Center for American Progress

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Mitigating Natural Gas Use in the Electricity Sector

Renewable Energy, Energy Efficiency, and the Role of States in Implementing the Clean Power Plan

By Alison Cassady December 2014

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Introduction and summary

Climate change poses a real and present danger to people in countries all over the world. Scientists agree that we need to move swiftly and aggressively to decarbonize the global economy—that is, to reduce the amount of carbon released per unit of gross domestic product—by deploying clean energy technologies and making energy systems more efficient.

In the United States, electric utilities are the largest source of carbon pollution. Therefore, the reduction of power-sector emissions needs to be a central component of any meaningful climate mitigation strategy. In June, the Environmental Protection Agency, or EPA, released a landmark proposal to establish the first-ever carbon-pollution standards for the nation's power plants.

This proposal, the Clean Power Plan,[1] establishes a "best system of emissions reduction" based on four building blocks that combine to make the nation's electricity system more efficient and less reliant on carbon-heavy coal-burning power plants. The EPA also proposed carbon-pollution reduction targets for each state, including an interim carbon-pollution reduction goal—calculated as an average over the 10-year period from 2020 to 2029—and a final goal in 2030.

One of the Clean Power Plan's central elements is increasing the use of lower-carbon natural gas combined cycle, or NGCC, units to generate some of the electricity now produced by higher-carbon coal-fired power plants. States can use this approach to achieve relatively quick carbon-pollution reductions starting in 2020 while ramping up the deployment of programs that promote renewable energy and energy efficiency.

The EPA modeled two compliance scenarios to understand the costs, benefits, and potential energy-related impacts of the Clean Power Plan. This modeling suggests that the electricity sector's natural gas consumption will increase sharply at the beginning of the Clean Power Plan's implementation period as states shift power generation from dirtier coal-fired plants to cleaner-burning NGCC plants. The EPA also predicts that states will build new NGCC plants to replace retiring coal plants and to help meet their carbon-reduction targets.

By 2030, however, the EPA's models forecast that more renewable energy and energy-efficiency programs will come online as states continue to implement the Clean Power Plan. Electricity generation from renewable sources will displace some generation from NGCC and coal-fired power plants. Energy-efficiency programs, meanwhile, will reduce electricity demand, slowing generation and curbing carbon pollution from the power sector as a whole. By the end of the Clean Power Plan's compliance period in 2030, the EPA predicts that the electricity sector's natural gas consumption will be higher than it is today but lower than it would have been without the plan.

From a climate perspective, successful deployment of renewable energy technologies and energy-efficiency programs will be critical. While natural gas burns cleaner than coal, it is still a fossil fuel that releases carbon pollution. In addition, methane, a potent greenhouse gas, can escape throughout the natural gas production and supply cycle. For these reasons, several recent studies by prominent researchers have questioned whether natural gas can form the core of an effective climate mitigation strategy.

The Clean Power Plan's renewable energy and energy-efficiency components serve the important purpose of mitigating the electricity sector's natural gas use over time. But states have the potential to do even more than the plan envisions. Recent studies by the Union of Concerned Scientists and the American Council for an Energy-Efficient Economy suggest that the EPA may be underestimating states' capacity to generate more electricity from renewable sources and achieve more significant energy savings.

By acting decisively to implement ambitious renewable energy and energy-efficiency programs, states can help ensure that the United States does not overcommit to natural gas and that it continues on a path toward decarbonization of the economy. States do not need to wait for the EPA to finalize the Clean Power Plan to get started. The Center for American Progress offers the following recommendations to state policymakers:

- States should strengthen existing—or enact new—renewable energy standards to deploy additional renewable energy generating capacity as quickly and as aggressively as possible.

- States should enact the strongest possible Energy Efficiency Resource Standards to set clear energy-savings targets for electric utilities. States also should adopt and implement stringent building efficiency codes and other product and equipment efficiency standards to cut customer demand for electricity.

- States should enact policies to cut methane pollution from the oil and gas sector. This will achieve important reductions in greenhouse gas emissions and maximize the climate benefit of generating electricity from natural gas rather than coal.

- States should consider innovative financing approaches, such as green banks, to attract private investment in new, low-carbon clean energy projects.

Without question, switching from coal to natural gas for power generation can reduce carbon pollution from the power sector. But fuel switching does not go far enough to achieve the deep reductions necessary to avert catastrophic climate change. States should make renewable energy and energy efficiency a cornerstone of their Clean Power Plan implementation and climate mitigation strategies.

Urgent need to move to a cleaner energy system

The world's leading climate scientists agree: The climate is warming, and it is "extremely likely" that humans have been the dominant cause of the observed warming since the mid-20th century.[2]

The Intergovernmental Panel on Climate Change, or IPCC, the foremost scientific body tasked with assessing climate change, has released several major reports detailing climate change's scientific basis and impacts, as well as opportunities to mitigate them. On November 1, the IPCC finalized its Synthesis Report, which integrates the key findings of three working groups for the IPCC's Fifth Assessment Report—the most comprehensive assessment of climate change completed to date. The Synthesis Report states that rising temperatures already "have caused impacts on natural and human systems on all continents and across the oceans."[3] It also concludes with "high confidence" that continued, unmitigated warming "will lead to high to very high risk of severe, widespread and irreversible impacts, globally," including heat waves, species extinction, sea-level rise, and global food insecurity.[4]

World leaders can reduce the risks of climate change by limiting the rate and magnitude of warming, but the window of opportunity is closing. The IPCC concludes with "high confidence" that delaying efforts to mitigate climate change until 2030 will "substantially increase the challenges" associated with limiting dangerous levels of warming, requiring countries to cut emissions much more quickly, steeply, and at greater cost.[5] If world leaders want to limit warming to no more than an increase of 2°C, or 3.6°F, above pre-industrial levels—a target that many countries have accepted as a shared goal[6]—then they must phase out the uncontrolled use of fossil fuels for power generation by 2100 and dramatically increase power generation from zero-carbon sources.[7]

