



**Congressional
Research Service**

Informing the legislative debate since 1914

Clean Energy Standards: Selected Issues for the 117th Congress

Updated November 2, 2021

Congressional Research Service

<https://crsreports.congress.gov>

R46691



R46691

November 2, 2021

Ashley J. Lawson
Analyst in Energy Policy

Clean Energy Standards: Selected Issues for the 117th Congress

For many years, policies to reduce greenhouse gas (GHG) emissions have been of interest to Congress. Congressional and constituent interest continues in the 117th Congress. One option to reduce GHG emissions from electricity generation is a clean energy standard.

A clean energy standard (CES), sometimes called a clean electricity standard, is a policy that requires a minimum share of electricity to be generated from eligible “clean” sources. No universal definition of clean energy exists, and proposals differ in what technologies are included. Some proposals, usually referred to as a renewable portfolio standard (RPS), include only certain renewable energy sources (e.g., solar), while other proposals also include nuclear power, fossil fuels equipped with carbon capture and storage (CCS) technology, certain natural gas technologies, or other energy sources. As of 2020, thirty states and the District of Columbia have implemented a CES, including 10 jurisdictions that will ultimately require 100% of covered electricity sales to come from eligible clean energy sources. In addition, eight states have nonbinding goals of carbon-free electricity, and many utilities have committed to reducing their GHG emissions to varying degrees and over different time frames. State targets and utility goals cover 77% of total U.S. electricity sales, with 69% of total sales covered by a carbon-free target or goal.

Members of Congress have demonstrated a long-standing interest in CES policies, with proposals for a national CES dating at least to 1997. None has been enacted. Most recently, four bills introduced to date in the 117th Congress would establish a national CES (sometimes in conjunction with other policies). The measures differ in eligible sources, final targets, and implementation details. For example, one bill would require 70% of covered electricity sales to come from new renewable energy sources by 2030. Another bill would establish CES targets consistent with 80% reductions in electricity GHG emissions. The 116th Congress considered but did not enact seven similar CES bills.

The Biden Administration has expressed support for a 100% CES as part of its commitment to reduce U.S. GHG emissions by 50%-52% from 2005 levels by 2030. A Clean Electricity Performance Program (CEPP) was proposed to help achieve this goal. The proposed CEPP would aim to achieve the same goals as a CES but through a different policy structure (one designed to meet requirements for passage through budget reconciliation). For context, renewable sources made up 21% of U.S. electricity generation in 2020, nuclear power made up 20%, natural gas made up 40%, and coal (without CCS) made up 19%. In February 2021, the U.S. Energy Information Administration (EIA) projected the share of total U.S. electricity generation coming from renewable sources in 2050 might vary from 33% to 57%, depending on factors such as future energy prices and economic growth. The share from all nonemitting sources (i.e., renewables and nuclear) in 2050 varied from 44% to 67% in the projections, and the share from nonemitting sources together with natural gas varied from 86% to 93%.

Concerns and criticisms raised against a CES include its potential to reduce electric reliability, increase electricity rates, and negatively impact environmental justice efforts. To a certain extent, a CES policy can be designed to address these concerns, and some bills have included provisions to do so. Efforts to address one impact could exacerbate others, though uncertainty remains on potential impacts of any specific policy. For example, multiple studies have evaluated the cost of achieving a 100% CES policy, with estimates ranging from \$106 billion to over \$2 trillion in cumulative costs. Some studies have also estimated monetary benefits of a 100% CES, finding \$715 billion to \$1.7 trillion in cumulative benefits. In all cases where costs and benefits were both estimated, studies found that benefits outweighed costs.

The future makeup of the U.S. electricity system might affect congressional perceptions of the necessity or feasibility of a CES. Estimating the future energy system makeup typically is challenging, especially over 15 years or more (i.e., the time periods covered by recent CES proposals). Another complicating factor is the possibility that the 117th Congress could change U.S. energy policy (not including consideration of a CES). For example, infrastructure legislation under consideration aims to accelerate deployment of certain kinds of clean energy technologies. Additionally, noncongressional action, such as executive actions or state policies, could affect the U.S. electricity system. The interactions among some or all of these factors might be relevant, should Congress choose to debate a CES.

Contents

Introduction	1
Bills Introduced in the 117 th and 116 th Congresses	2
Potential Considerations.....	4
Putting a 100% Target in Context	8
Current Clean Energy Use.....	8
State Targets and Utility Commitments	9
Outlook for Clean Energy in the U.S. Electricity System	10
Concluding Observations.....	12

Figures

Figure 1. 2020 U.S. Electricity Generation by Source Type.....	9
Figure 2. Projected Share of Total U.S. Electricity Generation, by Source Type	11

Tables

Table 1. National Clean Energy Standard (CES) Legislative Proposals in the 117 th and 116 th Congresses.....	3
Table 2. Cost and Benefit Estimates for 100% Clean Energy Standards	6

Contacts

Author Information	12
--------------------------	----

Introduction

Congress continues to study and discuss a range of policies to reduce U.S. greenhouse gas (GHG) emissions, and the Biden Administration has made reducing GHG emissions a priority. Several legislative and executive actions could achieve such a goal. One legislative option, targeting the U.S. electricity system, is a clean energy standard.

