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SUSTAINABLE ENERGY STUDY #17

U.S. Energy Information Administration Releases Renewable Energy Consumption and Electricity Preliminary 2006 Statistics:

U.S. Energy Information Administration, August 21, 2007

http://www.eia.doe.gov/cneaf/solar.renewables/page/prelim_trends/rea_prereport.html

Renewable Energy Data Profile, 2006: Overview

Preliminary data indicates that total renewable energy consumption increased 7 percent between 2005 and 2006 (Table 1). In contrast, total U.S. energy consumption declined 1 percent, mainly due to decreased consumption of fossil fuels (including decreased natural gas consumption in the residential sector and decreased coal and petroleum consumption in the electric power sector).[1]

Renewable energy's market share stood at almost 7 percent in 2006, slightly greater than for 2005 (Table 1 and Figure 1). Total renewable consumption stood at 6.844 quadrillion Btu. Consistent with historical patterns, the electric power sector consumed the majority (56 percent) of renewable energy (Table 2). The industrial sector consumed 28 percent, with the transportation and commercial sectors using the remainder. Hydroelectric conventional power had the largest absolute year-to-year change at 186 trillion Btu, but this represented only a 7 percent increase, while biofuels[2] consumption increased by 164 trillion Btu or 28 percent, and wind increased by 80 trillion Btu or 45 percent.

Renewable Energy Consumption: Quadrillion Btu Change -- 2005-2006 (Percent)

Total	6.844 -- 6.9
Biomass	3.277 -- 5.2
Biofuels	0.758 -- 27.6
Waste	0.404 -- 0.3
Wood Derived Fuels	2.114 -- (0.1)
Geothermal Energy	0.349 -- 1.8
Hydroelectric Conventional	2.890 -- 6.9
Solar/ PV Energy	0.070 -- 6.5
Wind Energy	0.258 -- 45.1

Source: Table 1 of this report.

The Role of Renewable Energy Consumption in the Nation's Energy Supply, 2006

Biofuels

Ethanol production increased about 25 percent from 3.9 billion gallons in 2005 to 4.9 billion gallons in 2006.[3] A number of factors contributed to this growth:

Continued replacement of methyl tertiary butyl ether (MTBE) by ethanol as a gasoline additive.

Strong world oil demand and higher crude oil prices, which have raised the price of gasoline and thus the demand for, and price of, ethanol as a substitute.

Federal tax laws that provide incentives, such as the 51 cent per gallon tax credit available to blenders for each gallon of ethanol blended into gasoline.

The Energy Policy Act of 2005, which mandates annual renewable fuel use in gasoline at 7.5 billion gallons by 2012.

At 2006 production levels, ethanol accounted for nearly 4 percent of U.S. finished motor gasoline production.[4] While this had a significant impact on the energy sector, the impact on the agricultural sector may have been greater.

The United States Department of Agriculture (USDA) estimates that 14 percent of corn use in the 2005/2006 crop year went for production of ethanol up from 11 percent in the 2004/2005 crop year and 6 percent in 1999/2000.[5] Furthermore, the price of corn hit nearly \$4 per bushel during 2006, the highest price seen in the last two decades and considerably higher than the average price of \$2.40 seen over that twenty-year-period.[6] Increased ethanol production in the U.S., coupled with increased demand from Asian countries for meat from corn-fed livestock, is contributing to the increased demand for corn.

Meanwhile, the Renewable Fuels Association reported early in 2007 that the number of ethanol plants operating in the United States increased from 95 in January of 2006 to 110 in January 2007, with 76 plants under construction or expanding at that time.[7] Ethanol production capacity increased by almost 1.2 billion gallons per year for a total capacity of nearly 5.5 billion gallons per year online in January 2007. Consumption of ethanol in the transportation sector, which also includes the impact of trade and stock changes, increased from 334 to 448 trillion btu between 2005 and 2006 (Table 2). This included an expanding share of consumption of imports, largely from Brazil.[8]

Biodiesel production, currently a far smaller component of biofuels production than ethanol, was about 91 million gallons in 2005, based on data from the USDA Commodity Credit Corporation. The Commodity Credit Corporation ended its program and its data collection on March 31, 2006. While private estimates of biodiesel production for 2006 called for a steady increase, no verifiable alternative data source has been found to replace the discontinued Commodity Credit Corporation data.[9]

Renewable Electricity Generation and Capacity

In 2006, hydroelectric conventional generation increased to 288 billion kilowatt-hours, the highest level since 2003 (Table 3). However, 2006 output was not as high as levels seen during the high water years of the later 1990's. Furthermore, hydroelectric generation actually declined substantially in the Southeast, only to be more than offset by gains in the Northwest.