In 2012, the International Energy Agency, or IEA, drew similarly sobering conclusions in its annual World Energy Outlook. In the report, the IEA examined cumulative carbon emissions from the global energy system and warned that the world's existing power plants, factories, and other infrastructure had already "locked in" almost four-fifths of the global carbon budget—the amount of carbon

pollution the world can emit before 2035 without exceeding a 3.6°F increase of warming and triggering dangerous climate change. The IEA also warned that if the world does not take serious steps before 2017 to deploy zero-carbon and energy-efficiency technologies, then the whole carbon budget will be locked in by the energy infrastructure that exists at that time.[8]

In 2014, PriceWaterhouseCoopers, or PwC, released its sixth Low Carbon Economy Index report, which examines how quickly the world needs to decarbonize the global economy in order to avert irreversible climate change. PwC found that to limit warming to a 3.6°F increase, world leaders need to decarbonize the economy by 6.2 percent each year through 2100. This is more than five times the current rate.[9]

Decarbonizing electricity generation is a key component of any cost-effective strategy to stretch the global carbon budget and mitigate climate change.[10] The EPA's Clean Power Plan is one attempt to reduce the carbon intensity of the United States' electricity generation mix and transition the country to a lower-carbon energy infrastructure.

The EPA's Clean Power Plan

On June 2, the EPA proposed its Clean Power Plan, a strategy for how to cut carbon pollution from the nation's existing fossil-fuel-fired power plants.[11] After taking public comment, the EPA plans to finalize the Clean Power Plan in June 2015.[12]

The Clean Power Plan outlines the best system of emissions reduction, or BSER, for carbon pollution from existing power plants and establishes state emissions-reduction targets based on cost-effective and demonstrated methods of pollution control. The proposal grounds the BSER determination in four key "building blocks" that, implemented together, would significantly increase efficiency and lower carbon pollution from power plants. Building block 1 focuses on making existing coal-fired power plants run more efficiently, while building blocks 2 and 3 strive to replace higher-carbon electricity generation with lower- or zero-carbon generation. Building block 4 seeks to reduce overall electricity demand. (see text box)

The EPA uses a standard formula to propose state-specific carbon-pollution reduction targets based on each state's ability to apply the BSER, given the characteristics of each state's power plant fleet and electricity generation mix. The EPA proposes that each state meet an interim carbon-pollution reduction goal, calculated as an average over the 10-year period from 2020 to 2029. They also would have to meet a final goal in 2030.

The four building blocks of the EPA's proposed Clean Power Plan[13]

1. **Reduce the carbon intensity of generation at individual affected electric generating units, or EGUs, through heat rate improvements.** Goal: Improve the average heat rate for coal-fired steam generating units by 6 percent.

2. **Reduce emissions from the most carbon-intensive EGUs in the amount that results from substituting generation at those EGUs with generation from less carbon-intensive EGUs.** Goal: Replace electricity generated from coal- and oil-fired power plants by increasing generation from natural gas combined cycle plants up to 70 percent of their capacity.

3. **Reduce emissions from EGUs in the amount that results from substituting generation at those EGUs with expanded low- or zero-carbon generation.** Goal: Deploy new electricity generation capacity from renewable sources, complete nuclear units under construction, and avoid retirement of 6 percent of existing nuclear capacity.

4. **Reduce emissions from EGUs in the amount that results from the use of demand-side energy efficiency that reduces the amount of generation required.** Goal: Increase demand-side energy efficiency efforts to reach 1.5 percent annual electricity savings over the compliance period.

The EPA proposal does not dictate the policies that states must use to achieve their carbon-pollution reduction goals. Instead, it provides them with individual flexibility to implement all, some, or none of the building blocks or to apply alternative measures that reduce carbon pollution from existing power plants. The EPA proposal also offers states the choice to pursue compliance alone or to form regional partnerships and develop multistate plans to achieve the required reductions.

In order to estimate the costs and benefits—as well as the energy-related impacts—of implementing the Clean Power Plan, the EPA modeled two illustrative compliance scenarios: one that reflects state implementation and one that reflects regional implementation. The EPA had the following caveat about the results:[14]

> *These illustrative compliance scenarios are designed to reflect, to the extent possible, the scope and nature of the proposed guidelines. However, there is considerable uncertainty with regard to the precise measures that states will adopt to meet the proposed requirements, since there are considerable flexibilities afforded to the states in developing their state plans. Nonetheless, the analysis of the benefits, costs, and relevant impacts of the proposed rule attempts to encapsulate some of those flexibilities in order to inform states and stakeholders of the potential overall impacts of the proposal.*

This report references the results of the EPA models to discuss the potential impacts of the Clean Power Plan on natural gas consumption, as well as the role that renewable energy and energy efficiency play in mitigating this consumption. The Clean Power Plan includes a preferred policy proposal—option 1—and an alternative proposal—option 2, which includes less stringent carbon-reduction targets and a shorter compliance period. This report focuses only on option 1, the EPA's preferred option.

The central role of natural gas in the Clean Power Plan

The first building block of the Clean Power Plan reduces carbon pollution from coal-fired power plants by improving their average heat rate—a measure of the amount of fuel needed to produce a unit of electricity—by 6 percent. The emissions reductions achieved by building block 1 are relatively modest.[15] Building block 2, however, secures much more significant pollution reductions by moving the electricity system away from coal and toward natural gas. This report focuses on building block 2, as well as on the clean energy and energy-efficiency policies of building blocks 3 and 4, respectively.

In recent years, the electric power sector has increased its use of natural gas to take advantage of low prices and abundant domestic supplies. The Energy Information Administration predicts that natural gas will surpass coal as the largest source of electricity generation within 20 years.[16] The Clean Power Plan builds on and accelerates this trend. Building block 2 of the Clean Power Plan achieves relatively quick carbon-emissions reductions by replacing more coal-fired generation with natural gas-fired generation.

