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before the

SUBCOMMITTEE ON ENERGY AND POWER COMMITTEE ON ENERGY AND COMMERCE

U. S. HOUSE OF REPRESENTATIVES

FEBRUARY 5, 2013

Mr. Chairman and Members of the Subcommittee, I appreciate the opportunity to appear before you today at this hearing on American Energy Security and Innovation: An Assessment of North America's Energy Resources.

The U.S. Energy Information Administration (EIA) is the statistical and analytical agency within the U.S. Department of Energy. EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding regarding energy and its interaction with the economy and the environment. EIA is the Nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the United States Government. The views expressed herein should therefore not be construed as representing those of the Department of Energy or any other Federal agency.

EIA provides a wide range of information and data products covering energy production, stocks, demand, imports, exports, and prices; and prepares analyses and special reports on topics of current interest. EIA prepares both short-term energy outlooks, examining monthly trends over the next one to two years, and long-term outlooks, with annual projections over the next 20-to-25 years.

While my testimony will be focusing primarily on the most recent production and resource information and the short term energy outlook, I would like to briefly point to some key results from the Annual Energy Outlook 2013 (AEO2013). The Reference case discussed in this testimony was released in December and is intended to represent an energy future through 2040 based on given market, technological, and demographic trends; current laws and regulations; and consumer behavior. EIA recognizes that projections of energy markets are highly uncertain and subject to geopolitical disruptions, technological breakthroughs, and other unforeseeable events. In addition, long-term trends in technology development, demographics, economic growth, and energy resources may evolve along a different path than represented in the projections. The complete AEO2013, which EIA will release this spring, will include a number of alternative cases intended to examine these uncertainties as well as changes in law since the reference case was released.

In the AEO2013, the application of technology innovation has a notable effect on the productivity and development cost of certain areas across the energy resource base. Domestic production of crude oil, particularly from shale and other tight formations, increases sharply. Cumulative production of dry natural gas from 2011 through 2035 in the AEO2013 Reference case is about 8 percent higher than in AEO2012, primarily reflecting continued increases in shale gas production that result from the dual application of horizontal drilling and hydraulic fracturing. The share of electricity generation from renewables grows from 13 percent in 2011 to 16 percent in 2040.

Electricity generation from solar and to a lesser extent wind energy sources grows as cost declines make them more economical. However, the AEO2013 projection is less optimistic than AEO2012 about the ability of advanced biofuels to capture a rapidly growing share of the liquid fuels market. Domestic coal production increases at an average rate of only 0.2 percent per year, from 22.2 quadrillion British thermal units (Btu) (1,096 million short tons) in 2011 to 23.5 quadrillion Btu (1,167 million short tons) in 2040. Before I discuss the different resource sectors, I would like to clarify that the methodologies for developing reserve and resource estimates differ across fuels. For example, “estimated recoverable reserves” for coal reflect a different concept than “proved reserves” for oil and natural gas. The EIA and the USGS both have a role with regard to oil, natural gas and coal. The renewable assessments are developed by the National Renewable Energy Laboratory. The data and forecasts in the rest of my testimony are largely from EIA’s most January Short Term Energy Outlook (STEO) which does not reflect the impact of the recent extension of various energy tax incentives.

TRENDS IN U.S. CRUDE OIL AND NATURAL GAS PRODUCTION

Crude Oil. EIA estimates that U.S. total crude oil production (which includes lease condensates) averaged 6.4 million barrels per day (bbl/d) in 2012, an increase of 0.8 million bbl/d from the previous year driven largely by growth in tight oil production (Figures 1 and 2). This increase in U.S. annual production is the largest since Colonel Drake drilled the first crude oil well in Pennsylvania in 1859. EIA forecasts that another record increase in production will occur this year, with domestic crude oil production expected to increase to 7.3 million bbl/d in 2013. The 7.9 million bbl/d EIA currently forecasts for 2014 would mark the highest annual average level of production since 1988. Central to this projected growth will be ongoing development activity in key onshore basins. Drilling in tight oil plays in the Williston Basin's Bakken formation in North Dakota and Montana, the Western Gulf Basin's Eagle Ford formation, and the Permian Basin in Texas is expected to account for the bulk of forecast production growth over the next two years.

Natural Gas. U.S. dry natural gas production has increased since 2005 mainly because of production of shale gas resources (Figure 3). That upward growth trend has been a little bumpy reflecting economic factors affecting natural gas prices and weather events. Declining production from less-profitable "dry" natural gas plays such as the Haynesville Shale has been offset by growth in production from liquids-rich natural gas production areas such as the Eagle Ford and wet areas of the Marcellus Shale as well as associated gas from the growth in domestic oil production. Total marketed production averaged 69.2 Bcf/d in 2012. EIA expects overall U.S. natural gas production to remain close to its 2012 level in both 2013 and 2014.

CRUDE OIL AND NATURAL GAS PROVED RESERVES

EIA's most recent published crude oil and natural gas reserves report is as of year-end 2010. For each fuel, net additions to proved reserves, which reflect the volume of reserves added during 2010 after subtracting the year's production, were – by a large margin – the highest ever recorded since EIA began publishing proved reserves estimates in 1977. I testified before this Subcommittee in some detail last August right after the report was released, but given the dramatic change in the U.S. crude oil and natural gas reserve profile, I am repeating some of that information here for new members of the Subcommittee. EIA is catching up on the reserves reporting following the 2011 budget cuts that delayed the program. The year end 2011 proved reserves will be published in the coming months.

Proved reserves are estimates of hydrocarbons that geologic and engineering data demonstrate with reasonable certainty can be recoverable from identified fields under existing economic and operating conditions. The data and estimates we develop and disseminate reflect a combination of survey data collected directly from operators and information provided by other Federal agencies and the states.

Crude oil (includes lease condensate) proved reserves increased by 2.9 billion barrels (12.8 percent) during 2010, ending that year at 25.2 billion barrels (Figure 4). Texas, North Dakota, and the Gulf of Mexico Federal Offshore had the largest increases in oil proved reserves in 2010 (Figure 5). An increase in the oil price boosted oil reserves in states with large producing oil fields.

U.S. proved reserves of wet natural gas increased by 33.8 trillion cubic feet (Tcf) (11.9 percent) during 2010, ending that year at 317.6 Tcf (Figure 6). Texas, Louisiana, and Pennsylvania had the largest increases (Figure 7).

CRUDE OIL AND NATURAL GAS RESOURCES

Next, I want to speak to the issue of resources. Technically recoverable resources, also known as TRR, are an estimate of hydrocarbons that are producible using currently available technologies and industry practices from both discovered resources and estimated potential resources without regard to economic considerations. Estimates of technically recoverable resources, while inherently uncertain, are a common measure of the long-term viability of U.S. domestic oil and natural gas as an energy source and are an important input to EIA's energy projections. TRR estimates are a "work in progress," changing as more production experience becomes available and as new production technologies are applied to these resources.