Wind generation increased to 26 billion kilowatt-hours, up from 18 billion kilowatt-hours in 2005. This moved wind's share of the renewable generation market from just 5 percent to 7 percent in one year. Altogether, renewable energy provided 9 percent of total U.S. generation in 2006.[10]

By state, the largest increases in renewable generation were for hydroelectric conventional power in California and the northwestern states: Idaho, Oregon and Washington (Tables 5 and 6). Hydroelectric conventional power accounted for 18 billion kilowatt-hours of the 27 billion kilowatt-hours increase in renewable generation. However, the increase in wind generation was also notable. Wind increased 8 billion kilowatt-hours between 2005 and 2006, spread across a number of states.

Total U.S. net summer capacity for all energy sources increased by 10,049 megawatts in 2006 to 988,069 megawatts, while renewable capacity expanded to 101,383 megawatts total and accounted for 2,637 megawatts or 26 percent of the national increase (Table 4). Wind capacity increased more during 2006 than any other renewable generation source with 2,413 megawatts of new capacity. This exceeds the increase of 2,251 megawatts during 2005.

The three states with the largest increases in wind capacity were Texas, Washington, and California, in order of capacity increase (Tables 7 and 8). Texas alone added 943 megawatts. All other renewable energy sources accounted for just 225 megawatts of the 2006 capacity increase. Hydroelectric conventional capacity remained essentially flat at 77,629 megawatts, increasing only 88 megawatts.

Wind Energy

By the end of 2006, wind net summer capacity stood at 11,119 megawatts, or about 2.8 times its level in 2002 (Table 4). Texas, with 2,698 megawatts of capacity in 2006, overtook California as the Nation's leader in wind capacity (Table 8). Fifteen states reported net increases in wind capacity. Total wind generation increased by 45 percent year to year. For 2007, the American Wind Energy Association reported the industry was on track to install over 3,000 megawatts of wind capacity.[11]

The following are factors driving this growth in wind energy:

Federal Renewable Production Tax Credit (PTC). This directly affects the economics of projects that can take advantage of the credit. The PTC provides a 1.9 cent per kilowatt-hour tax credit (adjusted for inflation) for electricity generated in the first ten years of the life of the project to new projects beginning operation by the end of 2008, when the current PTC expires.[12]

Renewable Portfolio Standards and State Mandates. The North Carolina Solar Center maintains the Database of State Incentives for Renewables & Efficiency (DSIRE), which contains summary information on renewable portfolio standards by state (see: <http://www.dsireusa.org/>) . While the objectives and conditions of renewable portfolio standards (RPS) and state mandates vary widely among the some 24 states reported by DSIRE to have them, some of the stricter ones (e.g., a mandatory RPS with a renewable generation requirement well above recent levels) are already providing an impetus to renewable development.[13] Differences in RPS provisions include variations in: what renewable energy sources will be counted; whether power can come from existing renewable capacity or must be from new capacity; what percentage of generation must be renewable and by when; how much of a challenge meeting that requirement will be for an individual state depending on the goal to be accomplished and the base from which the state starts; whether the provisions are mandatory or voluntary, or mandatory with conditions (such as a ceiling on cost increases); and whether renewable energy credits, as established by many RPS programs, will be traded.

Higher Natural Gas Costs. Although the cost of natural gas may not be the single deciding factor in choosing to build a wind plant, the average cost of natural gas received by electric power plants has been in an upward trend over the last decade.[14] While the average cost of \$6.92 per million Btu (nominal dollars including taxes) in 2006 was lower than the cost for 2005, it remained quite high by historical standards. Because wind power has no fuel costs, higher electricity prices, driven by higher natural gas and other fossil fuel costs, do improve wind's competitive position and make investment in wind more profitable, particularly as developers speculate that the trajectory of future natural gas costs may rise further.

Global Warming. Concerns over the potential impact of global warming have resulted in some states and regions establishing commitments to reduce greenhouse gas emissions. To illustrate, seven northeastern states formed the Northeastern States Regional Greenhouse Gas Initiative (RGGI) with the nation's first multi-state cap-and-trade system for carbon. Also, California, Oregon and Washington have banded together to form the West Coast Governors Global Warming Initiative to reduce global warming.[15] Development of wind power to meet electricity demand can help states and localities meet these commitments.

