Natural Gas

A Bridge Fuel for the 21st Century

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Summary

Natural gas is the cleanest fossil fuel—it produces less than half as much carbon pollution as coal. Recent technology advancements make affordable the development of unconventional natural gas resources. This creates an unprecedented opportunity to use gas as a bridge fuel to a 21st-century energy economy that relies on efficiency, renewable sources, and low-carbon fossil fuels such as natural gas.

Despite the potential energy, economic, and security benefits of natural gas, the recently House-passed American Clean Energy and Security Act, H.R. 2454, does not include enough opportunities to expand its use. The Center for American Progress and the Energy Future Coalition therefore propose a number of policies that would increase the use of natural gas and low-carbon energy sources while providing additional protection for our climate and communities.

Electricity

- Establish incentives to retire aging, inefficient, dirty coal-fired power plants, and replace them with renewable and low-carbon electricity.
- Create a renewables integration credit to offset specific costs associated with producing high levels of renewable energy and to reward going beyond the renewable electricity standard.
- Establish a dedicated incentive for development and deployment of "dispatchable" renewable energy to build markets for electricity storage technology.
- Require that the carbon price and other costs are included when determining the dispatch order for moving electricity onto the grid to prioritize natural gas and other clean electricity.

- Expand carbon capture-and-storage provisions to include other permanent storage technologies in addition to geologic sequestration. Ensure that carbon capture and storage research and deployment efforts include retrofitting existing coal- and gas-fired power plants.

- Remove regulatory barriers to recycling waste heat and power.

Transportation

- Expand the market for natural gas as a heavy-duty transportation fuel by increasing incentives for gas-powered buses and heavy trucks.

- Create incentives for communities to develop bus rapid transit systems that employ buses fueled by natural gas.

Clean natural gas development

- Conduct a comprehensive analysis of the impact of natural gas production on air, water, land, and global warming. Include a compilation of best practices and recommendations for new state safeguards.

- Support public disclosure requirements on the release of toxic chemicals used during the production of natural gas.

- Expand the Natural Gas STAR program where natural gas producers voluntarily capture and resell methane—a potent greenhouse gas—instead of releasing it into the atmosphere. Current participants make money on these methane sales. Medium and large emitters must undertake this practice.

Research

- Conduct research on more efficient turbines, storage of renewable electricity, and other technologies that would generate no- or low-carbon energy.

Capturing the new natural gas opportunity

The recent development of technology that enables the affordable development of significant shale gas reserves in the lower 48 states could fundamentally alter the U.S. energy system and play a larger role in helping to more rapidly and cost-effectively speed the

transition to a low-carbon economy and reduce global warming pollution. The Energy Information Administration estimates that the United States has approximately 1,770 trillion cubic feet (tcf) of technically recoverable gas, including 238 tcf of proven reserves. The Potential Gas Committee estimates total U.S. gas resources at 2,074 tcf. It is estimated that "technically recoverable unconventional gas" including shale gas accounts for nearly two-thirds of American onshore gas resources. At the current production rates, "the current recoverable resource estimate provides enough natural gas to supply the U.S. for the next 90 years."

These gas findings in Arkansas, Louisiana, Michigan, New York, North Dakota, Ohio, Pennsylvania, Texas, and elsewhere have increased proven reserves of U.S. natural gas by 13 percent, and driven potential reserves even higher.

Natural gas is "by the far the cleanest burning" fossil fuel, and produces slightly more than one-fifth of all U.S. energy. Oil and coal combined comprise about two thirds of all energy consumption. Their combustion produces substantially more global warming and other conventional pollution than natural gas. Combusting natural gas to make electricity produces about half of the global warming pollution of coal, and one-third of petroleum burned in cars. Given its domestic abundance and its lower pollutant levels, natural gas should play a larger role in our energy mix.