EIA's energy supply projections address the timing of economic production of oil and natural gas resources, which depend upon the production profile of individual wells over time, the cost of drilling and operating those wells, and the revenues generated by those wells based on projected oil and natural gas prices. For these reasons EIA is primarily concerned with determining well drilling and operating costs, production decline curves, and other economic parameters, such as tax, depreciation, and royalty rates. Although TRR estimates provide a context for the size of the potentially available resource, this aggregate number says nothing about whether a large or small portion of the resource will be economic to produce in the foreseeable future.

The EIA relies heavily on the expertise of the United States Geologic Survey (USGS) to develop many of the resource production characteristics and parameters that generate TRR estimates. The USGS estimates of TRR represent a snapshot of resource recoverability based on the wells drilled and technologies deployed prior to the assessment. The USGS re-estimates a formation's TRR, typically updating its estimates every 5 to 10 years, whereas EIA re-estimates initial production rates and production decline curves, and in turn, estimated ultimate recovery (EUR) per well and TRR for every

Annual Energy Outlook. In EIA's annual re-estimation process, EIA emphasizes current well productivity data, which inherently incorporates the latest technology. EIA also develops estimates for those formations that have recently gone into production, but for which the USGS has not yet developed a resource estimate.

Although each TRR parameter has some degree of uncertainty associated with it, the greatest uncertainty is associated with the determination of a formation's average initial production rate and production decline curve, which specifies a well's estimated ultimate recovery (EUR).

EIA will continue to solicit input from geologists, petroleum engineers, statisticians, and other experts to improve the methodology for developing estimates of TRR and to determine specific key assumptions. The ultimate goal is to establish a TRR methodology that is practical, reasonable, defendable, and uses the best available production data. Even so, EIA recognizes that even the best methodology and data will still result in highly uncertain TRRs that will change over time as more information becomes available and as management practices and technology evolve.

DATA COLLECTION FOR CRUDE OIL AND NATURAL GAS PRODUCTION

Finally, I want to raise an issue of importance to this subcommittee which has jurisdiction over EIA. As just discussed, the quality and timeliness of the data has become more important. EIA estimates for non-Federal oil production are based on monthly oil production data from state Government agencies and purchased third party data. Many of the states collect production data largely for revenue purposes, though some data are collected in order to regulate crude oil and natural gas production. Different data are collected by each state, and definitions vary from state to state on the most basic of questions and the lag from production to final reporting varies enormously. EIA currently collects monthly data on natural gas production from about 230 to 240 operators in five key states: Texas, Louisiana, Oklahoma, New Mexico, and Wyoming. EIA started direct collection of this data in 2005, because of the growing importance of timely and accurate monthly natural gas production data. Though more accurate than the oil production estimates, the current natural gas monthly production survey does not collect data for Federal lands or data on natural gas shale production, and it has not been expanded to identify and track major changes in natural gas production, such as the rise in shale gas production in Pennsylvania and Arkansas.

In its FY2013 budget, EIA has proposed spending an additional $550,000 per year to increase the timeliness and accuracy of both oil and natural gas production data. Additional funds would allow EIA to expand the natural gas collection to 15 producing states and to add collection of oil production. (For the federal offshore EIA would continue to cooperate closely with the Department of the Interior.) The proposal would improve data quality as well as enable EIA to identify and report on trends sooner.

COAL PRODUCTION, MARKETS AND RESOURCES

After reaching 1,172 million short tons in 2008, domestic coal production decreased by 12 percent to 1,027 million short tons by 2012; over half of this decline occurred between 2011 and 2012. In 2012, coal production decreased in the two top producing regions, Central Appalachia and the Powder River Basin (PRB), by 16 percent and 9 percent respectively. In contrast, 2012 coal production volumes in the Illinois Basin rose above its five-year range, up 9 percent from 2011. Illinois Basin coal has become more competitive as additional coal-fired power plants have installed scrubbers capable of reducing sulfur emissions by 90 percent or more. The increasing costs of mining Central Appalachian coal and the location advantages relative to PRB coal have had a positive impact as well. Regional coal production patterns from 2007 are illustrated in Figure 8.

The decline in domestic production corresponds to a significant reduction in coal consumption by electric utilities. EIA estimates coal consumption in the electric power sector will total 829 million short tons in 2012, the lowest since 1992, and 21percent lower than in 2007. Domestic coal use outside of the electric power sector is estimated at 65 million short tons in 2012, also a 21 percent decline since 2007.

Coal's general competitiveness has also been affected by a steady increase in the delivered cost of coal over time, reaching a national average of $2.40 per million Btu in 2012. A key driver of delivered coal prices is the rail transportation cost. More than 70 percent of coal shipments to power plants are by rail. These costs increased by approximately 50 percent from 2001 to 2010 and account for approximately 40percent of the total delivered coal price on average. However, delivered price increases are moderating in response to the reduction in demand since 2008 affecting both transportation and commodity prices.

Lower natural gas prices led to a significant increase in the share of natural gas-fired power generation in 2012. Wholesale (spot) coal prices across all basins fell during the first half of 2012 before stabilizing in the latter half of the year. Competition between natural gas and coal for electric power generation drove price declines in the Appalachian and Powder River Basins (PRB), two key sources for thermal coal, through the summer. Also, mild temperatures in the winter and high stockpiles at electric power plants limited demand for more purchases of coal in the second half of 2012. Spot prices represent a fraction of coal sales to power plants but do influence the setting of longer-term coal contracts, gradually affecting the delivered price of coal as coal supply contracts are renegotiated.

Record coal exports and slowing coal imports led to a 20 million short ton increase in net exports, partially offsetting declines in consumption in the power sector. Export volumes are volatile from year to year and depend on world coal market conditions which favored increasing coal exports over the past few years. While the majority of U.S. exports are metallurgical coal, growing steam coal demand for power generation is also fueling 2012 exports to an all-time high.

U.S. coal exports are largely concentrated in a few facilities, with the leading seven ports accounting for 93 percent of U.S. exports. Despite growing demand in Asia, the United States exports more coal to Europe (55 percent) than it sends to the rest of the world combined. About 82 percent of U.S. coal exports were shipped to Europe and Asia in the first eleven months of 2012. U.S. coal exports to Europe are primarily serviced out of the East Coast via Norfolk, Virginia (the largest coal export facility in the United States) and Baltimore, Maryland (the third largest). Exports to Asia originate mostly from the East Coast as well, primarily out of Baltimore. Among the top export facilities, only New Orleans and Seattle primarily export steam coal. Figure 9 shows the distribution of export shipments by region of the world and the U.S. port of origin. (These changes in coal production and markets have been reported in *Today in Energy*, a relatively new EIA series of short analytical pieces posted daily on the EIA website.)

There are three types of coal resource and reserves data at EIA: the demonstrated reserve base, estimated recoverable reserves, and recoverable reserves at producing mines.