The following states led the growth in wind capacity:

Texas. With 943 megawatts of new capacity, Texas led the nation in expanding wind capacity. In 2006, Texas brought online the second and third phases of the existing mammoth Horse Hollow Wind Energy Center, bringing total project capacity up to 736 megawatts and likely making it the largest wind farm in the world.[16] The project lies on 47,000 acres in Taylor and Nolan counties and employs 291 GE 1.5 megawatt turbines and 130 2.3 megawatt Siemens turbines.

In 1999, Texas adopted a renewable portfolio standard that required 2,000 megawatts of new renewable capacity be installed by 2009 in addition to the existing 880 megawatts. Texas has already met that requirement. In August 2005, realizing the 2009 goal would easily be met, Texas increased the mandate to 5,880 megawatts by 2015 (or about 5 percent of the state's electricity demand). New additions of wind capacity in Texas have contributed to the state's

meeting these goals. The 2005 legislation also streamlined the ability of the state Public Utility Commission to order transmission lines to meet this goal.

Washington. Washington was second in wind capacity additions with 428 megawatts coming online during 2006, which brought Washington's total non-hydro renewable capacity up to almost 1,200 megawatts. New capacity included the 200-megawatt Big Horn project in Klickitat County and the 229-megawatt Wild Horse project in Kittitas County.

In recent years Washington has committed to reducing greenhouse gas emissions and increasing renewable electricity generation. In September 2003, Washington's governor joined with the governors of California and Oregon to announce the West Coast Governors' Global Warming Initiative to reduce global warming. Later in 2004, the governors issued detailed recommendations on how this might be accomplished. Following these efforts, Washington's voters passed a renewable energy standard (included in ballot Initiative 937) in November 2006.[17] It calls for electric utilities that serve more than 25,000 customers to obtain 15 percent of their electricity from new renewable sources by 2020. Further, in February 2007 the governor issued an executive order which sets a goal of reducing greenhouse gas emissions in the state of Washington to 1990 levels by 2020. New wind projects in 2006 and any that follow will contribute to the state's meeting these related commitments.

California. This state was an early leader in the development of renewable energy for electricity generation in the U.S. It had 16 percent of the Nation's renewable electric capacity in 2006, and notably an even greater share – 24 percent – of non-hydro renewable capacity. Although California added just 212 megawatts of wind capacity (including the Shiloh I Wind Project) to its 2005 base of over 2000 megawatts of wind capacity, it may be expanding renewable capacity (including wind) even more in the future to meet its commitments described below.

California's current renewable portfolio standard requires retail sellers of electricity to purchase 20 percent of their electricity from renewable sources by 2010.[18] In addition, the governor signed Assembly Bill 32, the Global Warming Solution Act, into law in September 2006.[19] This Act caps California's greenhouse gas emissions at 1990 levels in 2020. Renewable energy is considered part of a broad-based solution. The speed of its development will depend in part on how fast issues such as the availability of adequate transmission capacity can be settled.

Data Revisions

Starting with EIA's March 2007 Electric Power Monthly and continuing with this and other reports, EIA has revised its methodology for classifying energy sources as renewable, and its estimates of renewable waste energy beginning in 2001. EIA's definition of renewable energy is "Energy sources that are naturally replenishing but flow limited. They are virtually inexhaustible in duration but limited in the amount of energy that is available per unit of time. Renewable energy sources include: biomass, hydro, geothermal, solar, wind, ocean thermal, wave action and tidal action." [20] Using this definition, EIA decided to revise renewable energy by excluding tires (whose natural rubber content is the smaller part of the total content) and the nonrenewable share of municipal solid waste (MSW).[21]

Details of EIA's analysis that revised MSW consumption are found in the EIA report, Methodology for Allocating Municipal Solid Waste to Biogenic and Non-Biogenic Energy (Washington, DC, May 2007).[22] In brief, most of the information EIA collects on MSW comes from the Form EIA-906, "Power Plant Report," and the Form EIA-920, "Combined Heat and Power Plant Report." However, power plants report only the total amount of MSW consumed and the average heat content. No distinction is made on the EIA surveys between renewable and nonrenewable components of MSW, so EIA had to develop a methodology to approximate the split.

The Environmental Protection Agency reports some information on the material composition of MSW on a periodic basis for various years in its report, Municipal Solid Waste in the United States: Facts and Figures. Associating this information with the appropriate heat content for each material category in MSW, EIA divided MSW into its biogenic and non-biogenic portions. In 2005, the split on a thermal basis was about 56 percent biogenic (or renewable) and 44 percent non-biogenic (or non-renewable). Implementing this approach lowered the estimate of renewable energy consumption by about 135 trillion btu in 2006 compared to what it would have been using EIA's prior methodology. EIA also expanded the level of detail in many renewable tables so the estimates of MSW biogenic and landfill gas can be seen separately.