Enhancing the role of natural gas is valuable for many reasons. Tens of gigawatts of highly efficient natural gas generation capacity were installed over the past two decades but only about two-fifths of this capacity is used at any given time. At little to no additional cost for infrastructure, natural gas generation can be easily substituted for existing coal-fired capacity without any new plant or transmission construction. In some parts of the country, a CO2 price of as little as $7 to $14 per ton would provide sufficient incentive to give priority to dispatch of gas-fired electricity into the grid over that of coal.

Natural gas can serve as a bridge fuel to a low-carbon, sustainable energy future. In particular, natural gas can provide the critical low-carbon "firming" or back-up fuel that can enable deep market penetration of both wind power and concentrated solar thermal power. The marriage of gas and renewable energy in the form of hybrid wind-gas and solar-gas plants addresses the issue of renewable intermittency, greatly enabling low-cost/low emissions power generation.

Using clean domestic natural gas will also enhance our economy. Since it is produced in the United States, higher gas demand will create more jobs, and using domestic gas in lieu of imported oil would reduce our trade imbalance, keeping energy dollars at home instead of exporting oil dollars overseas. Gas could also be the basis for development of new, clean-energy technologies such as wind-gas hybrid electricity plants, carbon capture and storage, and natural gas transportation fuels. Such low-carbon technologies would find a market overseas. America and the world's needs for new jobs and new energy sources

coincide with the emergence of a powerful wave of clean-energy investment. More than $155 billion was invested in clean-energy technologies in 2008 alone and investments are expected to triple in the next three to four years.

The American Clean Energy and Security act, or ACES, passed by the House on June 26 has a number of provisions that promote no- or low-carbon energy, including natural gas. However, the bill could become more effective at job creation, oil reduction, consumer protection, and greenhouse gas pollution reduction if it did more to encourage and require a broad range of no- or low-carbon energy technologies. The Senate has an opportunity to incorporate such proposals into its bill during the debate on energy and global warming legislation this fall.

Low-carbon electricity

Electricity is responsible for about 30 percent of all U.S. greenhouse gas emissions. Currently coal fuels nearly 50 percent of U.S. power generation, while natural gas and nuclear account for about 20 percent each, with non-hydro renewables hovering around 3 percent. Coal-fired power plants and motor vehicles are the two largest sources of greenhouse gas emissions.

The goal of the policies mentioned below would be to meet future electricity demand with efficiency in addition to wind, solar, geothermal, biomass, and other similar renewable sources as well as natural gas. New nuclear power plants are simply too expensive and slow to build, and they consume too much water in operation to provide much of a solution to greenhouse gas pollution. Nonetheless, these policies would create more incentives to build nuclear power plants, though they may not be adequate to overcome the aforementioned hurdles.

In the electricity sector, natural gas is already cheap, available, and ready to meet the nation's power needs while improving climate security. It emits about half the carbon dioxide and far fewer of the heavy metals associated with coal, which has traditionally been relied upon for base power. And gas is even more appealing for peak-power needs because it can be turned on and off easily and immediately.

Retire old, dirty power plants

The average U.S. coal plant is 35 years old. The plants older than 35 are some of the dirtiest, most inefficient electricity generators, and represent 7 percent of worldwide carbon pollution. Most older coal plants cannot be retrofitted for carbon capture and storage if and when such technology is available.

As a nation, we can save money and reduce emissions by retiring these older coal-fired plants, or "electricity clunkers," and using wind, solar, or natural gas power instead. The national "cash for clunkers" program that focuses on transportation provides a model for the nation's power sector. Using money from the sale of greenhouse gas pollution allowances under a cap-and-trade program, we could create economic incentives to foster the rapid shutdown of dirty, decades-old coal belchers in exchange for renewable and gas electricity.. Any transition must ensure strong protections for affected workers and communities.

Renewable integration credit

Utilities that use large amounts of solar or wind power may sometimes encounter specific additional costs due to the variable nature of these energy sources. These costs include keeping generators on reserve to provide system balancing; wear and tear on baseload plants; construction of rapid-start natural gas power plants; new engineering and controls for generation, storage, and system management; and other direct costs resulting from integrating high volumes of low-carbon but intermittent energy.