Demonstrated Reserve Base. The largest category of reserves is the demonstrated reserve base (DRB), which represents coal reserves in the ground that have been identified to specified levels of accuracy and are in thickness ranges and at depths that are considered minable**.** As of January 1, 2012, the demonstrated reserve base was estimated to contain 483 billion short tons. The DRB was originally estimated in 1974 by the U.S. Bureau of Mines as part of the last comprehensive assessment of U.S. coal resources and reserves. Because of higher priority needs, EIA has not completed a full national reassessment of the DRB, although it has made several new regional assessments over the years.

Estimated Recoverable Reserves. The actual proportion of coal reserves that can be produced from undisturbed deposits varies from less than 40 percent in some underground mines to more than 90 percent at some surface mines. Because of property rights, land use conflicts, and physical and environmental restrictions, EIA has estimated that only about 50 percent of the DRB may be available or accessible for mining. Thus, EIA estimated that the remaining U.S. estimate recoverable reserves totaled 259 billion short tons.

Recoverable Reserves at Producing Mines. The smallest category of reserves is recoverable reserves at producing mines, which are reported to EIA annually by mine operators. These reserves essentially reflect the working inventory at producing mines. As of January 1, 2012, they were estimated at 19 billion short tons.

TRENDS IN RENEWABLE RESOURCE USE IN ELECTRICITY AND LIQUID FUELS

In 2012, the consumption of most renewable energy forms including wind, solar, and biofuels are projected by EIA to have grown. EIA expects hydropower production will have fallen 13.7 percent from the unusually high levels seen in 2011, leading to an overall decline of 2.5percent in renewable energy consumption. Even so, the overall growth in renewable energy consumption from 2010 to 2012 was 10.3percent. In October of 2012, electricity generation from *Other Renewables* (wood, black liquor, other wood waste, biogenic municipal solid waste, landfill gas, sludge waste, agriculture byproducts, other biomass, geothermal, solar thermal, photovoltaic energy, and wind) surpassed conventional hydroelectricity generation (Figure 10) for the first time.

EIA projects that wind-powered generation grew by 17 percent in 2012. According to a recent analysis by the National Renewable Energy Laboratory (NREL), the estimated annual domestic resource potential for wind (onshore as well as offshore) is 49,700 TWh. Onshore wind accounts for 32,700 TWh of the estimated resource potential, and is present in nearly every state, being largest in the western and central Great Plains and lowest in the southeastern United States. Technical estimated potential for offshore wind power is 17,000 TWh, and is present in significant quantities in all offshore regions of the United States.

Solar energy continues robust growth and is projected to grow by 32 percent in 2012. According to NREL, the estimated annual resource potential is 399,700 TWh, with the largest potential coming from rural utility scale PV (280,600 TWh). Concentrating solar power technologies also comprise a substantial segment of the total solar resource potential with an estimated annual potential of 116,100 TWh.

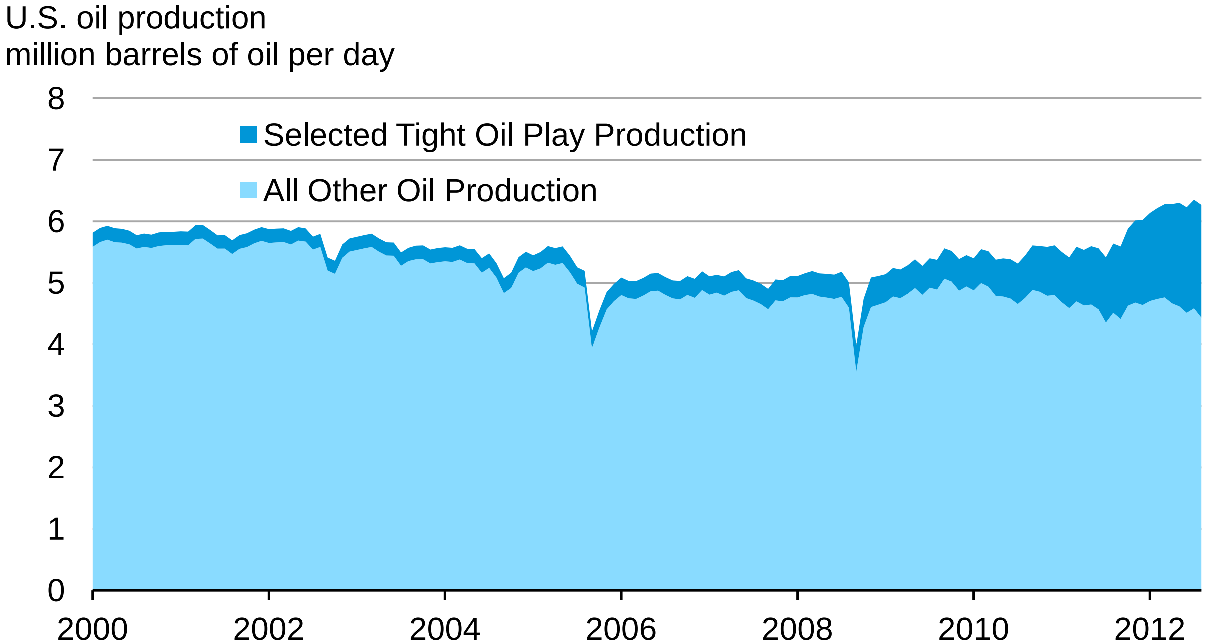
Enhanced geothermal systems (EGS) have an estimated annual domestic resource potential of 31,300 TWh. The vast majority of the geothermal potential for EGS within the contiguous United States is located in the westernmost portion of the country. The Rocky Mountain states, and the Great Basin particularly, contain the most favorable resource (17,400 TWh).

Because of drought conditions depressing corn harvests throughout the Midwest, fuel ethanol production fell from an average of 900,000 bbl/d during the first half of 2012 to an average of 820,000 bbl/d in the second half of the year. EIA expects ethanol production will remain near current levels through mid-2013 before recovering to pre-drought production levels, averaging 870,000 bbl/d (13.3 billion gallons) for the year. Ethanol production is expected to rebound in 2014 as previously idled capacity comes back on line. Biodiesel production averaged about 65,000 bbl/d (1.00 billion gallons) in 2012. Forecast biodiesel production averages 74,000 bbl/d in 2013 and 2014, with biodiesel blending meeting the RFS requirement of 1.28 billion gallons set for 2013.

Finally, EIA has developed a new interactive energy mapping feature incorporating the various resource ranges and GIS data on energy infrastructure. The maps allow the user to select the layers to show resources and infrastructure at the national, state, or county level. We will soon add Congressional districts.   Figure 11 A-D demonstrates different resource and infrastructure combinations for several different states.

