

Coal to Remain Key U.S. Source of Electrical Power

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Some politicians, journalists, and others warn the U.S. must “wean” itself from coal and other hydrocarbon-based fuels and convert to “green” energy. They label these as “dirty” fuels. Despite this, recent data indicates that coal provides 48 percent of U.S. electrical power needs, a one percent increase since 2000. Natural gas and nuclear combined provide another 41 percent and hydroelectric provides 6 percent. Given the wide use of coal, this prompts many to ask: Is this political puffery or is green energy realistic? And how important is coal for generating electricity in the U.S. and can “green” power replace coal power generation? Knowing North America contains the world’s largest coal resource endowment, the following examines coal, wind, and solar as sources for U.S. electrical power.

The Department of Energy’s Energy Information Agencyⁱ says there are 586 coal-fired electrical generating plants in the U.S. Of these, 347 plants are located in 13 mid-western and eastern states that are the largest users of coal power. These states are, in decreasing order of power generated from coal, Texas, Ohio, Indiana, Pennsylvania, Illinois, Kentucky, West Virginia, Georgia, North Carolina, Alabama, Missouri, Michigan, and Florida. Total electrical power generated in these states in 2008 ranged from 65 to 147 million megawatt-hours, for a 13-state total of 1,239 million megawatt-hours (1,238,944,955 MW-hrs) (black and darkest gray shading on Figure 1). Coal-fired generation in these states is more than 62 percent of all U.S. power generated from coal while exceeding 30 percent of the electricity generated from all U.S. fuel sources.

Now let’s look at renewablesⁱⁱ. Renewable sourcesⁱⁱⁱ, wind, solar, geothermal, pumped storage, and biomass contributed only 131 million megawatt-hours, or 3 percent of all electricity generated in the U.S. Wind and solar contributed less than one-half of this amount (indicated by pie charts, Figure 1) although wind power has grown 206 percent since 2005. Texas boasts nearly one-third of this wind and solar percentage, or about 16 million megawatt-hours generated in 2008. The next five largest generators of wind and solar in California, Minnesota, Iowa, Washington, and Colorado contributed another 21 million megawatt-hours in 2008.

Wind has substantial disadvantages. It only blows intermittently. An analysis of Iowa’s wind energy generation, the second largest wind generator, shows that the additional wind and solar electrical generation is unable to keep pace with demands. Iowa’s wind generating efficiency is the lowest of any state at 16.7 percent of its installed nameplate capacity of 2,791 MW^{iv,v}. Iowa generated 7 percent of its power from wind in 2008, a 148 percent increase since 2005. However, from 2005 to 2008, Iowa added 6.1 million megawatt-hours of coal-fired-generation while wind added only 2.4 million megawatt-hours. This makes clear that wind either (1) cannot adequately provide the power demanded by economic or population growth, (2) permanent additional electrical generation from other backup sources must provide fill-in power to compensate for intermittent wind power, or (3) both. This inadequacy is true despite of the exceptionally-distorted federal subsidies favoring wind and solar^{vi}. The U.S. subsidizes wind and solar at \$53/MWhr compared to \$1/MWhr subsidy to coal and other fuels.

To meet the U.S. Renewable Energy Standard (RES) that wind and solar provide 25 percent of power by 2025 requires construction of 660,740 2.5-MW, or average size, wind turbines occupying 44.3 million acres, larger than the combined areas of Rhode Island, Delaware, Connecticut, Hawaii, New Jersey, Massachusetts, New Hampshire, Vermont, Maryland, and West Virginia for towers and transmission facilities. To accomplish this feat, the total required capacity of wind turbines must exceed the combined capacity, in MW, of all existing U.S. power generating installations in use today (coal, oil, natural gas, nuclear, etc.) and Canada’s too. Raw materials required for towers are 119 million yards³ of concrete and 109 million tons of steel^{vii}, about two years of U.S. consumption^{viii}. For nuclear to accomplish the same 25 percent RES needs only an area equal to one-third the area of Poughkeepsie, NY for all plants.

The pie charts^{ix} (Figure 1) indicate available sources of electrical power. Thirty-four states require coal for more than 30 percent of their electrical generation and that 25 states required coal for more than 50 percent of their electrical generation. The total electrical power generated by these 34 states was 1,924 million megawatt-hours in 2008, or 97 percent of all coal-fired electrical generation in the U.S. Since 2005, coal-fired generating growth has slowed while electrical generation from natural gas increased 15 percent. These are clear statements that, short of a massive construction of nuclear power plants, coal and hydrocarbon sources will remain as mainstays of U.S. power generation for the long term.