Establishing a tax credit to offset these additional costs, designed to increase with rising renewable energy production and going beyond compliance with the RES, would provide a strong incentive for utilities to maximize their renewable potential. In addition, offsetting these direct costs would protect consumers by ensuring that higher rates of clean energy do not translate into higher bills.

Incentives for "dispatchable" renewables and electricity storage

As the nation's electricity supply relies increasingly on intermittent zero-carbon energy including wind and solar sources, there will be a need for instantly available (or dispatchable) power to maintain system reliability and reduce integration costs. This makes the construction of a more robust transmission grid and coordinated regional grid operations top priorities. But in addition to these needs, energy storage technology that allows for the storage and dispatch of these resources on demand will become increasingly important to the stability of the grid. Many exciting and innovative technologies for energy storage are being researched and developed, including advanced batteries, compressed air, hydraulic storage, and other approaches to storing intermittent renewable energy resources.

Establishing a dedicated incentive for deployment of "dispatchable" renewable energy will create demand for electricity-storage technologies and eventually move them into widespread adoption. Several options exist to create stronger incentives for storage, including a bonus credit for storage solutions within the previously mentioned renewable integration credit as well as a dedicated stream of allowances for storage technologies within a climate bill. A storage incentive could also apply to economic hybrid renewable-fossil plants that use renewable energy as their primary source and fossil fuels to cover gaps.

Power plants dispatch order and carbon pricing

One of the reasons for high greenhouse gas levels from electricity production is that coal plants run at higher capacity than cleaner natural gas plants. Coal-fired power plants run at an average of 74 percent capacity, while natural gas combined-cycle and simple-cycle plants run at 42 percent and 11 percent capacity, respectively. This difference is due to several factors, including the lower price per kilowatt-hour for coal. The coal price, of course, does not account for its carbon emissions.

Coal combustion produces twice as much greenhouse gas pollution compared to natural gas, so a carbon price from a cap-and-trade program would have twice as much impact on the price of coal as it would on gas. Because priority access to the grid is currently granted principally on the basis of "least cost" electricity generation, it is essential that full carbon costs be included in determining dispatch order. With proper accounting, even a low-carbon price could displace 25 percent or more of the electricity generated by the dirtiest and least-efficient coal plants. The replacement electricity would come from existing and underutilized natural gas plants.

Carbon capture and storage

CCS is the most promising technique to dramatically reduce CO2 emissions from coal-fired power plants. ACES provides $60 billion for CCS demonstration projects for coal plants. This should include research and demonstration projects for carbon capture in natural gas plants and coal plants co-fired with at least 10 percent biomass, as well as coal-fired power plants.

The Senate energy bill should also modify definitions associated with carbon capture and storage to remove technology bias. This includes shifting from a focus on "underground" sequestration to the support of "permanent" sequestration strategies that may include surface storage of CO2 in solid mineral form, as well as deep-well injection of CO2 gas. Because the potential to reduce U.S. carbon emissions is much greater in the existing fleet of power plants than in new ones, any climate policy should ensure that CCS research and deployment efforts focus attention on retrofits of existing plants with carbon capture in addition to developing and deploying new integrated gasification combined-cycle power plants.

Energy efficiency

Many industrial facilities waste energy by emitting waste heat and power generated as a byproduct of their manufacturing processes. It is estimated that capturing and reusing this resource to generate steam for electricity or provide heat in a "combined heat and power" system could save nearly 30 percent of U.S. fossil-fueled generation, reduce U.S. CO2 emissions by 20 percent, and save $150 billion to $250 billion per year.

A number of facilities already employ such systems. Unfortunately, there are a number of federal and state regulatory barriers to more widespread use of combined heat and power systems. One way to increase efficiency, reduce costs, and cut pollution would be to remove these barriers by:

- Requiring the Federal Energy Regulatory Commission, or FERC, and state public utility commissions to review regulations to ensure that they maximize energy efficiency and minimize the production of global warming pollution.