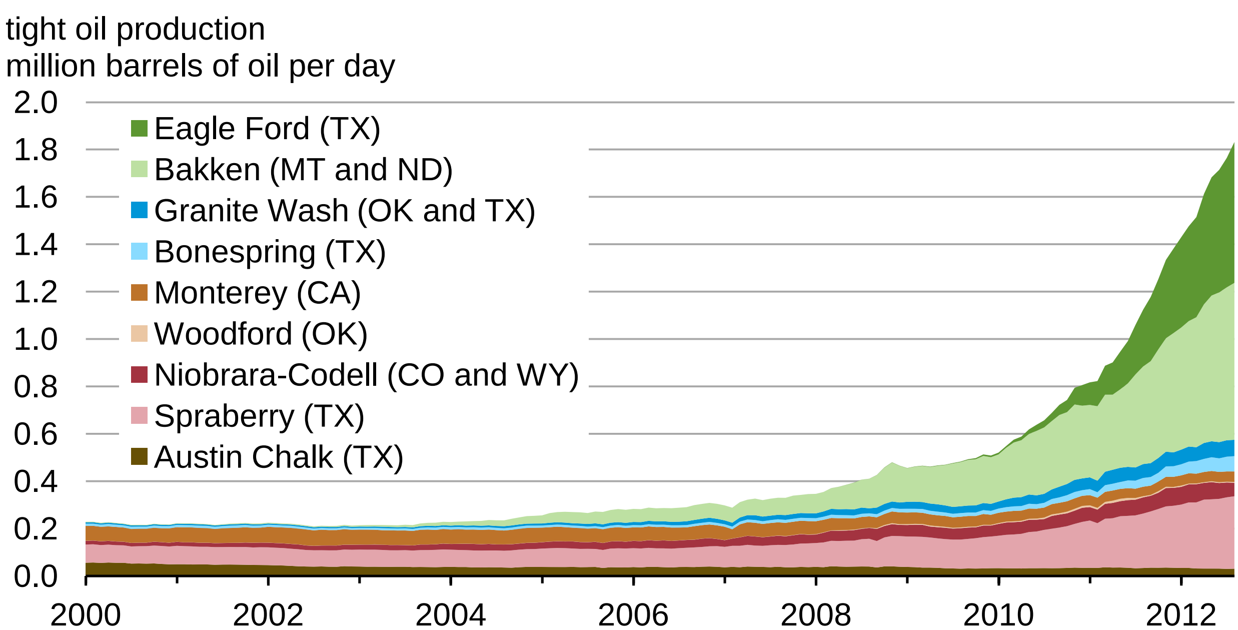
Thank you for the opportunity to testify before the Subcommittee.

Figure 1. Crude oil production beginning to grow due to tight oil development, led by Bakken and Eagle Ford plays



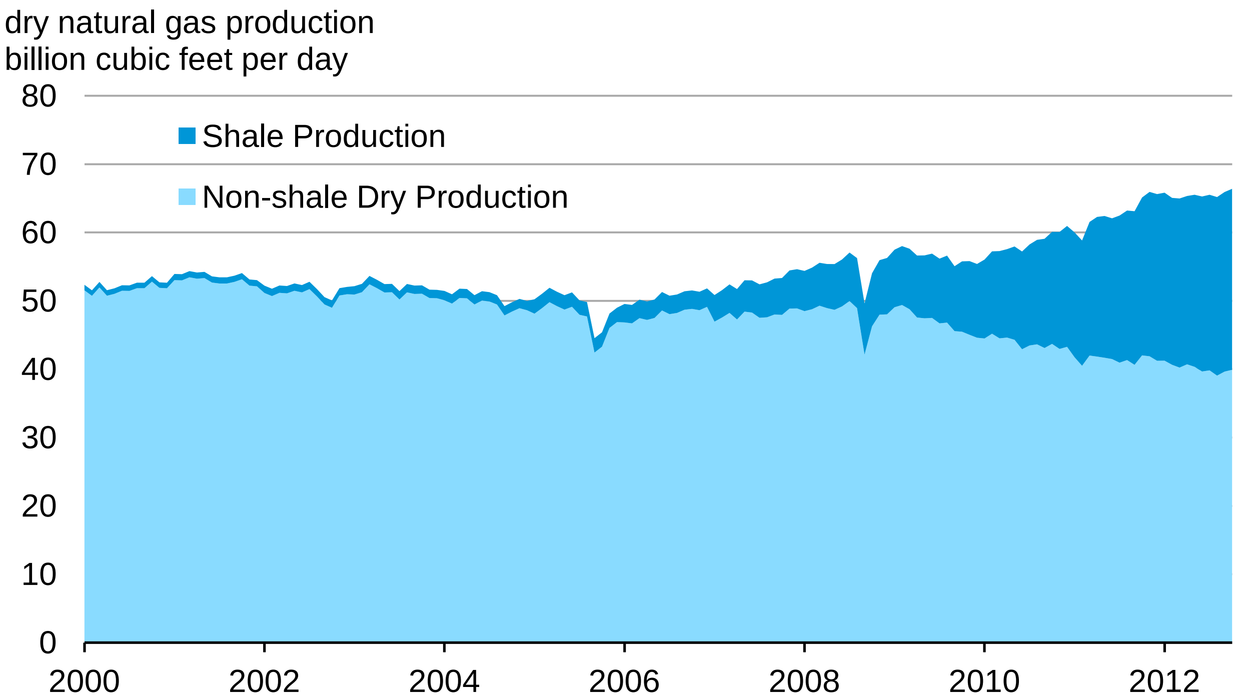
Source: U.S. Energy Information Administration, DrillingInfo (formerly HPDI), Railroad Commission of Texas, and North Dakota Department of Mineral Resources, through August 2012

Figure 2. Tight oil production for selected plays through August 2012 exceeds 1.8 million barrels per day