A clean energy standard (CES), sometimes called a clean electricity standard, aims to increase the share of U.S. electricity generated from qualified clean energy sources. No agreed-upon definition of “clean energy” exists, so the exact set of energy sources supported by a CES proposal is one of its defining characteristics. Members of Congress have introduced legislation to establish a national clean energy standard in every Congress since at least the 105th (1997-1998).¹

The Biden Administration has expressed support for a CES as a key policy to reduce U.S. GHG emissions by 50%-52% from 2005 levels by 2030, the target President Biden announced pursuant to the Paris Agreement.² For example, the American Jobs Plan includes a 100% CES, and the Department of Energy’s FY2022 budget request included funding for “programmatic infrastructure” for a CES.³ An executive order issued January 27, 2021, also states the goal to “achieve or facilitate a carbon pollution-free electricity sector no later than 2035.”⁴ A Clean Electricity Performance Program (CEPP; also called a Clean Electricity Payment Program)—which would aim to achieve similar outcomes as the Biden Administration’s proposed CES, albeit through a different policy structure—was proposed as part of the FY2022 budget reconciliation process. Details of the program were included in House Committee on Energy and Commerce budget reconciliation legislative recommendations, debated in August 2021. The CEPP text was not included, however, in updated budget reconciliation language released in October 2021 by the House Rules Committee.⁵

As of 2020, 30 states and the District of Columbia have a CES.⁶ Of these, 12 are to require all covered electricity sales to come from eligible clean energy sources: California, Colorado, the

¹ Seven of these measures were passed in at least one chamber, in all cases as part of comprehensive energy or environmental legislation. No CES provision was enacted into law. For more information, see CRS In Focus IF11316, *A Brief History of U.S. Electricity Portfolio Standard Proposals*, by Ashley J. Lawson. Past proposals have used alternative names such as renewable portfolio standard (RPS) or clean electricity standard. An RPS includes only renewable sources while a clean energy (or electricity) standard typically also includes nonrenewable sources like nuclear power. Most policy considerations apply equally to RPS or CES. For simplicity, this report generally uses the term CES to refer to any policy that would require certain sources be used for electricity generation, reflecting the predominant usage in the proposals in the 116th and 117th Congresses. For more information about CES, see CRS Report R45913, *Electricity Portfolio Standards: Background, Design Elements, and Policy Considerations*, by Ashley J. Lawson.

² White House, “Fact Sheet: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies,” April 22, 2021. For discussion of the Paris Agreement, see CRS In Focus IF11746, *United States Rejoins the Paris Agreement on Climate Change: Options for Congress*, by Jane A. Leggett.

³ The American Jobs Plan includes an Energy Efficiency and Clean Electricity Standard aimed at “100 percent carbon-pollution free power by 2035.” White House, “Fact Sheet: The American Jobs Plan,” March 31, 2021; and U.S. Department of Energy, “Budget in Brief,” June 2021, p. 1.

⁴ Executive Order 14008, “Tackling the Climate Crisis at Home and Abroad,” 86 *Federal Register* 7619, February 1, 2021. Campaign quote comes from <https://joebiden.com/clean-energy/#>, accessed January 15, 2020.

⁵ For further discussion, see CRS Report R46934, *The Clean Electricity Performance Program (CEPP): In Brief*, by Ashley J. Lawson.

⁶ Some of these states have an RPS in place, setting goals for renewable energy use only. Three U.S. territories also have an RPS. Eight additional states and one additional territory have voluntary renewable portfolio goals in place.

District of Columbia, Hawaii, Illinois, Massachusetts, New Mexico, New York, North Carolina, Oregon, Virginia, and Washington.⁷ Additionally, at least eight states have nonbinding goals of 100% covered electricity sales from eligible clean energy sources: Connecticut, Louisiana, Maine, Michigan, Nevada, New Jersey, Rhode Island, and Wisconsin.⁸

Experts disagree about the extent to which achieving a 100% CES presents cost or feasibility challenges. Assessing the cost and feasibility of a 100% CES is beyond the scope of this report. This report provides some analysis and discussion to inform potential CES policy debate in the 117th Congress, including a summary of CES proposals to date in the 117th and 116th Congresses.

Bills Introduced in the 117th and 116th Congresses

CRS identified four bills introduced in the 117th Congress to date and seven bills introduced in the 116th Congress that would establish a national clean energy standard.⁹ **Table 1** summarizes the CES proposals identified in these 11 bills, focusing on two key policy features: the final target and eligible sources. The final target is typically expressed as the maximum required share of covered electricity sales to come from eligible sources and the year by which that share is to be met. Final targets for many state CES policies and past legislative proposals apply uniformly across all utilities (i.e., all utilities have to meet the same percentage in the same year); however, several bills included in **Table 1** set targets for each utility individually. This distinction is noted in the table. Eligible sources refer to the energy sources that may be used for compliance with the CES. Bills defined eligible sources by either source type (e.g., renewable energy, nuclear power) or carbon intensity (i.e., the volume of GHG released per unit of electricity generated).

N.C. Clean Energy Technology Center Database of State Incentives for Renewables & Efficiency (DSIRE), *Renewable Portfolio Standards and Clean Energy Standards*, September 2020.

⁷ The District of Columbia, Hawaii, Massachusetts, and Virginia each require 100% of covered electricity sales to come from renewable energy sources. The dates for achieving those targets vary. In some jurisdictions (e.g., Colorado, North Carolina), only investor-owned utilities meeting size requirements are covered. In 2020, Arizona regulators approved a 100% CES, but the policy is not yet finalized. Additionally, Puerto Rico has a 100% RPS.

