program, as well as the distribution of economic impacts. In attempting to model a CES consistent with the President's clean energy targets, it was necessary to make assumptions on a number of key design elements. These design elements, and the assumptions made in this analysis, are summarized below. Note that BPC is not necessarily advocating the specific design described, but rather using it as a starting point to examine different CES approaches.

- *Eligible technologies and credit levels.* Based on the President's proposal, the CES modeled by BPC provides full credit to qualifying renewable, hydro, and nuclear generation, and partial credit to generation from NGCC units, coal units co-firing with biomass, and coal with CCS. Eligible NGCC generation was assigned 0.5 credits per KWh, and biomass co-firing and coal with CCS were credited in proportion to their CO_2 reduction from baseline levels. Supply and demand side efficiency improvements are assumed not to be eligible for CES credit. Further, there is no restriction on the percentage of the CES target that can be met by an individual technology.

- *Treatment of existing clean energy generation relative to new and incremental generation*. President Obama's 80 percent target in 2035 includes existing generation as well as the incremental generation that would be necessary in order to reach 80 percent. In practice, existing CES proposals have credited existing generation only when it is from non-hydro renewable sources, while crediting new and incremental generation at other clean energy sources.[5] Assuming that the CES requirement is adjusted in proportion to which types of units will receive credit, the impacts of this decision are primarily distributional, in that it affects which utilities will be net buyers or net sellers of CES credits.[6]

  In this analysis, BPC has adopted a crediting approach similar to that included in the Graham and Lugar proposals. BPC's crediting approach is summarized in comparison with those two proposals in Table 1. The largest difference is the inclusion of natural gas as a qualifying resource. In interpreting the Administration's calculation of current electricity from clean energy, BPC assumed that rather than discounting all MWhs produced by NGCC units by 50 percent, the calculation omitted the 50 percent of generation from the NGCC units that were least efficient. Based on this interpretation, only the most efficient NGCC units are assumed to

[5] In this paper, "incremental" is used to refer to additional generation from existing plants as a result of capacity additions through efficiency improvements or uprates. For NGCC units, increased output due to higher utilization rates is also counted as incremental generation.

[6] An exception would be a standard that credited only generation from new capacity for a technology where existing sources have the potential to increase utilization, such as NGCC. By disincentivizing increased utilization, this approach would increase the cost of achieving the overall standard. In addition, it is important to note that where a CES credits only new and incremental generation, retirements of existing clean generating units would reduce the likelihood of achieving the overall clean energy target.

be eligible for partial credit for incremental generation. This approach may be more conservative than what the Administration intends.[7]

Table 1. Comparison of Crediting Approach in BPC Analysis and Existing CES Proposals

Technology	Graham	Lugar	BPC Analysis
Solar, wind, geothermal, dedicated biomass, and other non-hydro renewables	Existing and incremental/new	Existing and incremental/new	Existing and incremental/new
Biomass co-firing	Existing and incremental/new	Existing and incremental/new	Existing and incremental/new
Hydropower	Existing excluded from baseline; credit for generation from incremental/new capacity	Existing excluded from baseline; credit for generation from incremental/new capacity	Existing excluded from baseline; credit for generation from incremental /new capacity
Advanced coal with CCS	Existing and incremental/new	Existing and incremental/new	Existing and incremental/new
Nuclear	Credit for generation from incremental/new capacity	Credit for generation from incremental/new capacity	Credit for generation from incremental/new capacity
Efficient Natural Gas (NGCC)	No credit	No credit	Credit for incremental generation above baseline levels (average of previous 5 years) at most efficient units; credit for generation from new capacity

- *Timeline and trajectory of CES targets.* The Administration's CES proposal did not indicate when the program would start, or how the targets would escalate prior to 2035. It was therefore necessary to make an assumption about the trajectory of the overall target, as well as translate this target into an actual CES requirement that adjusts for existing clean energy resources that are assumed to be ineligible for credit under the program. In addition, the CES requirement was further adjusted to reflect the exclusion of existing hydropower and municipal solid waste (MSW) from the denominator against which compliance with the standard is calculated.[8] Table 2 displays BPC's assumptions about how the Administration's goal would increase prior to 2035,

[7] The alternative approach would be to count each KWh generated by a NGCC as 0.5 KWh. Under that approach all existing NGCC capacity would likely be treated as eligible for credit.

[8] This adjustment is similar to what was included in the Graham bill. The Lugar bill excluded only hydro from the baseline.

as well as how the goal would be converted into an actual CES requirement given the crediting determinations outlined above. [9]

Table 2. Relationship between Total Clean Energy Goal and Assumed CES Requirement

Year	Total Clean Energy Goal	CES Requirement
2013	45%	11%
2015	50%	16%
2020	55%	23%
2025	60%	29%
2030	70%	40%
2035	80%	50%

- *Banking and borrowing.* By allowing flexibility on the timing of compliance, banking and borrowing allow LDCs to minimize the cost of compliance with the CES over time. Both Senator Graham's and Senator Lugar's proposals allowed utilities to bank CES credits. Senator Graham's proposal allowed an LDC to borrow credits from the following three years if it could submit a compliance plan demonstrating that the targets for those years would be achieved. Senator Lugar's proposal included a provision that would allow a waiver for up to three years if an LDC could demonstrate that it would meet requirements at the end of that compliance period. BPC's analysis does not restrict banking or borrowing, though borrowing is never utilized in the model.

- *Alternative compliance payment*. An alternative compliance payment (ACP) effectively sets a price ceiling on CES credits, by allowing LDCs to submit a specified payment to the implementing authority in lieu of CES credits. Senator Lugar's proposal included an ACP of 5 cents/KWh, and Senator Graham's included an ACP of 3.5 cents/KWh. An ACP would increase price certainty for CES credits, but if set close to expected prices, it increases the likelihood that the clean energy target will not be achieved. In this analysis, BPC did not include an ACP, but believes it should be considered in a final CES proposal.

- *Definition of covered LDCs.* Senator Graham's CES provided an exemption for LDCs with sales below 4 million MWh per year. This exemption would affect primarily rural electric cooperatives and municipal utilities, though it could potentially exempt about 25 percent of generation. BPC's modeling does not include an exemption for small LDCs.