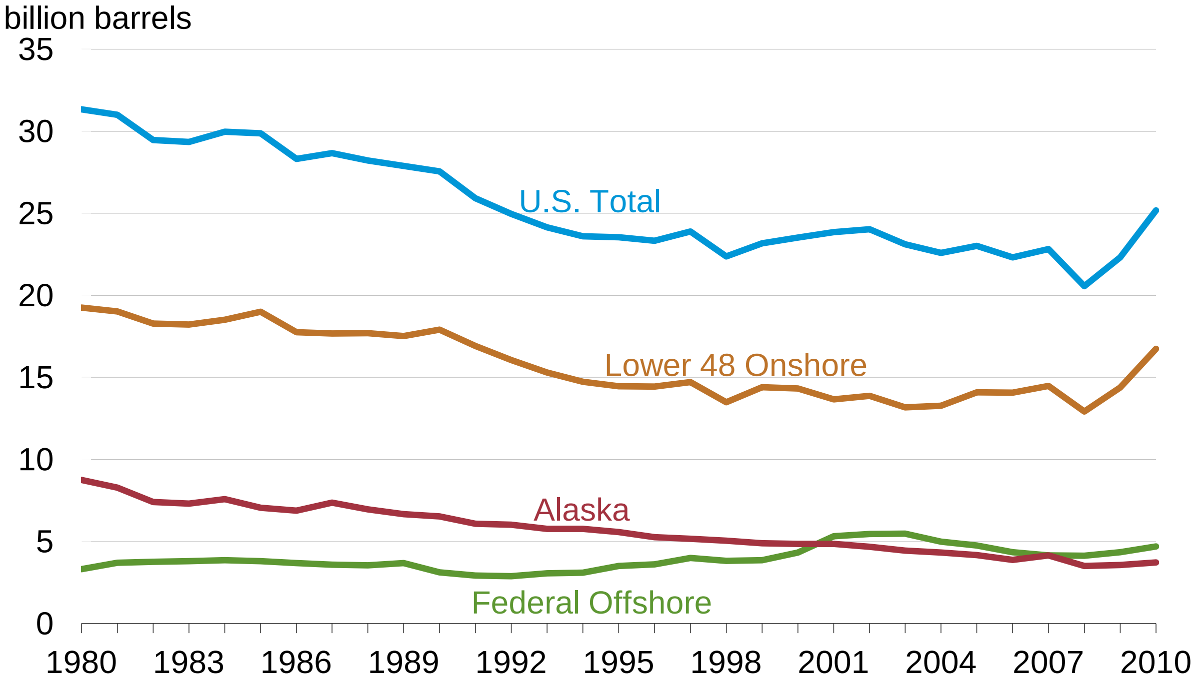
Source: U.S. Energy Information Administration, DrillingInfo (formerly HPDI), Railroad Commission of Texas, and North Dakota Department of Mineral Resources, through August 2012

Figure 3. U.S. shale gas production comprised over 35 percent of total U.S. dry production in 2012



Source: U.S. Energy Information Administration and LCI Energy Insight through October 2012

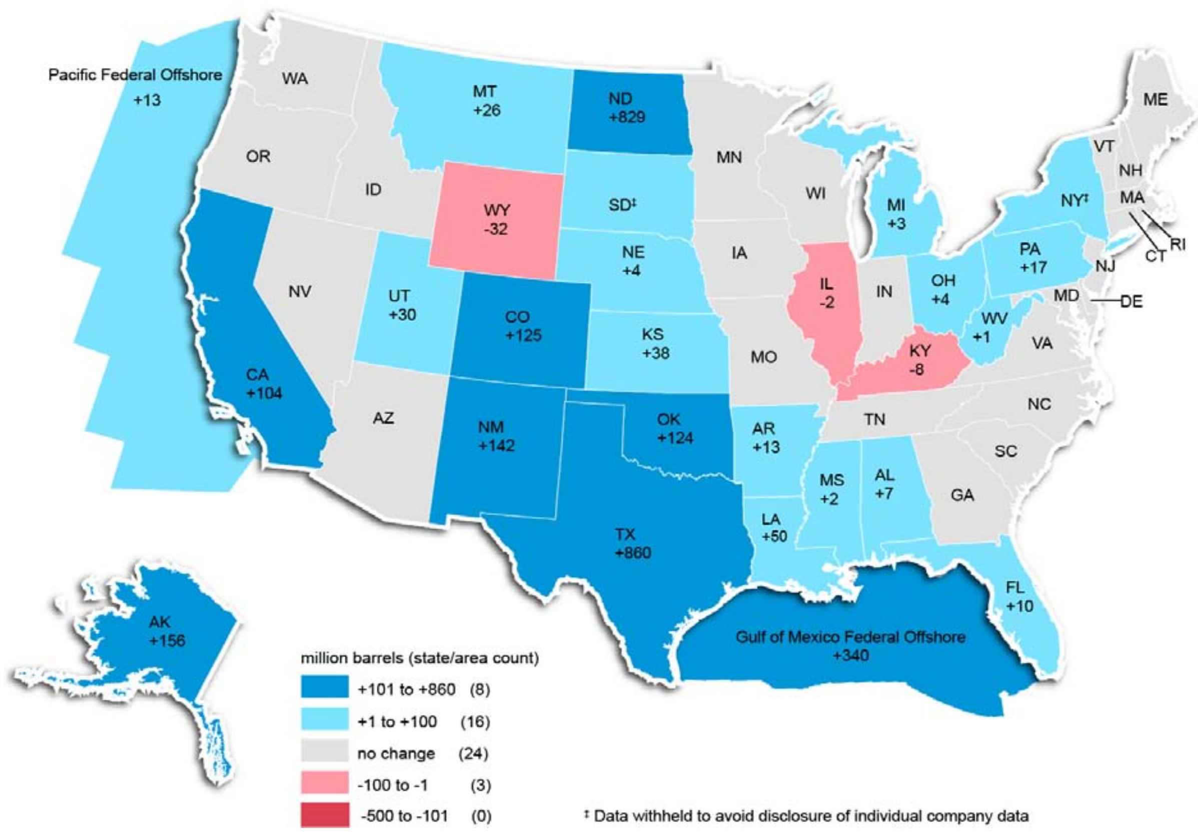
Figure 4. U.S. crude oil plus condensate proved reserves, 1980-2010



Source: U.S. Energy Information Administration

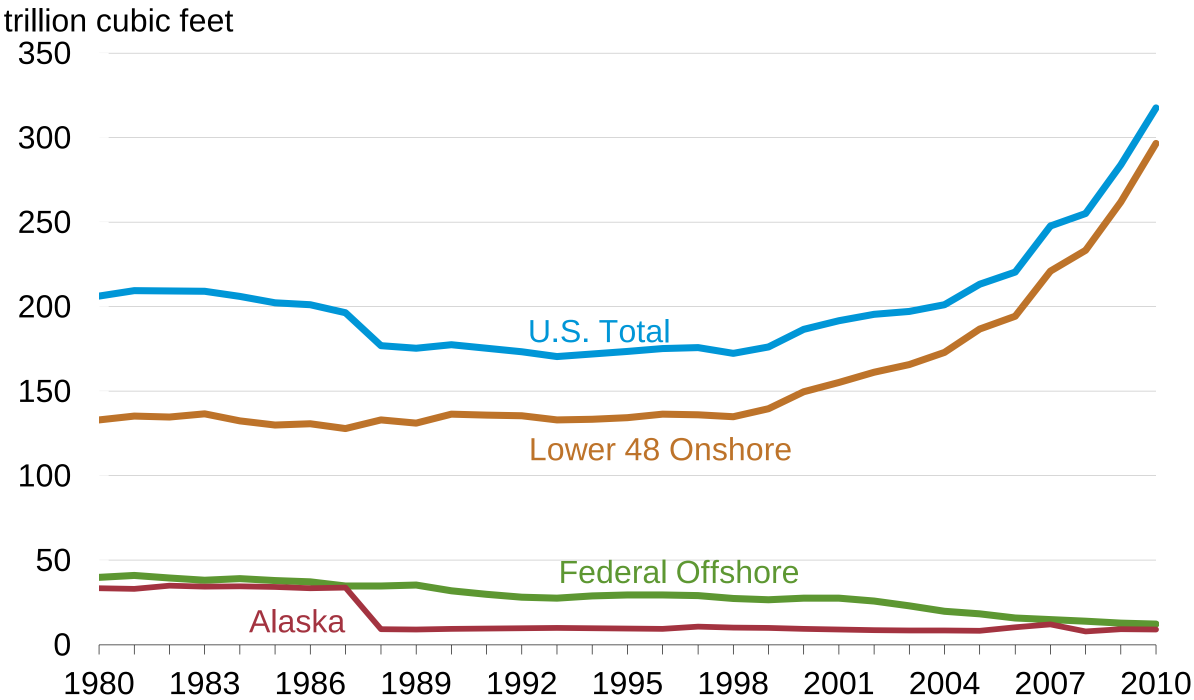
Figure 5. Changes in oil proved reserves by state/area 2009-10

