

Impacts and Implications of a Clean Energy Standard
*Analysis of Two Proposed Clean Energy Standard Proposals
and the Implications for the Southeast*

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Summary

Based on an analysis of two competing proposals, a Clean Energy Standard is unlikely to significantly increase renewable electricity generation in the Southeast or effectively achieve the greenhouse gas emissions reductions necessary to stave off the worst effects of climate change. Under both CES scenarios, the Southeast becomes the predominant supplier of nuclear energy for the country; meanwhile, renewable energy supplies substantially less electricity than natural gas or even coal-fired generation in the year 2035.

Introduction

Greenhouse gas emissions from the electricity sector are expected to continually rise, unless there is some form of a comprehensive strategy to reduce these emissions. Thus far, such a strategy has not been undertaken in the United States to stave off the worst effects of climate change. A “Clean Energy Standard” (CES) has been suggested as a policy tool to reduce greenhouse gas emissions.

Most CES proposals require or at least incentivize a certain percentage of “clean energy” generation by a certain date. Nuclear, natural gas, carbon capture and sequestration for coal plants as well as more traditional renewable energies (such as wind, solar, geothermal, hydropower and biomass) may qualify as viable sources to fulfill a CES. The idea of a CES has been around at least since early 2010 when Senator Lindsey Graham (R-SC) first floated the concept as an alternative to a more traditional Renewable Energy Standard (RES), which would incentivize only the traditional renewable energies.¹ The following year, President Barack Obama mentioned a CES in his 2011 and 2012 State of the Union addresses.²

Two recent analyses by the Energy Information Administration (EIA) have been completed on competing CES proposals from Representative Ralph Hall (R-TX) and Senator Jeff Bingaman (D-NM). Neither of these proposals substantially increases the amount of renewable energy in the Southeast nor staves off the worst effects of climate change. This paper will focus on these two proposals as two of the most recent versions of the CES and were analyzed by EIA using similar metrics – making the comparison more relevant. A CES proposal could be introduced in the new 113th Congress and so this analysis will serve to guide a discussion that may happen in the near future.³

Variables for a CES

The primary purpose of a CES is to reduce carbon emissions, regardless of electric generation sources. Despite similarities in the name, it is important to note that a CES is not a Renewable Energy Standard (RES). Under an RES, only renewable energy sources count towards fulfillment of the standard. Solar, wind, geothermal, biomass, hydropower and marine hydrokinetics are examples of qualifying sources that have

commonly been included in RES legislation. The following descriptions are meant as general explanations of a few variables included in recently evaluated CES policy.

Defining “Clean Energy”

In the most prominent proposals to date, a CES builds upon an RES model (which include all renewable energy resources) and expands its definition of qualifying facilities to include nuclear, natural gas and some types of coal-fired power plants. A CES could even include energy efficiency measures or standards. It is more accurate to say that a “clean energy” standard is really a “low-carbon energy” standard.

Standards

Once the qualifying resources are chosen (e.g., nuclear, renewables, natural gas, etc.), a standard is set requiring a certain percentage of all electric generation be provided by those qualifying resources (e.g. 80% of U.S. electricity demand or generation is met by qualifying clean energy sources by 2050). Ideally, the latest scientific literature would drive the prescribed clean energy standards to stave off the worst effects of climate change.* Generally, these standards have focused on a 2035 or 2050 deadline with high ratios of qualifying “clean energy”.

Credits

Similar to an RES, a CES will assign full or partial credits to qualifying facilities for electricity generation. Credits are awarded typically on a per megawatt hour of “clean energy”. Qualifying “clean energy” technologies may receive full or partial credits based on how much carbon dioxide is emitted from generating electricity, with zero-carbon resources (wind, solar, etc.) receiving full credit and carbon-intensive resources (natural gas, carbon sequestration, coal, etc.) receiving partial or no credit. In part, the credits monetarily exemplify the externalized benefits of lower-carbon electric generation. Utilities may opt to generate, purchase or sell clean energy credits within a newly created market in order to fulfill the standard.

Existing and New Generation

Existing or new-build electric generation resources can be treated differently under a CES. Allocating credits to existing facilities is likely to provide a profit windfall to utilities and prolong operation of aging facilities instead of modernizing to more efficient forms of electricity generation. Utilities that maintain already existing nuclear power plants, hydroelectric dams or natural gas facilities may opt to extend these facilities beyond their useful lives if the utilities receive free CES credits. Alternatively, by excluding

* As noted in a National Research Council report in 2011, “Moreover, emissions reductions larger than about 80% (relative to whatever peak global emission rate may be reached) are required to approximately stabilize carbon dioxide concentrations for a century or so at any chosen target level (e.g., 450 ppmv, 550 ppmv, 650 ppmv, 750 ppmv, etc.).” The best estimate to maintain a 2 degree Celsius rise in global temperature is to stabilize carbon dioxide equivalent emissions to 430 parts per million. See National Research Council (2011). Climate Stabilization Targets: Emissions, Concentrations, and Impacts over Decades to Millennia.

existing facilities from receiving credits, a utility may expedite decommissioning of a power plant before it is completely depreciated in favor of constructing a new facility that would receive credits. Retiring power plants prior to complete depreciation may increase the costs associated with implementing a CES.