⁸ Generally, a nonbinding goal has no penalty for failing to meet it, while a binding goal or a requirement does. Some nonbinding goals were enacted through legislation, while others were adopted by executive order. The group Clean Energy States Alliance (CESA) tracks state goals and provides a table with more information about state clean energy targets. CESA, “States with 100% Clean Energy Goals,” at <https://www.cesa.org/projects/100-clean-energy-collaborative/guide/table-of-100-clean-energy-states/>. As of the time of this writing, CESA identifies the eight states listed in the body of this report. Governors in other states, such as North Dakota and Wyoming, have made public statements supporting carbon reductions in their states, though not necessarily carbon-free electricity generation. See Adam Willis, “Gov. Doug Burgum Calls for North Dakota to be Carbon Neutral by 2030,” *Grand Forks Herald*, May 12, 2021; and Mead Gruver, “Governor of Top Coal-Mining State Sets Carbon-Negative Goal,” *AP*, March 2, 2021.

⁹ Bills were identified by searching [Congress.gov](https://www.congress.gov) using the phrases “clean energy standard,” “clean electricity standard,” “clean energy,” “renewable electricity,” “renewable energy,” and “renewable portfolio standard” in full bill text or bill summaries. Search results were refined by including only the Subject-Policy Area terms “Energy” and “Environmental Protection.” Some bills contained policy provisions other than CES, but those other policies are not summarized in this report.

Table I. National Clean Energy Standard (CES) Legislative Proposals in the 117th and 116th Congresses

Short Title	Bill Number(s)	Final Target	Eligible Sources	Selected Distinguishing Feature(s)
117th Congress				
CLEAN Future Act	H.R. 1512	100% by 2035	Renewables, nuclear, CCS, natural gas	Targets set individually for every electric utility. Certain sources must account for GHG emissions during production and transport of fuel. Direct air capture eligible for credits. Eligible sources must meet defined labor standards.
American Renewable Energy Act of 2021	H.R. 3959	70% by 2030	Renewables, excluding existing hydropower	Carve outs for distributed generation and generation located in defined impacted communities.
Clean Energy Future Through Innovation Act of 2021	H.R. 4153	80% reductions in power sector emissions by 2050	Any source with annual carbon intensity less than 0.82 metric tons carbon dioxide per megawatt-hour	The CES comes into effect 10 years after enactment, or earlier if defined market penetration criteria are met for certain technologies (e.g., coal-fired power plants with CCS).
Clean Energy Innovation and Deployment Act of 2021	H.R. 4309	100% by 2050	Renewables, nuclear, CCS, natural gas	Targets set individually for every electric utility. Emissions reductions outside the power sector (e.g., electrified space heating, electric vehicle charging, direct air capture) covered by the CES.
116th Congress				
Climate Solutions Act of 2019	H.R. 330	100% by 2035	Renewables	Additional policy details not set in legislation; instead, to be determined by DOE regulations.
Clean Energy Standard Act of 2019	S. 1359 / H.R. 2597	100% by 2050, or potentially later for some utilities	Renewables, nuclear, CCS, natural gas	Targets set individually for every electric utility up to 90% before 2040, then increasing 1 percentage point each year after utility reaches 90%.
Renewable Electricity Standard Act	S. 1974	1.5 percentage points greater than 2019 levels in 2020; increasing by 2 percentage points annually for 2021-2029 and by 2.5 percentage points annually for 2030-2035	Renewables	Targets set individually for every electric utility.

Short Title	Bill Number(s)	Final Target	Eligible Sources	Selected Distinguishing Feature(s)
Clean Energy Innovation and Deployment Act of 2020	H.R. 7516	100% by 2050	Renewables, nuclear, CCS, natural gas	Targets set individually for every electric utility. Emissions reductions outside the power sector (e.g., electrified space heating, electric vehicle charging, direct air capture) covered by the CES.
American Renewable Energy and Efficiency Act	H.R. 9036	91% by 2039	Renewables	Program administered by the Federal Energy Regulatory Commission (as opposed to DOE)
Clean Energy Future Through Innovation Act of 2020	H.R. 9054	80% reductions in power sector emissions by 2050	Any source with annual carbon intensity less than 0.825 metric tons carbon dioxide per megawatt-hour	CES comes into effect 10 years after enactment, or earlier if defined market penetration criteria are met for certain technologies (e.g., coal-fired power plants with CCS).

Source: Prepared by CRS.

Notes: DOE = U.S. Department of Energy; CCS = fossil fuel-fired power plants equipped with carbon capture and sequestration. Bills for each Congress are listed in chronological order by date of introduction. Final target is the maximum share of eligible clean energy sources to be used for electricity generation required by the CES, and the year by which that share is to be met. Carbon intensity refers to the volume of greenhouse gases released per unit of electricity generation. Bills may have additional eligibility requirements for some sources beyond those listed here (e.g., limitations on biomass sources, minimum carbon intensity requirements for natural gas, consideration of upstream methane emissions for fossil fuels). Some bills contain additional policy provisions.

Other legislation introduced in the 117th and 116th Congresses would address energy sources for electricity generation directly (e.g., fossil fuel bans, net-zero emissions target) or indirectly (e.g., tax incentives for certain sources), but these measures are not discussed in this report. This report also does not discuss carbon pricing proposals, although they, too, could potentially affect the share of electricity coming from different sources.¹⁰

Potential Considerations

A number of stakeholders—including the Biden Administration, some Members of Congress, some climate change advocates, and some utilities—have voiced support for enacting a CES in the 117th Congress, though with some disagreement over policy details.¹¹ Among both policy

¹⁰ In carbon pricing proposals, policymakers attach a price to GHG emissions or the inputs that create them. A price on emissions or emissions inputs—namely fossil fuels—would increase the relative price of the more carbon-intensive energy sources. This result is expected to spur innovation in less carbon-intensive technologies and stimulate other behavior that may decrease emissions. A summary of carbon pricing bills is provided in CRS Report R45472, *Market-Based Greenhouse Gas Emission Reduction Legislation: 108th Through 117th Congresses*, by Jonathan L. Ramseur.