billion barrels of crude oil and lease condensate



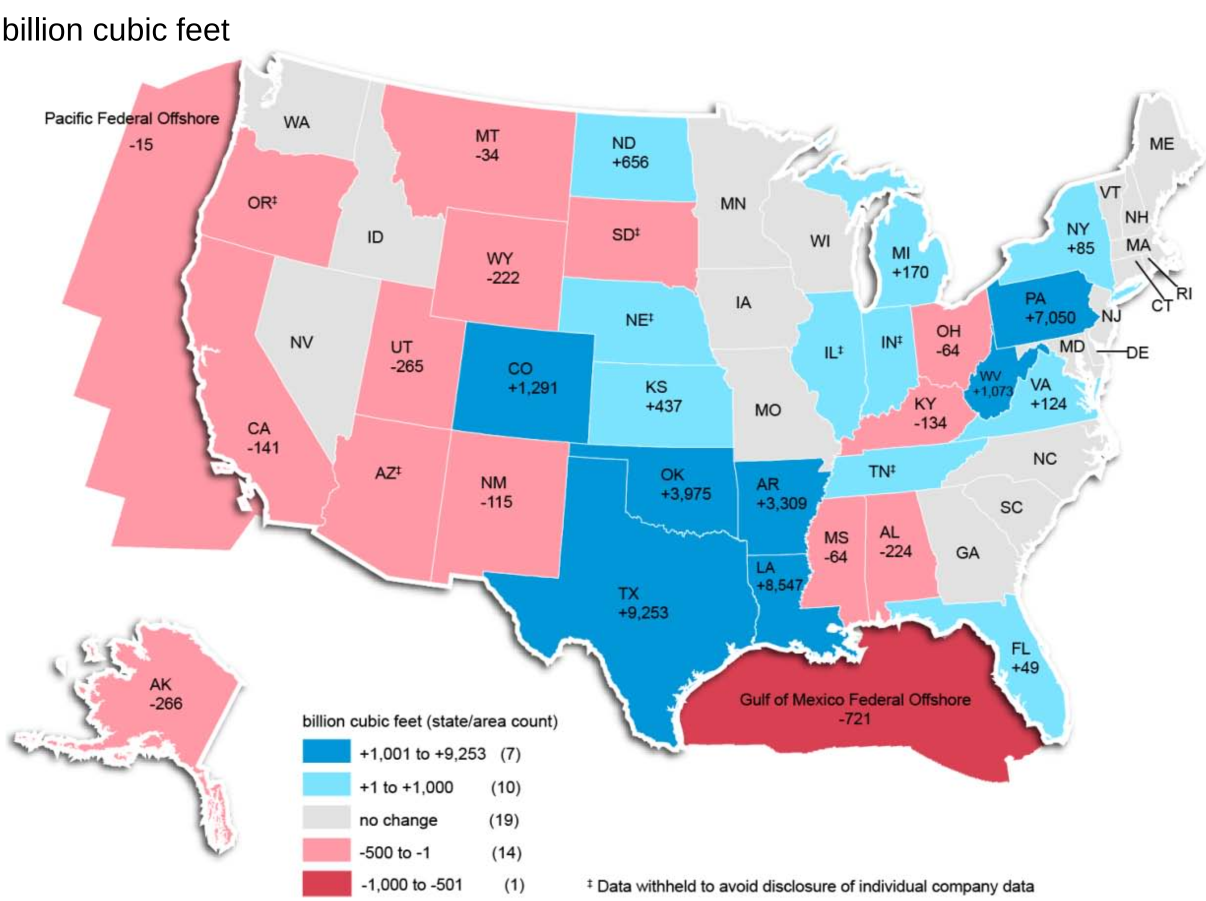
Source: U.S. Energy Information Administration

Figure 6. U.S. wet natural gas proved reserves, 1980-2010



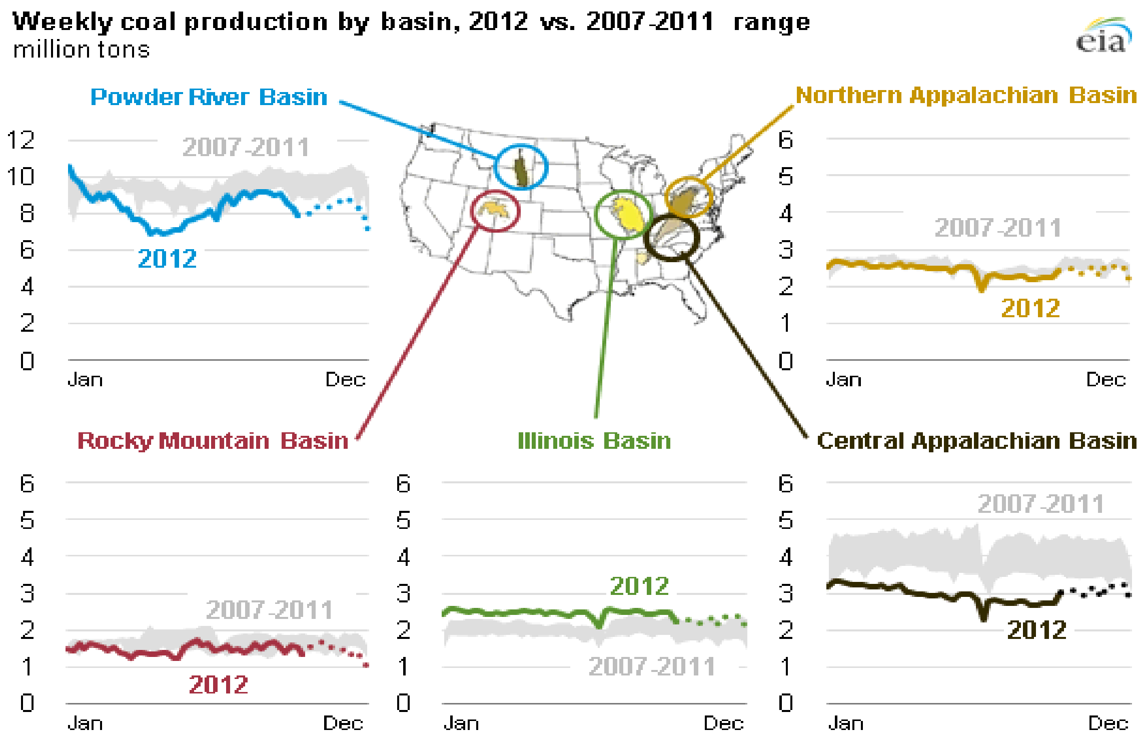
Source: U.S. Energy Information Administration