Alternative Compliance Payments

Alternative payments provide a kind of fee-based option for utilities if there are no CES credits available for purchase. In this instance, a certain penalty is assigned for each credit a utility is deficient. These penalties could be collected by the federal government without guarantee of their programmatic appropriation – fines collected via these alternative payments could go into the general funds for the government instead of being used for better promotion of sustainable practices. Alternative payment options must be priced high enough to discourage utilities from simply avoiding the CES requirements. Alternative payments, if priced high enough, discourage carbon-intensive generation; however, a measured reduction in carbon emissions is not guaranteed.

Clean Energy Standard Options Comparison

The variables under any CES ultimately affect the type and quantity of generation sources and the implementation period. As such, differing variables will result in different results. To minimize an excessive analysis on all possible policy options, this paper focuses on two recent competing CES proposals that were both evaluated by the Energy Information Administration (EIA). In late 2011, Representative Ralph Hall (R-TX) requested that the EIA evaluate a proposed CES with variables he described (denoted as “HCES” for “Hall CES”). The resulting analysis showed a CES could be an expensive policy option that results in an electric generation mix mostly made up of coal, nuclear and natural gas generation.⁴ In response, Senator Jeff Bingaman (D-NM) requested that the EIA conduct a second analysis with variable alterations (denoted as “BCES” for “Bingaman CES”). This secondary analysis resulted in a lower-cost CES option due to minor variable alterations (see Table 1.).⁵ A third EIA analysis has been conducted on Senator Bingaman’s officially introduced *Clean Energy Standard Act of 2012* (S. 2146); however, due to differences in EIA analyses methodology, the third analysis has been included as an Addendum at the end of this paper. All three analyses and data sets that are used in this paper are available from the EIA online.⁶

Table 1. BCES/HCES Proposed Clean Energy Standards and Timelines

	BCES	HCES
2013	--	45%
2015	45%	--
2020	50%	--
2025	60%	--
2030	70%	80%
2035	80%	80%
2040	85%	80%
2045	90%	80%
2050	95%	80%

Table 1 provides the timelines and ratios of both the BCES and HCES options. The HCES option places a flat 80% clean energy requirement to be achieved by 2030, and every year thereafter. Alternatively, the BCES gradually requires an increasing amount of clean energy from 45% in 2015 to 95% in 2050. However, due to the limitations of the Energy Information Administration, analysis was only available to the year 2035 for both the BCES and HCES options.

Table 2 lists qualifying technologies and their associated credits for both proposed clean energy standards. Both options both reward full credit to biomass, geothermal, landfill gas, municipal solid waste, new nuclear, solar and wind energy resources. Both options provide almost full credit for natural gas and coal-fired power plants with carbon capture and sequestration (CCS) technology) and about half credit to new and existing combined cycle natural gas power plants. Little to no credit is provided for integrated gasification combined cycle coal-fired power plants (IGCC). Existing hydropower and nuclear energy either receive full or no credits under the two options.

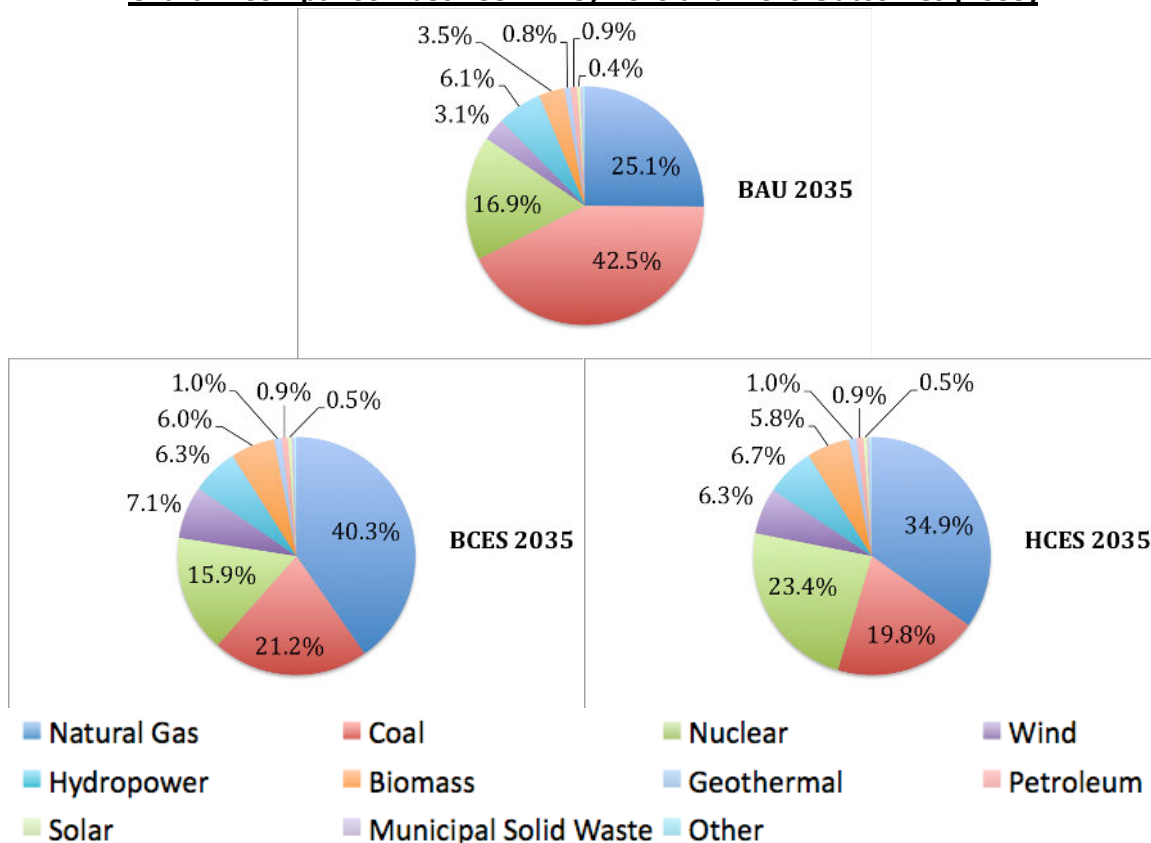
Table 2. BCES/HCES Qualifying “Clean Energy” Facilities and Associated Credits

