



Clean Energy Standard: Design Elements, State Baseline Compliance and Policy Considerations

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Summary

During his State of the Union speech on January 25, 2011, President Obama announced an energy goal for the country: “By 2035, 80% of America’s electricity will come from clean energy sources.” The White House, on February 3, 2011, released a Clean Energy Standard (CES) framework focused on U.S. electricity generation. The framework describes the fundamental goals and objectives of such a policy to include doubling clean electricity, sustaining and creating jobs, and driving clean energy innovation.

Congress, if it chooses to take up CES legislation, will likely sort through and evaluate a number of policy options that might be considered during the formulation of a federal Clean Energy Standard policy. Understanding previous CES proposals, the Administration’s CES policy framework, state-level baseline CES compliance, and policy considerations might assist a CES debate during the 112th Congress. These areas are the focus of this report.

CES and related concepts have been debated for more than a decade and several Clean/Renewable Energy Standard proposals were offered during the 111th Congress, although none became law. The scope of this report includes a comparative analysis of four proposals of the 111th Congress: S. 20, Clean Energy Standard Act of 2010; S. 3464, Practical Energy and Climate Plan Act of 2010; S. 3813, Renewable Electricity Promotion Act of 2010; and a substitute amendment offered for H.R. 2454, American Clean Energy and Security Act of 2009. This analysis, which illustrates commonality and key differences among the legislative proposals, includes an assessment of each bill based on a uniform set of design elements. While the proposals considered generally agree on the definition of “renewable energy” (wind, solar, geothermal, etc.), they differ on certain policy aspects including (1) base quantities of electricity, (2) target/goal for the standard, and (3) alternative compliance payments, among others.

The Administration’s proposal states that 40% of delivered electricity is generated from “clean energy” sources today and 80% should be generated from clean energy sources by 2035. Clean energy sources are defined to include (1) renewable energy, (2) nuclear power, and (3) partial credits for clean coal and efficient natural gas. However, the amount of partial credits received by clean coal and efficient natural gas generation is not explicitly defined.

CRS analysis of 2009 electricity generation data from the Energy Information Administration (EIA) also suggested that 40% of electricity generated could be considered clean energy if renewable energy, nuclear power, and 50% of electricity generated from natural gas combined cycle (NGCC) power plants are classified as clean energy. Further analysis of EIA data assessed the amount of clean energy generation in each state. This work revealed differences among the states regarding existing clean energy generation, with some states currently generating more than 80% of electricity from such clean energy sources and other states generating less than 5%.

Finally, the Clean Energy Standard debate involves several policy design options that Congress might consider, including (1) Should the policy credit existing and/or incremental clean energy generation? (2) What should be the value of alternative compliance payments? (3) Should utility companies of a certain size be exempt? (4) Should preference be given to renewable energy generation? and (5) Which generation sources would qualify as clean energy? These, and other, policy options are presented and discussed in this report.

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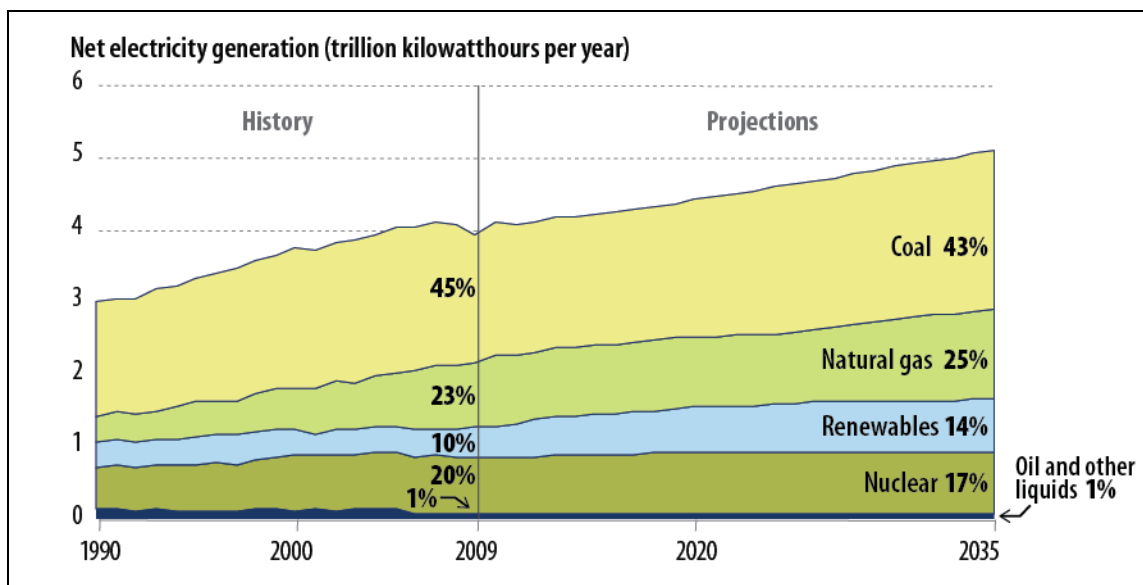
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Background and Introduction

In 2009, approximately 4 trillion kilowatt hours of electricity were generated by the U.S. power sector. By 2035 electricity generation is expected to rise to more than 5 trillion kilowatt hours, a roughly 25% increase from 2009 levels. The fuel mix for U.S. electricity generation includes four primary categories: (1) coal, (2) natural gas, (3) renewables, and (4) nuclear. As illustrated in **Figure 1**, coal is the largest electricity generation fuel source for both actual (2009) and projected (2035) generation. However, EIA projects that natural gas and renewables are the only fuel sources that would experience growth, in terms of percentage of the electricity generation mix, over the projection period.

Figure 1. Projected Fuel Mix for Electricity Generation



Source: Energy Information Administration (EIA), Annual Energy Outlook (AEO) 2011 Early Release Overview, available at [http://www.eia.gov/forecasts/aeo/pdf/0383er\(2011\).pdf](http://www.eia.gov/forecasts/aeo/pdf/0383er(2011).pdf). Adapted by CRS.

Notes: EIA analysis assumes that current laws and regulations remain unchanged throughout the projection period. "Oil and other liquids" is a fifth fuel source category, however electricity generated from these fuel sources is marginal.

During his January 25, 2011 State of the Union speech, President Obama proposed a Clean Energy Standard (CES) policy framework that would result in 80% of U.S. electricity generation coming from "clean energy" sources by 2035. "Clean energy," as described by President Obama, would include renewables, nuclear power, and partial credits for clean coal and efficient natural gas.

While there is no official definition, a federal Clean Energy Standard might be defined as a requirement to generate a percentage of electricity from certain energy sources. It is a policy designed to encourage U.S. electricity generation from "clean" or "cleaner" energy sources within a certain time period. Many CES proposals require individual utility companies to comply with a federal CES, although some utilities may be exempt from CES requirements based on their total amount of annual electricity sales. Generally, utilities can comply with CES requirements through a combination of (1) electricity generation from qualified clean energy sources, (2) purchasing

clean energy credits, and (3) making alternative compliance payments (ACPs). Each of these will be discussed below.

