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Domestic Energy Challenges in the 21st Century

Overview

Advances in technology have dramatically increased U.S. oil and natural gas production (**Figure 1**). This increase has important policy implications for energy markets, infrastructure, security, and the environment. The Energy Information Administration (EIA) projects that electricity demand will continue growing, with generation fuel shifting further away from coal toward natural gas and renewables. An increase in electricity demand would put strain on transmission capacity. How best to leverage all domestic energy supplies (fossil fuels, renewables, and nuclear) to promote economic growth while balancing the economic, environmental, and security tradeoffs inherent to energy use is an enduring question.

In the 114th Congress, the House and Senate debated major energy legislation addressing topics such as energy efficiency, pipeline permitting, exports, and energy development on federal land, among other topics. If enacted, S. 2012 would have been the most comprehensive energy legislation in nearly 10 years. The conference committee has met, but there are significant differences in the two versions, including differences over non-energy provisions such as access to and use of federal lands.

Oil and Natural Gas

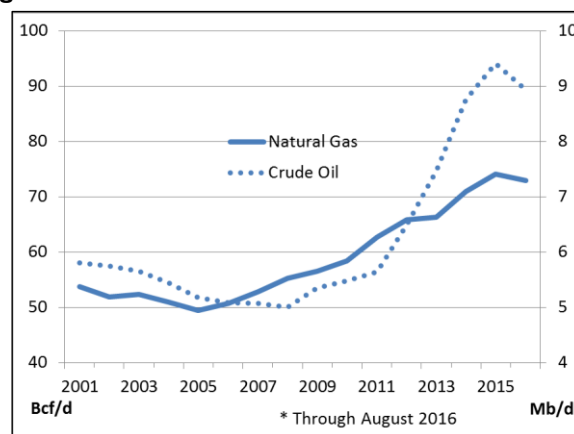
Expanded domestic oil and natural gas supply through techniques such as hydraulic fracturing and horizontal drilling increase the likelihood of the United States becoming a net exporter of both commodities (U.S. natural gas exports exceeded imports for the month of November 2016), but have also led to concerns over air pollution, water supply and quality, and induced seismicity. These techniques have dramatically lowered natural gas cost and increased supply, which has helped reduce overall power plant emissions, including greenhouse gases (GHGs), and made it uneconomic to operate many existing coal-fired and nuclear power plants. At the same time, cheap, abundant natural gas could forestall movement to even lower carbon options such as renewables and advanced nuclear reactors.

Commodity Prices. The expansion of natural gas supply has led to a dramatic drop in prices since 2008 (**Figure 2**), with implications for many different sectors including electricity generation and manufacturing. Over that time, oil prices remained volatile, but dropped in late 2014, and have remained lower since then. Note that while oil is traded on a global market, natural gas is much more of a regional commodity. International price disparities for natural gas have diminished as more liquefied natural gas (LNG) has become available to global buyers.

Exports. Abundant domestic resources also present the possibility for the United States to export large quantities of natural gas and crude oil, although the long-term prospects

for further increases in either export remains unclear. With growing U.S. crude oil production and falling prices, there was keen interest in the 114th Congress in eliminating a 40-year limitation on exports of most U.S.-produced crude oil. In December 2015, Congress passed the Consolidated Appropriations Act for FY2016, which included a repeal of the oil export ban. Before the ban was lifted, U.S. crude oil exports averaged roughly 500,000 barrels per day (bpd), mainly to Canada. Since the ban was lifted, exports have generally fluctuated around or below that 500,000 bpd mark, although exports did reach a record level of 662,000 bpd in May 2016. Most notably, the number of countries receiving U.S. crude has expanded, including countries in Europe, Asia, the Middle East, and the Caribbean.

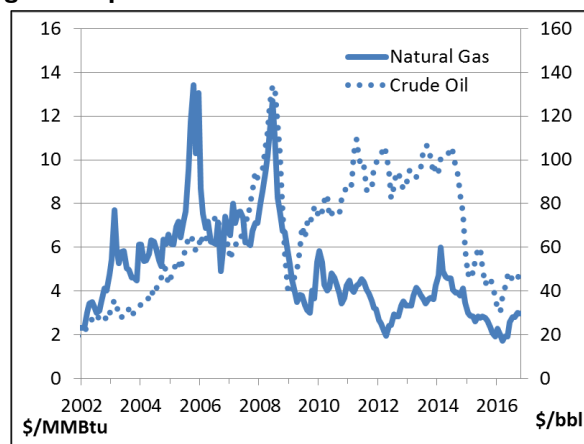
Figure 1. U.S. Natural Gas and Crude Oil Production



Source: Energy Information Administration (EIA). Prepared by CRS.

Notes: Bcf/d = billion cubic feet of natural gas per day; Mb/d = million barrels of oil per day.