	BCES	HCES
Biomass	1	1
Geothermal	1	1
Landfill gas	1	1
Municipal Solid Waste	1	1
New Nuclear	1	1
Solar	1	1
Wind	1	1
Incremental Hydro	1	-
Natural Gas w/CCS	0.95	0.9
Coal w/CCS	0.9	0.9
New Natural Gas Combined Cycle	0.59	0.5
Existing Natural Gas Combined Cycle	0.48	0.5
New Natural Gas Combustion	0.45	-
Existing Natural Gas Combustion	0.16	-
IGCC Coal	0.15	-
Existing Hydro	0*	1
Existing Nuclear	0*	1
*(no credits, but count towards total goal)		

National Implications of a Clean Energy Standard

The BCES/HCES options both achieve a different electricity mix from the Business-As-Usual (BAU) scenario. The slight variable differences between BCES/HCES tend to either encourage more or less natural gas and nuclear energy development between the two scenarios; yet, in both scenarios, natural gas use increases compared to the BAU scenario mostly at the expense of coal-fired generation. See Chart 1 below.

Chart 1. Comparison between BAU, BCES and HCES Outcomes (2035)



Clearly, the difference between the BAU and both CES scenarios is that coal-based energy is reduced (approximately 50% reductions in both scenarios). The largest total increase in electricity generation comes from natural gas generators in both CES scenarios, with mixed results on nuclear energy expansion. Under the CES options, coal, natural gas and nuclear energy represent approximately 78% of total electric generation, compared to 84.5% in the BAU scenario by 2035. Renewable energy resources (hydro, wind, solar, geothermal and biomass) do benefit from both CES options over the BAU scenario, but these five technologies only represent about 20% of total electricity generation. Put another way, renewable energy generation contributes about the same amount of electricity compared to coal-fired generation under either CES options.



Table 3. Estimated Electricity Generation Comparison, 2035 (billions of kWh)

	BAU 2035	BCES 2035	HCES 2035
Natural Gas	1,293	1,980	1,676
	%change	53%	30%
Coal	2,184	1,044	951
	%change	-52%	-56%
Nuclear	868	783	1,127
	%change	-10%	30%
Wind	159	351	301
	%change	121%	89%
Hydropower	314	312	321
	%change	-1%	2%
Biomass	181	295	281
	%change	63%	55%
Geothermal	42	49	49
	%change	17%	17%
Petroleum	47	43	45
	%change	-9%	-4%
Solar	21	24	23
	%change	14%	10%
Municipal Waste	17	17	17
	%change	0%	0%
Other	16	16	16
	%change	0%	0%
Total	5,142	4,916	4,809
	%change	-4%	-6%

As a portion of market share, the largest source of electricity generation under both CES options is natural gas – mostly to the detriment of coal-fired power. In both options, natural gas would become the country’s dominant source of electricity. Under both CES options, when compared to the BAU reference case, wind energy increases the most as a percentage of generation as compared to the other generation resources. BCES would encourage the most wind energy development (351 billion kilowatt hours worth in 2035, a 121% increase over BAU), but wind energy would still only account for 7.1% of total electricity generation nationwide. Biomass increases by 55% to 63% over the BAU reference case. Even with this significant build-out, biomass would only represent approximately 6% of total electricity generation by 2035. Hydropower, geothermal and solar energies received mixed results from the CES. Under HCES, all three technologies see very slight increases (2%, 17% and 10% respectively) over BAU to total 8.2% of total electricity generation. Under BCES, hydropower actually sees a 1% decline below BAU, with the same amount of geothermal power (17%) and slightly more solar (14%) as HCES. In total, these three renewable energies under BCES contribute 7.8% of total electricity generation.