Previous CES proposals have addressed multiple policy design parameters, including (1) technologies that qualify, (2) base quantities of electricity, (3) goals and requirements, (4) alternative compliance payments. Understanding the implications and inter-relationships of these parameters is an important element of CES policy design and will assist Congress with considering if overall objectives such as increasing clean energy generation, minimizing rate payer impacts, and job creation are likely to be achieved.

This report evaluates design elements of previous CES proposals, summarizes the Administration's CES policy framework, provides state-level baseline CES compliance analysis, and presents several policy options that Congress might consider as part of a CES debate.

Summary and Design Elements of Previous Clean Energy Standard Proposals

During the 111th Congress several Clean/Renewable¹ Energy Standard policies were proposed, although none became law. In order to provide background on previously proposed CES legislation, four proposals were analyzed and compared against multiple design parameters (See **Table 1**).²

Table 1. Clean/Renewable Energy Standard Proposals—111th Congress

Bill #	Title	Proposed Standard
S. 20	Clean Energy Standard Act of 2010	50% of base quantity by 2050.
S. 3464	Practical Energy and Climate Plan Act of 2010	50% of base quantity by 2050.
S. 3813	Renewable Electricity Promotion Act of 2010	15% of base quantity by 2021.
Substitute amendment to H.R. 2454	Energy Production, Innovation, and Conservation Act	15% of base quantity by 2020.

Source: Legislative Information System and Congressional Quarterly.

Notes: S. 3813 might be considered a purely “Renewable” Energy Standard as it does not include nuclear or other fossil energy generation as qualified sources. The substitute amendment to H.R. 2454 includes a number of energy policies and the only portion analyzed was Title I—Clean Energy Standard. The substitute amendment is dated May 19, 2009. There may have been a subsequent version with some changes/modifications submitted to a committee. S. 3464 also includes several other energy policies and this analysis focused on Title III—Diverse Domestic Power. Each proposed standard analyzed has a different definition for “base quantity” of electricity.

¹ A Renewable Energy Standard is a policy that requires electricity generation from “renewable” energy sources such as wind, solar, geothermal, biomass, etc. Many Clean Energy Standard proposals are broader and typically include renewable energy as well as other energy sources such as nuclear power and coal with carbon capture and sequestration.

² For specific information about a Federal Renewable Electricity Standard, see CRS Report R41493, *Options for a Federal Renewable Electricity Standard*, by (name redacted).

A more detailed analysis of these proposals is presented in a side-by-side comparison matrix that can be found in **Appendix A**. All proposals were compared in order to assess areas of commonality and divergence. While not an all-inclusive or exhaustive list, following is a brief overview and discussion of the design elements considered for this analysis.

Base Quantity of Electricity

The base quantity of electricity is a critical Clean Energy Standard design element as it establishes the amount of electricity, typically measured in kilowatt-hours, that applies to CES goals and requirements. Proposals analyzed have base quantity definitions that range from 100% of utility power sales to sales less the amount of power generated by hydro-electricity and municipal solid waste (MSW) incineration. A hypothetical example of how different utilities might derive their respective CES base quantities in the latter case is provided in **Table 2**.

Table 2. Hypothetical Base Quantity Calculations

	Pre-Adjustment	Factors for Adjustment		Pre-Adjustment Less Factors	15% Standard
	Total Sales (kWhrs)	Hydroelectricity (kWhrs)	MSW (kWhrs)	Base Quantity (kWhrs)	CES Target (kWhrs)
Utility 1	100 billion	0	0	100 billion	15 billion
Utility 2	100 billion	50 billion	50 billion	0	0
Utility 3	200 billion	100 billion	50 billion	50 billion	7.5 billion

Source: CRS.

Notes: This analysis assumes that the base quantity of electricity is calculated by subtracting electricity generated from hydroelectricity and Municipal Solid Waste (MSW) incineration from the total amount of electricity sales.

Target/Goal

Clean Energy Standard targets and goals set the percentage of electricity that must be generated from clean energy sources by a certain date. The percentage articulated in a CES proposal is applied to the base quantity of electricity to calculate the number of kilowatt-hours that must be generated from clean energy sources in order to achieve compliance by a certain date. Examples of CES targets/goals include (1) 50% of base quantity by 2050, (2) 15% of base quantity by 2039, and (3) 15% of base quantity by 2020.

Qualifying Energy Sources

Defining and determining which energy sources will qualify under a CES proposal could be a design element worthy of consideration. A clear definition of qualifying sources is important as it allows a utility company to determine which electricity generation options are available for compliance. Each of the four proposals analyzed in this paper include typical renewable energy³

³ Renewable energy typically includes biomass, solar, wind, and geothermal. The definition of “biomass” is somewhat different across the four proposals, with some proposals including a detailed description of what would be considered (continued...)

as qualified sources. All four proposals also include coal-mine methane and landfill gas as qualifying sources. Differences among the proposals, generally, are associated with the inclusion and definition of qualified hydropower and incremental geothermal as well as the inclusion/definition of waste-to-energy, qualified nuclear, advanced coal/fossil with carbon capture and storage, and re-powering/co-firing biomass at existing coal generation facilities.

Energy Efficiency/Savings Credits

Energy efficiency/savings typically refers to reductions in electricity consumption at end-use consumer facilities that are served by an electric utility company as well as reductions in distribution system losses. Some proposals also include output from combined heat and power systems as energy efficiency/savings. In order to qualify for energy efficiency/savings credits, utility companies may have to institute programs that result in consumer demand reductions. One example of such a program might be subsidies for high efficiency air conditioning systems. All four proposals analyzed allow for energy efficiency/savings credits, although some proposals place limits on how much energy efficiency/savings credits can be used to comply with a broader Clean Energy Standard. For example, one proposal allows utility companies to use energy efficiency credits to satisfy up to 25% of the CES target. Therefore, 75% of a utility company's CES target must be met by generating electricity from qualified sources, purchasing CES credits, or making alternative compliance payments. One challenge associated with energy efficiency/savings credits might be determining a baseline for calculating energy efficiency and therefore the number of credits that result from various energy efficiency programs.

Alternative Compliance Payments

Alternative compliance payments (ACPs) can be paid by utility companies in lieu of generating qualified clean energy or purchasing clean energy credits. Typically expressed in cents per kilowatt-hour, ACPs provide utility companies with some degree of flexibility associated with meeting the targets/goals of a Clean Energy Standard. From a policy perspective, determining the value of ACPs can be somewhat complicated. Setting the ACP too low could potentially result in minimal development of "clean" electricity generation because some companies might choose to pay the ACP instead of generating or purchasing qualified clean energy. At the same time rate payer costs may increase as utility companies seek to recover their compliance costs. However, setting the ACP value too high might result in relatively large electricity rate increases in areas/regions that lack clean energy resources. Nevertheless, ACPs are basically a cost containment mechanism that effectively place a cap on the value of clean energy credits. Determining the value of ACPs will likely involve comparing the cost of generation from all qualified sources to the lowest generation cost from any fuel (e.g., coal, natural gas, nuclear, renewable) source. Some proposals suggest that funds generated through receipt of ACPs will be used to provide grants in support of new "clean energy" electricity generation projects.

