COMMITTEE VII
Global 2000 Revisited: Re-assessing
Man's Impact on Spaceship Earth

DRAFT - 11/15/86
For Conference Distribution Only

Discussant Paper on Jovan Jovanovich's Paper

POSSIBLE REPLACEMENTS FOR FOSSIL FUELS AND COMPARATIVE ENVIRONMENTAL IMPACTS

by

Kazem Omidvar
Laboratory for Atmospheres
NASA/Goddard Space Flight Center
Greenbelt, Maryland

The Fifteenth International Conference on the Unity of the Sciences
Washington, D.C. November 27-30, 1986

DISCUSSION PAPER ON "POSSIBLE REPLACEMENT FOR FOSSIL FUELS AND COMPARATIVE ENVIRONMENTAL IMPACTS"

Kazem Omidvar

Laboratory for Atmospheres

NASA/Goddard Space Flight Center

Greenbelt, MD 20771

Of the five major energy sources in the world, three are fossil fuels. These are oil, coal, and gas. The two non-fossil fuels are the hydro-electricity and nuclear electricity. Dr. Jovanovich has pointed out that the other forms of energy; wind electricity, biomass fuels, geothermal heat, and ocean thermal energy conversion, are not substantial sources of energy, and could not provide more than a few percent of the total energy needed by a technological world. Solar energy, although immense in its amount, is a dilute form of energy, and is not suitable for most energy needs.

According to Dr. Jovanovich, at the present rate of the energy consumption, the fossil fuel (oil, coal, gas) will last 400 years, and if we assume that the consumption will increase and reach saturation, it will last only 40 years. All fossil fuels produce carbon dioxide which will change the climate dramatically. Our atmospheric carbon dioxide has increased by 20% in the last 150 years. As a result, a measurable increase in the global temperature of 1-2 degrees has been observed.

In addition, burning coal produces sulfur dioxide and nitrogen oxides, which produce acid rains with catastrophic effects.

Hydroelectricity provides 7% of the world energy. We are then left with the choice of the nuclear energy, only.

Dr. Jovanovich argument that the nuclear energy is the logical solution to the future world demand of energy, appears to be convincing. However, there are omissions, and I would disagree with some of the arguments that he has presented.

Comparison of the radiation from the nuclear wastes and reactor cores, with radiation from the cosmic rays, is superficial and misleading. Cosmic rays at sea level, consist mainly of charged muons. Radiation from the nuclear wastes and the reactor cores consist mainly of gamma rays and radiations from heavy isotopes like cesium-137, strontium-90, and iodine-131. Cesium-137, strontium-90 and iodine-131 have half lifes of 30 years, 28 years, and 8 days, respectively. These isotopes have selective absorptions in the body, and upon being inhaled or ingested, are lodged in particular organs, emitting damaging concentrated ionizing radiation. Although the two forms of radiations may have equal rems, they have different biological effects.

An important omission in Dr. Jovanovich paper is the catastrophic event that can occur to a power reactor. This event can take the form of (a) sabotage, (b) natural catastrophe like earthquake, (c) enemy bombing of the reactor, and (d) the drop of a heavy object, like an airplane, on the reactor. These events have much more grave consequences than similar events that can occur to other forms of power producing plants, like a hydroelectric dam. There are ways to reduce the damages due to these catastrophies, but they cannot be completely eliminated.

Another omission is the risk of mismanagement of the huge number of power reactors that eventually will be installed in third world countries. How the safe operation of the reactors can be guaranteed in countries without sufficient number of technological staff? How the repeat of the experiment by the engineers at the Chernobyl which led to the bursting of the power reactor

can be prevented in third world countries? These questions have not been addressed by Dr. Jovanovich.

On the positive side, on the subject of the safety of the nuclear reactors, many improvements can be made to make the reactors almost accident proof. An example is the recently developed helium cooled reactors. These reactors are small with an output of about 80 MW. The configuration of the reactor's core, and the reactor's size make sure that the core temperature never rises above 1600°C, not enough to damage the fuel or cause a meltdown. Many of these small reactors can be put to work in parallel, instead of having single GW power reactors.

A point can also be made in favor of the safety of the low-level radiations. Dr. Jovanovich has correlated the hazards of radiation linearly with the amount of radiation. Actually, in most biological systems, synergism is operative which means that 2+2 is more than 4. As an example, the effects of two drugs given together is more than similar effects if the drugs were given separately in different times. This means that the law of linearity underestimates the hazards of medium and high level radiations. This in turn means that the linearity law overestimates the hazards of low-level radiation.

On the subject of hazards of the increase of the atmospheric carbon dioxide, although the potential danger of excessive increases of the carbon dioxide should not be discounted, no accurate prediction for the future of the world, based on quantitative calculation of the increase of the CO_2, is available.

As an example, Dr. Jovanovich has argued that the amount of the desert area represented by Sahara in Africa is expanding, and this may be due to the 20% increase in our atmospheric CO_2. It also can be argued that the enhanced

amount of CO_2 in the atmosphere would increase the rate of photosynthesis by plants, which counterbalances the desertification. Increases of the atmospheric CO_2 and warming of the atmosphere may have beneficial effects in the agriculture of some parts of the world.