Written by **Ed Hiserodt** on September 30, 2007

Blown Away: Wind Energy Analyzed

Hardly a stump speech goes by without a political candidate calling for "more renewable sources of energy such as wind or solar" to either stop our dependence on foreign oil or to slow the CO2 emissions that mean certain doom for our planet. The politicians are doing what most politicians do: spewing rhetoric that they know voters want to hear; proposing programs they know little or nothing about.

But as of August 3, [2007] the rhetoric was backed by action and the stakes became serious — as they say, "The price of poker just went up." On that day the U.S. House of Representatives voted to require electrical utilities to obtain 15 percent of their power from renewable sources. Since in some cases four percent of the renewable requirement could be satisfied by some "energy efficiency methods," this means that as "little" as 11 percent would need to come from renewable sources. The deadline for this conversion is 2020, with the threat of millions of dollars in penalties for those not meeting the requirement.

With only a Democrat-controlled Senate to temper the House bill, and a president who has shown a reluctance to veto terrible legislation, e.g., the Campaign Finance Law, the House bill represents a clear and present danger to the economy of the Republic — and will not lead to any reduction in our dependence on foreign oil or to any decrease in global warming.

To bring the scope of what is being proposed closer to home, let's use my home state, Arkansas, as a microcosm of the country as a whole. The State of Arkansas has almost exactly one percent of the U.S.population and is about midway in terms of area.

At a 2.2-percent growth rate in electrical consumption, the total for Arkansas in 2020 would be approximately 63 billion kilowatt hours (kWh) of electricity. As a comparison a 100-watt light bulb operating for a year (8,760 hours) would consume 876,000 watt-hours of power, or 876 kWh. Taking the lesser figure from the House Bill of 11 percent of "renewable" energy required, Arkansas utilities would be forced to provide 6.9 billion kWh from "renewable sources," which is clearly meant to be either wind or solar. (We will concentrate in this article on wind power because it is in much wider use than solar electrical production.)

Looking at Wind Generators

News stories about wind generation generally follow something like this: "The G.E. 1.5 megawatt [1,500

kW] wind turbine will provide enough electrical energy for 1,200 homes." And if you were to go look at the generator section of a wind turbine that is some 18 stories above ground level, it would indeed say 1.5 megawatts. Multiplying this by the hours in a year gives 13 million kWh. Since the average U.S. home consumes 11,000 kWh per year, it indeed appears the figures are correct. Except for the fine print that notes the generator capacity is when operating in a wind of 26 to 55 miles per hour (above which the blades must be "feathered" to avoid destruction of the machine).

The amount of electrical power generated by a wind turbine is a function of the cube of the wind speed. If the speed drops by one half, then the generating capacity falls to (1⁄2)3 or one-eighth. Obviously selection of a site with steady winds in the 26 to 55 mph range is a major factor in the output of a wind turbine generator. Unfortunately many parts of the country have few if any locations that meet this criterion.* So how do we determine what the actual generating capacity of a particular wind turbine is? We measure the kWh delivered to the network and compare that to
the output if the system had been operating at its full capacity for the entire year. This figure is known as the capacity factor.

Capacity factors can run as high as 35 percent in mountain passes and ridges, but more commonly in the mid-twenties, though often falling below 15 percent even in areas where the wind was predicted to be brisk and relatively constant. For now let us use 30 percent, the same capacity factor used by the Environmental Protection Agency (EPA), and reexamine the claim of 1,200 homes. Obviously, the number of homes
provided power drops by 70 percent, to 360 homes. There are other factors that make even this number unrealistically high since it's based on average, not peak loads.

Meanwhile back in Arkansas, let's see what it will take to convert 11 percent of the electrical output to wind power. First we will have to estimate the capacity factor of a particular turbine generator used in an expected wind environment. Because of less-than-optimal wind speeds in all of Arkansas, the capacity factor would not be 30 percent but something in the neighborhood of five percent, but let us generously assign a 15-percent capacity factor to a 1,500 kW turbine with a blade diameter four-fifths the length of a football field. This one unit would produce 1,971,000 kWh of electricity over a year. Remember how many kilowatt-hours we need for that 11 percent of green power? Yes, 6.9 billion. Dividing 6.9 billion by 1,971,000 gives us the number of wind turbine generators needed: 3,516.

Farming the Wind

Wind turbines cannot be lined up in a row as the resulting turbulence would lower the downwind turbines to zero production if not destroy them from asymmetrical wind forces. So there is just so much power that can be generated per acre of wind farm. And remember, these will
have to be sited in areas that some environmentalists will go to the wall for to prevent development, including the construction of transmission lines. The figure given by the EPA, assuming a 30-percent capacity factor, is 1.23 watts per square meter, or about 5 kW per acre. At our lower capacity factor, this becomes roughly 2.5 kW per acre so that over a year's time there would 21,900 kWh per acre of electrical generation.