(...continued)

"biomass" and others simply referring to the definition provided in section 203(b) of the Energy Policy Act of 2005 (42 U.S.C. 15852(b)). For a more detailed discussion of biomass, see CRS Report R40529, *Biomass: Comparison of Definitions in Legislation Through the 111th Congress*, by (name redacted) and (name redacted).

Credit Trading

Under most of the four Clean Energy Standard proposals, utilities would be awarded credits for each kilowatt-hour of electricity generated from qualified clean energy sources. Utility companies can submit clean energy credits as a means of compliance with annual CES requirements. If a utility has more CES credits than are required for a given year, the utility may either “bank” the excess clean energy credits for a certain period of time or the utility can trade the excess credits, in exchange for cash, to other utilities. For those proposals that allow energy efficiency to count towards CES compliance, energy efficiency credits are typically handled in a similar manner. Details regarding the mechanics of how CES credit trading may work are not clearly defined in the four proposals analyzed and responsibility for establishing trading programs is delegated to the Secretary of Energy.

Multiple Credits

Three of the four CES proposals analyzed include provisions for double and triple credits. Multiple credits could be an approach that further incentivizes certain types of clean energy projects or the development of projects in certain locations. Some examples of projects that might receive multiple credits include (1) projects on Indian lands, (2) on-site electricity generation, (3) first five advanced coal facilities that sequester 1 million tons per year of carbon dioxide (CO₂), among others.

Credits for Demonstration Projects

Some CES proposals include provisions that allow demonstration projects to receive clean energy credits. For example, S. 20 would provide clean energy credits for advanced coal demonstration projects, based on the amount of CO₂ that is captured and sequestered. Providing credits for demonstration projects might be viewed as an incentive to develop, deploy, and commercialize emerging clean technologies.

Civil Penalties

Most CES proposals include a civil penalty for utilities that fail to comply with CES requirements. Civil penalties are typically computed by multiplying the annual kilowatt-hour target shortfall times a multiple of the alternative compliance payment (e.g., 200% of the ACP— inflation adjusted).

Exemptions

In some cases, CES proposals may exempt certain utility companies from compliance. Two of the four proposals analyzed exempt utilities that sell less than 4 million megawatt⁴-hours of electricity in the preceding year. All utility companies in Hawaii are also exempt.

⁴ A megawatt is equal to 1,000 kilowatts.

Loans to Support Compliance

Some CES proposals empower the Secretary of Energy to make loans to support the development of qualified clean energy projects. The purpose of the loans is to assist with CES compliance and reduce cost impacts to utilities and retail consumers.

President Obama's Clean Energy Standard Proposal

On January 25, 2011, during the State of the Union address, President Obama announced a clean energy goal for the country: "By 2035, 80% of America's electricity will come from clean energy sources."⁵ On February 3, 2011, the White House released a document titled "President Obama's Plan to Win the Future by Producing More Electricity Through Clean Energy," which summarizes the goals of the President's plan.⁶ Primary objectives of the Administration's plan include:

- Double the share of clean electricity in 25 years
- Draw on a wide range of clean energy sources
- Deploy capital investment to sustain and create jobs
- Drive innovation in clean energy technologies
- Complement the clean energy research and development agenda

Furthermore, President Obama's plan described five core principles for the Clean Energy Standard proposal. These principles are summarized in the following text box.

⁵ President Barack Obama, 2011 State of the Union address, January 25, 2011, available at <http://www.whitehouse.gov/the-press-office/2011/01/25/remarks-president-state-union-address>.

⁶ White House Office of Media Affairs, "President Obama's Plan to Win the Future by Producing More Electricity Through Clean Energy," February 3, 2011, available at <http://www.whitehouse.gov/the-press-office/2011/02/03/president-obama-s-plan-win-future-making-american-businesses-more-energy>.

President Obama's Proposal for a Clean Energy Standard

Doubling the share of clean electricity over the next 25 years. To mobilize capital and provide a strong signal for innovation in the energy sector, a CES should be established that steadily increases the share of delivered electricity generated from clean energy sources, rising from 40% today to 80% by 2035.

Credit a broad range of clean energy sources. To ensure broad deployment and provide maximum flexibility in meeting the target, clean energy credits should be issued for electricity generated from renewable and nuclear power; with partial credits given for clean coal and efficient natural gas.

Protecting consumers against rising energy bills. The CES should be tailored to protect consumers, and coupled with smart policies that will help American families and businesses save money by saving energy.

- The CES should be paired with energy efficiency programs that will lower consumers' energy bills, such as stronger appliance efficiency standards, tax credits for energy efficiency upgrades, and the proposed Home Star program.
- The CES should also include provisions to help manufacturers invest in technologies to improve efficiency and reduce energy costs.

Ensuring fairness among regions. Different regions of the country rely on diverse energy sources today, and have varying clean energy resources for the future. The CES must ensure that these differences are taken into account, both among regions and between rural and urban areas.

Promoting new technologies such as clean coal. The CES should include provisions to encourage deployment of new and emerging clean energy technologies, such as coal with carbon capture and sequestration.

Source: White House Office of Media Affairs, "President Obama's Plan to Win the Future by Producing More Electricity Through Clean Energy," February 3, 2011, available at <http://www.whitehouse.gov/the-press-office/2011/02/03/president-obama-s-plan-win-future-making-american-businesses-more-energy>.

As discussed and presented in the following sections, baseline compliance with President Obama's CES proposal differs among the states and several policy considerations may warrant further evaluation as the CES policy debate evolves.