Taken alone, building block 2 has the potential to appreciably increase the electric power sector's consumption of and dependence on natural gas, which, although cleaner burning than coal, is still a fossil fuel that releases carbon when burned. While state policymakers can switch from coal to gas as a means to cut carbon pollution in the short term, this approach only gets the United States part of the way toward the goal of decarbonizing its energy system.

To achieve even deeper emissions reductions over the longer term, the EPA has placed building block 2 within a broader system of emissions reduction that includes clean energy and energy-efficiency policies. These policies, encompassed in building blocks 3 and 4, work together to slow the electricity sector's demand for natural gas in the coming decades.

Building block 2: Lowering carbon pollution by switching from coal to natural gas

Because the U.S. electricity system is interconnected, electric utilities and grid operators enjoy a certain flexibility to choose which power plant to call upon, or dispatch, to generate a unit of electricity. Electric utilities and grid operators make these dispatch decisions based on a number of considerations, including changes in electricity demand, plant availability, and the variable operating costs of existing generating capacity. In practice, system operators routinely redispatch generation to meet electricity demand in the most cost-effective way possible while still maintaining grid reliability.

This common industry practice provides the foundation for building block 2 of the Clean Power Plan, which looks to achieve carbon-pollution reductions through increasing the dispatch of lower-carbon natural gas combined cycle, or NGCC, units to replace electricity generated by higher-carbon coal-fired power plants. Essentially, building block 2 calls for running existing NGCC plants more and coal plants less. The potential for carbon-pollution reductions is significant. In 2012, the average coal steam unit emitted 2,220 pounds of carbon per megawatt-hour, while the average NGCC unit emitted only 907 pounds per megawatt-hour.[18]

In 2012, system operators dispatched only 46 percent, on average, of the nation's NGCC capacity.[19] The EPA examined the operation of NGCC units across the country and proposed that a 70 percent utilization rate is both technically feasible and adequately demonstrated.[20] The EPA estimates that if NGCC plants had operated at this rate in 2012, carbon dioxide emissions from coal-fired power plants and NGCC units would have been 13 percent lower.[21]

Notably, a state can employ this building block only if it has one or more NGCC units with excess generating capacity to displace generation from higher-carbon sources. As a result, the 70 percent dispatch rate is a ceiling that the EPA considers when it assesses states' potential to redispatch and sets states' carbon-pollution reduction goals. On average, the proposed state goals reflect a 64 percent NGCC utilization rate.[22]

To calculate the proposed interim and final goals for each state, the EPA assumes that states will meet their targeted NGCC utilization rates by 2020—the first year of compliance—and maintain them through the 10-year phase-in period. Given this approach, the EPA calls building block 2 "a viable method for providing [carbon] emission reductions at existing [power plants] by the 2020 compliance start date."[23]

What is an NGCC generating unit?

NGCC units are one of the most efficient thermal power plants in operation today. An NGCC unit produces power in two ways. First, a turbine burns natural gas, turning a rotor that drives an electrical generator to produce power. Second, rather than venting the hot exhaust gas after it passes through the turbine, as happens in a simple cycle unit, the NGCC unit directs the hot gas to a recovery system, which captures the heat from the gas and converts it to steam. This steam is used to drive a turbine and generate more electricity.[17]

Some stakeholders have expressed concerns about this approach. On October 28, the EPA released a notice of data availability, or NODA, to provide additional stakeholder information about the Clean Power Plan and request comment on a number of issues.[24] In the NODA, the EPA explains that some stakeholders are worried that as currently crafted, building block 2 would require states to achieve a "significant portion of the required CO2 emission reductions early in the interim period."[25] The EPA has therefore requested comment on two proposals to develop state carbon-pollution reduction targets based on a gradual phase-in of building block 2. But such proposals could weaken or delay carbon-pollution reductions in the short term unless the EPA strengthens the guidelines of the other building blocks.[26]

The NODA also describes stakeholder concerns about perceived inconsistencies in state goals due to disparities in the availability of spare NGCC capacity. In Arizona, for example, the EPA's goal-setting methodology assumes that the state doubles its NGCC generation from existing units and, in doing so, achieves almost three-fourths of its emissions-reduction goal. Similarly, for Minnesota, the EPA formula assumes that the state obtains almost half of its required emissions reductions by nearly tripling its generation from existing NGCC facilities. Because Kansas and Montana currently have no NGCC capacity available for redispatch, the EPA projects that these states will not use building block 2 to meet their targets.[27]

In the NODA, the EPA points out that it already has requested comment on one way to address these perceived disparities: setting state goals under building block 2 based on the regional availability of spare NGCC generation capacity, rather than just in-state availability.[28] But the EPA also has requested comment on a potential new solution—to "establish some minimum value as a floor for the amount of generation shift for purposes of building block 2."[29] This would increase the obligation of states with little to no NGCC-generating capacity to employ more natural gas for electricity generation. Essentially, for the purpose of goal-setting, the EPA would assume that each state with coal-fired power plants replaces a minimum amount of coal-fired electricity with generation from existing NGCC units, newly constructed NGCC units, or coal plants that are co-fired with natural gas.[30]

Impact on electricity generation from natural gas

As proposed, the Clean Power Plan will increase electricity generation from natural gas power plants that are currently operating or under construction. According to the EPA's compliance scenarios, natural gas-fired generation from existing

