

**DOCKET****09-IEP-1M**DATE AUG 10 2009RECD. AUG 10 2009**STATEMENT TO THE CALIFORNIA ENERGY COMMISSION****At the CEC Workshop****August 10, 2009****by****Robert F. Williams, PE, retired****INTRODUCTION**

It is a pleasure to be in Sacramento today to provide comments and recommendations to the California Energy Commission, as members and staff deliberate on plans for California's energy and environmental future. I have had the pleasure of providing input to the Integrated Energy Plan in both 2007, and 2009, and look forward to participating in future updates to the program.

In my brief statement today I want to emphasize three points.

- Nuclear power is being adopted throughout the world as a major technology to address climate change in a cost effective and environmentally sound way. California should get on board.
- Jobs for wind power and solar power are already being outsourced to China, Vietnam, and elsewhere. Nuclear power will have more domestic job content because of the large amount of concrete, rebar, and heavy section vessels and piping that are less attractive to outsource.
- A robust strategy for the next 50 years would address the possibility that some climate change will occur despite our best efforts, due to China, India and others not getting on board. Water scarcity as regions of rainfall change is among the more likely occurrences.[1] Nuclear power is among the technologies best suited for water desalinization as well as power generation. A nuclear Green Farm [2] is a synergistic way to address food, water, and energy needs.

**I. California needs to get into step with the rest of the world in making nuclear power and element of the planned growth of the state energy infrastructure.** At the national level 31 new nuclear plants are in various stages of planning and license application. Unfortunately, while China and India and Europe are pursuing nuclear plants as part of their plans to reduce the discharge of green house gases, California still stands behind the weak rationale in the Warren Alquist Act, and refuses to modify the Act in light of dramatically changed circumstances, that would encourage, indeed require that nuclear power be a major element of the electrical grid expansion.

I have previously provided testimony on how the Waste Isolation Pilot Plant in Carlsbad New Mexico meets the intent of the legislature in providing a licensed demonstration of the disposal of HLW, albeit from the US weapons complex. The Defense Nuclear Facility Board, the Environmental Protection Agency, the NRC, and the State of New Mexico have completed several reviews of the WIPP, and find it suitable for disposal.

With respect to reprocessing, three nations have operated large plants, the UK at Thorp, the French at Marcoule, and the Japanese, that meet the test of commercial reprocessing demonstration. In addition nations with nuclear weapons programs including Russia, China, India, and the United States have sophisticated nuclear fuel reprocessing plants as part of their nuclear weapons programs.

There are both economic, technical, and environmental reasons to resume the development of nuclear power. The fundamental economic reason that nuclear power is attractive is that the thermal energy generated in a light water reactor with low enriched uranium cost only \$0.50 per million British Thermal Units (MBtu). By comparison, natural gas at \$4.0 per TCF results in a thermal

energy cost of about \$4.00 per MBTU. Oil at \$60 per barrel has a thermal energy cost of about \$6.00 per MBTU. The fundamental low cost of nuclear fuel, together with the technical advantage of essentially zero emissions, and no carbon dioxide emissions cannot or at least should not be ignored.

**II. Solar energy and wind energy are ostensibly free, but have major limitations that result in higher than expected end cost.** The higher than expected end cost is due to the diffuse nature of sunlight and the diurnal pattern in the case of solar power, and the intermittency of the wind in most parts of the world. For solar energy, this means some type of energy storage system is required, either at the power plant if solar thermal is the option, in the grid, or with the end user as is the case with electric vehicles. The Congress seems to believe there are three reasons for either wind or solar energy, JOBS, JOBS, JOBS. Let me remind you that because of the small and modular nature of most of the solar and wind options, these are JOBS THAT CAN BE READILY SHIPPED OVERSEAS. Where is the biggest producer of Solar panels located, with 50% market share already? My understanding is in China.

Where does General Electric plan to produce wind turbines? A major initiative was recently announced for Vietnam. Granted, a wind turbine facility is making progress in the Midwest, but because of the small and modular nature of many of the solar and wind systems, many of the manufacturing jobs are vulnerable to be outsourced to the lower cost labor markets.

The jobs in the U.S. are likely to be lower paid installation and maintenance jobs, not the manufacturing jobs that pay higher wages, and the related RD and D that is routinely done by a manufacturer with the biggest market share to maintain his market share.

**SO THIS IS THE SECOND BIG REASON TO MAKE NUCLEAR POWER A KEY ELEMENT OF BOTH THE US PROGRAM, AND THE CALIFORNIA ENERGY PROGRAM. The large plant components and the large amount of concrete and rebar mean JOBS AT HOME. Nuclear power can be a major factor in re-industrialization of the United States.**

**III. A third element I would like to emphasize is the need to consider the fresh water needs of California and the West Coast of the United States,** under various global warming scenarios. A robust energy plan would not bet all the chips that carbon dioxide gas can be controlled sufficiently to avoid global climate change, and some amount of global warming. If climate change does occur, either because major sources of carbon dioxide in developing countries such as China, India, South America, and Africa are not controlled, or for other reasons, perhaps carbon dioxide release IS ONLY ONE OF MANY FACTORS, AND CLIMATE CHANGE DOES OCCUR, WHAT ELSE SHOULD BE ADDRESSED?

The short answer is fresh water supply. I have recently become aware of a large body of research underway at the University of California at Davis. I commend this work to the CEC and to the panel on the next IER. My interest is again stimulated by the major role that nuclear generation can play in desalting ocean water, or brine from inland seas.

A look at the planet from a thermodynamic point of view says that if more heat is put into the atmosphere, oceans and land mass, the climate engine must churn faster to discharge the heat back into space until the temperatures are again at equilibrium. This argument says that there is likely to be more rainfall somewhere, most likely in latitudes further to the North than California, so two general lines of reasoning should be pursued. (1) One is to look at North-South water transfer, from British Columbia and Alberta in Canada that may well have water 'coming out their ears' to the more arid regions to the South, e.g. the United States. But just in case the heavy rainfall moves

further north to the Northwest territories of Canada, the United states must be prepared to build very large scaled desalting plants.

NUCLEAR POWER, because of the very low cost of the thermal energy, and in the case of light water reactors, relatively low plant efficiency and consequently abundant low temperature energy in the cooling water, these plants are ideally suited to become electric power and de-salting hybrid plants.

**THIS IS THE THIRD MAJOR REASON THAT NUCLEAR POWER SHOULD BECOME AN ELEMENT OF THE CALIFORNIA ENERGY PLAN. NONE OF THIS CAN BE MADE TO HAPPEN OVERNIGHT, so it is important to start the phased development of nuclear power and a few de-salting prototypes to be prepared for the growth of population, as well as the potential for significant climate change.**

I hope you will take these remarks to heart! Nothing would be more persuasive to the California legislature than for the California Energy Commission to strongly recommend a major role for nuclear power in California.

#### References:

[1] Jay R. Lund, et. Al. "Climate Warming and California's Water Future," Department of Civil and Environmental Engineering, Department of Agriculture and Resource Economics, University of California at Davis, presented at ASCE World Water Congress, 2003.

[2] Edwin D. Sayre, "The California Nuclear Green Farm," presented to the California Energy Commission November 10, 2005.