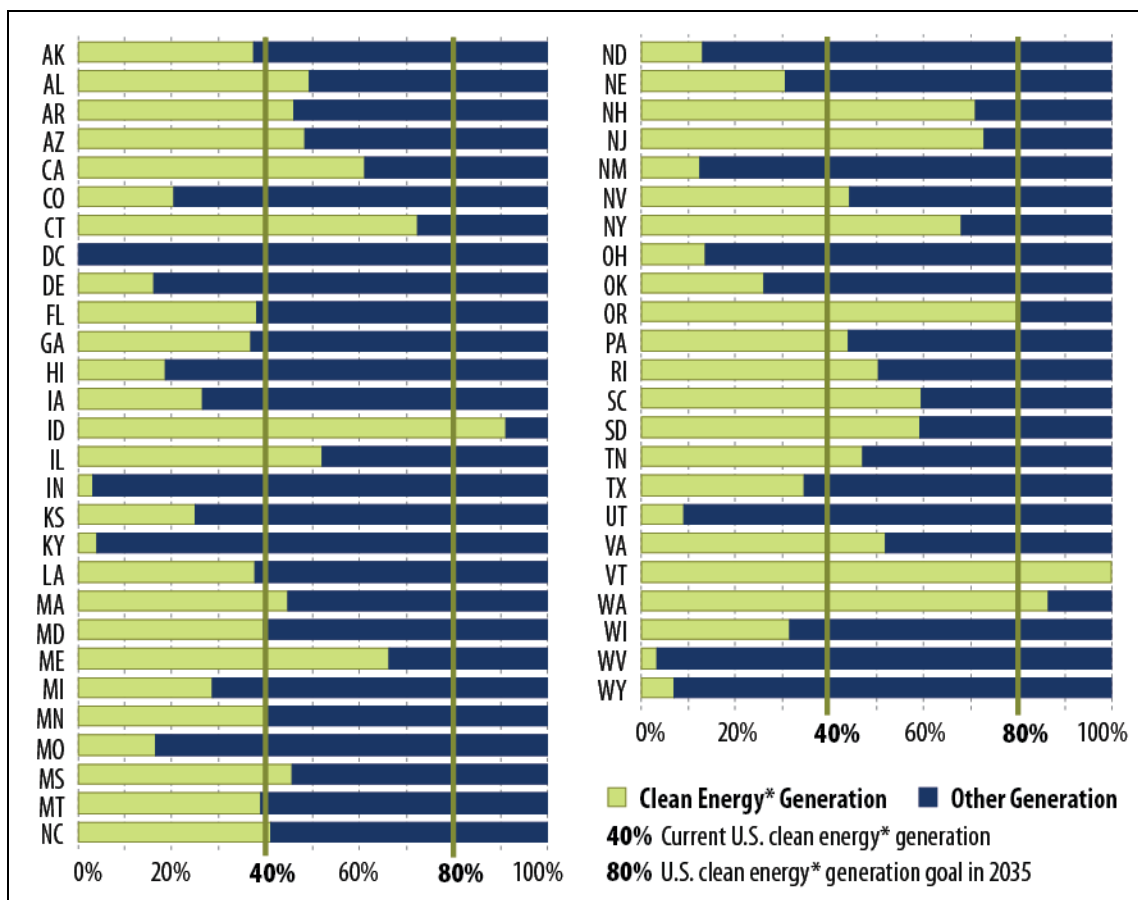
Baseline State Compliance Assessment (President Obama's CES Proposal)

President Obama's Clean Energy Standard proposal states that 40% of electricity currently generated nationwide comes from "clean energy" sources.⁷ However, each state and each utility required to comply with a federal Clean Energy Standard has a unique electricity generation mix. The following figure shows how each state would currently comply with the CES proposal based

⁷ CRS was able to replicate this number by analyzing EIA's 923 electricity generation survey and Electric Power Annual—2009 data. Analysis results indicate that the 40% clean energy number announced by the President during his 2011 State of the Union address includes generation from the following energy sources: geothermal, hydroelectric, nuclear, biomass, pumped storage, solar thermal and photovoltaic, wind, wood/wood derived fuels. Also, a 50% CES credit per kilowatt hour was provided for natural gas combined cycle (NGCC) generation. The 50% credit for NGCC is based on emission data that indicates NGCC carbon emissions are about 50% less than coal carbon emissions. DOE's National Energy Technology Laboratory (NETL) reports the following: CO₂ emissions (lb/MWh_{gross}) for Supercritical Pulverized Coal = 1,675; CO₂ emissions (lb/MWh_{gross}) for NGCC = 790. See "Cost and Performance Baseline for Fossil Energy Plants Volume 1: Bituminous Coal and Natural Gas to Electricity," Department of Energy National Energy Technology Laboratory, November 2010, p. 5, available at http://www.netl.doe.gov/energy-analyses/pubs/BitBase_FinRep_Rev2.pdf.

on existing electricity generation from qualified “clean energy” sources. Data sources and the calculation methodology used to generate **Figure 2** and **Figure 3** are described in **Appendix B**.

Figure 2. State-Level Clean Energy Compliance (2009 electricity generation)



Source: CRS analysis of Energy Information Administration (EIA) Electric Power Annual 2009—Data Tables and Form 923 electricity generation survey data for 2009.

Notes: * Sources classified as Clean Energy, based on the White House Clean Energy Standard framework, include geothermal, hydroelectric, nuclear, biomass, pumped storage, solar thermal and photovoltaic, wind, wood/wood derived fuels. Also, a 50% CES credit per kilowatt hour was provided for natural gas combined cycle (NGCC) generation.

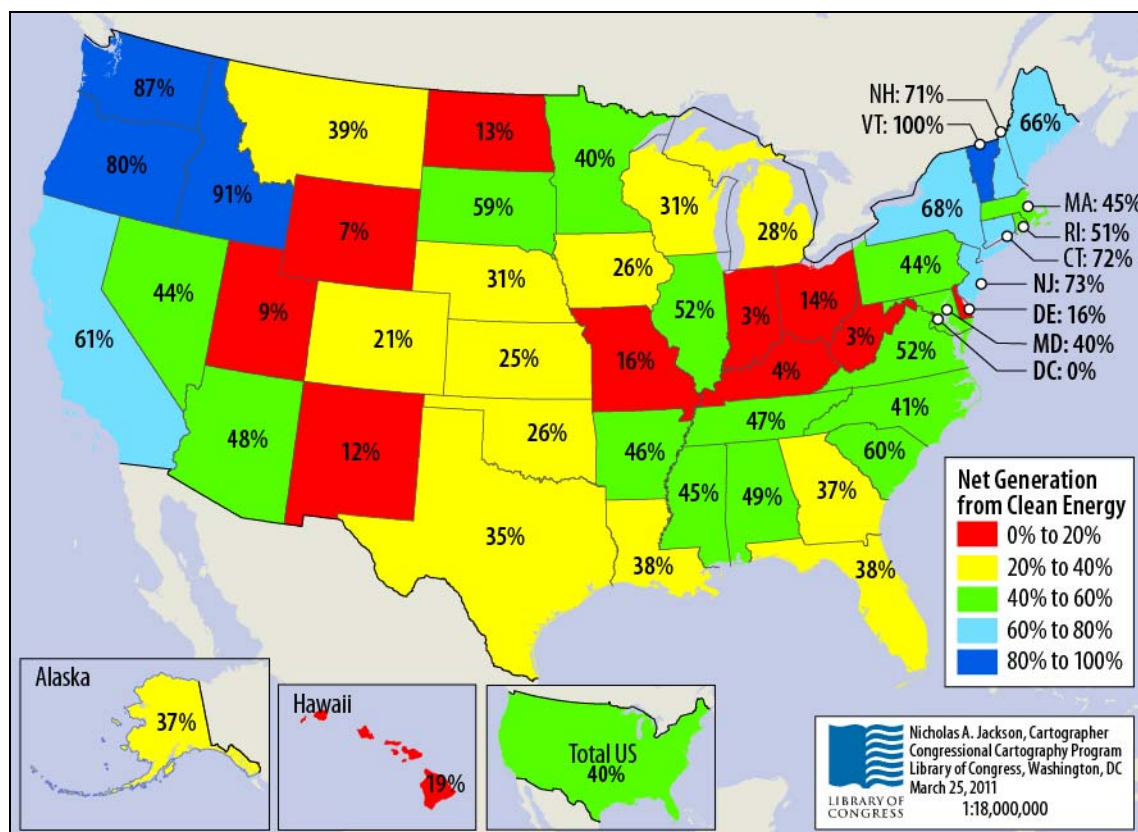
As indicated in **Figure 2**, some states may be better positioned than others to comply with a Clean Energy Standard, with some states already exceeding the 80% goal for 2035 and other states generating a relatively small percentage of electricity from qualified clean energy sources. Previously proposed CES legislation has typically applied to electric utilities and has been based on the amount of electricity sold to consumers.