¹¹ See example statements in Ben Geman, “Exclusive: The Big Push for a Clean Power Mandate,” *Axios*, April 26, 2021; Miranda Willson, “Clean Electricity Standard: A Boost for Coal?,” *E&E News*, May 18, 2021; and Zack Budryk, “More Than 75 Companies Ask Congress to Pass Clean Electricity Standard,” *The Hill*, July 7, 2021.

supporters and opponents, several concerns and criticisms have been raised against a national CES. To a certain extent, a CES can be designed to address these concerns. In some cases, efforts to address any one concern could exacerbate others.

One consideration concerns nuclear power and carbon capture. Electricity generation using these technologies generally receives policy support under most CES proposals, often at a level comparable to electricity generation from renewable energy sources. Some environmental justice advocates and others oppose policy support for these technologies for various reasons.¹² For example, the White House Environmental Justice Advisory Council included nuclear and CCS in its list of “projects that will not benefit a community.”¹³ ACES is widely viewed as being supportive of nuclear power and carbon capture projects, in contrast with a renewable portfolio standard (RPS) that supports renewable energy only. Some CES proposals attempt to address environmental justice concerns, either by excluding nuclear and carbon capture or through other provisions. For example, the American Renewable Energy Act of 2021 (H.R. 3959) would establish an RPS that also includes a carve out aimed at incentivizing the development of renewable energy projects in defined “environmental justice communities,” among others.

A second consideration is electricity affordability, a topic of long-standing interest to Congress and one receiving particular attention during the COVID-19 pandemic.¹⁴ Many studies estimate a CES would increase national average electricity prices compared with what they would be without one. **Table 2** summarizes cost estimates from studies of 100% clean energy standards or clean energy standards with comparable goals.¹⁵ Some studies attempted to model specific policy details from bills listed in **Table 1**, while others modelled 100% CES policies in general. Given the uncertainty in projecting power sector conditions in the future (even over the relatively short period of 10-15 years), none of these studies individually is likely to correctly project future costs. However, the range of cost estimates in these studies is likely a good indicator of the range of outcomes should a 100% CES policy be enacted, assuming policy details are generally similar to those assumed in these studies.¹⁶

¹² See discussion and points of view summarized in, for example, Letter from Center for Biological Diversity et al. to Sen. Chuck Schumer, Majority Leader, Rep. Nancy Pelosi, Speaker of the House, Sen. Joe Manchin, Chairman of the Energy & Natural Resources Committee, and Rep. Frank Pallone, Chairman of the Energy & Commerce Committee, May 12, 2021, at https://www.biologicaldiversity.org/programs/energy-justice/pdfs/2021-5-12_600-Group-Letter-for-RES.pdf; U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Environment and Climate Change, *The CLEAN Future Act and Environmental Justice: Protecting Frontline Communities*, 117th Cong., 1st sess., April 15, 2021; and Anthony Adragna, “Democrats’ Next Big Fight: What Exactly Is Clean Energy?,” *Politico*, April 30, 2021.

¹³ White House Environmental Justice Advisory Council, *Final Recommendations: Justice40, Climate and Economic Justice Screening Tool and Executive Order 12898 Revisions*, May 21, 2021, p. 59.

¹⁴ For example, many states implemented moratoria on service disconnections for nonpayment (i.e., shut-offs) in 2020 so that individuals could maintain access to electricity during stay-at-home orders. For further discussion, see CRS Report R46401, *COVID-19 Electric Utility Disconnections*, by Richard J. Campbell and Ashley J. Lawson.

¹⁵ One group modelled an 80% clean by 2030 standard on the grounds that “the Biden administration goal of 100 percent clean power by 2035 implies an interim goal of at least 80 percent by 2030.” Mike O’Boyle et al., *A National Clean Electricity Standard to Benefit All Americans*, Energy Innovation, April 2021, p. 1. Some modelling groups identified in **Table 2** are collaborations among researchers from several organizations (e.g., the Clean Energy Futures Project). Media and other reports of these studies may refer to them by different names, such as one member of the group. **Table 2** excludes studies that looked at decarbonization in general but not a CES specifically.

¹⁶ The range of cost estimates in **Table 2** probably do not reflect likely outcomes of the proposed CEPP, because that policy is expected to shift costs from electricity customers to federal taxpayers, relative to a CES. Lindsey Walter, *Don’t Call It a Standard: What’s Unique About the Clean Electricity Payment Program (CEPP)*, Third Way, August 12, 2021.

Table 2. Cost and Benefit Estimates for 100% Clean Energy Standards

Modelling Group	Policy Details	Policy Costs, Relative to Business-as-Usual	Policy Benefits, Relative to Business-as-Usual	Notes
Resources for the Future	77% clean in 2035	\$106 billion increase in electricity costs; \$29 billion increased federal expenditure for increased use of energy tax credits	\$470 billion in reduced climate change impacts; \$226 billion in reduced premature deaths (due to lower levels of co-pollutants); \$19 billion in increased utility profits	Reported costs and benefits are the net present value of cumulative 2020-2035 costs and benefits.
Electric Power Research Institute	100% clean by 2050	50% increase in national average annual wholesale electricity price in 2050	not calculated	Study also reports changes in wholesale electricity prices by region. Alternative scenarios model a 100% by 2035 CES and variations on policy design elements (e.g., point of regulation, alternative compliance payment).
FTI Consulting	80% clean by 2030 and 100% clean by 2035	0.25% reduction in 2031-2035 average national GDP	not calculated	Costs reported as net GDP impacts, including, for example, economic benefits associated with increased investment in electricity infrastructure. Study also reports impacts in earlier years and by region.
National Bureau of Economic Research	100% clean by 2035	\$1-\$4/MWh increase in national average wholesale electricity price in 2035	not calculated	Study also reports electricity price changes by state.
Goldman School of Public Policy, GridLab, Energy Innovation	80% clean by 2030	6% increase in national average wholesale electricity costs in 2030	\$1.7 trillion in reduced climate change and health impacts (from power sector reductions only)	Policy scenario also includes increased electrification of end uses (e.g., transportation). Study also reports cost estimates with health and environmental externalities included.