- Establishing FERC guidance to regional transmission organizations to replicate what the New England independent system operator has done by including demand response and energy efficiency in forward-capacity market auctions for energy supply or incur penalties for above-cost resources.

- Launching a FERC-led dialogue on the creation of similar programs outside of the territory covered by regional transmission organizations.

- Rewarding the lowest cost/cleanest power sources regardless of facility age or proximity to central electricity generation.

- Examining the governance of the regional transmission organizations to ensure that they are truly representatives of all interests—including consumers—and not dominated by particular industries or companies.

These and other steps could reduce the bias against local, decentralized generation of electricity from waste energy produced by local industrial facilities.

Transportation

Transportation accounts for about 70 percent of U.S. oil consumption and about one-fifth of U.S. greenhouse gas pollution. There are already efforts underway to reduce this amount. The renewable fuel standard in the Energy Independence and Security Act of 2007 requires 15 billion gallons of conventional ethanol and 21 billion gallons of advanced biofuels by 2022. These biofuels should replace some oil use. President Barack Obama's fuel economy standards will also increase fuel economy by one-third for new cars and light trucks by 2016, saving 1.8 billion barrels of oil. And ACES has incentives to buy plug-in hybrid electric vehicles that could get 100 miles per gallon or more. In addition, ACES would save nearly 1 million barrels of oil a day by 2030, according to the Energy Information Administration.

Despite these efforts, more should be done to reduce our foreign oil use by one-third by 2016, as proposed by President Obama in 2008. The expansion of known and potential reserves of natural gas could replace oil in heavy trucks that are often centrally fueled and

are too heavy for hybrid battery-petroleum engines. The following policy proposals would increase the use of natural gas as a heavy-duty transportation fuel, which would save oil and reduce greenhouse gas pollution.

The NAT GAS Act

The NAT GAS Act, S. 1408, sponsored by Senators Robert Menendez (D-NJ), Harry Reid (D-NV), and Orrin Hatch (D-UT)—and its House companion, H.R. 1835, sponsored by Representatives Dan Boren (D-OK), John Larson (D-CT), and John Sullivan (R-OK)—would boost investments in heavy-duty vehicles powered by natural gas. This fuel has the potential to replace 100 percent of the petroleum used in heavy-duty vehicles. The bill extends, expands, and modifies tax incentives to encourage the purchase of natural gas vehicles, as well as to build infrastructure for fueling them. When complying with federal fleet alternative fuel fleet purchase requirements, federal agencies shall purchase dedicated alternative-fueled vehicles, unless the agency can show that alternative fuel is not available or purchasing such vehicles is impractical.

Finally, under the bill the Department of Energy would provide grants to light and heavy-duty engine manufacturers for research and development of better natural gas engines.

Convert urban vehicle fleets to low-carbon fuels

Urban fleets—cabs, municipal vehicles, delivery trucks—are significant contributors to air and global warming pollution. These centrally fueled fleets could easily use cleaner, alternative fuels such as compressed natural gas. Converting the refueling infrastructure would be relatively easy.

Bus rapid transit

Bus rapid transit—which operates like a subway system, using a small number of dedicated intersecting roads or lanes for high-speed buses only—can address many problems at once. This system can provide public transit to get commuters out of their cars, reducing traffic congestion. This would also reduce oil use and greenhouse gas pollution. And construction of BRT systems cost 30 times less than a subway system. If the buses were powered by compressed natural gas, they would further reduce both oil use and pollution.

The House bill requires a study of heavy-duty vehicles and the potential for natural gas use. The study must make recommendations for additional incentives to increase natural gas use. The NAT GAS Act allows state and local governments to issue tax-exempt bonds for

natural gas-fueled heavy-duty vehicle projects. The Senate energy bill should include provisions that incentivize metropolitan transit systems to develop BRT systems that employ natural gas buses.