The same data used to create **Figure 2** were used to create the map shown in **Figure 3**. This map illustrates potential regional differences associated with CES compliance, based on existing electricity generation sources. This map does not provide utility-level percentages, which could be the basis for CES implementation.

Limits of Analysis

Information provided in this report does not provide specifics at the utility level and does not represent the total amount of electricity sales to consumers. Such level of analysis is beyond the scope of this report. Nevertheless, the information presented here does illustrate generation profile differences among the U.S. states and may be useful as a baseline assessment of state and regional differences associated with CES legislation.

Figure 3. Regional Clean Energy Standard Compliance Assessment (2009)



Source: CRS analysis of Energy Information Administration (EIA) Electric Power Annual 2009—Data Tables and Form 923 electricity generation survey data for 2009.

Policy Considerations

In evaluating possible Clean Energy Standard legislation, policy considerations might include the following.

Should the Policy Provide Credit to Existing and/or Incremental “Clean Energy” Generation?

President Obama’s CES proposal states that 40% of U.S. electricity is generated from “clean energy” sources. However, as illustrated in **Figure 2** and **Figure 3**, each state has a different

generation mix that results in a wide range of initial baseline compliance levels. Allowing existing “clean energy” generation to count toward the standard would enable each state to receive credit for its respective “clean energy” capacity. However, allowing existing generation to count toward a CES puts some states in a better position when compared to other states, as indicated in **Figure 3**. Under this scenario, and depending on specifics of the proposed legislation, some states may experience some degree of wealth transfer as a result of purchasing CES credits from states with an excess of qualified “clean energy” electricity generation. Alternatively, Congress might decide to only allow incremental generation capacity added after the policy is enacted to count towards CES compliance. If such a policy were adopted, Congress may choose to structure the CES in a different manner than that proposed by President Obama. For instance, President Obama’s 80% of total electricity generation by 2035 would be much more difficult to achieve if existing qualified generation sources are not eligible.

What Should Be the Value of Alternative Compliance Payments?

As discussed earlier, alternative compliance payments (ACPs) provide utility companies with some degree of flexibility associated with CES compliance. In essence, ACPs act as a cost ceiling for complying with a Clean Energy Standard. Setting the value of ACPs can be complicated by factors such as the cost of electricity generation, transmission availability, regional “clean energy” resources, and finance costs for advanced technology. As a result, setting a single ACP that encourages “clean energy” electricity generation for the entire country can be difficult and challenging. An ACP set too low may simply raise rate payer electricity costs and encourage minimum amount of “clean energy” generation. In contrast, an ACP set too high may not be acceptable for states that are not endowed with “clean energy” resources. Evaluating the levelized cost of electricity (LCOE) of qualified “clean energy” generation options may be a way to begin estimating an ACP.⁸ However, since each region’s “clean energy” resource base varies (solar in the southwest versus the northeast) and each technology may have different financial requirements due to real or perceived levels of technology risk, an LCOE-based analysis of ACP levels may, at best, only produce a reasonable range for the ACP. Setting a single, absolute ACP value that will be perceived as fair and equitable for all regions, and for all technologies, may be a challenging endeavor.

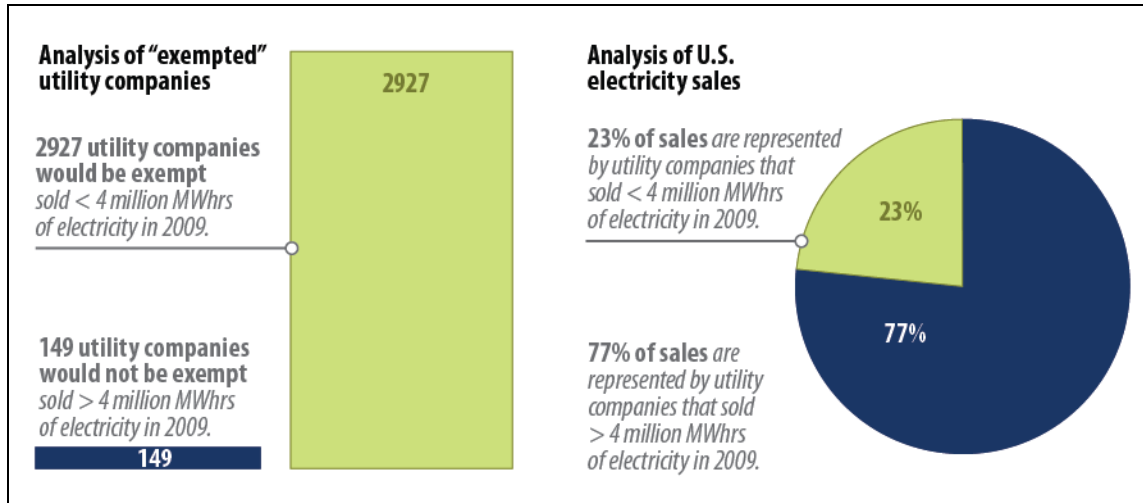
Should Utility Companies of a Certain Size Be Exempt?

Three of the four legislative proposals analyzed for this paper exempt certain utilities from complying with the respectively proposed Clean/Renewable Energy Standard. Two proposals exempt utilities that sell less than 4 million megawatt hours and one proposal exempts utilities that sell less than 1 million megawatt hours. If Congress were to choose to exempt certain utilities from compliance with the proposed standard, an analysis of how much electricity generation is represented by exempt utilities as a percentage of total U.S. electricity generation may be useful. CRS analyzed EIA data to estimate two items: (1) the number of utility companies that would be required to comply with a CES, and (2) the amount of electricity sales represented by non-exempt

⁸ Levelized cost of electricity (LCOE) is a methodology used to compare the cost of electricity generation from multiple energy sources while taking into account capacity factor, operations and maintenance, fuel cost, and financial cost differences. More detail along with DOE/EIA LCOE estimates for multiple energy sources can be found at http://www.eia.doe.gov/oiaf/aeo/electricity_generation.html.

utility companies. The analysis assumed that utility companies selling less than 4 million megawatt-hours per year are exempt. Results from this analysis are provided in **Figure 4**.

