Nuclear Energy: Will It Save the World?

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Nuclear Energy; The Recent Past:

For the past quarter century there was a surplus of electricity in the US. This occurred because in the late sixties and early seventies electricity use was doubling every ten years. Then in 1973, came the Arab oil boycott that led to an increase in energy costs, and a resulting decrease in energy growth. The orders placed before 1973 resulted in the US electricity surplus.

Before 1973, nuclear energy orders in the US were dramatically growing, with tens of new orders a year. It was projected that nuclear energy would exceed a thousand plants by the end of the century. The environmental movement was favorable to nuclear energy, compared to fossil plants. Indeed, the Sierra Club was a major influence in the acceptance of Pacific Gas & Electric's Diablo Canyon nuclear plant in California.

However, after 1973, the environmental movement became opposed to nuclear energy, as well as to coal, and gas, and oil, and dams, and geothermal plants. Solar and wind power were the only new plants favored. Although solar and wind power cannot meet a major share of energy needs, it didn't matter because of the surplus.

The Present and Future Problems:

Alas, our surplus has now ended, and in California we face uncomfortable energy difficulties that are projected to extend to other parts of the nation. More important is the world growth of energy use, and in the coming decades the projected global warming disasters and the potential international hostilities over limited energy supplies. It may not be remembered that one reason for Japan's entry into WWII was its concern over needed energy.

Fossil fuels, which today provide over 80% of our energy, are heading into a disturbing period. First, the potential disasters from global warming are due primarily to the CO_2 from fossil fuels. In addition, oil and gas supplies are projected to be depleted in this century, and coal in the next. Should we wait until the resulting energy tragedies take place before we try to mitigate them? Why is it that some organizations frighten the public about nuclear energy wastes ten thousand years out, and don't indicate that the real energy problems and potential disasters are approaching in the coming decades.

In the next fifty years the high birthrate in the undeveloped world is expected to cause world population to go from today's six to ten billion people. If, by then, world per person energy use reaches a third of that in the US today, then world energy use will triple. Where will we get the needed energy? If we don't, will there be international fighting over the lack of needed energy? And if the global warming projections are real, how can we prevent them?

Solutions:

Let us hope that an infinite amount of new fossil energy is found, and that global warming is not real. Let us hope that fusion, or cold fusion is developed. Should we count on this? Solar and wind power can help; but the large areas needed and their lack of continuous energy production limit their large-scale economic and environmental viability. There is only one available energy source that can significantly mitigate, or eliminate the potential disasters for our future: Nuclear Energy.

The Start of Peaceful Nuclear Energy:

Peaceful nuclear energy began in this country in 1954 under President Eisenhower who was concerned with the expansion of nuclear weapons development by other nations, "perhaps all nations". Peaceful nuclear power was initiated and agreements were made with other nations that gave them access to our peaceful nuclear technology in

return for their agreement to abandon nuclear weapon's development. Despite the recent nuclear bomb tests by India and Pakistan, very few new nations have developed nuclear weapons; and none have been used.

Peaceful nuclear energy began with a key requirement - safety. In the fifties, before computers were generally used, safety requirements were set to assure that even if there were a "double guillotine break" of the main pipes coming from the vessel containing the nuclear reaction, no significant radiation would reach the public. US (and western) reactors were designed with a "containment" building surrounding them so that even with a major accident, the radiation would be contained, and would not reach the public. The only major nuclear power plant accident in the US has been the Three Mile (TMI) core meltdown due to operator misunderstanding of some instrument indications. It may surprise readers to hear this author's conclusion that TMI, in view of the safety backups, could be looked at as a success. A person who stayed at the TMI fence for the entire accident would have received less extra radiation than from taking a two week vacation in Denver, where nature's radiation is higher than at TMI. And guess what? People live longer in high radiation areas like Denver, than they do in low-level areas.

Nuclear Radiation:

The public has not been well educated about nuclear radiation. For example, few know that nature's normal background radiation is over 30 times higher than the radiation at the fence of a nuclear reactor. Radiation studies tend to indicate that exposure to less than 100 times nature's radiation poses no harm to an individual; indeed the low-level radiation seems to add to human health. (Does this address why people seem to live longer in Denver?)

About half our radiation exposure comes from radon, a radioactive gas coming from natural materials in the ground. Prof. Bernard Cohen of the University of Pittsburgh did a US study of the effects of radon, and found that people in areas with the highest radon areas had less cancer than those in the low-level areas.

A recent study by the United Nations Scientific Committee on the Effects of Nuclear Radiation concludes that the number of deaths from the Chernobyl accident was about 50. They did not bring out that there were some tens of thousands of additional deaths in Europe. These deaths were due to abortions by women who were frightened of the effects of radiation moving over Europe from Chernobyl, the radiation in Europe was much less than nature's radiation. Clearly, European deaths were not due to Chernobyl, but to irrational nuclear radiation fears spread to the public? What is our present radiation education in the US?

The point of the above discussion is that no one in the public has been harmed by nuclear energy in the US and the West. (Chernobyl type reactors would not have been allowed here, and Russia is now adopting our safety standards.)

In a similar vein, nuclear wastes, which frighten the public, have harmed no one There are two basic types of nuclear wastes; low-level and high-level wastes. High-level wastes are the used fuel elements that powered the reactor. Low-level wastes are those from irradiated materials in the reactor. In addition, low-level wastes are from some 50,000 yearly medical uses of radiation that save lives, and from industrial uses of radiation that permits production of equipment that would otherwise be difficult or impossible to produce. Consider that your Teflon coated frying pan, to which eggs don't stick, is irradiated so that the Teflon joins to the metallic base of the pan, and stays, even after frying.