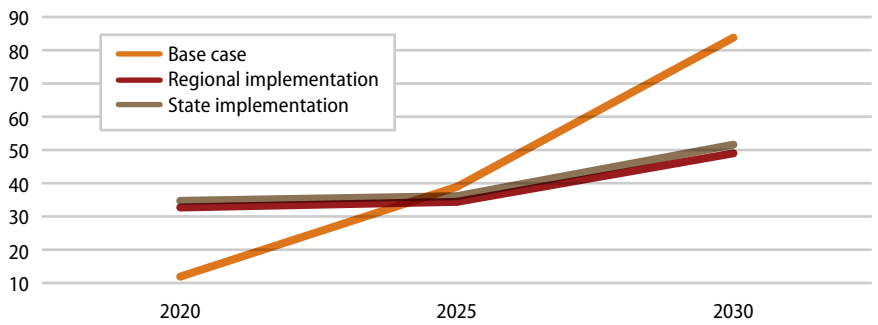
NGCC facilities will increase by 4 percent to 6 percent relative to the base case—that is, business as usual without the Clean Power Plan—by 2020; it will increase by 18 percent to 19 percent relative to the base case by 2030.[31]

In addition to increasing generation from existing NGCC plants, the Clean Power Plan is likely to result in the construction of new natural gas plants as coal-fired plants retire. The EPA estimates that the Clean Power Plan will result in an additional 21 to 23 gigawatts of new NGCC capacity by 2020. This is almost triple the projections under the base case.[32] (see Figure 1)

FIGURE 1

Cumulative projected natural gas combined cycle capacity additions under the proposed Clean Power Plan

In gigawatts



Source: U.S. Environmental Protection Agency, *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants* (2014), available at http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf.

Implementation of the renewable energy and energy-efficiency policies in building blocks 3 and 4 plays an important role in slowing the construction of new NGCC capacity over time. This is essential from a climate mitigation perspective, as each new NGCC unit locks in a certain level of carbon pollution over the unit's 30-year lifespan. As seen in Figure 1, by 2030, new NGCC capacity additions will be significantly lower than they would have been without the proposed Clean Power Plan. This is largely due to increased use of renewable energy sources and the implementation of energy-efficiency measures that cut overall electricity demand, relieving the need for new NGCC capacity.[33] The EPA estimates that the demand-side energy-efficiency measures in building block 4 will reduce total generation by 3 percent relative to the base case by 2020 and by 11 percent by 2030.[34]

One outstanding question is whether states can build new natural gas-fired power plants to meet their carbon-reduction targets under the Clean Power Plan. In its proposal, the EPA writes that new NGCC capacity "cannot be directly counted towards the average emissions rate" used for state compliance with the target, but it "can displace some generation from covered sources and thus indirectly lower the average emissions rate from covered sources."[35] The EPA requests public comment on this matter, asking "whether we should consider construction and use of new NGCC capacity as part of the basis supporting the BSER."[36] If the EPA chooses to count construction of new NGCC units as part of the best system of emissions control, states may have additional incentive to invest in new natural gas generation capacity. It is unclear whether this investment would come at the expense of investment in cleaner energy technologies.

Impact on natural gas consumption

More natural gas-fired generation leads to more domestic natural gas consumption. The EPA's compliance scenarios for the Clean Power Plan predict that the electricity sector's natural gas consumption will increase by as much as 1.2 trillion cubic feet in 2020, or from 12 percent to 14 percent above the base case level.[37]

But the scenarios also show that the Clean Power Plan will reduce the electricity sector's natural gas use over time. In fact, by 2030, natural gas use for power generation will be lower than currently projected although still higher than today. (see Figure 2)

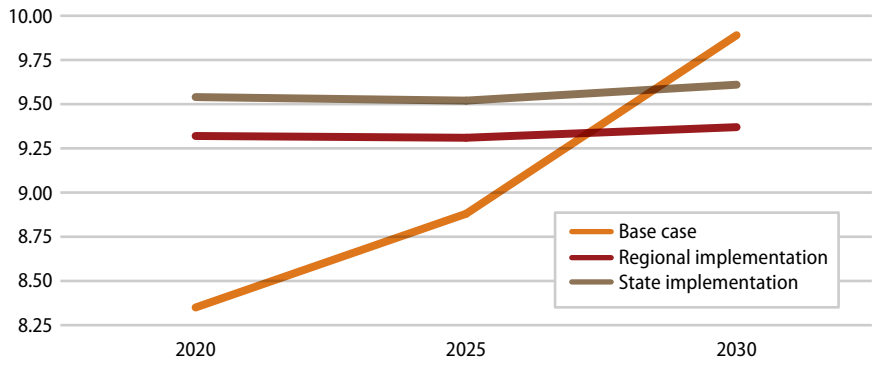
Clean energy and energy efficiency are key to bending this demand curve. Under the plan, implementing building block 3 will bring more renewable energy capacity online and displace generation from more carbon-intensive fossil-fuel-fired plants. Implementation of the energy-efficiency measures in building block 4 will reduce economy-wide electricity demand by 11 percent from the base case level by 2030.[38] Less electricity generation translates into lower natural gas use.

Indeed, the EPA notes that if states implement the clean energy and energy-efficiency policies in building blocks 3 and 4 more quickly than the Clean Power Plan suggests, then the projected rise in natural gas use could be mitigated even more.[39] This is consistent with other studies showing that renewable energy and energy efficiency can displace natural gas-fired electricity generation and curb natural gas demand.[40]

FIGURE 2

Natural gas consumption by the electricity sector under the proposed Clean Power Plan

In trillions of cubic feet



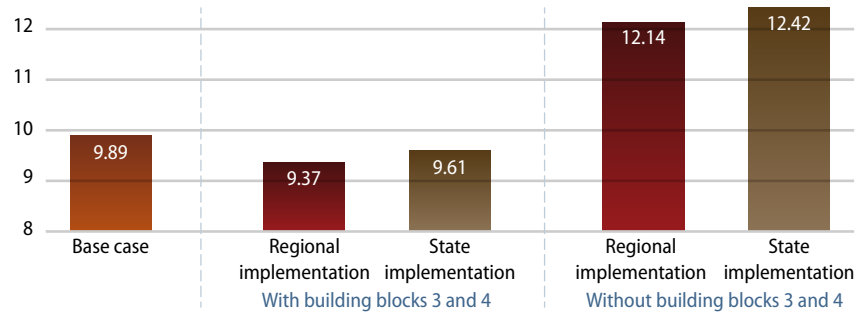
Source: U.S. Environmental Protection Agency, *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants* (2014), available at http://www2.epa.gov/sites/production/-files/2014-06/documents/20140602ria-clean-power-plan.pdf.