Figure 7. Changes in wet natural gas proved reserves by state/area 2009-10



Source: U.S. Energy Information Administration

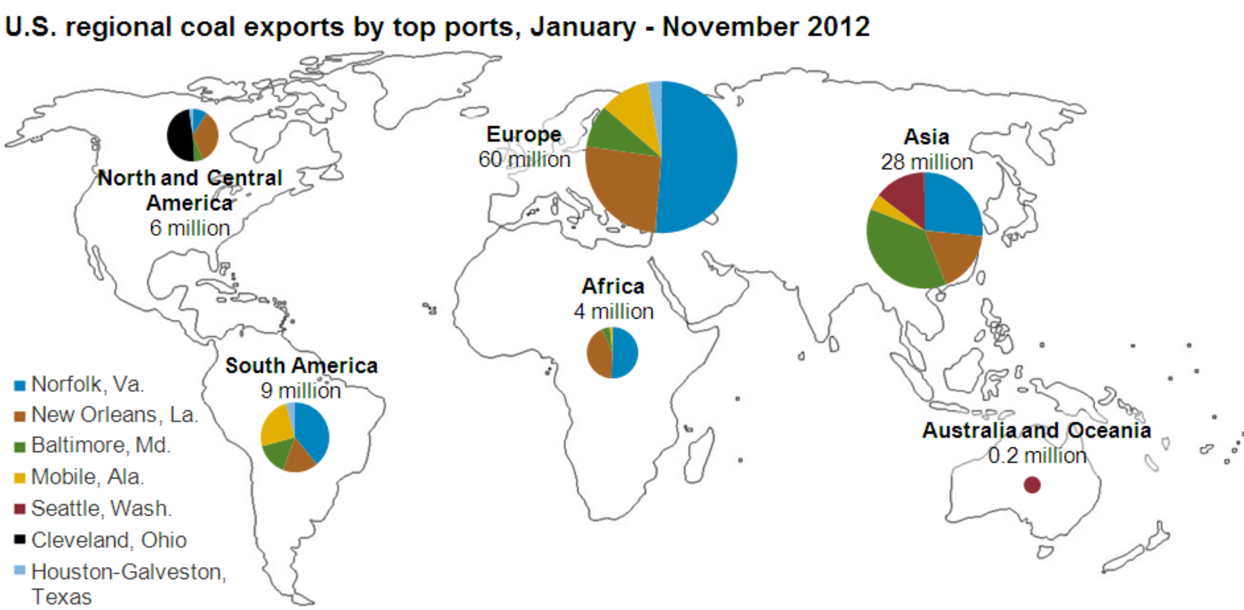
Figure 8. Weekly Coal Production by Basin, 2012 vs. 2007-2011



Source: U.S. Energy Information Administration, Weekly Coal Production, based on MSHA

Note: Data for January 2007 through September 2012 are revised to match the Mine Safety and Health Administration (MSHA). October 2012 through December 2012 are preliminary EIA estimates and denoted with dotted lines.

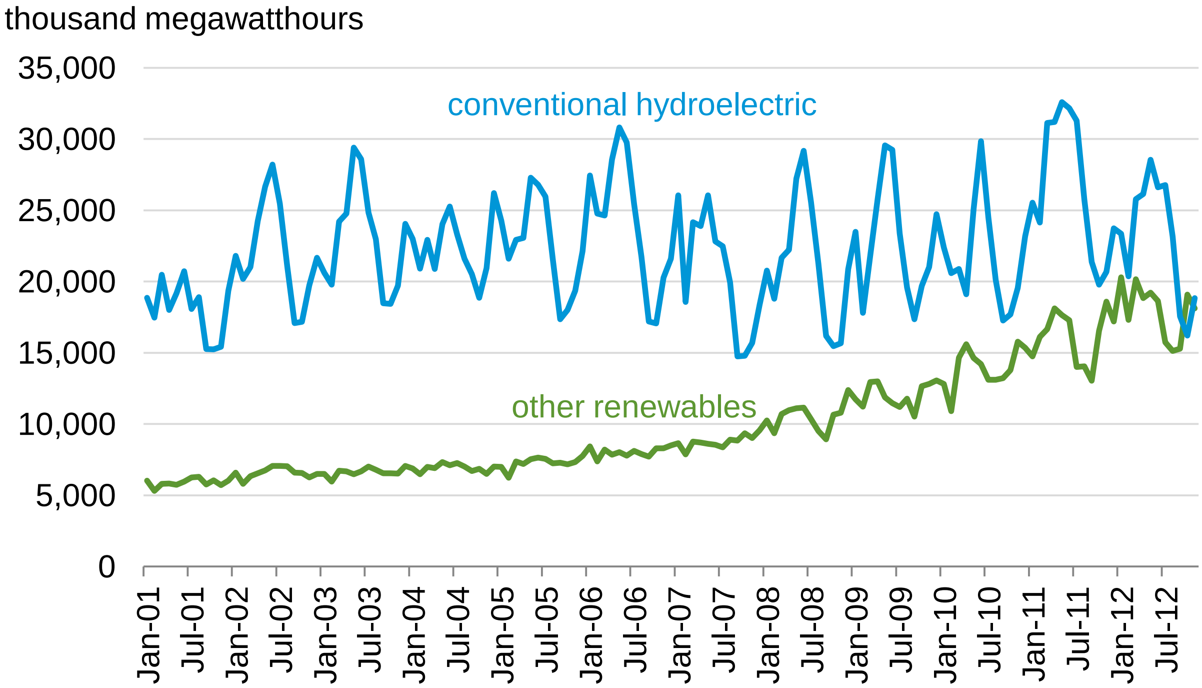
Figure 9. U.S. Regional Coal Exports by Top Ports, January - November 2012



Source: U.S. Energy Information Administration based on U.S. Census Bureau data

Note: For top seven ports totaling 93 percent of U.S. exports. Data for 2012 run through November. Due to limited volumes, Central America is combined with North America.