[9] Note that the assumed trajectory of the Administration's target is likely to have implications for the cost of the CES, even with the flexibility provided by banking and borrowing. The final CES requirement was calculated as follows: existing hydro and MSW were subtracted from projected retail sales to develop the baseline. This baseline was multiplied against the Total Clean Energy Goal specified in Table 2. Existing NGCC (at 50%) and nuclear generation were subtracted from that value to develop the final CES requirement to be implemented in the model.

- *Interaction with state RPS programs.* Consistent with existing CES proposals, BPC's analysis assumes that a KWh of generation that would qualify for credit under both a state RPS and the federal CES would be eligible for credit toward the requirements of both programs.

- *Special crediting provisions.* Existing CES proposals have included bonus crediting provisions for CCS (Lugar and Graham), retiring coal-fired facilities (Graham), and distributed generation (Graham). BPC's analysis does not contain any bonus crediting provisions.

4. Overview of Analysis

BPC conducted this analysis using the Integrated Planning Model (IPM®), ICF International's proprietary model of the power sector. IPM uses a dynamic linear programming structure to determine unit dispatch and environmental compliance decisions, generation capacity expansion, coal, electricity, and emission allowance prices. For each region, the model optimizes the use of existing generation resources, new generation resources, and transmission such that it meets assumed load and peak demand at least cost, while complying with specified environmental constraints.

BPC modeled five scenarios, including two reference cases and three policy cases:

- Reference Case 1: BPC developed this reference case in early 2010. Electric demand, as well as new build overnight capital costs and financing assumptions, were taken from EIA's Annual Energy Outlook (AEO) 2010. Pollution control cost and performance assumptions were taken from EPA's Base Case v.3.0, with some adjustments made by BPC to reflect recent market prices for SO_2 and NO_X controls. Natural gas supply assumptions were based on information from EIA's AEO 2010. The treatment of investment and production tax credits for renewable generators were also consistent with EIA AEO 2010, assuming the production tax credit for wind expires at the end of 2012 and the investment tax credit for other renewable generators expire at the end of 2013. Reference Case 1 contains the Clean Air Interstate Rule (CAIR) but does not contain any national level GHG, air toxics, or ash and water regulations. It also contains state renewable portfolio standards and state air quality regulations affecting the power sector.

- CES: This scenario contains a CES with the design elements discussed in section 3, implemented with electricity market conditions as specified under Reference Case 1.

- CES Low Gas: This scenario is the same as the CES case, except that the price of natural gas is assumed to be $1.00 per mmBtu lower over the model time horizon than the projected price in that case. Note that this gas price adjustment reduces the extent to which this case can be directly compared to ReferenceCase1 as a means of calculating the incremental impacts of a CES. For that reason, it is compared primarily against the CES case above.

- Reference Case_EPA: This case expands Reference Case 1 to capture the potential impacts of forthcoming EPA regulations that will impact the power sector. This includes BPC's representation of EPA's Transport Rule, regulation of hazardous air pollutants (MACT), regulation of cooling water intake systems under Section 316(b) of the Clean Water Act, and regulation of coal ash residuals under the Resource Conservation and Recovery Act. These regulations, all of which are expected to be finalized in 2011 or 2012, will result in changes to the generation mix with implications for the costs and impacts of a CES. In particular, they are likely to result in significant pollution control technology retrofits, lead to the retirement of older and less efficient coal-fired capacity, and increase electricity generation from natural gas in the near term.

- CES_EPA: This scenario implements the CES discussed above on top of electricity market conditions as specified in Reference Case_EPA.

It is important to note that since BPC's Reference Case 1 was developed, EIA has published the early release of its AEO 2011. The most significant change in AEO 2011 relative to AEO 2010 is the upward revision of recoverable shale gas resources. This results in a wellhead natural price in 2025 that is about 90 cents lower per mmBtu than in AEO 2010, and greater utilization of natural gas in the reference case. The inclusion of the CES Low Gas scenario helps to address this disparity. In addition, AEO 2011 also includes higher costs for new nuclear and wind capacity.[10] Overall, the revisions in AEO 2011 would likely imply slightly less wind and nuclear capacity, and more natural gas, than is projected to occur under the CES in this analysis.

5. Modeling Results

National Level Impacts

Generation Mix

Figure 2 displays the projected electricity generation mix under the reference and CES cases for 2020 and 2030. In the 2020 timeframe, the CES leads to an increase of natural gas and wind generation, primarily at the expense of coal, though the availability of biomass co-firing at some plants limits the impact on coal in the near term.

By 2030, the model projects a significant decline in generation from conventional coal, though this is limited somewhat by the availability of biomass co-firing and the improving economics of coal with CCS. Total generation from coal-fired facilities declines by about 18 to 23 percent relative to reference case levels. The model projects between 150-250 thousand GWh of generation from coal with CCS in 2030 under the CES, with the lower end of this estimate occurring in the low gas price scenario. While this is significantly more CCS generation than has been projected in earlier CES analyses, these analyses have generally reflected less stringent targets.[11]

[10] See EIA 2011. AEO 2011 Early Release Overview. http://www.eia.gov/forecasts/aeo/pdf/0383er(2011).pdf.
[11] See for example, EIA 2007. Energy Market Impacts of a Clean Energy Standard – Follow Up. http://www.eia.doe.gov/oiaf/servicerpt/portfolio/index.html, and Palmer, Sweeney, and Allaire, 2010. Modeling Policies to Promote Renewable and Low-Carbon Sources of Electricity, http://www.rff.org/RFF/Documents/RFF-

