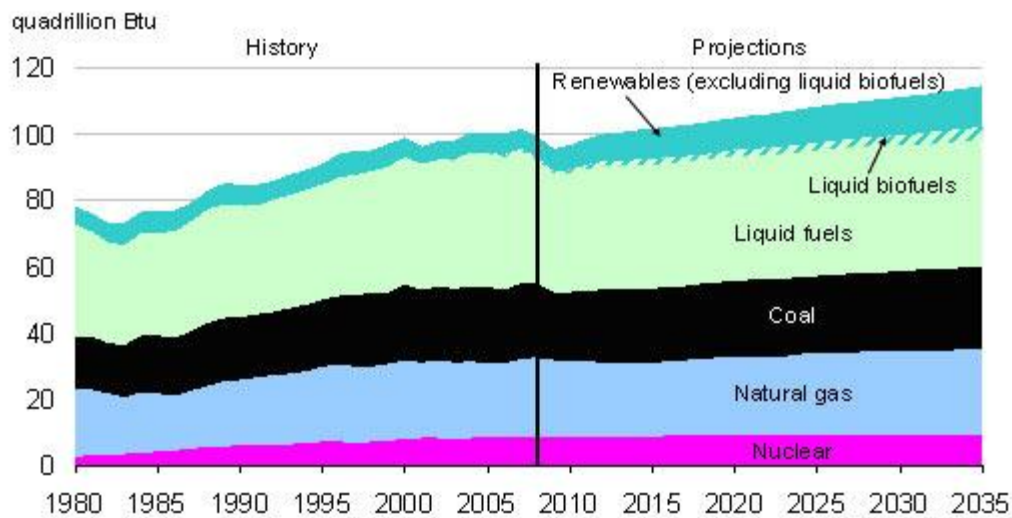


Fossil Energy Still King in 2035—Carbon Dioxide Emissions Rise with Fossil Fuel Growth

The United Nation’s Climate Change Conference in Copenhagen isn’t stopping the Energy Information Administration (EIA) from forecasting an increase in carbon dioxide emissions in the early release of their Annual Energy Outlook 2010 reference case forecasts.¹ According to the EIA, the Department of Energy’s independent statistical arm, carbon dioxide emissions in the United States will be up by almost 9 percent in 2035 from 2008 levels. That’s because fossil fuels will still dominate our energy future. Fossil fuels are expected to supply 78 percent of our energy needs in 2035, compared to 84 percent today. The agency expects liquid fuels and other petroleum demand to be up almost 10 percent by 2035, natural gas demand up by almost 7 percent, and coal demand up by 12 percent, all from 2008 levels.

Figure 1. Non-fossil energy use grows rapidly, but fossil fuels still provide 78 percent of total energy use in 2035



Source: Annual Energy Outlook 2010

In terms of the non-carbon dioxide emitting fuels, EIA is forecasting an increase of 11 percent for nuclear energy, and 81 percent for all forms of renewable energy (hydropower, biomass, wind, solar, and geothermal). Hydropower is expected to be 22 percent higher due to improved water conditions and some minor capacity

additions, biomass 88 percent higher, and wind, solar, and geothermal combined 187 percent higher.

But even with these sizeable increases, they can only lower the fossil fuel share of consumption by 6 percentage points from its current 84 percent share. That's because of nuclear power's high capital cost, the intermittency and cost of wind and solar power, and the lack of many new sites for hydro and geothermal power. Wind and solar increases tend to flatten out once their subsidies either end (for wind) or are reduced (for solar), even though over half the states have a renewable portfolio standard mandating a certain percent of their generation to come from renewable sources. However, it seems that only Texas is meeting its renewable generation mandates.²