National Reductions in Emissions

Under both CES options, sulfur dioxide, nitrous oxides, mercury and carbon dioxide emissions are reduced. If the main target for a CES is only to reduce carbon dioxide, then the HCES option is the best option. HCES reduces carbon dioxide output by 54% over 2009 levels - more than the BAU (16% increase) and the BCES option (34% reduction).

Table 4. National Emissions Change

	2009	BAU 2035	BCES 2035	HCES 2035
	5.7	3.7	2.7	2.4
SO ₂ (million tonnes)	change%	-35%	-53%	-58%
	2	2	1.4	1.2
NO _x (million tonnes)	change%	0%	-30%	-40%
	41	29.2	14.5	15
Hg (tonnes)	change%	-29%	-65%	-63%
	2,160	2,500	1,428	991
CO ₂ (million tonnes)	change%	16%	-34%	-54%

The prevailing scientific information suggests that an 80% reduction of greenhouse gas emissions from 1990 levels by 2050 is required to stave off the worst consequences of climate change. In 1990, the United States electric power sector contributed 1,868.9 million metric tons of carbon dioxide equivalent.⁷ The HCES reduces carbon dioxide emissions by 47% under the 1990 levels and does not increase the level of “clean energy” past 2035 (see Table 1) – thus, the HCES option would not stave off the worst effects of climate change, only perhaps delay them. The BCES option does not reduce carbon emissions at a greater rate than the HCES by 2035; however, it does have a provision to increase the usage of “clean energy” by 95% by 2050. The alternative compliance payment option, as well as the lack of analysis to 2050 means the BCES cannot guarantee reaching the 80% reduction in carbon dioxide emissions by 2050 goal.

Southeastern Implications of the Clean Energy Standard Options

Based on the analyses completed by the EIA, the Southeast is split up into five separate regions. These regions correlate with various electric reliability councils, and subregions within councils, that help maintain grid stability. Most of the Southeast is covered under four Southern Electric Reliability Corporation (SERC) subregions, in addition to the Florida Reliability Coordinating Council (FRCC), which covers most of Florida. The SERC subregions that fall within the Southeast include Delta (SRDA, including portions of Arkansas, Louisiana, Mississippi and Texas), Central (SRCE, all of Tennessee, most of Kentucky, and small portions of Alabama, Georgia and Mississippi), Southeastern (SRSE, most of Alabama and Georgia and some of Mississippi) and Virginia-Carolina (SRVC, all of North Carolina, South Carolina and most of Virginia).

Chart 2. Energy Information Administration Evaluated Electricity Market Regions



As a region, the Southeast's electric generation is likely to change fairly significantly under both CES scenarios. Coal-generated electricity is expected to decline by approximately 60%, to represent about 20% of total electric generation by 2035. To make up for this decline, natural gas, nuclear energy and renewable energy all increase. Natural gas generation increases modestly by about 20% to represent 25% of total electric generation. Nuclear energy increases 53% to 65%, and represents more than



44% of all electric generation for the region under the CES options by 2035. As of 2010, nuclear energy generated approximately 26% of the region's electricity. Renewable energy increases by about 60% to 70% over the BAU scenario; however, renewable energy represents only 8% of total electric generation by 2035. As of 2010, renewable resources generated approximately 3% of the region's electricity. Both CES options reduce electric generation for the region as a whole.

Table 5. Southeastern Electrical Generation 2035 (billions of kWh)

	BAU	BCES	HCES
Coal	599.69	241.4	258.04
	%change	-60%	-57%
Petroleum	16.77	15.15	16.2
	%change	-10%	-3%
Natural Gas	264.43	317.4	309.48
	%change	20%	17%
Nuclear	352	581.45	539.19
	%change	65%	53%
Pumped Storage/Other	-1.39	-1.4	-1.41
	%change	1%	1%
Renewables	62.82	106.11	99.68
	%change	69%	59%
Distributed Generation	0.04	0	0
	%change	-100%	-100%
Total	1294.34	1260.12	1221.19
	%change	-3%	-6%

*Chart represents combined electrical generation in FRCC, SRDA, SRCE, SRSE and SRVC
%change represents the CES scenario generation figures divided by the BAU generation figures*

Overall, the largest changes for the Southeast from the CES options are the decline of coal-fired electric generation and the increase of nuclear energy as percentages of total electricity supply. While renewable energy and natural gas generation increase under both CES options over the BAU scenario, the increases are not as significant as the changes in coal and nuclear generation.