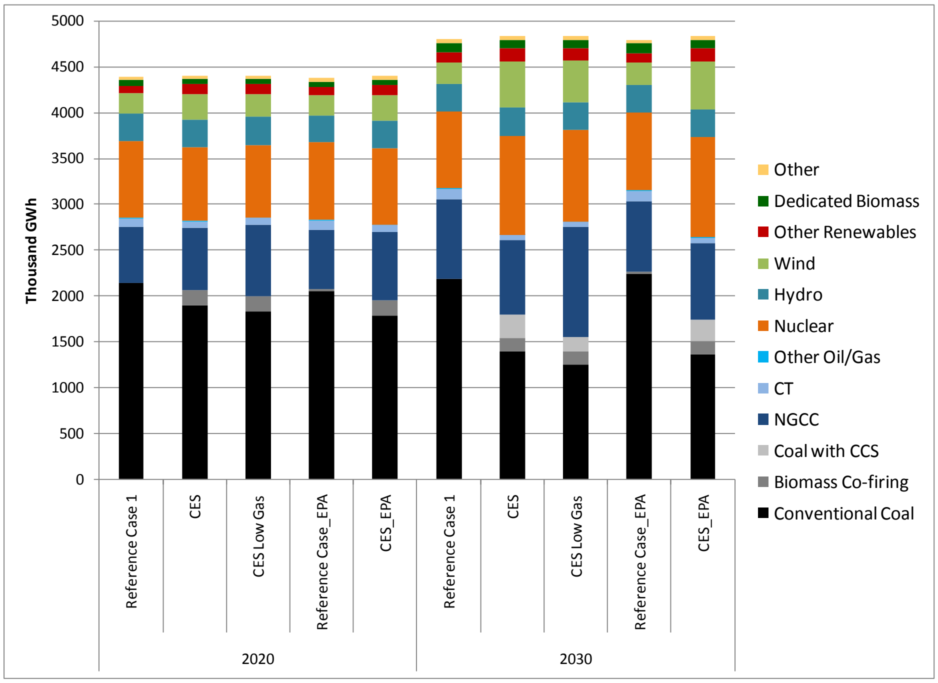
For most of the time horizon analyzed in the model, electricity generation from natural gas is projected to be higher than reference case levels under the CES. However, the impact of the CES on electricity generation from natural gas in 2030 is unclear. In the main CES case, generation from natural gas fired facilities is slightly lower (by about 6 percent) than in Reference Case 1. However, in the Low Gas CES case, electricity generation from natural gas is projected to be about 50 percent higher than in the main CES case. In the CES_EPA scenario, generation from natural gas is projected to be about 8 percent higher than under Reference Case_EPA in 2030.

The model projects a significant increase in nuclear generation in 2030. Nuclear generation is projected to increase by about 30 percent in 2030 under the CES and CES_EPA scenarios relative to their respective reference cases, though this increase is reduced in the CES Low Gas case. This result is driven by both the increasing stringency of the target and small improvements in nuclear capital costs that are assumed to occur over the model time horizon. Should capital costs remain high, or siting and permitting difficulties impede nuclear power development, much of this generation would likely be replaced by natural gas and renewables.

Electricity generation from non-hydro renewables is projected to increase under all CES scenarios. Generation from wind is projected to increase by about 30 percent relative to reference case levels in 2020, and more than double from reference case levels by 2030. Electricity from other renewables is projected to increase by about 30 percent relative to reference case levels in 2020 and 2030. The CES Low Gas scenario suggests that lower gas prices would temper this growth in wind and other renewables only slightly. The share of CES credits resulting from renewable electricity generation is projected to be between 35 and 50 percent, depending on the scenario and year being analyzed.

BCK-Palmeretal%20-LowCarbonElectricity-REV.pdf. Palmer et al. contains one scenario that projects a higher CES credit price (CEPS-All). This was intended to replicate the non-coal generation shares projected in modeling of a CO_2 cap-and-trade program based on H.R. 2454.

Figure 2. Projected Generation Mix, 2020 and 2030



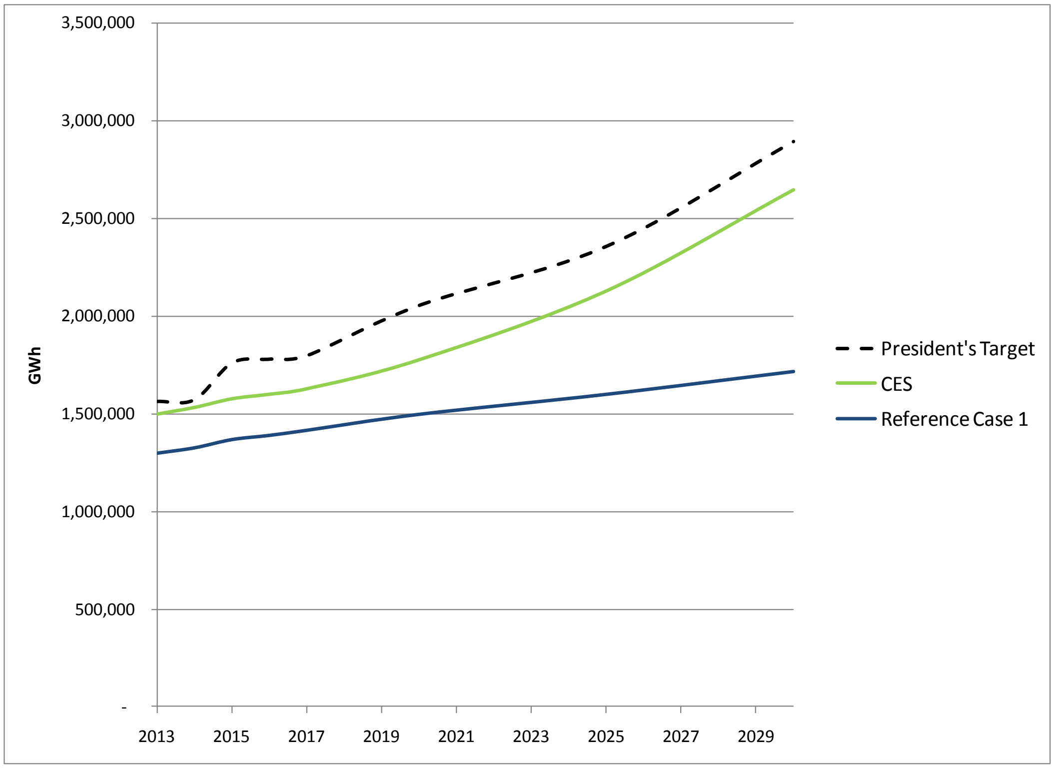
Comparison with Overall Clean Energy Target

Figure 3 presents the trend in total clean energy (new and existing) under the CES and Reference Case 1, in comparison with BPC's assumptions, from Table 2, about the President's goal through 2030.[12] As discussed in the previous section, existing levels of generation from nuclear and NGCC units are not credited under the CES modeled by BPC, though these units are eligible for credit for *incremental* generation. Under this assumption, generation from existing NGCC units declines.[13] This is because BPC's assumed baseline for crediting incremental generation from NGCC units (annual average of previous 5 years of generation) is too high to be economic for existing NGCC units, the utilization of which declined during the recession. As a result, the CES favors more efficient new NGCC capacity over generation from existing units.[14] Because of the decline in generation from existing NGCC units, total clean energy is below the total clean energy target. In 2030, clean energy is projected to comprise 64 percent of total retail electricity sales, 6 percentage points below the 70 percent target. This result underscores an important policy consideration – if a CES is designed to credit only incremental and new generation from clean energy technologies, a decline in generation from existing clean facilities will compromise the ability to achieve the overall clean energy goal. In addition, this result suggests that

[12] The President's target was interpreted to represent a percentage of retail electricity sales. If intended to represent a percentage of total electricity generation, a slightly higher CES requirement would be necessary.
[13] Generation from existing nuclear plants, on the other hand, increases due to uprates.
[14] However, no NGCC units are projected to retire.

designing a CES that will encourage increased utilization of existing NGCCs will require careful analysis of an appropriate baseline.