Transportation Demand and Petroleum Supply

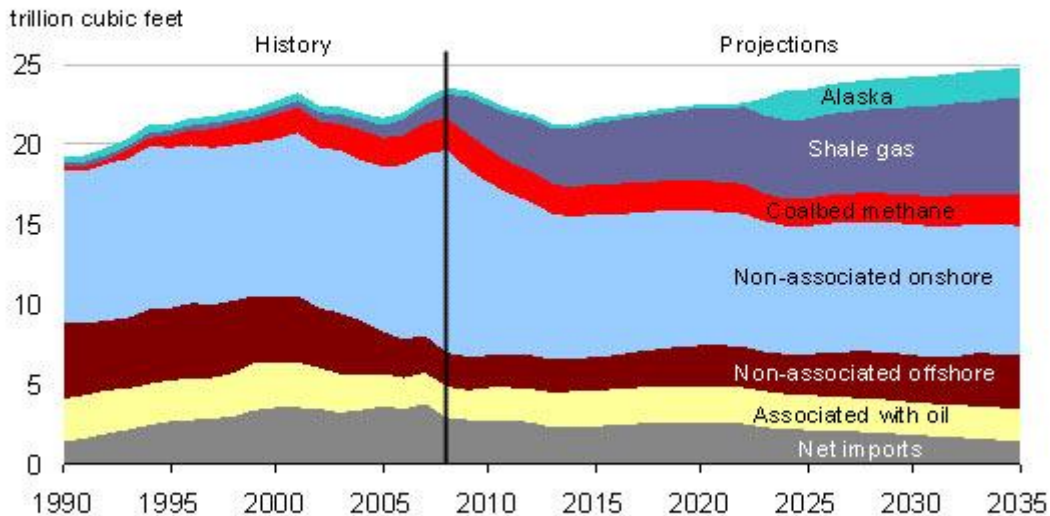
EIA is forecasting that the efficiency of new light duty vehicles will reach 40 miles per gallon in 2035, spurred by growth in flex fuel, hybrid, and diesel car sales that are expected to be over 9 million vehicles by 2035. That growth in sales is helped by tax credits for qualified vehicles mandated by the Energy Improvement and Extension Act of 2008 and by mandates in the Energy Independence and Security Act of 2007 for flex fuel vehicle sales and for a required increase in the Corporate Average Fuel Efficiency Standards. The efficiency of all new passenger cars and light trucks sold in the United States in 2020 must reach or exceed 35 miles per gallon. Most (83 percent) of the transportation sector's demand, including road, rail, air, and water travel, however, will still be supplied by petroleum since our current stock of vehicles and aircraft are mainly fueled by petroleum based products.

Domestic oil production is expected to increase by 26 percent over 2008 production levels based on increased offshore and onshore production in the lower 48 states. Oil production increases by more than 1 million barrels per day. Because of increased production of oil and biofuels (ethanol, biodiesel, etc.), the U.S. net petroleum import dependence declines from 57 to 45 percent. However, that reduction still does not make the U.S. independent of foreign petroleum supplies.

Natural Gas Demand and Supply

Shale gas production, spurred by hydraulic fracturing technology, increases to 6 trillion cubic feet by 2035, and drives the growth in domestic natural gas production, reducing our dependence on natural gas imports. Domestic natural gas production increases by 2.7 trillion cubic feet by 2035, reducing the U.S. dependence on foreign natural gas supplies by 7 percentage points, from 13 percent in 2008, to 6 percent in 2035.

Figure 3. Shale gas and Alaska production offset declines in supply to meet consumption growth and lower import needs



Source: Annual Energy Outlook 2010

Increases in natural gas demand are mainly due to growth from the electric power sector where issues with emissions of greenhouse gases make the zero and lower emitting carbon dioxide fuels more attractive. The electric power sector increases its consumption of natural gas by 11 percent in 2035 from 2008 levels, but the share of natural gas falls slightly by 2035, from 21.4 percent in 2008 to 20.8 percent in 2035, due to the completion of coal plants under construction and the addition of new renewable capacity.

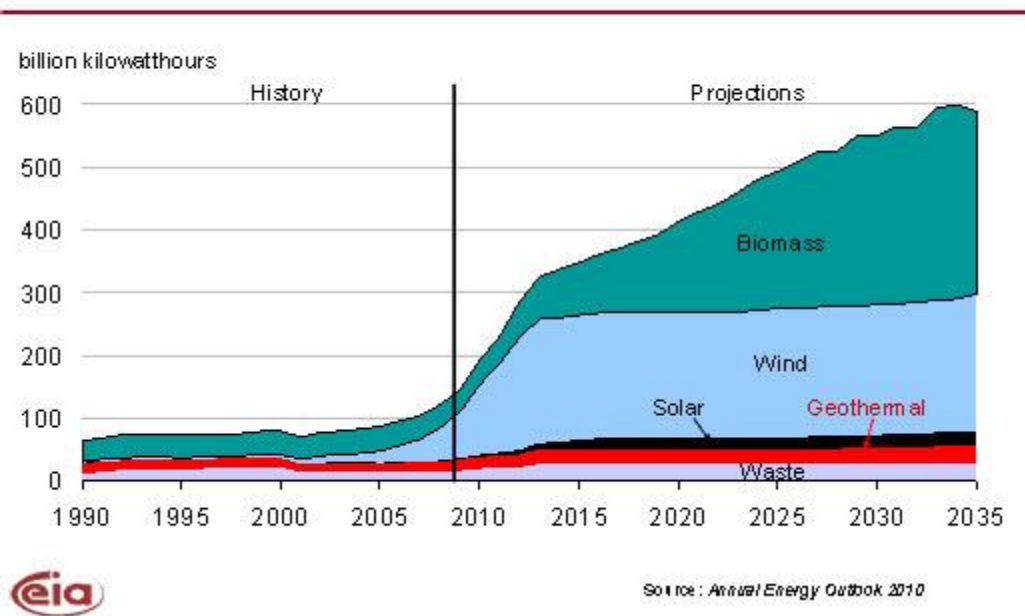
Electric Generation and Renewable Fuels

Growth in electric generation slows, but still increases at 1 percent per year due to new uses of electricity and continued penetration of electric using equipment such as PCs. The EIA expects 250 gigawatts of additional capacity will be needed by 2035, and renewable power is expected to supply 37 percent of that increase, second only to natural gas, which is expected to supply 46 percent.

