Is Nuclear Power the Solution to Global Warming? Jerrad Pierce

In recent years there has been a call for redeployment of commercial fission energy in the United States as a potential solution to cutting carbon emissions and reducing foreign oil dependency. This has been a long-standing Bush administration policy and the subject of recent editorial in Science by Roger Meserve. Should the U.S. build more nuclear power plants to reign in its greenhouse gas emissions? In short, no.

It is important to recognize how the issue is being framed as this significantly impacts the For instance, while the question has been posed in terms of nuclear energy for electricity to reduce green house gases this represents a distinct “electricity bias” (Connor, 2004). Transportation accounts for 1/3 of CO_2 emissions (DOE, 2002) with lion’s share of the remainder resulting from industry and 1/6 of the total from commercial and residential activity each. While it is true that some concepts for so-called Generation IV nuclear reactors might generate hydrogen, recapturing some of the energy end up as thermal pollution. This is no mean feat considering nuclear reactors, like fossil plants, discard roughly 60% of the available energy. The hydrogen would likely be used to power vehicles though it might also serve as a natural gas substitute, the cleanest fossil fuel. However promotion of nuclear derived hydrogen demonstrates a second bias, the “automobile bias”, as opposed to freight which would be considerably more difficult to convert to hydrogen (Connor, 2004). An additional example of the “electricity bias” is the absence of the acknowledgment that a large portion of non-transportation energy use is for temperature regulation. 17% of residential energy is used to heat water and another 40% to heat and cool (DOE, 2004). Heat is a low-quality form of energy and in many

cases it is wasteful to use high-grade sources as electricity or natural gas for low-temperature heating. It is possible to recover a portion of the energy from a nuclear reactor that would otherwise become thermal pollution for commercial use, a technique known as cogeneration, however there are siting concerns which arise; siting is addressed later in this paper. In phrasing the proposal as the use of nuclear energy to reduce green house gas emissions one promotes a binary (either-or) worldview. In fact systematic analysis of individual situations should be undertaken to development an energy source portfolio. One might then argue that the issue is then not truly a matter of national policy per se. Therefore, while it is difficult to rule out nuclear energy entirely, the case against it is strong.

Ignoring what is arguably the most prominent issue, waste disposal, for the moment let us examine the matter of nuclear fission fuels; it turns out that fuel decisions play a significant role in waste disposal. Fission currently represents approximately 8% of U.S. energy consumption however some countries, most notably Japan and France as well as Switzerland and Britain, are more heavily reliant upon it (Peters, Drake, Driscoll, Golay & Tester, 2004). At current usage levels there is a 100 year supply of uranium (Peters et al, 2004). Of course, increasing deployment to displace the 24% of energy derived from coal, the dirtiest common fossil fuel, would shorten the lifetime of this supply. Therein lies a subtle third bias, that of a steady state, convention dictates that a growing economy results in a growth of energy consumption which would diminish the nuclear fuel supply further (Connor, 2004). Does it make sense to invest in the capital conversion of our existing energy infrastructure to switch to another fuel with a limited supply? There are in

fact three techniques for extending nuclear fuel supplies, recycling or reprocessing, breeding, and use of the alternative fuel thorium. None of these techniques is widely used in the United States while other nations commonly use breeding reactors and reprocess fuel. Reprocessing fuel recovers additional material from spent fuel rods since only 5% of the material in a rod is typically consumed. The complicated recycling process creates concentrated, extremely high level waste which must be disposed of. While recycling does not significantly reduce the quantities of waste eventually disposed of, it does reduce the *rate* of disposal which may allow for additional research and development of disposal technologies and sites. In breeder reactors the fissile fuel is used in such a way as to create additional fuel With the common ^{238}U the new fuel is ^{239}Pu. The clearly has implications for nuclear weapons proliferation, and is in fact why the United States has not pursued this technology, in the hopes of leading by example.

Long term nuclear waste disposal, a misnomer as it amounts to no more than storage, of partially spent rods or high level wastes is a matter the federal government has not effectively addressed in the 44 years of commercial nuclear power. While public concern regarding nuclear waste and facilities is generally focused on radiation the issue may be overemphasized. Most radionucleides associated with energy production are alpha and beta emitters. Of the three forms of nuclear radiation gamma rays are the most harmful. Alpha and beta radiation may be blocked by several inches of air, a sheet of paper, or skin. The overlooked problem of nuclear materials contamination is heavy metal poisoning. Like the mercury emissions lawmakers are currently seeking to regulate, or lead, uranium and its kin are heavy metals. Heavy metals are a class of elements which have

similar serious biological impacts including kidney failure. In combination with the significant mobility in groundwater of many portions of nuclear waste this poses a significant risk

A nuclear economy would result in an increased dependence on foreign energy. While the United States has significant uranium deposits, they like many of our oil deposits, remain economically unviable given the commodity pricing of uranium from international sources. There are two other issues with fuel acquisition. While uranium mining is not that different from coal mining the locations of american uranium deposits poses problems. Uranium deposits in the United States are largely in the Black Hills and Four Corners regions of the western U.S. Both are desert environments which may be more particularly sensitive to the impacts of industrial mining. Secondly, both locations are home to native peoples which poses questions of environmental justice. The relocation of indigenous people to marginal lands is morally questionable, but to then seek the ability to extract minerals from the these lands against there wishes is unjust.

There are wide variety of environmental injustices, past, present, and future, associated with nuclear energy which must be considered. Navajo miners employed in Four Corners uranium mines have filed suit on claims of improper notification of the associated occupational hazards. The siting of waste disposal facilities has become highly politicized and Nevada may become the final resting place by congressional fiat or tyranny of the majority. Some “analysts feel that utilities would be more likely to gain public acceptance for new nuclear facilities if they were sited or expanded near existing plants rather than in

new areas" (Switzer, 2004). As with any energy source, it is most effective to site sources near sinks i.e. population centers, this is particularly true if one hopes to take advantage of cogeneration. Of course, most americans would protest the construction and operation of a nuclear facility to provide the energy services they demand, deemed necessary by the need to curb global warming, near them with cries of "Not in My Back-yard." A final example of conflicting demands with implications for justice regards the water use of most nuclear power plants. The discarded 60% of the available energy is typically discarded in a local waterbody, with significant repercussions for the ecosystem. This demand for large volumes of water could also potentially conflict with other needs such as agriculture and consumption.

Fission may be a seemingly abundant and attractive energy source at first blush, however it too has numerous drawbacks. Drawbacks which while not insurmountable, do not presently warrant its promotion as a panacea to our energy and environmental woes.

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