Figure 3. Projected Clean Energy Generation in Comparison with the Target Levels



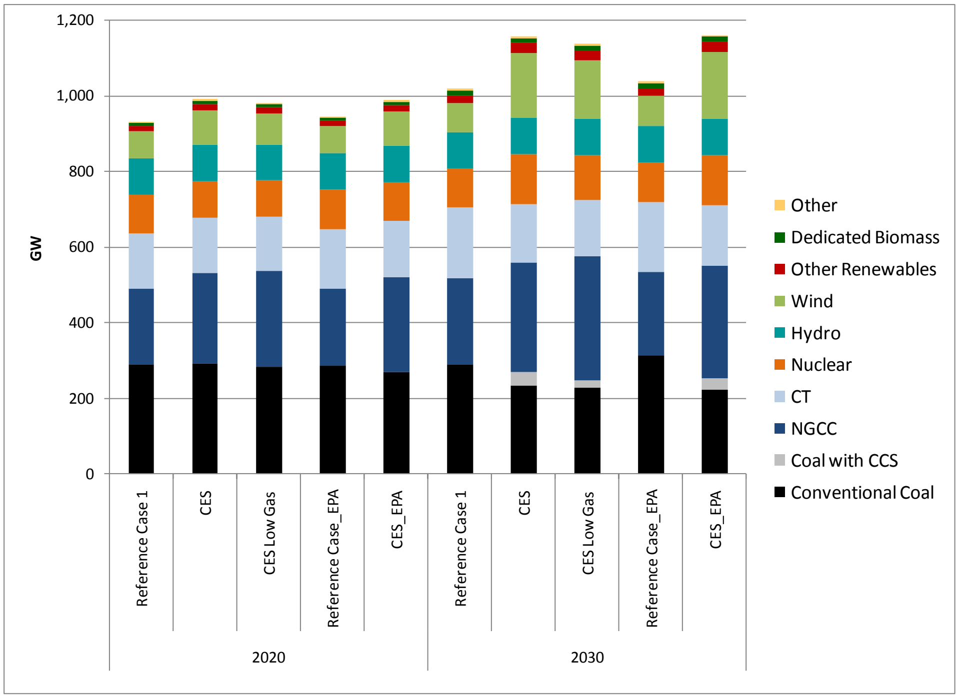
Note: excludes hydro and MSW

Capacity

Figure 4 displays the mix of total electricity generation capacity under the reference case and CES policy scenarios. Total capacity is projected to increase under the CES.[15]

[15] Much of this increase is due to the significant wind capacity projected. Effective capacity from wind is much lower than nameplate capacity, which is what Figure 4 displays.

Figure 4. Projected Capacity Mix, 2020 and 2030



Before 2020, the CES is projected to have a fairly limited impact on conventional coal-fired capacity, though this impact is larger when EPA regulations are considered. By 2030, however, total coal-fired capacity is projected to decline by about 21 to 60 GW, with the high end of the range reflecting incorporation of EPA regulations into the analysis.[16] Through a combination of new capacity and retrofits, between about 21 and 34 GW of coal with CCS is projected to become available, with the low end of that range reflecting the CES Low Gas scenario. In all cases, the CES is projected to lead to higher NGCC capacity. In 2030, NGCC capacity is 27 percent greater under the main CES case, and 34 percent greater when EPA regulations are incorporated into the reference case. Projected NGCC capacity is about 14 percent higher in 2030 under the Low Gas CES case relative to the CES case.

In the 2020 timeframe, nuclear capacity under the reference and CES cases is projected to be about equal, though the CES does lead to an additional 30 GW of nuclear capacity by 2030. A lower gas price would make new nuclear capacity less attractive under the CES, and reduce this amount.

With respect to renewables, the largest growth is observed in wind capacity. Wind capacity is projected to increase by almost 30 percent relative to the two reference cases by 2020, and by more than 120 percent by 2030. Almost 100 GW of additional wind capacity is projected to come online under the CES by 2030. Finally, capacity of other renewable energy technologies is projected to increase substantially in percentage terms under the CES, increasing by about 40 percent relative to the reference cases by

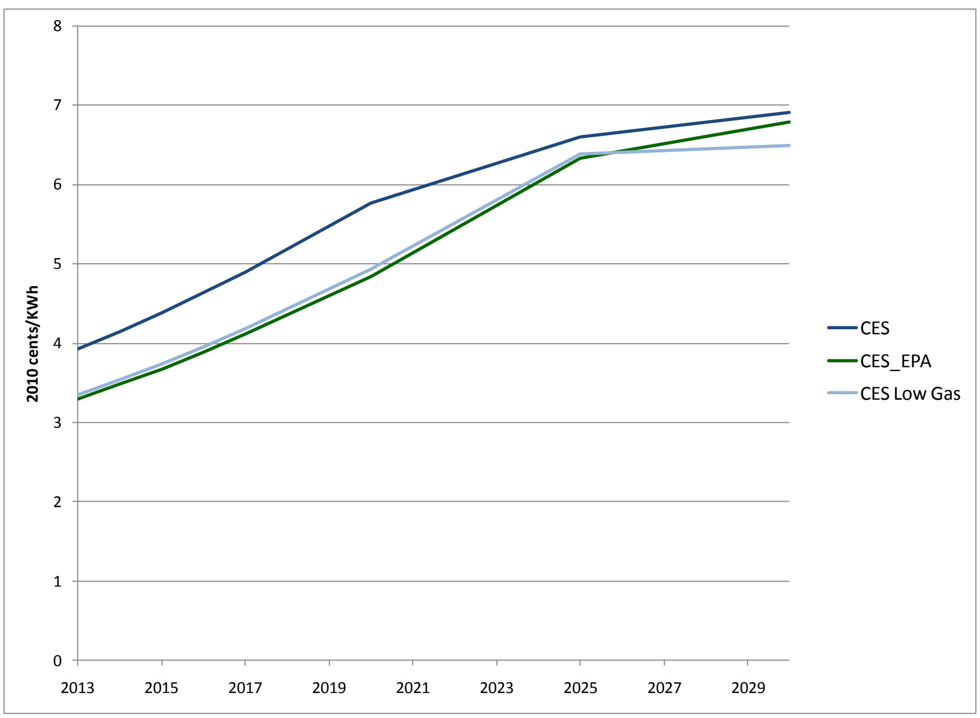
[16] Note that total coal-fired capacity is projected to be slightly higher under Reference Case_EPA, relative to Reference Case 1, in 2030. Lower coal prices in that scenario, and the absence of regulation of CO_2 emissions, lead to a small amount of new coal capacity coming online in 2030.