The largest increase in renewable generating capacity is expected from wind power (46 gigawatts), followed by biomass (29 gigawatts), and solar power (13 gigawatts). Except for wind power, most of the renewable penetration is not in the central station generating sector, but at industrial sites (for biomass) and on residential and commercial rooftops (for solar). Because, of the lower capacity factors for wind and solar power, the increase in renewable generation comes mainly from biomass, which supplies almost half of the increase in renewable generation. Wind power supplies 32 percent of that increase, followed by hydropower (10 percent) and solar (4 percent).

However, when we look at the total increase in generation, the shares of new generation are quite interesting. Coal leads with 27 percent of the total increase in generation (1,143 billion kilowatt hours), biomass is second with 22 percent of that figure, followed by natural gas with 19 percent. Wind supplies 14 percent, nuclear 8 percent, hydropower 5 percent, and solar only 2 percent. Thus, solar power contributes only 0.5 percent to the total generating mix in 2035. It makes one question whether the taxpayer subsidies make any sense for that technology, in particular.

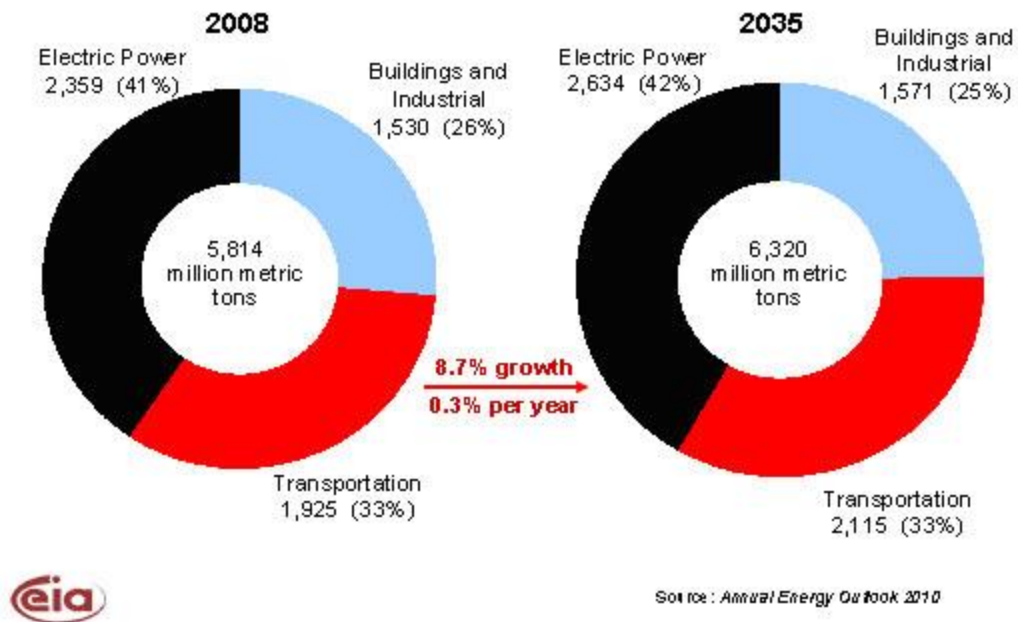
Figure 5. Nonhydropower renewable sources meet 4.1% of total electricity generation growth from 2008 to 2035



Conclusion

Even with large gains in renewable capacity, fossil fuels will still dominate our energy landscape by 2035 to fuel the country's economic growth expected to increase at 2.4 percent per year. Energy consumption is expected to increase by 14 percent by 2035 with large percentage increases in renewable fuels, but far larger absolute quantity increases in fossil fuels, making them the dominate source of energy for the foreseeable future. Carbon dioxide emissions will therefore continue to grow and EIA expects that growth to average 0.3 percent per year. However, due to structural changes in our economy and to efficiency improvements, carbon intensity (carbon dioxide emissions per unit of gross domestic product) will continue to decline. EIA expects that decline to be 2.1 percent per year. Carbon dioxide emissions per capita also decline by 0.6 percent per year.

Figure 4. Assuming no new policies, growth in energy-related CO₂ is driven by electricity and transportation fuel use



¹ All quantities and percents come from EIA's Early Release of the Annual Energy Outlook 2010, December 14, 2009, <http://www.eia.doe.gov/oiaf/aeo/index.html?featureclicked=1&>

² "A National Renewable Portfolio Standard: Politically Correct, Economically Suspect," Robert J. Michaels, April 2008 Electricity Journal.