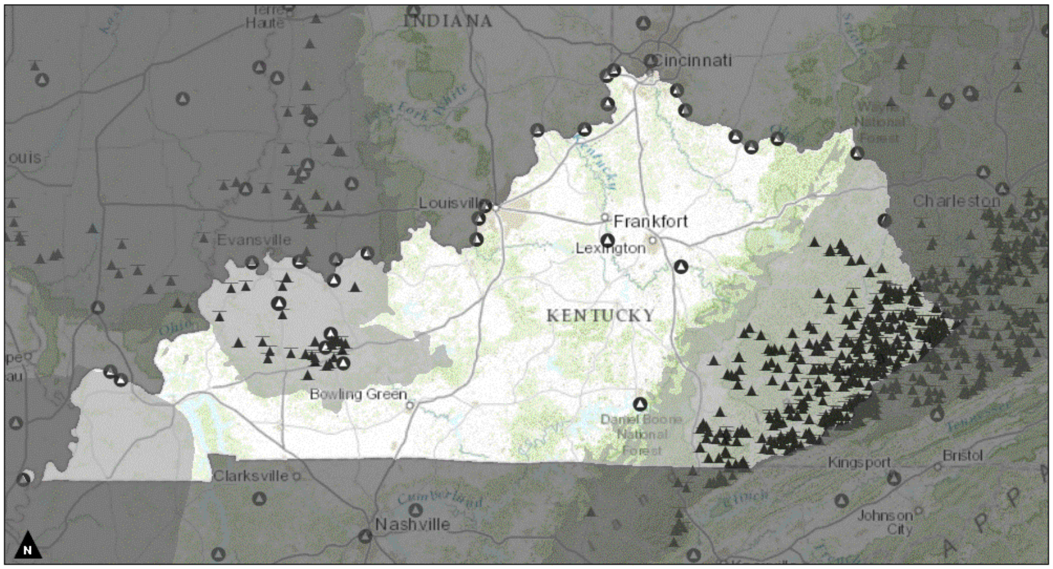
Figure 10. Generation from conventional hydroelectric and other renewable sources



Source: U.S. Energy Information Administration, Electric Power Monthly

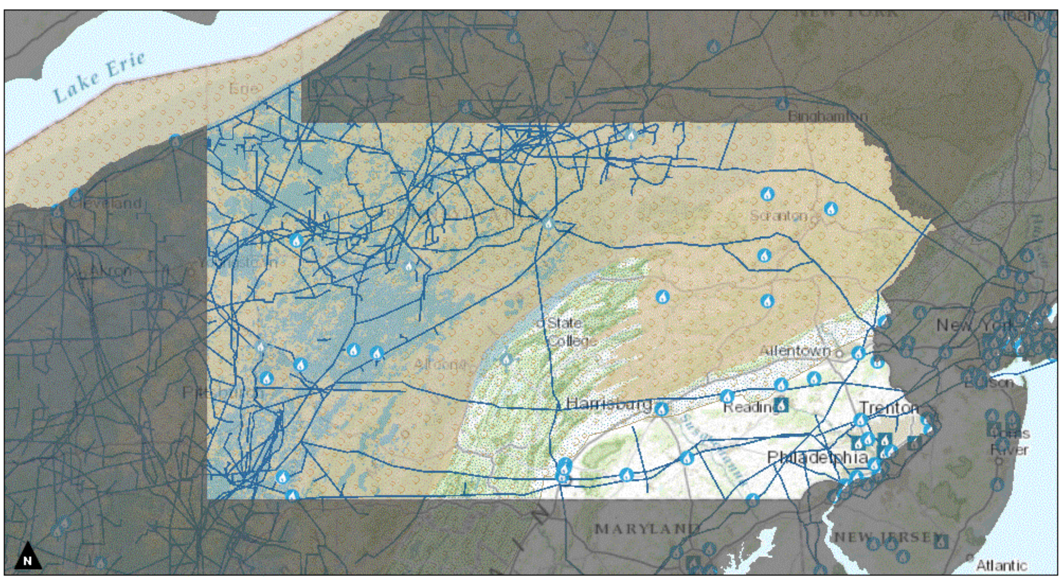
Note: Data for 2012 are preliminary. Other renewable sources include wood, black liquor, other wood waste, biogenic municipal solid waste, landfill gas, sludge waste, agriculture byproducts, other biomass, geothermal, solar thermal, photovoltaic energy, and wind.

Figure 11A-D.



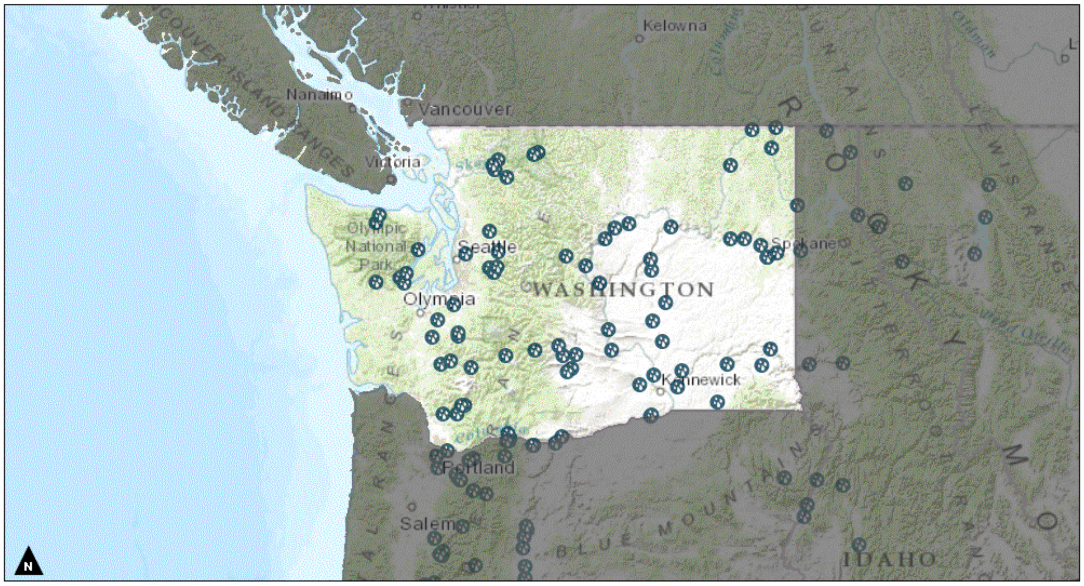
Topographical:Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

- Mask
- Surface Coal Mine
- Underground Coal Mine
- Coal Power Plant
- Coal Field



Topographical:Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

- Mask
- Natural Gas Power Plant
- Liquefied Natural Gas Facility
- Liquefied Natural Gas Import/Export Terminal
- Natural Gas Transmission Hub
- Natural Gas Pipeline
- Oil and Gas Field
- Shale Basin
- Shale Play
- Tight Gas Basin
- Tight Gas Play



Topographical:Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Mask
Hydroelectric Power Plant
Pumped Storage Power Plant

Topographical:Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS,

Mask
Wind Power Plant
On Shore 50 Meter Tower Wind Potential
7 Superb
6 Outstanding
5 Excellent
4 Good
3 Fair
2 Marginal
1 Poor

Off Shore 90 Meter Tower Wind Speed
8.14 to 11.63
6.89 to 8.13
6.14 to 6.88
4.89 to 6.13
1.63 to 4.88