2030. As is the case with nuclear capacity, lower gas prices slightly reduce the role of renewable technologies in meeting the CES in favor of NGCC capacity.

Clean Energy Credit Prices

As shown in Figure 5, CES credit prices are projected to range from about 3.5 to 4 cents per KWh when the program begins in 2013, increasing to between 6.5 and 7 cents per KWh by 2030. This result suggests that the target proposed by the President may be more costly than what was deemed acceptable under earlier CES proposals. The Lugar and Graham CES proposals included ACPs of 5 cents/KWh and 3.5 cents per KWh, respectively, adjusted annually for inflation. Including forthcoming EPA regulations, which are projected to lead to the retirement of some inefficient coal capacity, in the baseline reduces the cost of meeting the CES, as do lower gas prices. CES credit prices are projected to be about 0.6 to 0.9 cents per KWh lower under the first decade of the CES when EPA regulations are taken into account. The inclusion of complementary energy efficiency policies would also be expected to lower the CES credit price.

Figure 5. Projected CES Credit Price

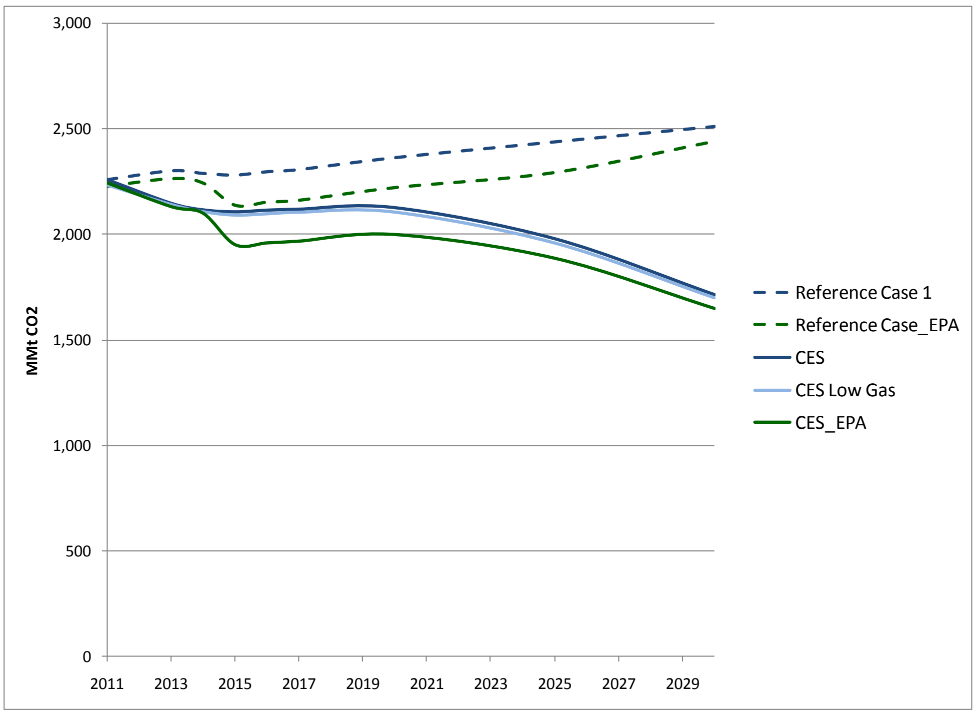


Note: While other results are presented in 2006 dollars, the CES credit prices are presented in 2010 dollars to facilitate comparison against ACP levels in existing proposals.

CO_2 Emissions

Figure 6 displays projected CO_2 emissions under the reference and CES cases. The CES provisions modeled result in CO_2 reductions from the reference case of 10 to 11 percent in 2020 and 30 to 32 percent in 2030, with the higher end of those ranges reflecting the inclusion of EPA regulations. Relative to 2005 emissions, emissions are about 11 to 12 percent lower under the CES and CES Low Gas scenarios in 2020, and emissions under the CES_EPA scenario are 17 percent lower in 2020. By 2030, emissions under the CES and CES Low Gas scenarios are about 29 percent below 2005 emissions, and emissions under the CES_EPA scenario are 31 percent below 2005 levels.

Figure 6. Projected CO_2 Emissions



Gas Prices and Consumption

Figure 7 presents projected natural gas prices, and Figure 8, projected natural gas consumption. Both CES scenarios are projected to lead to an increase in natural gas prices in the near term, relative to their respective reference cases. As noted previously, the CES Low Gas price sensitivity shifts the gas price from the main CES case down by $1 per mmBtu.[17] Gas prices increase sharply in the EPA regulatory cases because of coal plant retirements and an increased reliance on natural gas in the near term. Natural gas consumption is projected to increase by 7 to 23 percent relative to reference case levels by 2020, the lower end of that range reflecting the inclusion of EPA regulations in the modeling. Although power sector natural gas consumption under the CES cases remains higher than relevant reference case

[17] As such, the gas price does not reflect movement in the Henry Hub gas price based on market conditions as the other scenarios do, but the price trend is included here for reference.

levels for most of the time period captured by the model, by 2030, natural gas consumption under the CES is projected to be slightly below reference case levels.