Figure 4. Analysis of Potential Utility Company Exemptions



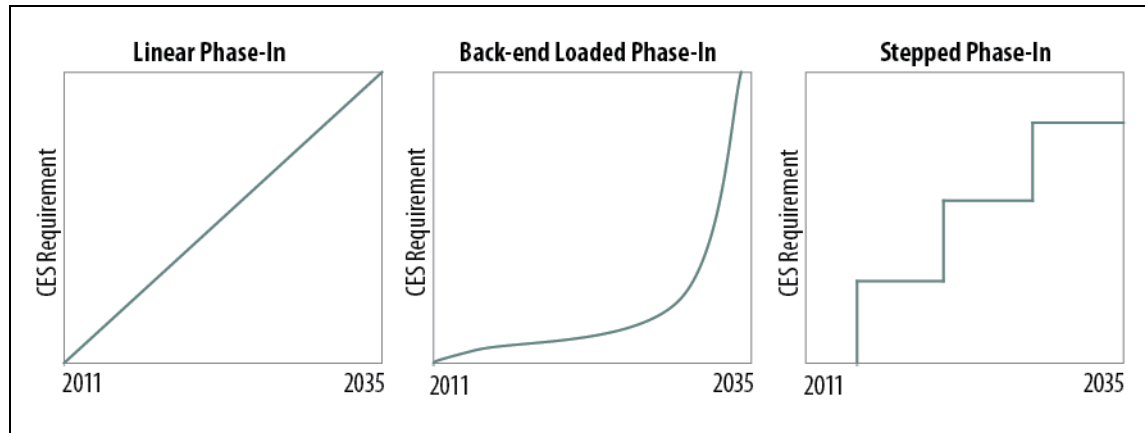
Source: CRS analysis of Energy Information Administration Form 861 survey data for 2009.

Notes: EIA Form 861 includes annual retail sales (in megawatt hours) information for more than 3,000 utility companies in the U.S. CRS categorized each utility based on annual retail sales being either more than or less than 4 million megawatt hours per year. Many of the 2,927 exempt utility companies include electric cooperatives and municipal utilities. Utility companies included in EIA’s Form 861 survey data may include wholly owned subsidiaries of a parent company that may reflect retail sales less than 4 million megawatt hours. The parent company of these subsidiaries may have aggregate retail sales of more than 4 million megawatt hours. However, an assessment of parent and subsidiary companies is beyond the scope of this analysis. Please see the preceding paragraph for more detail on possible qualified exemptions. EIA’s Form 861 data can be found at <http://www.eia.doe.gov/cneaf/electricity/page/eia861.html>.

According to the analysis summary in **Figure 4**, 149 of more than 3,000 utility companies would have to comply with the CES based on the assumed exemption criteria. These 149 utility companies represent 77% of annual U.S. electricity sales. Including an exemption as part of a CES policy may prompt consideration how to effectively achieve a CES target given that a portion of U.S. electricity might be exempted from compliance. Based on the above analysis, non-exempt utilities could be required to generate more (greater than 80% by 2035 for example) electricity from “clean energy” sources in order to meet an 80%-by-2035 goal, assuming that was a goal established through legislation.

How Should Interim CES Targets/Goals Be Structured?

All four proposals from the 111th Congress include interim targets for CES implementation. These interim milestones serve as a means to phase in “clean energy” over a period of time. **Figure 5** illustrates three possible phase-in approaches.

Figure 5. CES Phase-In Conceptual Approaches

Source: CRS.

First, the linear approach, which might consist of annual increases, may be advantageous to renewable energy and natural gas generation since development timelines for these sources are relatively short. However, nuclear and “clean coal” may be at a disadvantage under this scenario due to long development timelines (nuclear) and technology maturity/commercialization (“clean coal”).⁹ Second, the back-end loaded approach, where targets are low in the beginning years of a policy and then increase steeply in later years, may be beneficial for nuclear and “clean-coal” generation as it allows more time for development and commercialization. However, under this scenario if beginning year targets are too low some may argue that this approach does not result in demand large enough to incentivize investment in new renewable and natural gas projects. Finally, the stepped approach might include targets and goals that increase every three to five years (example: 45% by 2015, 50% by 2020, etc.). This approach offers an alternative phase-in option but may result in flurried periods of project development followed by periods of stagnant, or non-existent, market growth. Manufacturing and job sustainability may be challenged under a stepped scenario.

Should Preference Be Given to Renewable Energy Generation?

President Obama’s proposal allows a number of “clean energy” generation sources to qualify for CES compliance. This approach provides utility companies with some degree of flexibility when choosing among “clean energy” generation alternatives and it allows nuclear, coal generation with carbon capture and storage, and natural gas to compete directly with renewable (wind, solar, geothermal, etc.) generation.

Some may advocate a preference for renewable energy in the form of a specific percentage of generation dedicated to renewable energy or through a multi-tiered CES credit approach that provides more credit value for electricity generated from renewable sources.¹⁰ Others may argue

⁹ For detailed information about carbon capture technology, see CRS Report R41325, *Carbon Capture: A Technology Assessment*, by (name redacted).

¹⁰ The Center for American Progress has proposed that a federal Clean Energy Standard include a provision that requires 35% of U.S. total electricity generation come from “truly renewable” sources by 2035. See Richard W. Caperton, Kate Gordon, Bracken Hendricks, and Daniel J. Weiss, *Helping America Win the Clean Energy Race: Innovating to Meet the President’s Goal of 80 Percent Clean Electricity by 2035*, Center for American Progress, (continued...)

that a CES should include a broad array of qualified electricity generation sources and state/regional markets should determine the generation mix selected for CES compliance.

Which Generation Sources Qualify As “Clean Energy”?

Qualified “clean energy” sources described in President Obama’s CES proposal include (1) renewable electricity, (2) nuclear power, and (3) partial credits for clean coal and efficient natural gas. The proposal indicates that “clean coal” refers to coal-based electricity generation that includes carbon capture and sequestration and “efficient natural gas” refers to natural gas combined cycle (NGCC) electricity generation. Based on the choices of qualified sources, it appears that a “clean energy” objective is to encourage the development of low-carbon power sources. If this is the case, some may argue that supercritical and ultra-supercritical pulverized coal generation should qualify for partial credits since the carbon dioxide emissions profile is less than conventional subcritical pulverized coal generation. Sorting out qualified “clean energy” sources and determining the amount of whole and partial credits awarded for various electricity generation types could warrant further analysis in consideration of a federal Clean Energy Standard.