Returning to our 6.9 billion kWh required by the politicians, we see that the wind farms would require 316,400 acres to meet their demands — a mere 494 square miles. Well, there goes The Natural State.

But at least we could get rid of some of our polluting coal power plants, right? Well actually, no we couldn't. The weather in the United States is
often dominated in both summer and winter by what is known as a "dome of high pressure." Such a

condition leads to winds that are “light and variable” — certainly not of a quality to turn a wind turbine. Consequently, all the existing power plants would have to remain.

How can I possibly claim that every kilowatt hour generated by wind power doesn’t eliminate that much pollution from a coal-fired plant? Because it’s true. Most of our country is tied together in electrical grid so that power can be routed from one area to another as demands change from place to place. Electricity is not stored on the grid. If a portion of the power comes from wind generation, there must always be a backup in the event this drops significantly — like perhaps to zero. These backup plants must be kept running as it requires hours if not days to bring them up to a level where they can provide power.

Wind power enthusiasts become very defensive when reminded that wind turbines produce annoying noise and kill large numbers of birds. Wind-
power promoters point out that good aerodynamic design and the noise produced naturally by the wind masks the “whooshing” sound of
the turbines that some people consider objectionable. But there’s more to turbine noise than a mere “whooshing” sound. Left unaddressed
is the low frequency thumping noise caused as each blade passes the supporting structure. In rural areas, particularly at night when ambient noise levels are low, the thumping interrupts sleep and leads to related health issues. This noise has led the French Academy of Medicine to call for a halt of turbine projects within 1.5 kilometers (0.9 miles) of any residence. Similarly, the U.K. Noise Association recommends a one-mile set-
back from residential areas.

As for birds killed by turbines, it has been noted that an unusual number of raptors — hawks, owls, eagles — along with bats fall victim to the 200-mile- per-hour turbine blades. One theory behind the significant numbers of raptors killed, as opposed to other birds — say songbirds — is
that birds of prey have eyes oriented in a forward direction, while other birds (the preyed upon) have eyes on the sides of their heads and are able to detect the motion of the blades more readily. Whatever the reason for the deaths, it has caused the U.S. Fish and Wildlife Service to issue siting guidelines recommending that wind turbines not be installed near wetlands, mountain ridges, or shorelines where birds tend to concentrate.

If wind power is so unreliable, doesn’t replace power plants, and promises to have many siting restrictions, why would anyone support it? Perhaps the most reliable method of analyzing a government project is the old standby: follow the money trail. While no estimates have surfaced regarding the costs of this project nationally, we can look at Arkansas as representative of the country and use it to determine how much money will be spent to meet the needs of this junk science. You may recall that Arkansas, which represents about one percent of the energy equation, requires 3,516 1.5-megawatt turbines to produce the required capacity for that state’s “renewable” energy. The average cost of wind turbine generators is about $1.5 million per megawatt. Catch your breath and do the math: $7.9 billion. And that’s just Arkansas! Nationwide the taxpayers would need to cough up $790 billion to implement this scheme. In 1991, the Interstate Highway System was considered complete at a cost of $129 billion. Taking into account inflation since 1991, the proposed cost of wind power would be over 4 times the cost of the interstates.

You may wonder, “If wind turbines aren’t useful as a source of power, why were so many being built even before the House passed its legislation?” The answer is government subsidies.

A case study of how wind power is dependent on government subsidies and dictates is the Cape Wind project, a proposed wind-turbine complex slated to be built offshore from Cape Cod in Nantucket Sound. That project became notorious because of opposition from ultra-liberal U.S. Senator Edward Kennedy, who was not concerned about the cost but didn't want the view from his yacht infringed upon. David G. Tuerck, executive director of the Beacon Hill Institute, analyzed the pro forma information on the project and noted: "What we found was quite remarkable. Cape Wind stands to receive subsidies worth $731 million, or 77 percent of the cost of installing the project and 48 percent of the revenues it would generate." This project was given final approval by the State of Massachusetts last March, and is now awaiting other government approvals.

Without government interference in the marketplace, wind power would be a relic for our historical entertainment. Do U.S. congressmen have any idea of the physical realities of what they have just voted for or its costs or consequences? Obviously not. Guess it's time we told them. ?

*See a wind map at hhtp://www.bergey.com/Maps/USA.Wind.Lg.htm