Where biomass fits on energy grid

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In an interview aired Jan. 1 on WUNC-TV with former UNC President William Friday, Gov. Bev Perdue outlined the state's offshore and onshore energy alternatives, citing "solar, wind, whatever." But in the broad realm of "whatever," the governor never defined one of the state's key emerging energy resources. The following is a primer on biomass electricity:

What does biomass mean and how is it used to create bioenergy?

Biomass is renewable organic material, energy stored from the sun in the form of cellulose by trees and plants. The energy can be:

- Refined to replace petroleum in the making of biofuels and the manufacture of chemicals.
- Burned for home or office heat, replacing old, polluting woodstoves with cleaner, more efficient units.
- Burned to generate electricity for the grid at power plants or at combined heat and power plants for small communities or at industrial facilities such as hospitals, factories or universities.

This third use of cellulosic feedstocks — basically, burning wood, forest waste, bark, paper pulp and crop residue at direct-fired power plants to create electricity via steam-driven turbines — is intended to transition away from coal consumption.

With electricity rates in the South stable, why should we care about this?

Transition away from coal, which supplies about 40 percent of the South's power, is inevitable because of environmental factors and economics. Coal-fired power plants are the single largest source of greenhouse gases in the U.S., which is second only to China as the biggest polluter on the planet. U.S. coal-burning plants have installed scrubber technology to reduce harmful smokestack emissions, but in 2011 this resulted in plants being cited for numerous violations in effluent water quality. Meanwhile, in July 2011, a key effort to build carbon-capture technology and reduce greenhouse gas emissions at a large, 31-year-old West Virginia plant serving 11 states collapsed, marking an indefinite end to a pilot project that represented the cutting edge for U.S. clean coal research and development.

Won't burning wood create more greenhouse gases from smokestacks?

Although smokestack emissions from biomass power plants are, at first, higher than from fossil fuels, forests constantly sequester carbon. When the biomass burned is forest waste or residue, the result is greenhouse gas levels lower than those that would have resulted from continued burning of fossil fuels that took millions of years to form.

Other pollutants can still be a concern, but if biomass is converted efficiently, wood-energy plants emit little smoke, in contrast to the noxious emissions from coal-fired power plants. Also, recent EPA regulations require biomass power plants built today to be equipped with extensive filters and other emission-control equipment.

Aren't there other alternatives to coal?

Yes, but in the short term, each alternative presents challenges:

- Natural gas, the second-largest fuel source of electricity, is plentiful, cheap, easy to transport and clean to burn, without the toxins of coal. The problem, apart from natural gas being a nonrenewable fossil fuel, is that utility companies mining recently discovered gas deposits in the Northeast used a hydraulic fracturing drilling technique known as "fracking" without first studying the health and environmental impact of boring holes through the earth's crust to get at the shale below. This resulted in methane blowouts from well drilling and toxic runoff in the water supply, and most recently, a series of small earthquakes apparently caused by large volumes of wastewater pumped back into the earth by fracking operations. Subsequently, other states, including North Carolina, have been much more cautious.
- Petroleum involves the national security risks and economic ramifications of dependence on foreign oil, another nonrenewable fossil fuel, as well as the environmental dangers of domestic offshore drilling.
- Nuclear reactors, although improving in technology and reduction of waste, appear to be prohibitively expensive to build. Construction cost overruns range from 60 to 100 percent, making the economics of nuclear power difficult for utility companies to sustain by passing costs on to rate payers.
- Solar energy is playing an important and increasing role in power generation in states that provide proper incentives. Yet solar is too intermittent to provide the amount of power that utilities need to meet minimum customer demands.
- Wind farms also show promise, depending on the location. Like solar, wind is declining in price and growing in importance; but the disadvantage remains that it is unable to meet customer demand.
- Hydroelectric (using rivers and waterfalls to create power) and geothermal (using hot water from wells drilled into the earth's core and piped to steam-powered turbines), hold the promise of clean technology. Like solar and wind, however, they are not economically feasible in every part of the country.

Logs ready to be pulverized are stacked at WoodFuels in Bumpass, Va., one of the southeastern pellet mills in an exploding industry. Woodfuels is partners with Enviva, a huge biomass plant-building company.

Can biomass be carbon-neutral?

Yes, but this depends on several variables.

- The life cycle of what is being converted to energy and whether it is being harvested sustainably (e.g., wood waste versus forests that are clear-cut).
- The life cycle of the trees being cut (e.g., fast-growing pines in the South versus slow-growing hardwoods in the North).
- The proximity of the resource and the efficiency of the conversion process from wood to energy (factoring in transportation and production).
- The fuel source the biomass is replacing on the grid (e.g., carbon-dense coal and petroleum versus clean-burning natural gas).