Figure 7. Henry Hub Natural Gas Prices

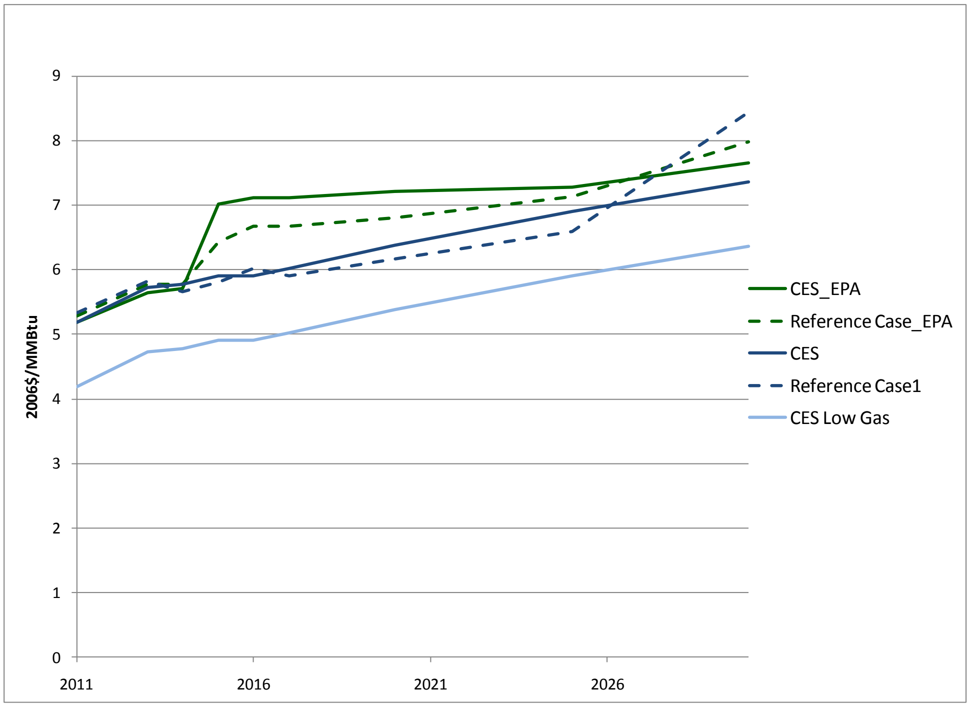
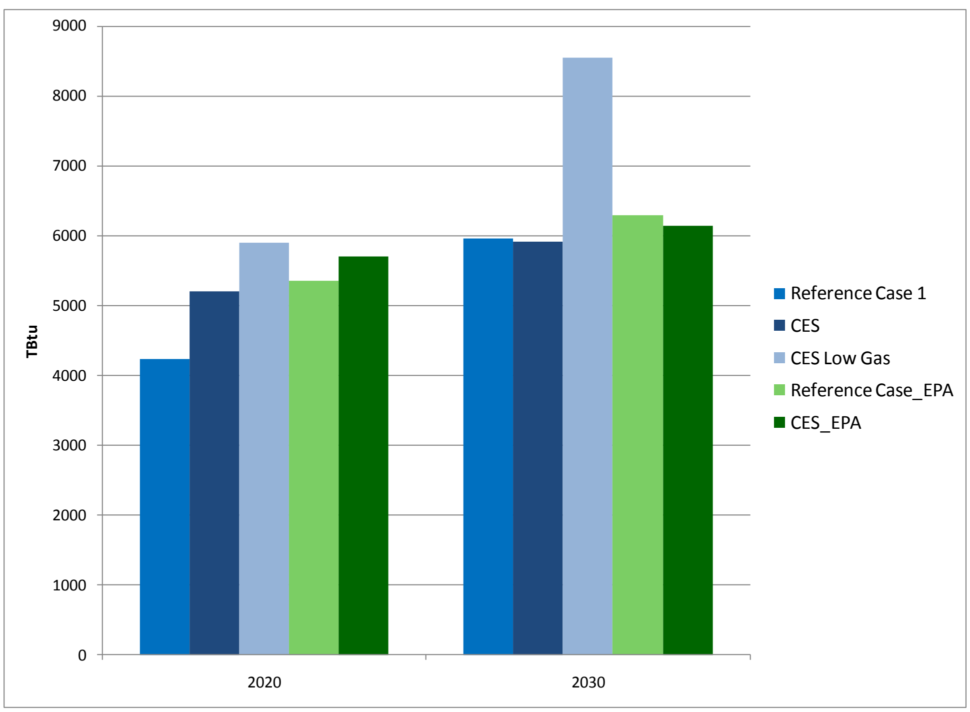


Figure 8. Projected Power Sector Natural Gas Consumption



Coal Prices and Consumption

Figures 9 and 10 display projected coal prices and consumption. Because the CES displaces coal-fired generation, coal prices are projected to fall relative to the reference cases. Coal consumption is projected to decline under the CES and CES_EPA cases by about 12 to 13 percent in 2020 and 22 to 27 percent in 2030, relative to their respective reference cases. Lower gas prices would lead to a further decline in coal consumption.