At the same time, EIA made a correction to classifying tires. Since only a minor portion of tires is made of natural rubber (considered to be renewable) and the larger share is non-renewable, EIA removed energy from tires from the other biomass category, following the EIA's definition of renewable energy. Implementing this change lowered renewable energy consumption by about 50 trillion btu in 2006.

Finally, unrelated to waste energy classification, EIA redistributed small portions of fuel ethanol consumption to the commercial and industrial sectors from the transportation sector, though the total remained unchanged, and revised its estimates from 1989 forward. The distribution is based on each sector's share of motor gasoline supplied.[23]

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Endnotes:

[1] Energy Information Administration (EIA), Monthly Energy Review May 2007, DOE/EIA-0035 (2007/05) (Washington, DC, May 2007) Tables 2.1-2.6.

[2] Biodiesel, biodiesel feedstock, ethanol, and ethanol feedstock.

[3] Energy Information Administration, Form EIA-819, "Monthly Oxygenate Report."

[4] Energy Information Administration, Petroleum Supply Monthly, February 2007 (Washington, DC, February 2007) Table 2.

[5] Westcott, Paul C., United States Dept. of Agriculture (USDA), Economic Research Service (ERS), Ethanol Expansion in the United States – How Will the Agricultural Sector Adjust?, FDS-07D-01 (Washington, DC, May 2007) and the USDA ERS feed grains database here:

<http://www.ers.usda.gov/Data/Feedgrains>.

[6] Manor, Robert, Chicago Tribune, "Ethanol demand fuels corn price jump," January 12, 2007. The benchmark price of corn on the Chicago Board of Trade reached \$3.965 a bushel on January 12th.

- [7] See Renewable Fuels Association website here: <http://www.ethanolrfa.org/industry/statistics/#C>. Accessed May 25, 2007.
- [8] Energy Information Administration (EIA), Petroleum Supply Monthly (Washington, DC, February 2006 and 2007), Table 38.
- [9] Pursuant to provisions of Energy Policy Act 2005 and subject to actual funding, the Energy Information Administration is required to survey biodiesel producers, but it is unclear whether it will collect data for any years prior to 2008.
- [10] Energy Information Administration (EIA), Monthly Energy Review May 2007, DOE/EIA-0035 (2007/05) (Washington, DC, May 2007) Table 7.2a.
- [11] American Wind Energy Association, "U.S. Wind Industry to Install Over 3,000 Megawatts of Wind Power in 2007: First Quarter Market Report," see website: http://www.awea.org/newsroom/releases/AWEA_First_Quarter_Market_Report_2007.html.
- [12] Technologies that qualify are wind, solar, geothermal and "closed-loop" bioenergy facilities. Other technologies such as "open-loop" biomass, incremental hydropower, small irrigation systems, landfill gas, and municipal solid waste receive a lesser credit.
- [13] Last accessed May 2007.
- [14] Energy Information Administration, Monthly Energy Review June 2007, DOE/EIA-0035 (2007/06) (Washington, DC, June 2007) Table 9.10.
- [15] See Environmental Defense Fund website: <http://www.environmentaldefense.org/article.cfm?contentID=4889> and Pew Center – Global Climate Change website: http://www.pewclimate.org/what_s_being_done/targets.
- [16] FPL Energy website: <http://www.fplenergy.com/news/contents/090706.shtml>.
- [17] For details, see: <http://www.dsireusa.org/library/includes/tabsrch.cfm?state=WA&type=RPS&back=regtab&Sector=S&CurrentPageID=7&EE=1&RE=1>.
- [18] Originally SB 1078, which was enacted in 2002, required 20 percent by 2017. The schedule has been accelerated. Includes only hydropower projects less than 30 megawatts in capacity. For complete details of what's specified in the standard, how renewable sources are defined, etc. see <http://www.dsireusa.org/library/includes/tabsrch.cfm?state=CA&type=RPS&back=regtab&Sector=S&CurrentPageID=7&EE=1&RE=1>.
- [19] See California governor's press release for details: <http://gov.ca.gov/index.php?/press-release/4111>.
- [20] Other methodologies define any recurring waste stream as renewable.
- [21] Refers to the share of MSW that is non-biogenic (or nonrenewable). This includes various plastics and rubber. Biogenic (or renewable) MSW includes paper and paper board, wood, food, leather, textiles and yard trimmings.
- [22] See the EIA website here: <http://www.eia.doe.gov/fuelrenewable.html>.
- [23] Energy Information Administration, Annual Energy Review 2006 (Washington, DC, June 2007), Tables 5.11 and 5.13a.