Conversely, the EPA modeled the energy impacts that states would experience if they were to rely only on building blocks 1 and 2 to achieve emissions reductions—that is, without implementing complementary clean energy and energy-efficiency policies. It found that if states chose this path, the electricity sector's natural gas use would surpass the currently projected levels of consumption by as much as 25 percent by 2030.[41] (see Figure 3)

FIGURE 3

Projected natural gas consumption in 2030 by the electricity sector under the proposed Clean Power Plan: With and without building blocks 3 and 4

In trillions of cubic feet



Sources: U.S. Environmental Protection Agency, *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants* (2014), available at http://www2.epa.gov/sites/production/-files/2014-06/documents/20140602ria-clean-power-plan.pdf; U.S. Environmental Protection Agency, *Memo: Emission Reductions, Costs, Benefits and Economic Impacts Associated with Building Blocks 1 and 2* (2014), available at http://www2.epa.gov/carbon-pollution-standards/clean-power-plan-proposed-rule-memorandum.

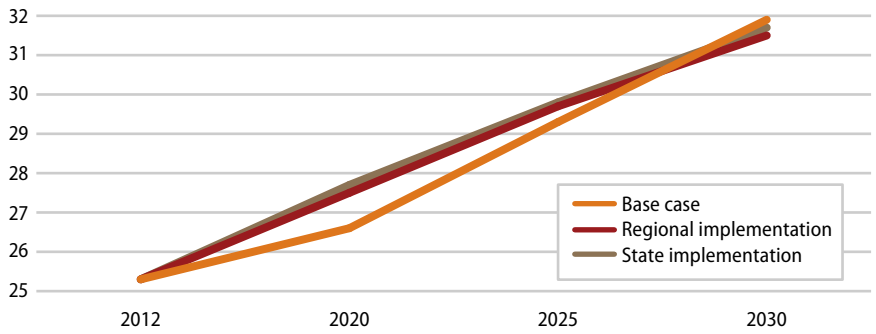
Impact on natural gas production

The increased domestic natural gas consumption promoted by building block 2 would drive additional natural gas production in the United States. The EPA's compliance scenarios predict that natural gas production in 2020 will be 3 percent to 4 percent higher under the Clean Power Plan than under the base case, but the scenarios also suggest that renewable energy and energy-efficiency programs will help slow this growth in the later years of the Clean Power Plan's compliance period. By 2030, the EPA's modeling shows that natural gas production could be slightly lower than currently projected levels as states deploy the renewable energy resources and demand-side energy-efficiency measures envisioned in blocks 3 and 4.[42] (see Figure 4)

FIGURE 4

The proposed Clean Power Plan's impact on natural gas production

In trillions of cubic feet



Sources: For 2012 data, see U.S. Environmental Protection Agency, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units," *Federal Register 79* (117) (2014): 34864, available at http://www.gpo.gov/fdsys/pkg/FR-2014-06-18/pdf/2014-13726.pdf; For future projections, see U.S. Environmental Protection Agency, *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants* (2014), available at http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf.

Mitigating natural gas demand with clean energy and energy efficiency

Building blocks 3 and 4 of the Clean Power Plan outline a path for states to deploy clean energy and energy-efficiency technologies and achieve steeper carbon-pollution reductions from power plants. If states shift even more aggressively to renewable energy and implement all available energy-efficiency measures, they can help ensure the electricity system does not become over-reliant on natural gas and quicken the pace of decarbonization in the electricity sector. Tremendous potential exists for states to make renewable energy and energy-efficiency programs the cornerstone of their carbon-reduction strategies.

Building block 3: Implementing renewable energy programs

Building block 3 expands the availability of zero-carbon generating capacity to displace electricity generation from more carbon-intensive, fossil-fuel-fired power plants.

The EPA proposes a rather conservative methodology to determine the state-level renewable energy targets within this building block. First, it divides the country into six regions. For each region, it sets targets for electricity generation from renewable sources; these are based on the average 2020 target of any existing state-level renewable electricity standards within the region. The EPA then calculates the growth rate that the region needs to achieve its target by the end of the Clean Power Plan's compliance period, using 2012 as the baseline. It applies this regional growth factor to each state to calculate individual state renewable energy targets. The EPA methodology assumes that states will not exceed these renewable generation targets.[43]

Under this approach, the EPA estimates that the United States will add more new non-hydroelectric renewable capacity to the grid over the next 15 years than it otherwise would. The EPA's compliance scenarios show that by 2030, the United States will have added up to 28 percent more new renewable energy capacity than is currently projected.[44] But non-hydro renewables will continue to comprise a

small percentage of the power mix by 2030. That year, the EPA estimates that 9 percent of U.S. electricity will come from non-hydro renewables, only slightly higher than the share predicted under the base case.[45]

The Union of Concerned Scientists, or UCS, examined building block 3 and concluded that the EPA significantly underestimates the potential for increasing electricity generation from renewable sources, resulting in an "average" system of emissions reductions rather than the "best" system required under the Clean Air Act.[46] Specifically, the UCS wrote:

