

Energy Matters

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The Forever Technology

By Roger Witherspoon

“There’s no reason why technologically we can’t employ nuclear energy in a safe and effective way. Japan does it and France does it. And it doesn’t have greenhouse gas emissions, so it would be stupid for us not to do that in a much more effective way.”

–President Barak Obama

New Orleans, 10/15/09

“That’s going to finally make clean energy the profitable kind of energy in America — legislation that will make the best use of resources we have in abundance, through clean coal technology, safe nuclear power, sustainably grown biofuels, and energy we harness from the wind, waves, and sun.”

–President Barak Obama

Arcadia, Florida

10/27/09

It is surprising that an administration known for its technological savvy and appreciation for science has difficulty distinguishing between the promise of a theory and the reality of an engineering endeavor. And it is puzzling that the Administration would be willing to commit a large portion of the limited funding for clean energy development on expensive projects which do not exist or will not be available for decades.

At the beginning of the week, President Obama spoke forcefully about supporting an expansion of “clean coal technology” and safe nuclear power. At the end of the week, Energy Secretary Steven Chu told the Senate Energy Committee the widespread deployment of new nuclear power plants would occur within 10 years, and he supported the development of a special type of nuclear reactor which used reprocessed spent fuel and would provide electricity while literally eating away at the growing problem of what to do with mountains of high level radioactive waste.

The problem with these pronouncements is that there is no proven technology for “clean coal,” the next generation of nuclear power, or a nuclear reactor which totally consumes nuclear reactor fuel. And while there are reasonable expectations that updated versions of existing nuclear technology will be available at some point, it

cannot be widely disseminated without the expenditure of nearly \$1 trillion in taxpayer funding – the amount of federal support requested by the industry.

Clean coal is a prime example of a technology actively pursued but not yet ready for prime time. The coal industry and the Electric Power Research Institute (EPRI), the industry's research arm, has widely touted an experiment at the Alstom Power coal facility in Pleasant Prairie, Wisc., as proof that the elusive target is in sight. The Financial Times reported Oct. 24 that the experiment was successful, the carbon emitted by the coal fired plant was captured and "the carbon is then buried underground."

Unfortunately, however, that is an unfulfilled wish. The experiment at Alstom was designed to prove a concept – that an ammonia bath could successfully remove 90% of the CO₂ from a waste stream. The experiment only involved one percent of the emissions from the coal power plant, and none of the captured gas was pumped underground because Wisconsin's geological formations are not suited for long term gas storage.

The Wisconsin experience raised questions about the future of carbon storage:

- How many regions of the country are really suited to long term compressed gas storage?
- What states will be capable of handling compressed gas deposits from their own power plants and carbon dioxide from multiple exporting states?
- What will host states charge and what impact will transportation and storage fees have on the cost of cleaned coal energy?

In addition, scaling up is not a matter of simply building a larger experiment and running it for a month or two. It is likely to take more than a decade before a full scale carbon capture prototype has worked successfully at a 1,000-megawatt power plant long enough long enough to be deemed an off-the-shelf prototype. It will then take decades before a majority of existing plants are retrofitted with a cleaner system.

That is long past any "tipping point" to stem or reverse the rise in global temperatures.

The issue is even stranger when it comes to the next generation of nuclear power plants and the possibility of reprocessing the existing tons of spent fuel. The Nuclear Energy Institute, the industry's lobbying arm, is urging Congress to approve taxpayer funding for the construction of some 150 nuclear power plants, absorb all cost overruns, provide all insurance, and count the electricity as a "renewable source."

"This is pretty breathtaking," said Ellen Vanco energy economist at the Union of Concerned Scientists. "It frames the staggering amount they want. Just in loan guarantees the industry regards \$100 billion as a minimum acceptable loan volume. On top of that they are looking for investment tax credits, production tax credits, worker training tax credits, changes to the IRS code for nuclear decommissioning and the inclusion of nuclear power in renewable standards. That's pretty ambitious. This is what they say they need to make a nuclear expansion possible."

At the current rate, nuclear power plant construction is in the \$10 – \$12 billion range *per* plant and the reactors selected for the development have run into engineering problems. The Westinghouse AP-1000, for example, is on its 19th revision because of safety issues raised by examiners at the Nuclear Regulatory Commission while GE's reactor is on its 16th revision. Just last week, the NRC sent Westinghouse back to the drawing board to

redesign the shield building housing the reactor.

But Westinghouse and GE have track records and, at some point, their engineers are expected to come up with designs which pass all NRC safety tests. That is not the case, however, with reprocessing.

While Secretary Chu assured Rhode Island Senator Sheldon Whitehouse that he would work with him to promote nuclear power plants running on a free lunch of “reprocessed” spent fuel, he could have pointed out that such plants do not, and will not exist. It is a “solution” to the spent fuel problem which prominent climatologist James Hansen has touted in recent speeches around the country.

“Hansen has a lot to learn about nuclear engineering,” said Ed Lyman, a nuclear physicist and specialist on spent fuel technology with the UCS. “He may be a world expert on climate, but he has said things about fast breeder reactors which just aren’t correct. You can’t just take spent fuel and use it.

“And I don’t have the impression that Chu has made an investment to try to really get into the nitty gritty of nuclear power.”

The fission process inside nuclear reactors creates a basket of long and short lived, radioactive isotopes including plutonium, the deadliest material which can readily be used in atomic weapons. Reprocessing involves chemically teasing the plutonium out of the spent fuel – leaving a basket of radioactive material – mating that plutonium with new uranium and using that in a reactor.

The fuel is not consumed the way wood is broken down in a fireplace. Instead, the fuel is converted to other materials, many of them weapons grade, fissionable isotopes. Some, like technetium 100 and iodine 129 have half lives measured in the millions of years. It is theoretically possible, however, to create a revolving reprocessing system in which the newly created, unstable, radioactive elements are placed in another fission environment. Some of the material will be transmuted into stable elements, which can then be removed, and the rest must go through another cycle. But it is slow and expensive.

“The National Academy of Sciences did a study 13 years ago where they documented what it would take if you wanted to build that system and make it effective,” said Lyman. “You would have to operate it thousands of years before you made a significant dent in the amount of material you wanted to burn up. A system that you have to operate thousands of years makes less sense than burying it in a repository where you don’t have to do anything with it. The repository may leak into your water table after 1,000 years, but that’s less danger then letting a breeder reactor run by itself for a thousand years.”

Politicians tend to like simple, neat solutions. Clean coal solves an air pollution and climate change problem while allowing a major industry to continue to operate. Reprocessing spent fuel has a neat ring in that would eliminate the growing problem of high level radioactive waste while providing ostensibly clean electricity.

What is unfortunate is that Administration officials who should know better and have a responsibility to guide the discussion have chosen to roll with false impressions and the illusion of easy solutions to complex energy problems.

That course may produce a bill that can pass Congress. But it will not meet the nation’s energy needs.

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