Other Policy Considerations

Other policy considerations may acquire increased levels of importance warranting further analysis and evaluation. Such issues include:

1. Transmission requirements and how to allocate associated costs?
2. Which federal agency should have responsibility for implementing and managing a federal CES?
3. What should be the guidelines for credit trading under a CES policy?
4. How might a federal CES affect other economic sectors, such as coal and coal electricity generation?
5. How should energy efficiency be treated under a federal CES?
6. How might a CES align and interact with renewable portfolio standards currently established in 29 states, DC, and Puerto Rico?

Senate Energy and Natural Resources: Clean Energy Standard White Paper

On March 21, 2011, the Senate Energy and Natural Resources committee released a Clean Energy Standard white paper. This white paper solicits feedback on 6 broad policy design questions along with 36 clarifying questions.¹¹ The six broad design questions listed in the white paper are (1)

(...continued)

February 7, 2011.

¹¹ Senators Jeff Bingaman and Lisa Murkowski, *White Paper on a Clean Energy Standard*, Committee on Energy and Natural Resources, United States Senate, March 21, 2011, available at http://energy.senate.gov/public/_files/CESWhitePaper.pdf.

What should be the threshold for inclusion in the new program? (2) What resources should qualify as “clean energy”? (3) How should the crediting system and timetables be designed? (4) How will a CES affect deployment of specific technologies? (5) How should Alternative Compliance Payments, regional costs, and consumer protections be addressed? (6) How would a CES interact with other policies?

Appendix A. Comparative Analysis of Selected Clean Energy Standards Proposed During the 111th Congress

Table A-1. Clean Energy Standard Legislative Proposal Analysis
(111th Congress)

	Clean Energy Standard Act of 2010	Practical Energy and Climate Plan Act of 2010: Title III - Diverse Domestic Power	Renewable Electricity Promotion Act of 2010	Substitute Amendment for H.R. 2454 (dated May 19, 2009)
	S. 20	S. 3464	S. 3813	
<i>Base quantity</i>	Total electricity sold, less generation from hydroelectricity and MSW incineration.	Total electricity sold, less hydroelectric power (except for qualified hydropower as defined in the bill).	Total electricity sold, less hydroelectricity, less fossil fuel w/ sequestration, less new nuclear and nuclear improvements.	Total # of kWhrs sold.
<i>Target/goal</i>	50% of base quantity by 2050.	50% of base quantity by 2050.	15% of base quantity by 2021.	15% of base quantity by 2020.
<i>Interim targets/goals</i>	Yes	Yes	Yes	Yes
Qualifying Energy Sources				
<i>Biomass</i>	Yes. Biomass that provides electrical and thermal output is incentivized to maximize efficiency. Biomass can receive up to 1.5 credits depending on efficiency.	Yes	Yes	Yes
<i>Solar</i>	Yes	Yes	Yes	Yes
<i>Wind</i>	Yes	Yes	Yes	Yes
<i>Geothermal</i>	Yes	Yes	Yes	Yes
<i>Ocean</i>	Yes	No	No	Yes
<i>Landfill gas</i>	Yes	Yes (also mentions “biogas”)	Yes	Yes
<i>Qualified hydropower</i>	Yes. Defined as additional generation from efficiency improvements or capacity additions made on or after January 1, 1992. Capacity additions made on or after January 1, 2001. Small hydro (<50MW) in Alaska.	Yes. Additional energy from efficiency improvements or capacity additions, capacity additions to nonhydroelectric dams; new hydroelectric dams.	Identical to S. 20.	Yes
<i>Marine & hydrokinetic</i>	Yes	Yes	Yes	Yes

Clean Energy Standard Act of 2010		Practical Energy and Climate Plan Act of 2010: Title III - Diverse Domestic Power	Renewable Electricity Promotion Act of 2010	Substitute Amendment for H.R. 2454 (dated May 19, 2009)
S. 20		S. 3464	S. 3813	
<i>Incremental geothermal</i>	Yes. Defined as the excess of total kWhrs produced from a geothermal facility over the average kWhrs produced at the facility for 5 of the 7 previous years (eliminate the highest and lowest kWhr production years).	No	Yes. Defined as the excess of total kWhrs produced from a geothermal facility over the average kWhrs produced at the facility for 5 of the 7 previous years (eliminate the highest and lowest kWhr production years).	No. Geothermal is listed as a clean energy source, but not in the context of 'incremental' geothermal as articulated in other proposals).
<i>Coal-mine methane</i>	Yes	Yes	Yes	Yes (specifically called "mine methane gas").
<i>Qualified waste-to-energy</i>	Yes. Defined as energy from combustion of post-recycled MSW or from the gasification or pyrolyzation of such waste and the combustion of the resulting gas at the facility.	Yes. Termed simply as "waste-to-energy."	Identical to S.20	No. Not specifically mentioned, but may qualify as a carbon-based fuel if 50% of CO ₂ is captured and sequestered.
<i>Qualified nuclear energy</i>	Yes. Defined as a nuclear generating unit placed in to service on or after the date of enactment. Also includes "incremental nuclear" defined as additional generation from efficiency improvements or capacity additions.	Yes. Nuclear generating units placed in service after enactment of the proposed bill.	No	Yes. This proposal simply refers to "nuclear energy" and has no qualifications.
<i>Eligible retired fossil fuel</i>	Yes. Electricity generated by a fossil fuel generating facility with average CO ₂ emissions >2,250 lbs per MWhr and is permanently retired between the enactment date and January 1, 2015.	Section 302, "Fossil Fuel Generating Facility Retirement Program," offers regulatory relief for early retirement of electric generating units. Program is managed by EPA.	No	No
<i>Advanced Coal/ Fossil (w/CCS)</i>	Yes. New or existing coal generation facility that permanently sequesters or stores at least 65% of GHGs.	Yes. Advanced Coal defined as a coal generating facility that captures, sequesters, stores, or reuses at least 80% of GHGs produced.	No	Carbon-based fuels qualify if at least 50% of carbon is captured, sequestered, or converted.
<i>Combined heat and power</i>	Yes. However, CHP counts towards electricity savings.	Not mentioned.	Yes. However CHP counts towards electricity savings.	Yes. However CHP counts towards "Energy Efficiency/savings" credits.