> *While the EPA draft rule specifically allows states to use renewable energy as an affordable way to meet their emissions reduction targets, it significantly underestimates, in several ways, the potential role of renewable energy in setting state targets. The Clean Power Plan does not adequately capture renewable energy deployment rates that states are already achieving. The plan also fails to reflect the continued growth and falling costs of renewable energy projected by market experts. Indeed, the EPA's proposal falls short of the national renewable energy generation levels that the U.S. Energy Information Administration (EIA) projects would occur in 2020 under a business-as-usual approach; the proposal's 2030 results are only marginally higher than the EIA's projections.*[47]

Indeed, the EPA admitted in its proposal that the renewable generation targets are lower in some states than those states' 2012 baseline renewable generation.[48]

The UCS developed an alternative method to determine the best system of emissions reduction for building block 3. Its approach sets a national benchmark for the renewable energy growth rate based on demonstrated state growth between 2009 and 2013, assuming states will meet the requirements of any state-level renewable energy standards in place.[49] Under the UCS approach, the amount of U.S. electricity generated from renewable energy sources in 2020 would reach 14 percent of electricity sales in 2020, twice the level achieved by the Clean Power Plan. By 2030, renewable energy would comprise a 23 percent share of electricity sales under the UCS approach, compared with only 12 percent under the Clean Power Plan.[50]

The UCS analysis found that this more ambitious commitment to renewable energy could reduce carbon pollution by 40 percent below 2005 levels, compared with the 30 percent reduction envisioned by the Clean Power Plan. This assumes that the new renewable energy generation displaces mostly natural gas-fired generation.[51]

Building block 4: Setting demand-side energy-efficiency goals

Building block 4 is comprised of measures to curb electricity demand. If consumers use less electricity, then power plants burn less fuel and emit less carbon. Fossil-fuel-fired power plants tend to have higher variable fuel costs than nuclear power plants or renewable energy generation facilities. As a result, fossil-fueled generation is the first to be displaced when overall electricity demand falls.[52]

For this building block, the EPA developed a scenario in which states employ the best practices in demand-side energy efficiency. The best practices are based on the experiences of 12 states that have taken the lead in this area.[53] Using 2012 as a baseline, the EPA proposes that each state should be able to achieve a 1.5 percent annual electricity savings rate.

Before the EPA released its Clean Power Plan, the American Council for an Energy-Efficient Economy, or ACEEE, evaluated the potential for states to implement demand-side energy-efficiency measures and reduce greenhouse gas emissions from the electricity sector. It looked at four of the most common and effective policy options that states can use to improve demand-side energy efficiency: implementing strong energy-efficiency savings targets, adopting national model building codes, constructing combined heat and power systems, and adopting efficiency standards for products and equipment. The ACEEE found that if every state adopted these four policies, electricity demand in 2030 would be 25 percent lower than in 2012. This would eliminate the need for 494 power plants in 2030 and reduce carbon pollution by 26 percent.[54]

The ACEEE has offered some suggestions for how the EPA can strengthen building block 4 and achieve greater energy savings and carbon-emissions reductions from the power sector. The ACEEE says that the EPA should take building-efficiency codes into consideration when it determines the maximum emissions reductions achievable with demand-side efficiency standards.[55] The ACEEE also argues that the EPA should include combined heat and power in its application of the building block, calling it "a readily available energy resource that would provide states with substantial energy savings."[56] These recommendations suggest that states may have the potential to exceed the EPA's proposed 1.5 percent annual electricity savings rate.

Climate risks of rising natural gas use

The Clean Power Plan achieves significant carbon-emissions reductions by shifting electricity generation from high-carbon coal to cleaner-burning natural gas, particularly in the early years of the compliance period. This shift toward natural gas raises a couple of key climate-related concerns that underscore the importance of embracing ambitious renewable energy and energy-efficiency programs as quickly as possible in order to mitigate rising natural gas demand.

Methane emissions

Natural gas emits less carbon dioxide when burned than coal or oil, which is why building block 2 can achieve significant carbon-pollution reductions from existing power plants. But the climate benefit of switching from coal to natural gas is more complicated when examining the full life-cycle of natural gas, including production, storage, processing, transmission, and distribution. Methane can escape into the atmosphere at numerous points along the natural gas supply chain, potentially negating or diminishing the climate change benefits of switching from coal to gas. Methane is a powerful greenhouse gas that is 84 times more potent than carbon dioxide over a 20-year time frame.[57]

The EPA examined the potential impact of the Clean Power Plan on methane emissions from the natural gas system and concluded that "any net impacts from methane emissions are likely to be small" compared with the emissions benefits of shifting power generation from coal-fired power plants to NGCC units.[58] Specifically, the EPA found that by increasing the use of natural gas, the Clean Power Plan would increase methane emissions from natural gas systems and carbon dioxide from methane flaring. But it also will reduce methane emissions from coal mining by replacing coal-fired electricity generation with lower-carbon generation. The result is a net reduction in upstream methane emissions, with the drop in methane emissions from coal mines far outpacing the rise in methane emissions from increased natural gas use.[59] (see Table 1)

TABLE 1

Changes in upstream methane emissions under the proposed Clean Power Plan

In teragrams of carbon dioxide equivalent

	2020	2025	2030
Methane from coal mining	-16.1	-19.3	-19.1
Methane from natural gas systems	+5.1	+2.6	-1.0
Carbon dioxide from methane flaring	+0.4	+0.2	-0.3
Total change in upstream emissions	-10.6	-16.4	-20.5

Note: "Total change in upstream emissions" values pertain to "Option 1" of the Clean Power Plan and assume state—not regional—implementation.

Source: U.S. Environmental Protection Agency, *Regulatory Impact Analysis for the Proposed Carbon Pollution Guidelines for Existing Power Plants and Emission Standards for Modified and Reconstructed Power Plants* (2014), available at http://www2.epa.gov/sites/production/files/2014-06/documents/20140602ria-clean-power-plan.pdf.