Figure 2. Spot U.S. Natural Gas and Crude Oil Prices



Source: Energy Information Administration (EIA). Prepared by CRS.

Notes: \$/MMBtu = dollars per million British thermal units of natural gas; \$/bbl = dollars per barrel of oil.

Natural gas exports require a presidential determination that such exports are in the public interest. Exports to free trade agreement (FTA) countries are assumed in the public interest by statute, while exports to non-FTA countries require a public interest determination. To date, the Department of Energy (DOE) (to which authority has been delegated) has approved roughly 15 billion cubic feet per day (bcf/day) of LNG exports to non-FTA countries, with applications for significantly more capacity still under review. However, even with DOE authorization, there is no guarantee that all of these projects will be completed: these facilities require large infrastructure investments, and a variety of economic and other factors could hinder each project's completion. The first U.S. LNG exports from the lower-48 states began in February 2016, but most LNG export projects remain in the construction or planning phases. Proposals in the 114th Congress were introduced to expedite DOE's export approval process, including provisions contained in S. 1012.

Environmental Concerns. Increased use of advanced drilling and production techniques has raised questions about the environmental effects of the current oil and gas boom. These concerns include effects on water quality and supply, air quality, and GHG emissions. For example, waste water disposal raises concerns about water quality and seismicity. Diverse regulatory regimes across the states have led some to call for national regulation, while others prefer to maintain state authority. In the 114th Congress, some bills would have limited and others would have expanded federal regulation of hydraulic fracturing, while a few states and localities have adopted moratoria or bans on the practice.

Infrastructure. Increased North American oil and gas production, particularly in areas that historically were not major producers, has led to growth in demand to transport those commodities to market. Perhaps most notably, rail tanker oil shipments increased more than four-fold between 2011 and 2012. Since that time, several high-profile derailments have raised concerns over the safety of rail tankers. Barge traffic has also grown. Massive investments have been made in oil and gas pipelines, although controversy has arisen around projects such as the Dakota Access Pipeline and the Keystone XL Pipeline. As noted above, many projects aim to export LNG: if completed, these projects would encompass new terminal facilities at U.S. ports. In the 114th Congress, various bills would have amended rail safety standards, approved the Keystone XL pipeline, or promoted other oil and gas infrastructure projects.

Electricity

Generation. The Energy Information Administration projects that U.S. electricity demand will grow by 10-15% between 2016 and 2030. Because of economic and regulatory factors, renewable energy and natural gas-fired generation are projected to grow by 60-80% and 10-30%, respectively, over the same time frame. Coal-fired generation is projected to range between a 30% decrease and a 5% increase, remaining below historic levels, regardless. The former numbers reflect EIA's projections

assuming EPA's Clean Power Plan to reduce GHG emissions is upheld, while the latter numbers reflect projections based on a repeal of the plan. The future of U.S. nuclear power is unclear. GHG regulations could provide an opportunity for growth, but uncertainty about construction costs and long-term waste disposal raises investment risk.

Transmission. Growth in electricity demand would require the expansion and refurbishment of an aging and already-strained electric grid. Furthermore, concerns about both the physical and cyber-security of the grid remain, and may grow as digital "Smart Grid" technology expands.

Environment. Electric power is the largest consumer of fossil fuels in the United States and its interactions with the environment are often substantial. Concerns with electricity generation include air and water pollutant emissions, GHG emissions, and water use. For example, electricity generation accounts for roughly a third of U.S. GHG emissions and cooling water for power production represents 45% of U.S. water withdrawals. Thus policy actions to address concerns over air and water quality, GHG emissions, and the effects of drought will directly affect the economics of power generation. Some power producers have announced plans to retire existing coal-fired plants in anticipation of Clean Power Plan implementation. Various bills in the 114th Congress would have explicitly limited EPA's authority to regulate GHGs. Whether planned retirements would be reversed if GHG limits were repealed is unclear – the economics of coal vs. natural gas-fired generation remains a challenge for power producers.

Energy Efficiency

Increased efficiency could forestall the need for new electric capacity and help limit demand for U.S. energy supplies. In the 114th Congress, several bills would have promoted energy efficiency in the industrial, commercial, and residential sectors. At the same time, concerns have been raised about the effects of federal efficiency standards on consumer products such as lighting and furnaces.

States' Roles

Many decisions about energy markets, infrastructure, and regulation are implemented at the state level. Regardless of whether the federal government takes a more or less active role in the future, state and regional decisions often have national impacts. California's 2002 decision to regulate GHG emissions from automobiles had ripple effects throughout other states. Similar issues may arise with electricity, as 29 states have established renewable portfolio standards (RPS) for their electric grids. However, each state RPS is different. The interaction of state and local policies with national decisions is often complex.

For more information, see CRS Report R42856, *Energy Policy: 114th Congress Issues*.

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