Low-level radiation dies away in a few hundred years, whereas the high-level fuel elements maintain their radiation toxicity for thousands of years. Low-level radiation has been disposed of in underground "repositories" and has harmed no one. The government has now required that the low-level repositories be commercially, not federal government, supplied. California's Ward Valley Repository was planned as the first of these commercial repositories. It was studied over several years by a number of state and federal organizations that concluded that it would be safe. Before transferring the federal Ward Valley land to California for the repository, Secretary of the Interior Babbitt insisted that the prestigious National Academy of Sciences (NAS) perform a final study. After some 15 months NAS in 1995 concluded that Ward Valley was safe, and Sec. Babbitt stated that he would shortly transfer the land. Politics entered, and the land has still not been transferred.

Similarly, the high-level (fuel) waste repository at Yucca Mountain in Nevada has been delayed by anti-nuclear activists. After the Congress selected the site in 1987 it took over five years for the state of Nevada to give a permit just for site exploration. Nevada originally favored the site; but the anti's took over and it was only after threats of federal legislation that Nevada agreed to site work. The Department of Energy contractors have just completed an overall review that is positive. Next year the NRC will review the results and hopefully by the end of the decade the site will start receiving and placing the waste fuel underground.

One should understand that for the past four decades used nuclear fuel and lowlevel wastes, have been carefully maintained and have harmed no one. And despitethe arguments against shipping wastes, one should understand that they are shippedso safely that no one has been significantly radiated by shipments in the past decades. Indeed, one might be interested in learning that the spent fuel is shipped in such strong containers that, in a test, a locomotive going 50 MPH hit the container broadside and did not rupture the container.

In summary, nuclear wastes are a problem, but the problem is soluble and 40 years of experience indicates so. One may note that the wastes from a coal plant, which contains radioactive materials, and chemically dangerous materials, is a hundred thousand times larger in volume than the waste from the same size nuclear plant. And, of course a main problem with fossil fuels is the waste emitted to the atmosphere, and the potential dangerous chemicals in the solid waste.

U.S. Nuclear Plants Today:

One may note that the 103 nuclear plants in the US are in the 80 to 90% efficiencyoperating range, and supply about 20% of US electricity. The operating plants havehad, or are having their 40 year licenses extended for another 20 years. They are now the least expensive operating electricity producers.

However, after the Arab oil crisis of 1973, the licensing for a new plant became so burdensome from government (Nuclear Regulatory Commission) bureaucratic requirements, and from anti-nuclear court cases, that it has delayed construction 10 to 20 years and as a result caused billions of dollars of extra costs. On the other hand abroad, with need, and more efficient licensing systems, US manufacturers build US plants economically in 4 years.

The NRC has recognized its inefficient licensing system and has developed a newstandardized licensing system intended to be as efficient as systems abroad. This new system has been put into place and Combustion Engineering, GE, and Westinghousedesigned plants have each received a new standardized license. But the new licensing system has not been demonstrated; and despite its intent, who knows how the courts will handle an anti nuclear suit intended to delay construction? Thus, for a billion dollar construction project, will an organization risk the money before a demonstration takes place? We need a government program to financially protect the builders of the first couple of new plants to demonstrate that the new system works.

With the new higher price of gas and the added costs of coal plants to reduce unhealthy particle emissions and their CO_2, nuclear plants built in four years (as they are abroad) will be the most economic new electricity source, and will protect the environment. If we can soon revive the building of new plants here, we can maintain our world leadership and aid the future welfare of our nation and the world.

Future Benefits, and Problems:

f we revive nuclear energy here, and aid in expanding its use around the world we may save the world from environmental disasters and international hostilities. But as a result we may find a shortage of uranium to fuel our present type reactors. The solution is to develop the fast breeder reactor for future use. By converting unfissionable U238 to fissionable plutonium, the fast reactor can provide 100 times more energy from a pound of uranium than can our present plants, and thus can provide energy to the world for thousands of years. Indeed, with the use of uranium from seawater it could provide world energy indefinitely. Some 15 fast reactors have operated here and around the

world, but they haven't been developed as an economic power reactor, although they surely can be. Indeed, in Russia today, we have the BN350 (two reactor) plant that is supplying electricity.

The fast reactor fuel cycle has been studied and can be developed to prevent the diversion of the plutonium to weapons. Further, this type of fuel cycle produces wastes (like the low-level wastes) that decay in a few hundred years, rather than the thousands of years of potentially dangerous radioactivity from spent fuel from our present type reactors. Our present used fuel would be the source of the initial plutonium to fuel the start of the fast reactors, and thus would not be left to decay over thousands of years.

We have learned that it takes a decade, or several, to develop and optimize a new reactor plant, so that new fast reactor development should be starting soon.

Conclusions:

The world is growing, is using up the available fossil fuels that are contaminating the globe. The only available solution is a major worldwide expansion of nuclear power. In this country we should be efficiently building new nuclear plants; and we should be an international leader in providing needed, safe, non-proliferation prone, nuclear power for the world. The future of our nation, and the world may depend on our ability to build plants here as efficiently as we did before the Arab Oil Boycott, and as we have done abroad. In addition, as noted, we should be developing the fast reactor to be economic, and proliferation resistant, and provide the needed energy for the distant future.

The present energy problems in California were projected a few years ago, with no ameliorating actions. Should we wait for future national and world energy disasters before reviving new nuclear energy in the US?

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