Hydrogen Production by Nuclear Power

President Bush surprised many during his 2003 State of the Union address when he said he would vigorously support hydrogen production technology and fuel cell cars—an advanced technology that could lead to reduced greenhouse gas emissions and a reduction in oil imports and use. What he failed to mention was that the Bush-Cheney energy plan calls for producing that hydrogen by building new nuclear power reactors.

Producing Hydrogen (H2)

Although hydrogen (H2) is ubiquitous, it does not exist by itself naturally, so it must be separated out of substances such as water. Hydrogen separation can be accomplished in several ways. Heat can be used with chemicals and water (thermochemical), or water can be charged with an electric current (electrolysis) to isolate H2. Some separation processes combine heat and electricity (steam electrolysis). H2 can also be produced by bacteria and algae as a waste product.

Current hydrogen separation processes use fossil fuels to raise the temperature enough to separate H2 from either water or natural gas. This process releases greenhouse gases whether or not one is separating water or natural gas. But *additional* carbon dioxide is also released into the air as a by-product of natural gas separation. Separation of water results only in oxygen by-product.

Since CO2 is one of the gases responsible for climate destruction, use of fossil fuels in these separation processes is not environmentally friendly. Therefore, while cars running on H2 fuel would give us clean air in one respect, producing the hydrogen would still contribute to climate decimation.

Replacing natural gas combustion with an environmentally friendly energy source would result in no greenhouse gas emissions from this process.

Nuclear proponents claim, falsely, that nuclear power won't harm the climate. While this claim isn't valid, it will not be challenged here. (see instead NIRS fact sheet on climate change and nuclear power, www.nirs.org/factsheets/kyotonuc.html)

There are plenty of other reasons not to choose nuclear energy for H2 production: costs, energy production structure and the untenable problem of nuclear waste. Therefore, this push for an H2 fuel economy is really just a major effort to redefine and fund a new generation of nuclear energy as clean and necessary. The industry hope is to make tarnished nuclear power more palatable to the public, much like the atoms for peace campaign of the 1950's.

Bad technology, wrong reasons, limiting options

Linking nuclear power to H2 production would only ensure that industry chooses H2 technology compatible with industry's obsolete nuclear reactors. It would surely NOT guarantee us the best available H2 generating technology, or the cheapest. The H2 process compatible with nuclear reactors "is a difficult technology that is much further from commercialization than many other hydrogen production options," explains Joan Ogden, a researcher at Princeton. What is best for the preservation of the economically bankrupt nuclear power industry is not what is best for society or the economy. The growth rate for reactors is projected to double or triple if they are needed for H2 production-an obvious incentive, for some, to do the wrong thing.

Decentralization vs. Corporate Monopolies

Using the nuclear option for H2 generation would keep power production in the hands of a few major corporations rather than decentralizing it for real energy and national security. First, only major companies would be willing or able to afford the very shaky investment in nuclear power. Additionally, certain technical realities would make decentralizing this industry impossible.

Instead of using electricity generated by reactors, using heat is the method of choice because it is cheaper. Use of heat from reactors requires 1600 megawatt thermal (MWt) for efficient H2 production. Current reactors put out about 3000 MWt, but this heat is unusable because its removal would lessen the efficiency of electricity production. Such a huge heat requirement for nuclear H2 generation means we would abandon the hope of decentralized energy in favor of huge energy parks.

Centralized production of H2 by reactors would add unnecessary cost and danger because of the need for H2 transmission lines to distribution points. Currently the H2 fuel itself

costs much less than conventional car fuel. Its real cost resides in transport and distribution.

Centralized energy production facilities would provide an extremely tempting terrorist target, which if successfully attacked, could cripple the country.

Nukes can't have it all

Some researchers conclude that a nuclear reactor must be devoted either to H2 generation or electrical generation, but not both because of operating efficiency issues. Current reactors do not have the right temperature and pressure conditions for H2 production from heat, the least costly nuclear method. Additionally, the need for H2 will increase to a level unable to be matched by the current number of reactors.

Some in the industry paint a future where reactors would be solely devoted to H2 production, using the generated heat, while leaving electricity generation up to other technologies like renewables.

In any case, even industry agrees that major research, development and huge investment would be required; especially since most H2 eligible reactor designs are merely paper nukes, not even prototypes. The new designs which have been tested have failed miserably. The reactors must be able to function on their own before adding an H2 production system to the engineering mix. The reactor preferred now is the High Temperature Gas Cooled reactor (HTGR) of which the Pebble Bed Modular Reactor (PBMR) is one design.

Fuel requirements

The problems don't stop there. We are running out of uranium. The more we dig it out of the ground, the harder and more expensive its extraction becomes. Therefore H2 production using nuclear means more pressure to revive reprocessing, and other irradiated fuel separation methods to justify the investment in nuclear-H2 production technology. Industry also wants breeder reactors reconsidered even though current research concentrates on "new" fission reactors using fresh uranium.

Forcing a square peg into a round hole

Renewable technologies are more suited to H2 production for many reasons. Even if the production cost from renewable energy seems higher now, it will only get cheaper as the fuel for reactors becomes more expensive, either through mining or intensive reprocessing.

Electricity from wind is currently 4 cents/kWh. This is a verifiable, experienced cost. Wind energy and PV systems coupled to electrolyzers used for H2 separation are perhaps the most versatile of the approaches and are likely to be the major H_2 producers of the future. We have these systems now, but they are expensive. On the other hand, hydrogen production by nuclear power is entirely theoretical. Wind will only get less expensive as the technology is refined. If wind turbines are mass produced, cost would be 2-3 cents per kWh.

The projected cost of nuclear H2 production using thermochemical processes is $1.30 per kg of H2. Electrolysis is $3.00 per kg H2, however this is at a cost of 6 cents per kWh. This number is incorrect since wind has already reached 4 cents/kWh. This cost would drop even farther upon mass turbine production. However, the cost projections of the nuclear industry have never lived up to the "too-cheap-to-meter claim" and have consistently and copiously under predicted its life-cycle costs. There is no reason to believe their current predictions.

According to the Phoenix Project, 12 million one-megawatt wind energy systems could provide 100% of the U.S. energy requirements in the form of electricity and/or hydrogen. Given that the interior components of a wind generator are similar to the components found under the hood of a car or truck, and given that over 17 million cars and trucks are manufactured in the U.S. each year, these wind systems and related electrolysis subsystems could be mass produced and installed in just a few years.

For once it would be nice to have a Manhattan-like project focusing on improving people's lives by giving them *real* choices and more control, rather than harming their health and further removing them from power. The choice for H2 production is quite clear. *Cindy Folkers, 4/03*