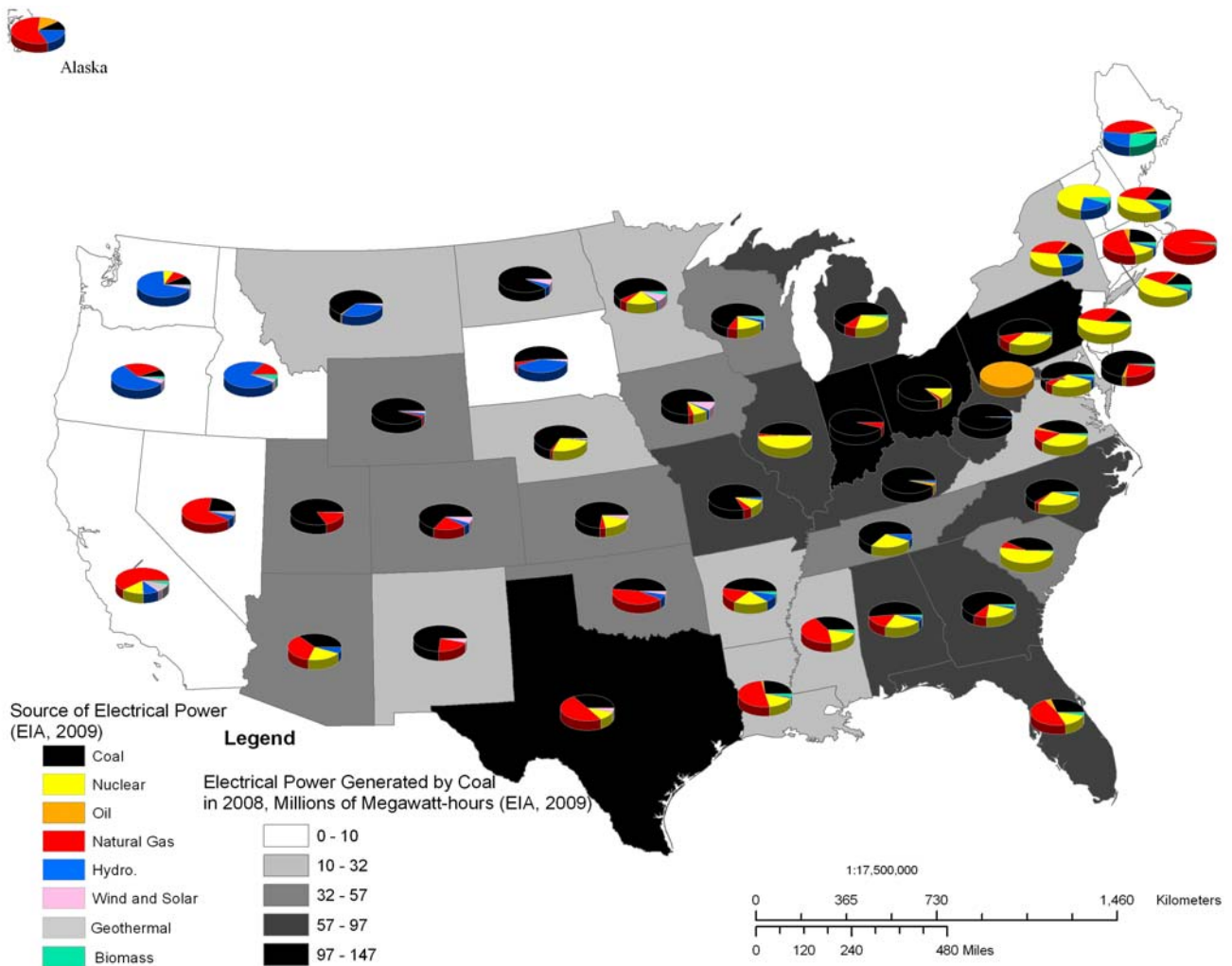


Figure 1. Electric power sources in the U.S. and quantity of power generated by coal.

The various sources of electrical power in the U.S. are shown by the pie charts for each state. Wyoming, for example with 10 coal plants with a total capacity of 6,408 MW, generates 94% of its power with coal, and with 2% each contributed from natural gas, hydroelectric, and wind. For example, Washington State's one, coal plant with a capacity of 1,460-MW, generated 8.7 million megawatt-hours from coal in 2008 although its power is contributed 70% by hydroelectric, 8% from nuclear, 8% from coal, 9% by natural gas, 3% from wind, and 1% from biomass.

Shown by the white-gray-black shaded pattern is the relative quantity of power generated by coal in each state (Data is for 2008; EIA, 2009). The largest generators of electric power from coal are (in decreasing order): Texas-147 million megawatt-hours and Ohio-130 million megawatt-hours. Other large generators of coal-fired electricity are Indiana, Pennsylvania, and Illinois. Rhode Island and Vermont use no coal for electrical generation. A few of the smallest users (in increasing order) are: Idaho, Maine, Alaska, Hawaii, and California. Texas has 18 coal-fired power plants with a combined capacity of 21,015 MW. Not shown is Hawaii. Hawaii has one 203 MW power plant provided 1.6 million megawatt-hours in 2008. Its power is contributed by crude oil (76%), coal (14%), biomass (4%), hydroelectric (1%), wind and solar (2%), and geothermal (2%).

ⁱ EIA, 2009 Form EIA-860, "Annual Electric Generator Report," - Generator File

ⁱⁱ EIA, 2009 http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html

ⁱⁱⁱ Hydro power, like nuclear power, is not considered among the "new renewables." However, conventional hydroelectric contributed over 6 percent of all electricity generation from all sources amounting to 254 million megawatt-hours in 2008. Washington, Oregon, New York, and California, the largest sources, generate 3.9 percent of U.S. power needs from hydroelectric

^{iv} Electrical Energy: Sound Scientific Solutions, by John Droz <http://www.slideshare.net/JohnDroz/energy-presentationkey-presentation>

^v American Wind Energy Association <http://www.awea.org>

^{vi} Federal financial interventions and subsidies in energy markets, 2007 <http://www.eia.doe.gov/oiaf/servicerpt/subsidy2/pdf/execsum.pdf>

^{vii} "A Problem with Wind Power" by Eric Rosenbloom <http://www.aweo.org/ProblemWithWind.html#models>

^{viii} USGS Mineral Commodity Summaries, 2010 <http://minerals.usgs.gov/minerals/pubs/mcs/>

^{ix} EIA, 2009 http://www.eia.doe.gov/cneaf/electricity/epm/table1_1.html