Chart 3. Southeastern Electrical Generation Mix by Type (2035)

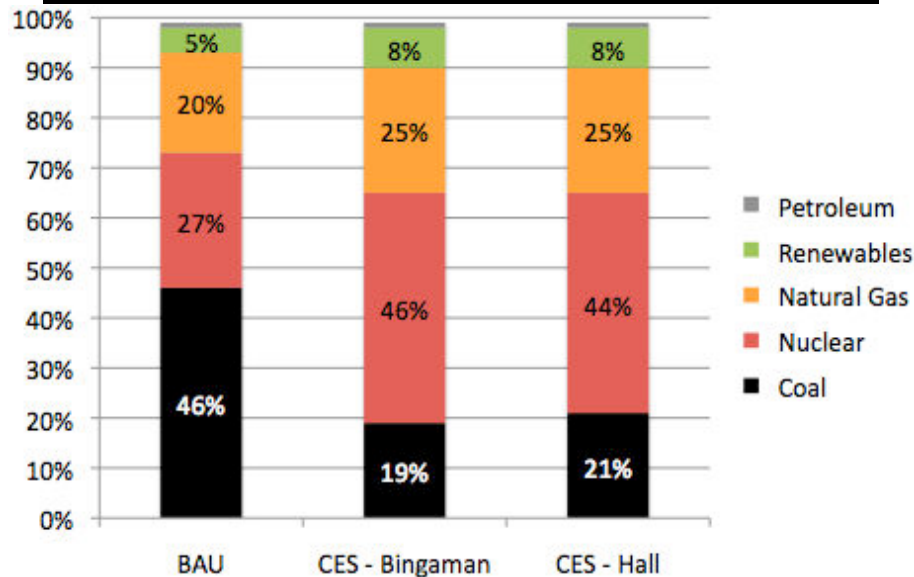


Chart represents combined electrical generation in FRCC, SRDA, SRCE, SRSE and SRVC

Even though both BCES and HCES scenarios appear to result in similar electric generation ratios for the Southeast, perhaps the most striking effect of both scenarios is how they affect all other regions. Effectively, under both CES scenarios, the Southeast becomes the nation's predominant source of nuclear energy. Under the BAU scenario, the Southeast is expected to generate 41% of all the nuclear energy in the country. The HCES scenario increases the nation's reliance on nuclear; however, the Southeast's proportion of nuclear energy increases to about 48%, or almost half of the country's total. Under the BCES, total generation by nuclear energy declines for the country; but nuclear energy generation increases in the Southeast. By 2035, under the BCES scenario, the Southeast retains 74% of the country's nuclear power generation. So while one-half to three-fourths of the nation's nuclear power resides in the Southeast with a CES, the region generates only about one-tenth of the nation's renewable energy.

Under both CES options, overall electricity costs increase. Costs increase less under the BCES option, but still by nearly 20% over BAU. Compared to BAU, HCES increases total average costs by 29%; however, costs increase less for three out of the five Southern regions shown in Table 6 below.

Table 6. Southeastern Electricity Costs 2035 (cents/kWh)

	BAU	BCES	HCES
FRCC	11.2	13.6	15
	<i>%change</i>	21%	34%
SERC Delta	7.5	9.7	7.3
	<i>%change</i>	29%	-3%
SERC Southeast	8.5	10.3	9.9
	<i>%change</i>	21%	16%
SERC Central	6	10.2	8.8
	<i>%change</i>	70%	47%
SERC VACAR	8.3	11.2	9.8
	<i>%change</i>	35%	18%
U.S. Average	9.4	11.3	12.1
	<i>%change</i>	20%	29%

%change represents the CES scenario costs per kilowatt hour figures divided by the BAU costs

Clean Energy Standard Electric Generation Implications for FRCC

The Florida Reliability Coordinating Council covers most of Florida. For FRCC, a Clean Energy Standard is likely to reduce electricity generation from coal and natural gas, but significantly increase generation from nuclear energy. Total electric generation increases over the BAU scenario under both CES scenarios, perhaps indicating less energy efficiency deployment.

Table 7. Florida Reliability Coordinating Council Electrical Generation 2035
(billions of kWh)

	BAU	BCES	HCES
	67.36	28.62	19.28
Coal	%change	-58%	-71%
	11.87	11.59	12.22
Petroleum	%change	-2%	3%
	132.13	104.42	99.58
Natural Gas	%change	-21%	-25%
	30.81	106.4	112.03
Nuclear	%change	245%	264%
	1.18	1.18	1.18
Pumped Storage/Other	%change	0%	0%
	3.79	7.93	6.28
Renewables	%change	109%	66%
	0.01	0	0
Distributed Generation	%change	-100%	-100%
	247.15	260.13	250.57
Total Electric Generation	%change	5%	1%

Coal-based electric generation in FRCC declines 58% to 71% under the BCES and HCES options compared to the BAU scenario, respectively. In 2035, coal represents approximately 11% to 8% of total generation in FRCC in 2035. Natural gas electric generation declines between 21% and 25%, and represents approximately 40% of total generation. Nuclear energy nearly triples under both CES options, and becomes the leading source of electric generation in FRCC with 41% to 45% of total electric generation. Renewable energy also benefits from a CES and nearly doubles by 2035; however, total contribution to electric generation by renewable energy reaches only about 3 percent by 2035 under both CES options.

Clean Energy Standard Electric Generation Implications for SRDA

The Southern Electric Reliability Council Delta (SRDA) subregion coordinates electricity grid control for portions of Arkansas, Louisiana, Mississippi and Texas. For SRDA, a Clean Energy Standard is likely to reduce electricity generation from coal, but significantly increase generation from natural gas. Depending on the scenario, nuclear energy either drastically decreases (as in the BCES scenario), or remains neutral (under the BAU and HCES scenarios). Renewable energy increases over the BAU scenario. Total electric generation increases (HCES) or decreases (BCES) over the BAU scenario.