Figure 9. Projected National Average Delivered Coal Price

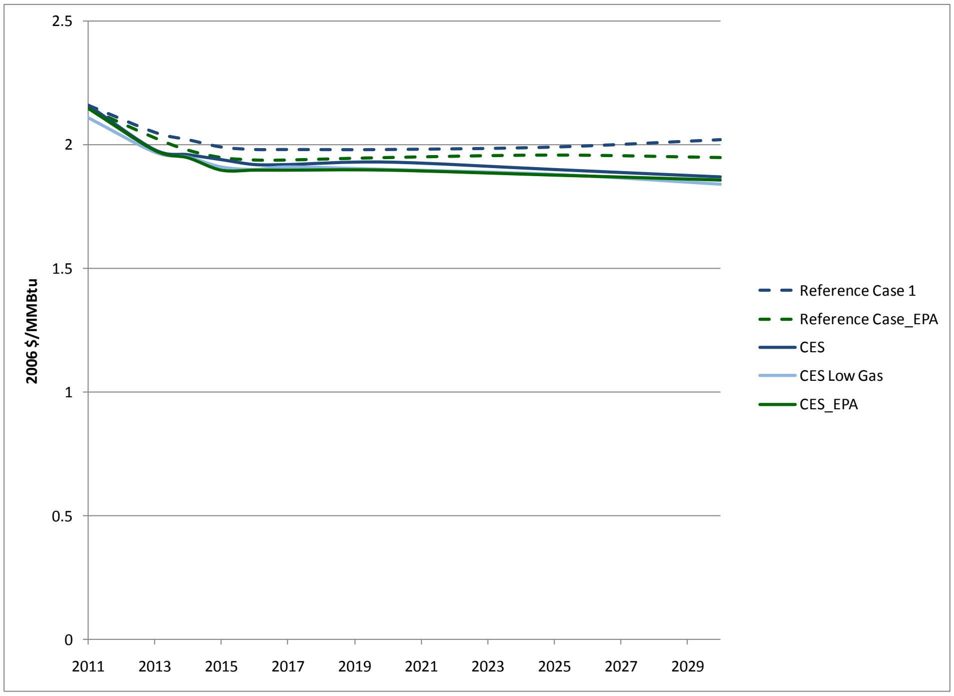
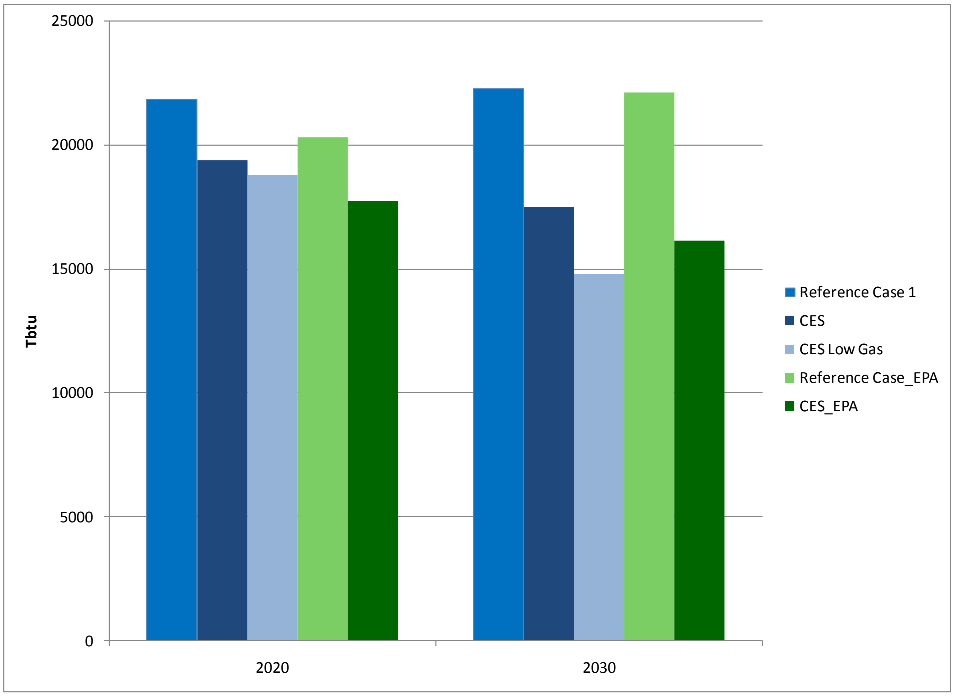


Figure 10. Projected Coal Consumption



Regional Impacts

Credit Sales and Purchases

A key question on clean and renewable electricity standards is their economic implications for individual regions. In general, the concern has been that policies such as a CES or RES would lead to large wealth transfers from regions with coal-intensive generation to regions with more renewable and clean energy resources, effectively leading coal-intensive regions to subsidize clean energy resource development in those regions. Figures 11 and 12 provide a sense of how a CES could lead to wealth transfers across regions. These charts show CES credits produced by each region in comparison to what the effective CES requirement would be for that region. While only the main CES case is shown, the credit positions of individual regions were similar among the three CES scenarios.

In the 2020 timeframe, as would be expected, regions with significant coal-fired capacity are projected to be net purchasers of CES credits. These regions tend to rely on biomass co-firing as the primary strategy for achieving the CES target, and purchase the remainder of credits from regions with significant renewable capacity. By 2030, coal-intensive regions are projected to develop a significantly more diverse electricity portfolio, including nuclear, coal with CCS and NGCC capacity, but are still generally projected to be net purchasers. Somewhat surprisingly, the northeastern states are projected to be net purchasers of CES credits over the duration of the program. Lower projected demand growth in the northeast relative to other regions of the country reduces the incentive to construct new capacity in that region. In addition, the northeast is somewhat constrained in its ability to construct new wind capacity relative to other regions.

Figure 11. CES Credits Generated by Region in Comparison to Regional Requirement, 2020