Environmental protection

One critical part of the process for producing shale gas in the United States, including shale gas, is called "fracking." It involves pumping water and other materials under high pressure deep into rock formations that hold gas. The process fractures the rock and holds open the fissures to allow the gas to flow to the surface more efficiently. This process can employ toxic chemicals such as benzene and has the potential to pollute deep aquifers, groundwater, and surface waters.

Natural gas production can also release methane, which is a very potent greenhouse gas. This occurs when natural gas is intentionally vented or from leaks throughout the system. According to the latest Environmental Protection Agency inventory, oil and gas systems are the second-largest human source of methane emissions in the United States, accounting for 23 percent of methane and 2 percent of total greenhouse gas pollution. For instance, a recent analysis found that natural gas production in the Barnett Shale region of Texas will produce as much global warming pollution as "two 750 megawatt coal-fired power plants."

There are other legitimate public health and global warming concerns about the impacts from natural gas production. Adjacent communities are concerned about the public health impacts from the use and release of toxic substances, both naturally occurring and those used in the natural gas production process such as benzene, formaldehyde, or radioactive materials. The process also yields significant amounts of air pollution. The gas production from the Barnett Shale in the five counties near Dallas-Fort Worth creates more emissions of smog-forming compounds than motor vehicles.

Any proposal to incentivize the development of natural gas must also address the potential health and global warming impacts of developing this resource. It makes little sense to encourage natural gas use as a lower greenhouse gas alternative to coal or oil combustion if natural gas production yields sizeable amounts of toxic, air, or global warming pollution.

As a first step, the EPA must undertake a comprehensive scientific analysis of the air, land, water, and global warming impacts from natural gas production, including a lifecycle greenhouse gas analysis. It should review the effectiveness of federal and state programs at protecting people, air, land, and water from gas production side effects. The EPA should also review new and emerging technologies to reduce this pollution. Based on the science, the analysis should recommend best management practices for companies and additional government safeguards that require pollution reductions.

After the release of this analysis, states should have the opportunity to adopt the appropriate safeguards to protect their residents and environment. If a state declines to act after a reasonable amount of time, then the federal government should have the authority to establish safeguards for the state based on the state's particular characteristics, including location of the gas, water system, and other relevant variables.

Fortunately, we need not wait for a comprehensive EPA study to address greenhouse gas pollution from natural gas production. The technology and method to capture and sell leaking methane already exists. The EPA, working with the oil and gas industry, collaborated to develop the Natural Gas STAR program. It encourages gas producers to capture and sell their methane emissions. In 2007, partners in the program reduced methane emissions by 92.5 billion cubic feet, which was worth nearly $700 million. The participants also reduced their global warming pollution by 37.4 million metric tons of CO2 equivalent, which equals emissions from 8.5 million cars.

Capturing and selling methane from natural gas production is quite cost effective. Devon Energy spent $15,000 to capture methane from a new well instead of releasing the gas into the air. It sold this methane for $35,000. A Devon Energy official said, "It's a win-win for everybody."

The Natural Gas STAR program is voluntary, however. Given the threat posed by global warming and the economic opportunity to capture and sell leaking methane, it should be a requirement for natural gas producers.

Medium and large natural gas producers should also publicly disclose the chemical constituents (but not the proprietary chemical formulas) used in natural gas production. This "right to know" requirement would enable communities and citizens to better know about the chemicals used and released near their homes.

Research

There has been relatively little money spent on natural gas research compared to other sources of energy. Since the fuel has potential as a low-carbon source of energy, we recommend a research agenda that includes the following topics.

- Higher-efficiency turbines.
- More environmentally benign fracking methods.
- Carbon capture-and-sequestration demonstrations for natural gas plants.
- Technologies and policies that link intermittent renewables with dispatchable natural gas.
- Electricity storage technologies.
- Carbon storage technologies not limited to sequestration underground.

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