Modelling Group	Policy Details	Policy Costs, Relative to Business-as-Usual	Policy Benefits, Relative to Business-as-Usual	Notes
American Action Forum	100% clean by 2035	\$1.8-\$2.13 trillion cumulatively, 2021-2035	not calculated	Costs are for generation assets only. Study also reports changes in customer utility bills.
Clean Energy Futures Project	100% clean by 2040	\$342 billion	\$637 billion in reduced climate change impacts; \$1.13 trillion in health impacts	Costs and benefits are reported as net present value of cumulative benefits 2020-2050. Study also reports air quality improvements by county.
Natural Resources Defense Council and Environmental Defense Fund	80% clean by 2030 or 100% clean by 2035 (study does not report results for individual scenarios)	\$17-\$22 billion annually, on average, through 2030	\$97-\$184 billion in 2030	Net present value of costs and benefits are reported as the range over multiple scenarios. Some scenarios include additional policies, such as tax credit extensions. At least one scenario models a Clean Electricity Payment Program.

Sources: Resources for the Future, “Projected Effects of the Clean Energy Standard Act of 2019,” May 2019, at <https://www.rff.org/publications/issue-briefs/projected-effects-clean-energy-standard-act-2019/>; Electric Power Research Institute, “Analyzing Federal 100% Clean Energy Standards,” February 2021, at <https://www.epri.com/research/products/000000003002020121>; FTI Consulting, “Power Market and Economic Impacts of a U.S. Clean Energy Standard,” March 2021, at <https://www.remi.com/event/scott-nystrom-power-markets-and-economic-impacts-of-a-u-s-clean-energy-standard-ces/>; National Bureau of Economic Research, “Robust Decarbonization of the U.S. Power Sector: Policy Options,” April 2021, at <https://www.nber.org/papers/w28677>; Goldman School of Public Policy, GridLab, and Energy Innovation, “2030 Report: Powering America’s Clean Economy,” April 2021, at <https://energyinnovation.org/wp-content/uploads/2021/04/2030-Report.pdf>; American Action Forum, “The Cost of Clean Generation,” June 2021, at <https://www.americanactionforum.org/research/the-cost-of-clean-generation/>; Clean Energy Futures, “An 80x30 Clean Electricity Standard: Carbon, Costs, and Health Benefits,” July 2021, at <https://cleanenergyfutures.syr.edu/>; Natural Resources Defense Council and Environmental Defense Fund, “80% Clean Power by 2030: Achievable With Massive Benefits,” August 2021, at <https://www.nrdc.org/experts/arjun-krishnaswami/80-clean-power-2030-achievable-massive-benefits>.

Notes: Some studies modelled policies other than 100% CES, but the modellers identified those policies as being comparable in stringency. Differences among studies include assumptions about business-as-usual conditions; the makeup of clean energy sources used to satisfy policy requirements; cost metrics; policy details; and the levels of greenhouse gas emission reductions. As a result, individual studies cannot necessarily be compared with each other. For simplicity, this table shows total national electricity system costs, or the nearest comparable cost estimate provided. Some studies estimated costs for different geographic scope (e.g., by state) or for a different metric (e.g., customer bills). The Notes column lists other reported cost estimates as a research aid.

A third consideration is electricity reliability, another issue of long-standing interest to Congress. Blackouts following extreme weather events in 2020 and 2021 reignited debate about whether

changing energy sources for electricity generation (i.e., increased use of wind and solar energy, decreased use of coal) pose threats to reliability.¹⁷ For example, a House committee held a hearing on the days-long power outages that affected much of Texas in February 2021, and issues of electric reliability and changing energy sources were discussed.¹⁸ Some stakeholders see inclusion of natural gas in a CES as a way to ensure reliability.¹⁹ Another option is to exclude from compliance calculations any emissions from power plants that are required for reliability purposes. The CLEAN Future Act (H.R. 1512, as introduced), for example, includes both these provisions.²⁰

Putting a 100% Target in Context

Current Clean Energy Use

As summarized above, most recent CES proposals would require nearly all electricity to come from eligible clean energy sources in the 2035-2050 timeframe. The distinction between “all” and “nearly all” arises from the policy details provided in some of the proposals. A 100% target does not necessarily require 100% of electricity to come from eligible clean sources. For example, a CES might exempt electricity sales from small utilities or allow alternative compliance payments.²¹ The actual amount of clean energy used would be affected by utility compliance choices, future technology costs, and other factors.

How much clean energy was used in the U.S. electricity sector in 2020? The answer depends upon what sources are considered to be clean, as shown in **Figure 1** and discussed in the following paragraphs. In 2020, renewable energy fueled 21% of U.S. electricity, while renewable energy plus nuclear power fueled 40%.²² These sources together with natural gas fueled 80% of U.S. electricity in 2020.