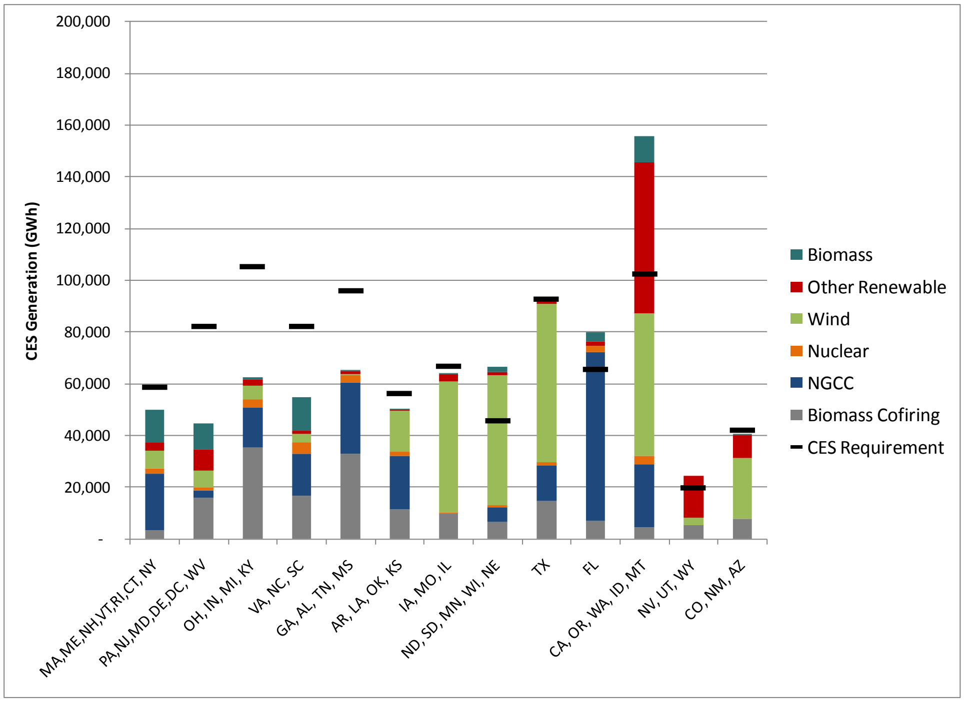
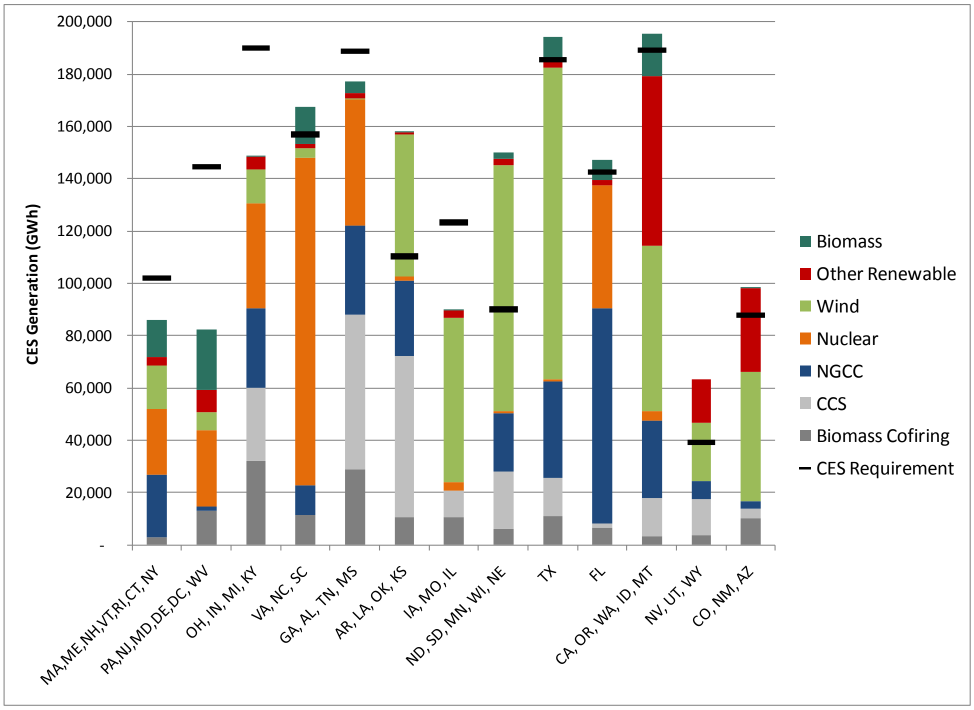


Figure 12. CES Credits Generated by Region in Comparison to Regional Requirement, 2030



It is important to note that aggregation to the regional level may overlook diversity among states and utilities in individual regions. In other words, while a given region may be projected to be short CES credits, individual states or utilities within the region could be generating excess credits.

It is possible that alternative policy design approaches could reduce the magnitude of wealth transfers across regions. One alternative that could be considered is reducing the level of credit given to existing renewable energy sources, or conversely, providing some credit to non-incremental generation from existing NGCC or nuclear units. Another alternative would be to remove existing clean energy generation from the baseline against which compliance with the requirement is compared.[18] A third alternative would be to vary the percentage requirement of the CES across regions (or individual utilities) based on current generation profiles.[19]

Retail Electricity Prices

Projections for retail price impacts under the CES case, relative to ReferenceCase1, are summarized in Table 3. Retail price projections were developed in one of two ways, depending on the regulatory structure of the region being analyzed.[20] Note that the regional definitions vary slightly from those

[18] The first two alternatives would require adjustment of the CES requirement to remain consistent with the overall clean energy target.

[19] Establishing the current generation mix of an LDC may be difficult in practice given the complexity of attributing a KWh sold by an LDC to a specific generator in competitive markets.

[20] For regions that rely on competitive retail pricing, retailers were assumed to purchase every clean energy credit necessary to meet the percentage of sales set forth by the CES. The total dollar amount of those purchases in each year was spread over the total retail sales in the region to arrive at a clean energy premium. That premium was

used to assess CES credit purchases and sales. In percentage terms, the electricity price impacts vary significantly across regions. Regions with significant existing renewable resources that are projected to have a surplus of CES credits, such as the Upper Midwest, ERCOT, and California, tend to see a decline in electricity rates. The largest percentage rate increases are projected for coal-intensive regions that are projected to undertake significant capital investments and also purchase credits in order to meet the standard. The Northeast is projected to see a decline in electricity prices, despite being a net purchaser of CES credits. This appears to be due to the displacement of some conventional combustion turbines by more efficient NGCCs, as well as biomass and wind, all of which qualify for credit and bid in at lower prices.

Table 3. Average Retail Electricity Price Impact of the CES

Region Name	**NERC Region**	**Regulatory Status**	**Projected Average Rate Impact**	
			2013 to 2020	**2013 to 2030**
Northeast	NPCC	Mix	-3%	-4%
Mid-Atlantic	RFC in PJM	Mix	7%	6%
Southeast	SERC (non-Delta)	Regulated	6%	8%
Florida	Florida	Regulated	1%	0%
Gulf Coast	SERC Delta	Regulated	7%	9%
Southern Plains States	SPP	Mix	1%	2%
Midwest	RFC (non-PJM)	Mix	7%	8%
Upper Midwest	MRO	Regulated	-6%	-4%
ERCOT	TRE	Competitive	-2%	-5%
WECC	WECC (non-California)	Regulated	1%	2%
California	California	Regulated	-7%	-7%
Total US	Continental US	Mix	1%	1%

then added to the firm power price, consisting of the wholesale energy price and the capacity price, for that region in that year, as well as assumed transmission and distribution (T&D) costs, taxes, T&D losses, and a retail gross margin, to arrive at the all-in retail price projection. For regulated regions, the retail price was built up on a cost-of-service basis. Projections of total fixed costs, including levelized capital expenditures, fuel costs and other variable costs of generating electricity in the region were summed and then spread over total sales to arrive at a cost of generation, accounting for electricity imports or exports. The CES premium for those regions was calculated as the net position of the region with respect to CES credits multiplied by the CES credit price. Regions that had fewer credits than they needed were assumed to purchase those credits at the market price. Regions that had credits in excess of their percentage requirements were assumed to sell the credits at the market price. Those expenditures or sales were spread over total sales and added to the generation cost to arrive at an all-in retail price of electricity to the region. Regions with a mix of both types of regulatory structures reflect the average of the subregion components, calculated as described above, weighted by load in each component region.