Some stakeholders have raised questions about whether the EPA analysis conducted for the Clean Power Plan underestimates the volume of methane emissions that would result from increased natural gas production and consumption.[60] Others have raised broader questions about whether the EPA consistently underestimates the volume and regional variation of methane pollution from the oil and gas sector.[61]

Regardless of the ongoing debate about the scope of the fugitive methane problem, methane emissions are an undeniable side effect of the production, distribution, and use of natural gas. If left unchecked, these emissions pose a significant climate risk. As part of the Obama administration's Climate Action Plan and Strategy to Reduce Methane Emissions, the EPA is in the process of deciding whether to issue new regulations on oil and gas operators to minimize methane emissions from the wellhead to distribution.[62] The Bureau of Land Management, or BLM, also is considering a rulemaking to reduce methane emissions from oil and gas operations on public lands.[63] In the meantime, some states are taking action to curb methane emissions from the oil and gas sector. In February, Colorado became the first state to directly regulate methane emissions from the oil and gas industry. In September, California Gov. Jerry Brown (D) signed a law directing state regulators to develop and implement a comprehensive strategy to reduce methane leaks in the state's natural gas distribution pipelines.

Cost-effective, proven technology exists to capture fugitive methane emissions while saving companies money and creating jobs. A study prepared by ICF International for the Environmental Defense Fund concluded that the oil and gas industry could cut methane emissions by 40 percent below projected 2018 levels by adopting available emissions-control technologies and operating practices. Implementing the most cost-effective methane-reduction opportunities would generate more than $164 million in net savings for oil and gas operators.[64] A Datu Research report, also prepared for the Environmental Defense Fund, showed that tackling methane emissions from the oil and gas sector creates well-paying jobs. Already, the need for methane mitigation has spurred a growing domestic manufacturing and service sector with more than 500 facilities in 46 states.[65]

Locking in natural gas infrastructure

Because natural gas is cleaner burning than coal, some researchers have expressed hope that it can serve as a "bridge" fuel to mitigate carbon emissions as the global economy transitions to renewable and zero-carbon sources of energy.[66] Others have argued that any such bridge needs to be short, given the closing window to achieve significant carbon-pollution reductions and avert dangerous warming.[67] Still others have argued that using natural gas as a fossil fuel is a bridge to nowhere.[68]

Several recent studies have raised new questions about whether natural gas can form the cornerstone of a carbon-emissions reduction strategy. In October, the Joint Global Change Research Institute—a collaboration between the Department of Energy's Pacific Northwest National Laboratory and the University of Maryland—published the results of work completed by five separate research teams from the United States, Australia, Austria, Germany, and Italy. These teams independently concluded that abundant natural gas use displaces not only higher-carbon coal-fired generation but also generation from renewable sources and nuclear power. As a result, the abundance of natural gas from unconventional sources "could substantially change the global energy system over the decades ahead without producing commensurate changes in emissions or climate forcing."[69]

Similarly, this September, researchers at the University of California, Irvine, published a study that concluded that abundant natural gas supplies could slow the process of decarbonization by delaying the deployment of renewable energy technologies—unless the U.S. government enacts strong limits on greenhouse gas

emissions or policies to drive electricity generation that comes from renewable sources.[70] In April, researchers at Duke University concluded that natural gas can help reduce greenhouse gas emissions but will not offer the significant pollution reductions needed to change the global emissions trajectory.[71]

In this context, it is important to examine whether the Clean Power Plan encourages states to move quickly enough to adopt renewable energy and energy-efficiency technologies. It is also necessary to look at the extent to which other state and federal policies may be needed to incentivize the deployment of these technologies.

NRG Energy, an electric utility that publicly supports transitioning to a low-carbon economy,[72] has raised concerns about the current structure of the Clean Power Plan, arguing that the rule incentivizes states to achieve the bulk of their emissions reductions by switching to natural gas. In written comments to the EPA, NRG Energy explains that many states will have to demonstrate the majority of their emissions reductions in 2020, since the interim 2020–2029 goals assume that NGCC utilization is maximized in each of the years in order to quickly displace coal-fired generation. Specifically, NRG predicts that states will turn to NGCC as the "cheapest, fastest to deploy, dispatchable resource to replace baseload coal energy production."[73] The EPA's October 28 notice of data availability responds to this general concern and asks for comment on whether and how to gradually phase in the redispatch of natural gas in building block 2 for purposes of state goal setting.[74]

But NRG Energy also suggests that the Clean Power Plan could "accelerate the 'lock-in' of large amounts of new natural gas generation, particularly in some regions, while generally delaying the deployment of tomorrow's cleaner and cheaper renewable energy and emerging competitive distributed energy resources."[75] NRG warns that this could result in the overbuilding of new natural gas plants, which would reduce the incentive to add new renewable generation capacity to the grid, locking out energy resources that are truly clean.[76]

This is just one company's perspective on the EPA's Clean Power Plan, but it is an interesting and important one to consider, given the need to rapidly deploy zero-carbon technologies to mitigate climate change and avoid all unnecessary commitment to new fossil-fuel-fired infrastructure.

Policy recommendations

The Clean Power Plan, as proposed, will significantly increase the electricity sector's consumption of natural gas and encourage the construction of new NGCC facilities in the short term. By 2030, the electricity sector will still be consuming more natural gas than it does today, but consumption will be lower than currently projected as the Clean Power Plan's clean energy and efficiency programs take hold.

Extended reliance on natural gas for power generation likely is incompatible with the aggressive response needed to avert the most serious impacts of climate change. In order to put the United States on a path toward a zero-carbon energy future, federal and state policymakers need to ensure the country does not overcommit to natural gas. Instead, policymakers need to act decisively to implement ambitious renewable energy and energy-efficiency programs as soon as possible.

The EPA plans to finalize the Clean Power Plan in June 2015, but states do not have to wait until then to begin to put the U.S. energy system on a more sustainable, low-carbon path. CAP recommends that state policymakers take the following steps.