¹⁷ Wind and solar energy have different operational characteristics than conventional energy sources (e.g., coal, natural gas, nuclear power), and they are variable in nature. Because the electricity grid was primarily designed to accommodate conventional sources that can be called upon as needed (barring extreme events or regular maintenance requirements), some system design and operational changes may be required to integrate large amounts of wind and solar energy. For a discussion of these issues and potential solutions, see CRS In Focus IF11257, *Variable Renewable Energy: An Introduction*, by Ashley J. Lawson.

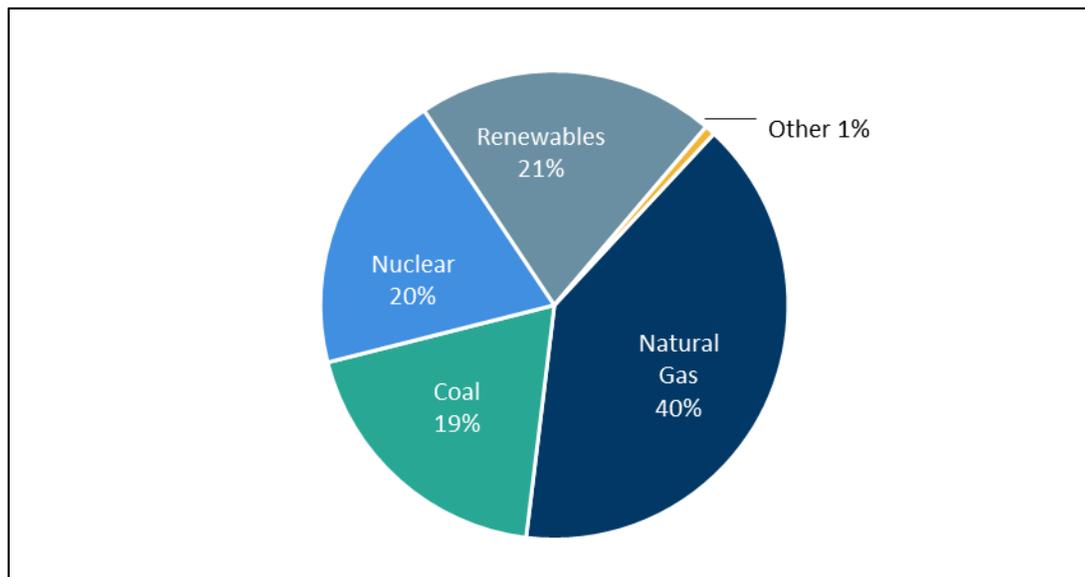
¹⁸ U.S. Congress, House Committee on Energy and Commerce, Subcommittee on Oversight and Investigations, *Power Struggle: Examining the 2021 Texas Grid Failure*, 117th Cong., 1st sess., March 24, 2021. Most experts do not identify changing energy sources as a main contributor to the Texas outages, though some observers see the two issues as being connected. For further discussion, see CRS Insight IN11608, *Power Outages in Texas*, by Richard J. Campbell.

¹⁹ See, for example, Molly Christian and Zack Hale, “Gas Treatment, Infrastructure Tensions Hamper Clean Electricity Standard Efforts,” *S&P Global Market Intelligence*, June 10, 2021.

²⁰ The CLEAN Future Act would set an emissions intensity threshold for eligibility, including greenhouse gas (GHG) emissions associated with fuel production and transport. Some natural gas-fired generators meet the eligibility threshold when considering onsite emissions. It is unclear how many such generators would be eligible after accounting for upstream emissions because the determination would be made pursuant to a to-be-determined U.S. Environmental Protection Agency standard. See the CLEAN Future Act, §204(d).

²¹ The point of regulation can also affect the extent to which a 100% target requires 100% of electricity to come from eligible sources. Regulating load serving entities (typically, distribution utilities), as is frequently the case, can leave “headroom” under the policy due to losses associated with electricity transmission and distribution. See discussion in Electric Power Research Institute, “Analyzing Federal 100% Clean Energy Standards,” February 2021, available at <https://www.epri.com/research/products/000000003002020121>.

²² U.S. Energy Information Administration (EIA), *Monthly Energy Review*, Table 7.2a and Table 10.6, July 2021.

Figure 1. 2020 U.S. Electricity Generation by Source Type

Source: U.S. Energy Information Administration, *Monthly Energy Review*, “Table 7.2a. Electricity Net Generation: Total (All Sectors)” and “Table 10.6. Solar Electricity Net Generation.”

Notes: Other includes petroleum and gases derived from fossil fuels. Details of energy source classification are provided in this report and in the EIA source.

Figure 1 uses the following classifications. Renewable energy means all renewable energy sources, including small-scale and distributed sources (e.g., rooftop solar), all hydropower, and all biomass. Some introduced CES bills would limit the eligibility of hydropower and biomass, for example by specifying types of eligible biomass feedstocks, but those limitations are not considered here. Natural gas means any power plant using primarily natural gas, regardless of technology type or carbon intensity. Some bills would allow natural gas plants to be eligible if they met certain carbon intensity thresholds, but those limitations are not considered here. Should Congress debate a national CES, it could set eligibility criteria based on energy source, carbon intensity, or other characteristics.