Table 8. Southern Electric Reliability Corporation – Delta Electrical Generation 2035
(billions of kWh)

	BAU	BCES	HCES
Coal	48.45	29.91	18.37
	%change	-38%	-62%
Petroleum	0.3	0.29	0.24
	%change	-3%	-20%
Natural Gas	53.25	83.58	84.11
	%change	57%	58%
Nuclear	43.68	11.65	43.68
	%change	-73%	0%
Pumped Storage/Other	-0.01	-0.01	-0.01
	%change	0%	0%
Renewables	3.23	8.88	5.97
	%change	175%	85%
Total	148.9	134.31	152.36
	%change	-10%	2%

Coal-based electric generation declines 38% to 62% under the BCES and HCES options compared to the BAU scenario, respectively. In 2035, coal represents approximately 12% to 22% of total generation in SRDA in 2035. Natural gas electric generation increases by nearly 60% and represents between 55% and 62% of total generation. Nuclear energy substantially declines (by 73% compared to BAU) under the BCES scenario to represent only 9% of electric generation. Meanwhile, the HCES leaves nuclear generation at the same level as the BAU scenario – 29% of total electric generation. HCES gives credit for existing nuclear generation, which may explain nuclear’s continuance under that policy, but near disappearance under BCES. Renewable energy benefits from a CES and nearly doubles or triples by 2035 depending on the CES scenario; however, total contribution to electric generation by renewable energy reaches just between 4% to 7% percent by 2035 of total electric generation.

Clean Energy Standard Electric Generation Implications for SRCE

The Southern Electric Reliability Council Central (SRCE) subregion covers all of Tennessee, most of Kentucky, and small portions of Alabama, Georgia and Mississippi. For SRCE, a Clean Energy Standard is likely to reduce electricity generation from coal, but significantly increase generation from natural gas. Nuclear energy is likely to remain relatively unchanged. Renewable energy increases from 8% to about 16% under both CES scenarios when compared to the BAU scenario. Total electric generation decreases slightly under both CES scenarios.

Table 9. Southern Electric Reliability Corporation – Central Electrical Generation 2035
(billions of kWh)

	BAU	BCES	HCES
Coal	159.98	99.98	86.75
	%change	-38%	-46%
Petroleum	0.76	0.37	0.37
	%change	-51%	-51%
Natural Gas	13.08	28.69	28.61
	%change	119%	119%
Nuclear	66.56	66.08	71.09
	%change	-1%	7%
Pumped Storage/Other	-0.35	-0.35	-0.35
	%change	0%	0%
Renewables	21.9	39.78	36.72
	%change	82%	68%
Total	261.92	234.56	223.19
	%change	-10%	-15%

Coal-based electric generation declines 38% to 46% under the BCES and HCES options compared to the BAU scenario, respectively. In 2035, coal represents approximately 40% of total generation in SRCE under the CES scenarios. Natural gas electric generation increases by 119% and represents about 13% of total generation for both CES scenarios. Nuclear energy declines by 1% under BCES, but increases 7% under HCES and accounts for approximately 30% of total electric generation. Renewable energy benefits from a CES; however, total contribution to electric generation by renewable energy reaches about 17% percent by 2035 of total electric generation.

Clean Energy Standard Electric Generation Implications for SRSE

The Southern Electric Reliability Council Southeast (SRSE) subregion covers most of Alabama and Georgia and some of Mississippi. For SRSE, a Clean Energy Standard is likely to reduce electricity generation from coal, but significantly increase generation from natural gas and nuclear energy. Depending on the scenario, renewable energy increases slightly (as in the HCES) or declines slightly (as in the BCES). Total electric generation decreases slightly under both CES options.

Table 10. Southern Electric Reliability Corporation – Southeastern Electrical Generation 2035 (billions of kWh)

	BAU	CES - Bingaman	CES - Hall
Coal	166.24	45.41	70.88
	%change	-73%	-57%
Petroleum	0.81	0.34	0.53
	%change	-58%	-35%
Natural Gas	52.4	74.85	79.79
	%change	43%	52%
Nuclear	68.19	137.8	92.02
	%change	102%	35%
Pumped Storage/Other	-0.57	-0.58	-0.58
	%change	2%	2%
Renewables	16.6	16.31	20.48
	%change	-2%	23%
Total	303.67	274.13	263.12
	%change	-10%	-13%

Coal-based electric generation declines 57% to 73% under the HCES and BCES options compared to the BAU scenario, respectively. In 2035, coal represents approximately 17% to 27% of total generation in SRDA under the CES options. Natural gas electric generation increases by about 50% and represents between 27% and 30% of total generation. Nuclear energy substantially increases under both CES scenarios to represent between 35% and 50% of total electric generation. Renewable energy benefits slightly from a CES; however, total contribution to electric generation by renewable energy reaches just 6% to 8% percent by 2035 of total electric generation.