Clean Energy Standard Act of 2010		Practical Energy and Climate Plan Act of 2010: Title III - Diverse Domestic Power	Renewable Electricity Promotion Act of 2010	Substitute Amendment for H.R. 2454 (dated May 19, 2009)
S. 20		S. 3464	S. 3813	
<i>Re-powering or Cofiring increment</i>	No. However, bill does include “incremental fossil fuel production” defined as additional generation from efficiency improvements or capacity additions that result in no additional GHG emissions.	No	No	Yes. Additional generation placed in service on or after January 1, 2001 to generate electricity from a clean energy source to include the portion of electricity generated from biomass co-firing.
Other Design Elements				
<i>Energy efficiency/ savings credits</i>	Yes. Can be used to comply with 25% of clean energy targets.	Yes	Yes. Can be used to comply with 26.67% of requirement.	Yes. Can be used to comply with the entire goal/requirement if the governor of a state petitions the Secretary of Energy to allow energy efficiency/savings credits to be used for standard compliance.
<i>Alternative compliance payments (ACP)</i>	Yes. \$0.035/kWhr annually adjusted for inflation.	Yes. Determined by the Secretary but not less than \$0.05/kWhr + inflation adjustment. ACPs are paid directly to each State and funds may be used for grants that increase the quantity of energy produced from diverse energy resources or offsetting costs to electricity consumers.	Yes. \$0.021/kWhr (inflation adjusted). 75% of ACPs are paid to the State in which the utility is located and the governor of such State may use these funds to provide grants that increase the quantity of electricity generated from renewable sources, and/or to promote electric drive vehicles in the state, and to offset costs to electricity consumers.	No. Bill language mentions an alternative compliance mechanism, but in the context of payments made to a individual states and for compliance with State renewable portfolio standard programs.
<i>Credit Trading</i>	Yes. Clean Energy Credits and Energy efficiency credits.	Yes. However credits for end-user savings and energy efficiency savings cannot be sold outside of the state in which the electricity is generated.	Yes. Clean Energy Credits and Energy efficiency credits.	Yes
<i>Double credits</i>	Yes. (1) facilities on Indian land, (2) first 5 advanced coal facilities that sequester 1 million tons/yr of CO ₂ , (3) first 5 retrofitted coal plants that capture at least 200MWe of flue gas and sequester CO ₂ . If captured CO ₂ is used for hydrocarbon recovery, then reduce credits by 0.25.	No	Yes. Projects on Indian land.	Yes. (1) Clean energy generation on Indian lands. Biomass co-fired with other fuels can receive double credits if biomass was grown on Indian land. (2) Distributed clean energy generation.

Clean Energy Standard Act of 2010		Practical Energy and Climate Plan Act of 2010: Title III - Diverse Domestic Power	Renewable Electricity Promotion Act of 2010	Substitute Amendment for H.R. 2454 (dated May 19, 2009)
S. 20		S. 3464	S. 3813	
<i>Triple credits</i>	Yes. Small distributed generators <1MW on Indian land.	No	Yes. For small distributed generation on Indian land and projects that use algae biomass.	Yes. (1) Clean energy generation at an on-site facility that is used to offset part or all customer electricity requirements. (2) On-site eligible facility on Indian land can receive no more than 3 credits per kWhr.
<i>Credits for advanced coal demonstration projects</i>	Yes, by formula: Calculation = Total kWhrs supplied to grid multiplied by (CO ₂ captured and sequestered/CO ₂ captured & sequestered + CO ₂ emitted).	Credits for demonstration coal projects during years 2015 – 2029. Projects must capture, permanently sequester, store or reuse 65% of greenhouse gases. Amount of credit calculated as: Total kWhrs to grid multiplied by CO ₂ captured and sequestered/ (CO ₂ captured & sequestered + CO ₂ emitted).	No	No
<i>Civil penalties (non-compliance)</i>	# of kWhrs in violation multiplied by 200% of ACP (inflation adjusted).	Same as S.20.	Same as S.20.	Not specifically addressed in the proposed bill.
<i>Exemptions</i>	Utilities that sold less than 4 million MWhrs in the preceding calendar year. All utilities in Hawaii.	None	Same as S.20.	Retail electric suppliers that sold less than 1 million MWhrs in the preceding calendar year. All utilities in Hawaii. All federal, state, and municipal-owned utilities. All rural electric cooperatives.
<i>Loans to support compliance</i>	Yes	No	Yes	Yes

Appendix B. State-Level Baseline Compliance Calculation Methodology

Data Sources

Two EIA data sources were used to perform the baseline CES compliance assessment:

1. Electric Power Annual 2009—Data Tables: 1990-2009 Net Generation by State by Type of Producer by Energy Source (EPA 2009).¹²
2. 2009: EIA-923 January-December Final, Nonutility Energy Balance and Annual Environmental Information Data (EIA-923).¹³

Methodology

Calculating the generation mix for each state started with data from EPA 2009, which provides information regarding state-by-state electricity generation. A pivot table¹⁴ was created to organize electricity generation data by state and by fuel source. However, the EPA 2009 data do not provide the detail necessary to distinguish between natural gas combined cycle (NGCC) generation and other natural gas generation technologies.¹⁵ As a result, EIA-923 data were used to extract NGCC generation figures. With electricity generation from NGCC power plants now available, the pivot table from the EPA 2009 was modified to include NGCC generation and “Other Natural Gas” generation.

To be consistent with President Obama’s Clean Energy Standard proposal, electricity generation sources were categorized as either “Clean Energy Generation” or “Other Generation.”¹⁶

Energy sources categorized as “Clean Energy Generation” include:

- Geothermal
- Hydroelectric Conventional
- Natural Gas Combined Cycle (50% of generation)¹⁷
- Nuclear

¹² Data file available at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html.

¹³ Data file available at http://www.eia.gov/cneaf/electricity/page/eia906_920.html.

¹⁴ A pivot table is a spreadsheet feature that organizes data in a spreadsheet database and groups data/information based on different parameters.

¹⁵ President Obama’s CES proposal specifically mentions “efficient natural gas” as a qualifying energy source. Natural Gas Combined Cycle (NGCC) is one of the most efficient natural gas electricity generation methods and this analysis assumes that “efficient natural gas” is synonymous with NGCC.

¹⁶ “Other Generation” generally includes electricity generated from fossil energy.

¹⁷ Analysis conducted assumes that Natural Gas Combined Cycle, since it is classified as “efficient natural gas,” receives a 50% CES credit. While this 50% NGCC credit is not specifically described in President Obama’s proposal (it does reference “partial credits for ... efficient natural gas.”) Department of Energy NETL analysis indicates that NGCC generation emits 50% less carbon dioxide compared to coal (see footnote 7 above). This was the basis for the 50% partial credit for NGCC. NGCC generation consisted of electricity generation categorized in prime mover codes “CA”, “CS”, and “CT” in EIA Form 923.

- Biomass
- Pumped Storage
- Solar Thermal and Photovoltaic
- Wind
- Wood and Wood-derived fuels

Energy sources categorized as “Other Generation” include:

- Coal
- Natural Gas Combined Cycle (50% of generation)
- Natural Gas Other
- Other Gases
- Petroleum
- Other

In order to calculate the percent of generation from sources that qualify as “clean energy,” the sum of “Clean Energy Generation” was divided by the total amount of generation. The same calculation was performed for “Other Generation.” The pivot tables allowed this calculation to be done for the entire country as well as for each state.

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