State Targets and Utility Commitments

As noted above, eleven states plus the District of Columbia have enacted legislation to achieve carbon-free electricity generation, and at least eight additional states have goals or executive orders targeting carbon-free electricity generation. Beyond these state requirements, some electric companies have made voluntary commitments to reduce GHG emissions from their electricity generation.²³

²³ These utility decarbonization goals vary in stringency, scope, and final target date. The most stringent decarbonization goal is for 100% carbon-free electricity, also referred to as carbon neutral, net zero, or 100% clean. Different terms for decarbonization are sometimes used interchangeably, though they can imply different implementation options. For example, 100% carbon-free generally means all generation sources will be carbon-free, while carbon neutral and net zero potentially leave open the possibility of offsetting some emissions with reductions outside the utility’s generation supply (e.g., retirement of renewable energy credits [RECs] from other states). Many decarbonization target dates are between 2040 and 2050, outside the typical planning horizon for utilities. As a result,

Combined, these state targets and utility commitments cover 77% of U.S. electricity sales.²⁴ The most stringent of these commitments—the carbon-free state targets and the utility commitments of at least an 80% reduction in GHG emissions—cover 69% of U.S. electricity sales.²⁵

Outlook for Clean Energy in the U.S. Electricity System

The possible future makeup of the U.S. electricity system might affect (among other things) congressional perceptions related to the necessity or feasibility of a CES. Estimating the future energy system makeup typically is challenging, especially over multi-decadal periods. The COVID-19 pandemic and other factors make such outlooks especially challenging.

One prominent estimate of future changes in the U.S. energy system is made each year by the U.S. Energy Information Administration (EIA) in its Annual Energy Outlook (AEO).²⁶ The AEO accounts for most federal and state energy policies (e.g., state CES policies) in place at the time of its preparation. In February 2021, EIA released its first long-term projections accounting for the pandemic. In EIA’s assessment, the pandemic’s impacts on the electricity sector will be mostly felt in the next few years. After that, long-term sectoral trends return to dominance: “EIA does not project long-term structural changes in electricity demand resulting from the pandemic, and the AEO2021 Reference case projects that demand largely returns to 2019 levels by 2025.”²⁷

In EIA’s 2021 projections, the share of total U.S. electricity generation coming from renewable sources in 2050 varies from 33% to 57%, depending on factors such as future energy prices and economic growth. The share from nonemitting sources (i.e., renewables and nuclear) in 2050 varied from 44% to 67% in the projections, and the share from nonemitting sources together with natural gas varied from 86% to 93%.²⁸ **Figure 2** compares EIA’s 2021 projections for the share of

many decarbonization targets—regardless of what they are called—do not have associated implementation plans. Because of this uncertainty, it is difficult to assess meaningful differences among terms.

²⁴ Total electricity sales reported by the EIA. The most recent annual data available are for 2019. CRS estimated the share of total U.S. electricity sales covered by a utility commitment by compiling lists of companies with a commitment from three sources: Smart Electric Power Alliance (SEPA), “Utility Carbon Reduction Tracker,” accessed August 23, 2021, at <https://sepapower.org/utility-transformation-challenge/utility-carbon-reduction-tracker/>; Clean Air Task Force (CATF), “State and Utility Decarbonization Commitments,” October 1, 2020; and Jeffrey Ryser, “Utility Emissions, Renewables Goals Accelerate, But Coal Retirements May Be Too Slow,” *S&P Global*, February 25, 2021. In some cases, the names of companies provided by SEPA, CATF, or S&P Global do not match the utility names in the EIA dataset. In these cases, CRS identified corresponding utilities (an exact name match was required to analyze the EIA data) using utility websites and other public documents. Some identified utilities are also covered by a state target. Sales from these utilities were counted once in the final estimate.

²⁵ For this analysis, CRS assessed utility target stringency based on its characterization by SEPA, CATF, and S&P Global. CRS did not independently verify utility targets. Most identified utility targets are based on an absolute (i.e., mass-based) reduction in GHG emissions. For example, a utility might target a 90% reduction in carbon dioxide emissions from 2005 levels by 2050. Some targets are based on relative (i.e., intensity-based) reduction in GHG emissions. In theory, intensity-based reduction targets can be achieved without a reduction in absolute emissions. Estimating future GHG emissions is beyond the scope of this analysis, so no attempt was made to “convert” intensity-based targets into absolute targets. For example, a utility might target a 70% reduction in GHG intensity from 2005 levels by 2040. For purposes of estimating the share of electricity sales covered by commitments, that target is treated the same as a 70% mass-based reduction target.