Clean Energy Standard Electric Generation Implications for SRVA

The Southern Electric Reliability Council Virginia-Carolina (SRVA) subregion covers all of North Carolina, South Carolina and most of Virginia. For SRVA, a Clean Energy Standard is likely to reduce electricity generation from coal, but significantly increase generation from natural gas and nuclear energy. Renewable energy also increases significantly under both CES scenarios when compared to the BAU scenario. Total electric generation is relatively unchanged under a CES.

Table 11. Southern Electric Reliability Corporation – Virginia-Carolina Electrical Generation 2035 (billions of kWh)

	BAU	BCES	HCES
Coal	157.66	37.48	62.76
	%change	-76%	-60%
Petroleum	3.03	2.56	2.84
	%change	-16%	-6%
Natural Gas	13.57	25.86	17.39
	%change	91%	28%
Nuclear	142.76	259.52	220.37
	%change	82%	54%
Pumped Storage/Other	-1.64	-1.64	-1.65
	%change	0%	1%
Renewables	17.3	33.21	30.23
	%change	92%	75%
Distributed Generation	0.03	0	0
	%change	-100%	-100%
Total	332.7	356.99	331.95
	%change	7%	0%

Coal-based electric generation declines 60% to 76% under the HCES and BCES options compared to the BAU scenario, respectively. In 2035, coal represents 10% to 19% of total generation in SRVA under the CES scenarios. Natural gas electric generation increases between 28% and 91% and represents about 6% of total generation for both CES scenarios. Nuclear energy substantially increases 54% to 82%. Nuclear energy accounts for approximately 54% to 82% of electric generation under a CES by 2035. Renewable energy nearly doubles from a CES; however, total contribution to electric generation by renewable energy reaches about 9% percent by 2035 of total electric generation.

Political Analysis

Near-term Impacts of Passage of a CES

After major legislative issues have been completed, it has been recently and frequently found that Congress declines to take up large, comprehensive legislation regarding similar issues. For recent examples, examine the after-effects of the American Recovery and Reinvestment Act (the Stimulus), the Affordable Healthcare Act (Obamacare) and American Clean Energy and Security Act (a cap and trade climate bill). If a CES is passed in the 113th Congress (which seems tenuous to predict at this point), it is likely that cap and trade legislation or a true renewable portfolio/energy standard will be effectively dead policy options - potentially past another presidential election cycle, or even longer. Aside from a potential lack of political will in a post-CES Congress, there may be a strong push to evaluate the effectiveness of the passed CES legislation prior to attempting to change it. In order to pass such a comprehensive bill, language placed in a CES could also hinder or prohibit the Environmental Protection Agency (EPA) from implementing federal greenhouse gas emission regulations as required by the 2007 Supreme Court decision in *Massachusetts vs. EPA*.⁸

Organized Industry Opposition and Support

The BCES and HCES options will illicit at least some response from the various industries analyzed. Already, the National Hydropower Association has criticized the BCES analysis for its failure to support hydropower.⁹ The BCES and HCES options offer some insights into how each industry trade group will react to the proposed variables. For example, for the BCES option, the coal industry is likely to be the major opposition along with hydropower industries, while nuclear, natural gas, wind, biomass and solar energy associations would likely support some elements. For the HCES option, again coal is likely to be the major opposition, but most other industries are only likely to request slight modifications to the policy variables to better improve their market penetration.

Table 12. National Generation Changes As Percentage of Impact Over BAU 2035

	BCES	HCES
Coal	-52%	-56%
Natural Gas	+53%	+30%
Nuclear	-10%	+30%
Wind	+121%	+89%
Biomass	+63%	+55%
Solar	+14%	+10%
Hydropower	-1%	+2%
Geothermal	+17%	+17%
Petroleum	-9%	-4%
Other	0%	0%

Same as Table 3.

Conclusions

The Clean Energy Standard as a policy tool has historically defined “clean energy” as renewable energy along with other “low carbon” technologies, including nuclear, natural gas, and coal that employs carbon capture and sequestration. These qualifying technologies are meant to make up some large portion of the U.S. electricity mix several decades into the future, with various CES recommendations coalescing around an 80% mix of “clean energy” by the year 2035.

Both the BCES and HCES scenarios would deliver significant reductions in greenhouse gases; however, neither option is guaranteed to achieve a level of greenhouse gas emission reduction necessary to stave off the worst effects of climate change. Under both options (BCES and HCES) natural gas represents the largest sources of U.S. electricity generation by 2035, with nuclear energy and coal energy contributing the second or third largest amount. Neither option raises renewable energy past 21% of total electricity generation by 2035. Nuclear energy greatly expands in the Southeast, while renewable energy remains a very small portion of total electric generation for the region under the CES options. The political viability of a CES in the 113th Congress is debatable. If a CES is passed, it is likely to be more difficult to pass other comprehensive energy or climate change legislation, which would have the potential to reduce carbon pollution and increase the market penetration of renewables.