Deploy new capacity to generate electricity from renewable energy sources as quickly and as aggressively as possible

The Clean Power Plan sets out a rather conservative path for states to ramp up their use of renewable energy for electricity generation. States should do more than the EPA models suggest, pursuing a more aggressive path toward a clean energy economy.

More than half of U.S. states have already adopted some form of renewable electricity generation requirements—requirements that states' utilities generate a certain percentage of their electricity from renewable sources by a specific date.[77] These states should review their targets and commit to generating more electricity from zero-carbon sources, such as wind and solar power. States that have not committed to increasing renewable electricity generation should enact a standard with an ambitious target.

Implement the full suite of demand-side energy-efficiency programs

Some states have been leaders in adopting strong energy-efficiency programs, while others have lagged behind. Each state should review and, if appropriate, quickly adopt the suite of demand-side energy-efficiency policies that others have successfully employed.

Specifically, all states should enact the strongest possible Energy Efficiency Resource Standard, or EERS, setting clear energy savings targets that electric utilities must meet by using efficiency programs to reduce customer energy demand. According to the American Council for an Energy-Efficient Economy, 24 states have fully funded EERS policies in place that establish specific energy savings targets, although they vary in their stringency.[78] Massachusetts, Rhode Island, and Vermont have established the strongest EERS requirements, requiring almost 2.5 percent savings annually—well above the standard that the EPA recommends in building block 4.

Since buildings account for more than 40 percent of the total energy consumed in the United States, states also should adopt the most stringent building-efficiency codes available today and enforce compliance. Even more opportunities are available to states that wish to maximize the benefits of energy efficiency. In its most recent scorecard of state energy-efficiency programs, the ACEEE details numerous policies that states could implement to achieve meaningful energy savings and cut pollution.[79]

Enact policies to cut methane leaks from the natural gas system

Methane emissions from the natural gas sector have the potential to diminish or negate the climate benefit of building block 2.

The EPA and BLM are considering federal standards to reduce methane emissions from the oil and gas sector, but states should not wait for the federal government to act. Instead, state regulators should follow Colorado's lead and examine what authority they have under existing statutes to cut methane emissions from the oil and gas sector throughout the supply chain—during production, processing, storage, transmission, and distribution to the end user. State legislators should act to supplement that authority when needed in order to achieve the necessary methane-pollution reductions from oil and gas operations.

Consider innovative financing to spur low-carbon investment

Building a clean energy, low-carbon economy will require significant public and private investment in new technologies. A report by CAP and the Political Economy Research Institute at the University of Massachusetts Amherst concluded that the United States needs to commit $200 billion annually in both public and private resources to improve the energy efficiency of the nation's economy and increase deployment of renewable energy technologies.[80] Clean energy projects, however, often struggle to obtain private-capital investment due to market barriers, such as a lack of demonstrated scalability or historic performance data on which to base performance expectations.

Several states have launched—and others are considering launching—state-chartered clean energy financing authorities to leverage public dollars to attract private-sector investment in clean energy projects and lower the cost of clean energy. These "green banks" generally offer private investors and consumers a range of financial products to encourage investment in clean energy projects, such as credit enhancements, on-bill financing, long-term and low-interest-rate loans, loan guarantees, and revolving loan funds.[81]

Connecticut launched the Clean Energy Finance and Investment Authority, or CEFIA, in 2011, making it the first state to create a clean energy financing initiative. In 2013 alone, the CEFIA used $40 million in public funds to leverage $180 million in private-capital investment in clean energy projects. Since the bank's launch, Connecticut has seen a tenfold increase in renewable energy deployment in the state.[82] The CEFIA has several successful programs. For example, the Commercial and Industrial Property Assessed Clean Energy program gives businesses access to lower-cost financing for clean energy and energy-efficiency improvements. Property owners pay for the improvements over time by paying an additional charge on their property tax bills.[83]

Green banks can help states remove barriers to clean energy deployment. States struggling to overcome these market barriers should consider clean energy financing authorities to drive new in-state investment.

Conclusion

The Clean Power Plan is a critical component of President Obama's strategy to tackle climate change and meet his international pledge to cut greenhouse gas emissions across the U.S. economy by 17 percent from 2005 levels by 2020. The EPA estimates that the Clean Power Plan will cut carbon pollution from the power sector by approximately 30 percent from 2005 levels by 2030,[84] reductions that are essential to achieve the president's goal.

Levels of energy-related carbon pollution have fallen in the United States in recent years, because, in significant part, power plants have switched from coal to cleaner-burning natural gas. The Clean Power Plan capitalizes on this trend and encourages additional and more rapid fuel switching. But the country cannot rely on natural gas—a fossil fuel—as the foundation of its climate mitigation strategy for long. To achieve steeper emissions reductions and mitigate rising natural gas use, state policymakers need to act swiftly and aggressively to deploy renewable energy and energy-efficiency technologies. The Clean Power Plan offers rather conservative guidelines for state implementation of clean energy and energy-efficiency programs. States can and should do more to decarbonize the U.S. economy and achieve the emissions reductions necessary to avert catastrophic climate change.

About the author

Alison Cassady is Director of Domestic Energy Policy at the Center for American Progress. Alison joined CAP after working as a senior professional staff member for Rep. Henry Waxman (D-CA) in the U.S. House of Representatives, first on the Committee on Oversight and Government Reform and then the Committee on Energy and Commerce. Alison spearheaded the committees' work on unconventional oil and gas development and led one of the first congressional investigations into the practice of hydraulic fracturing. Alison also developed expertise on climate change, air quality, and nuclear power issues and worked to advance chemical plant security legislation in 2009.

Before beginning her time in the House, Alison served as research director for Environment America and the U.S. Public Interest Research Group, where she worked with staff experts to develop and release reports on a range of energy, environment, and consumer protection issues. She is a graduate of the Georgetown University School of Foreign Service.

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