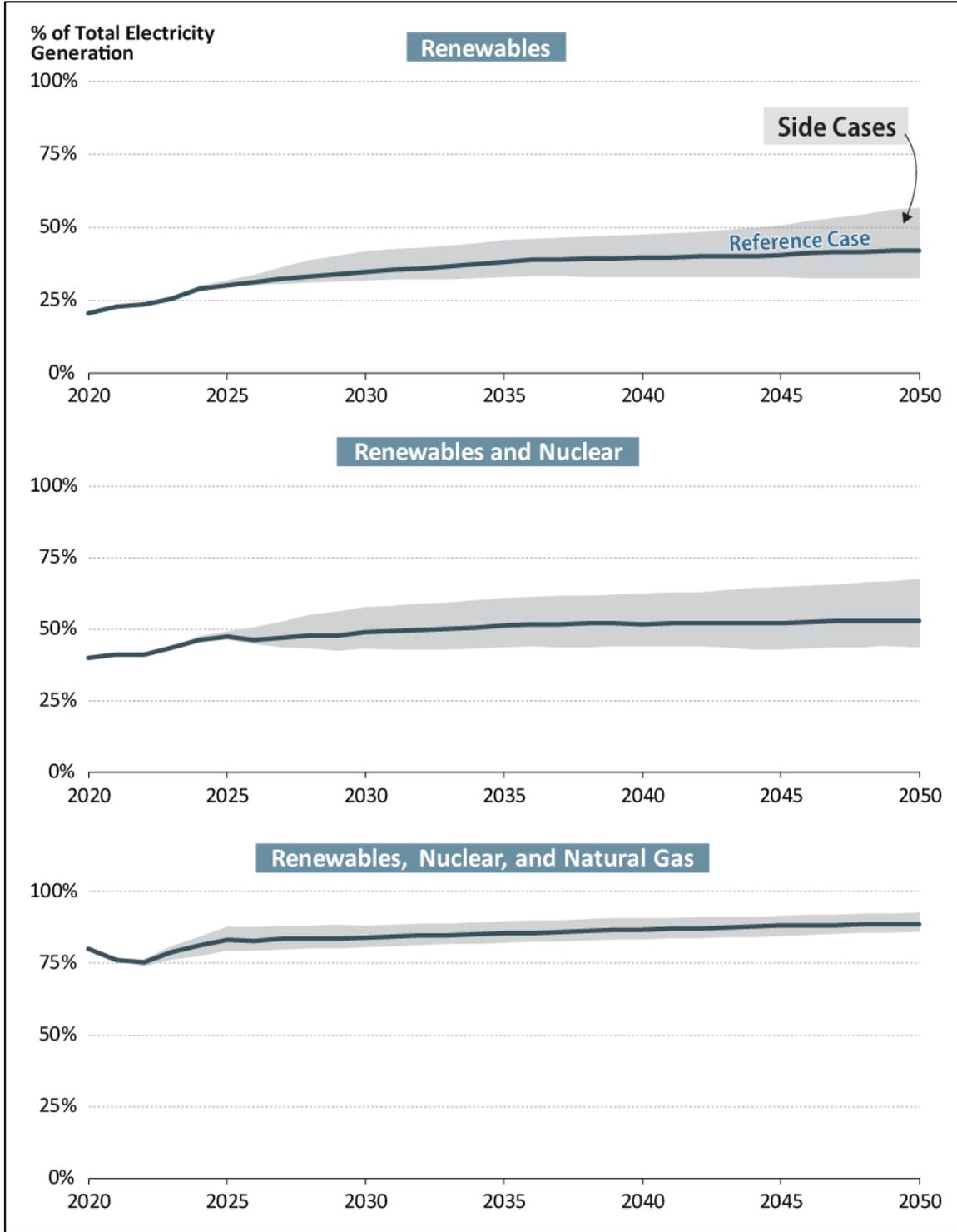
²⁶ For an overview of the Annual Energy Outlook, see CRS In Focus IF11691, *The Annual Energy Outlook (AEO): A Brief Overview*, by Ashley J. Lawson and Kelsi Bracmort.

²⁷ EIA, *Annual Energy Outlook 2021 Narrative*, February 2021, p. 12, https://www.eia.gov/outlooks/aeo/pdf/AEO_Narrative_2021.pdf.

²⁸ CRS calculations based on data from EIA, *Annual Energy Outlook 2021*, February 3, 2021. EIA’s projections do not include projections for CCS.

total U.S. electricity generation coming from these different source types. The classifications in **Figure 2** match those in **Figure 1**, and are used to provide context.

Figure 2. Projected Share of Total U.S. Electricity Generation, by Source Type



Source: CRS calculations based on data from EIA, *Annual Energy Outlook 2021*, February 3, 2021.

Notes: Details of energy source classification are provided in this report and in the EIA source. EIA side cases include alternative assumptions about future energy supply and prices, technology costs, and economic growth.

Concluding Observations

Congressional debate on options to reduce GHG emissions is ongoing, including consideration of a CES. Other issues being debated by the 117th Congress, such as infrastructure, could also affect future GHG emissions from the power sector. For example, non-CES legislation could influence power plant developers' choice about energy sources by altering their relative prices in the market (e.g., tax incentives to lower prices for certain sources or carbon pricing to increase prices for certain sources). Legislation also could affect electricity demand by increasing use of electricity in the economy (e.g., for transportation) or decreasing electricity demand by promoting efficiency measures. Legislation not directly targeted at the electricity system also could affect the outlook for clean energy in the U.S. electricity system. For example, legislation affecting overall economic activity could affect future electricity demand, and infrastructure policy could influence the private sector's decisions about what energy sources to use for electricity generation. Also, noncongressional actions (e.g., executive actions, state policies) affect the U.S. electricity system. For example, the Federal Energy Regulatory Commission initiated a rulemaking process in July 2021 aimed at "improv[ing] transmission planning and cost allocation and generator interconnection processes as the nation transitions to a cleaner energy future."²⁹

In short, numerous policies the 117th Congress might consider (and noncongressional actions as well) could affect the future makeup of the U.S. electricity system. Should Congress also choose to debate a CES, the interactions among some or all of these factors might be relevant.

Author Information

Ashley J. Lawson
Analyst in Energy Policy

Disclaimer

This document was prepared by the Congressional Research Service (CRS). CRS serves as nonpartisan shared staff to congressional committees and Members of Congress. It operates solely at the behest of and under the direction of Congress. Information in a CRS Report should not be relied upon for purposes other than public understanding of information that has been provided by CRS to Members of Congress in connection with CRS's institutional role. CRS Reports, as a work of the United States Government, are not subject to copyright protection in the United States. Any CRS Report may be reproduced and distributed in its entirety without permission from CRS. However, as a CRS Report may include copyrighted images or material from a third party, you may need to obtain the permission of the copyright holder if you wish to copy or otherwise use copyrighted material.

²⁹ Federal Energy Regulatory Commission, "News Release: FERC Begins Reform Process to Build the Transmission System of the Future," July 15, 2021.