Addendum

Updated Analysis on the Clean Energy Standard Act of 2012

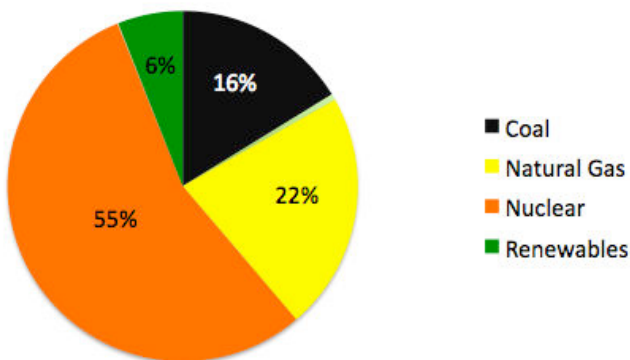
Senator Jeff Bingaman (D-NM) introduced the *Clean Energy Standard Act of 2012* (S. 2146) on March 1, 2012. The legislation (CESA) does not have a House of Representatives companion bill, but it does have 10 cosponsors (all democrats) and a hearing was held on the bill in May 2012. With exact text from a piece of legislation, the Energy Information Administration (EIA) completed a new analysis on CESA. EIA's new analysis included new estimates for many sources of generation resources (such as natural gas and solar energy), which confounded the ability to directly and easily compare CESA to the two other EIA analyses. The chart below is from the new EIA analysis, with updated Business-As-Usual (BAU) figures and effects of CESA on the Southeast.

Aside from some very minor policy changes from the BCES scenario, the changes in figures provided by EIA under CESA is also a result of new cost estimates from the EIA. This Addendum should serve as a reminder that all the figures throughout this paper are reliant on best available information at the time, but that information may still remain incomplete or incorrect in the years to come. Disruptive technologies (especially lower-cost technologies) could substantially alter the mix of our electric generation to look radically different than forecasted by the EIA.

Table 13. Southeastern Electrical Power Sector Generation under CESA 2035
(billions of kWh)

	BAU	CESA
Coal	566.18 %change	224.87 -60%
Petroleum	10.59 %change	7.63 -28%
Natural Gas	330 %change	304.77 -8%
Nuclear	352.39 %change	764.44 117%
Pumped Storage/Other	-1.44 %change	-0.92 -36%
Renewables	65.48 %change	83.16 27%
Distributed Generation	0.04 %change	0 -100%
Total	1412.92 %change	1383.97 -2%

**Chart 4. Southeastern Electrical Power
Sector Generation Mix Under CESA
(2035)**



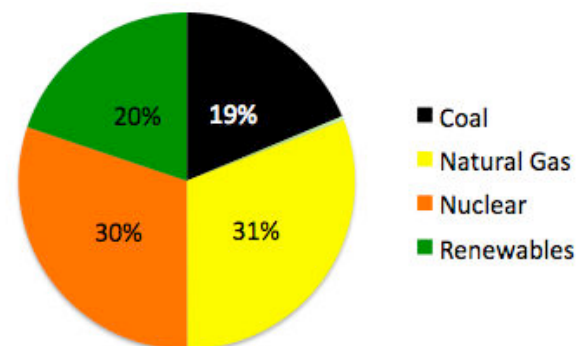
**Numbers do not add due to rounding, and smaller generation resources such as petroleum not highlighted here.*

Under CESA, the Southeast would gain minimal renewable energy while the nuclear energy supply would significantly increase. Nuclear energy would become the predominant electricity generation resource and half of the country's nuclear generation would be located in the Southeast under CESA. Renewable energy, including hydropower, would supply just 6% of the region's electricity generation by 2035. This means that CESA would enable fewer renewables and more nuclear energy than either BCES or HCES options for the Southeast. Natural gas usage is also reduced in the Southeast under CESA. Nationally, natural gas and nuclear reactors would each make up about 30% of the country's electrical generation, with approximately 20% each from coal and renewables by 2035.

**Table 14. National Electrical Generation
under CESA 2035 (Gigawatt Hours)**

	BAU	CESA
Coal	1951	901
	%change	-54%
Petroleum	32	18
	%change	-44%
Natural Gas	1368	1483
	%change	8%
Nuclear	894	1452
	%change	62%
Renewables	791	953
	%change	20%
Total	5,056	4828
	%change	-5%

**Chart 5. National Electrical Generation
Mix Under CESA (2035)**



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- ⁴ House of Representatives Committee on Science and Technology. (2011, Oct. 24). "Hall Releases EIA Report on President Obama's Proposed Clean Energy Standard," [<http://science.house.gov/press-release/hall-releases-eia-report-president-obama%E2%80%99s-proposed-clean-energy-standard>].
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- ⁷ United States Environmental Protection Agency. (2012, April). U.S. Greenhouse Gas Inventory Report, [<http://www.epa.gov/climatechange/ghgemissions/usinventoryreport.html>].
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- ⁹ National Hydropower Association. (2011, November 30). "EIA Releases Analysis of Bingaman CES Proposal," [<http://hydro.org/wp-content/uploads/2011/12/2011-11-30-Statement-EIA-CES-Analysis-FINAL.pdf>].