Testimonial

First, I introduce myself:

I am Dr. Francisco Eugenio Villaseca, a USA citizen, and a Professor Emeritus of Cleveland State University. My PhD degree is from Arizona State University.

I was a member of the CSU Faculty for 34 years, but after my retirement I continued teaching, at the graduate level, on a part-time basis, for two more years.

My expertise is in the Power and Energy field of knowledge, reflected in my teaching of both the undergraduate and graduate courses:

- **Electromechanical Energy Conversion**
- **Power Electronics**
- **Power Systems Operations and Control, and**
- **High Power Electronics,**

All pertinent to this presentation.

I have recognized for many years the importance of energy independence for our country and all efforts made to achieve it.

The emphasis on these efforts must be in the development of new electric energy and power sources achievable quickly, safely, economically, and with little environmental impact.

The fact that there exists a means to accomplish those goals, current regulations do not allow for a fast development and public demonstration of its desired qualities.

I am referring here to the implementation of Molten Salt Reactor technologies, one among which is the Liquid Fluoride Thorium Reactor. I know about this because the Oak Ridge National Laboratory demonstrated the operation of this type of reactor more than four decades ago.

I am a very strong supporter of the building a demonstration plant here in Ohio. Possibly at the Plum Brook Station, which was renamed the Neil A. Armstrong Test Facility on December 30, 2020. Or anywhere else in Ohio that is appropriate.

Current nuclear energy technology power plants, which supplied about 20 percent of the nation's electric power in 2010, have the very serious problem of what to do with their nuclear wastes, and their highly radioactive residues and considered one of the most hazardous substances on earth.

According to the Institute of Electrical and Electronics Engineering (the largest professional engineering organization in the world, and of which I am a Life Senior Member) has stated that the current national inventory of nearly 65,000 metric tons of commercial spent nuclear fuel is stored at 75 sites in 33 states and increases by about 2,000 metric tons each year.

The U.S. Congress approved the Yucca Mountain site as the location for the nation's nuclear wastes repository and it was scheduled to open for storage in 2020. These costs was to total $15.4 billion by 2020 and increase by an estimated $500 million for each year delay after that. However, an issue yet to

be resolved are the means and ways of their transportation from every plant in every State to the site.

Molten salt reactors (MSR) represent one of the most promising means to this end and have the potential of doing so quickly, safely, economically, and with little environmental impact:

1. **Thorium is a renewable energy source in the same way that geothermal energy is.**
2. **Nuclear reactors do not generate greenhouse gases, do not require the damming of rivers, do not cover vast areas of land with windmills, do not require dedicating vast agricultural areas to biofuel crops, do not require covering vast land areas with solar panels, and are able to provide power when it is needed.**
3. **MSRs do not require any conceptual "breakthroughs" because the Oak Ridge National Laboratory demonstrated the operation of this type of reactor more than four decades ago.**
4. **Thorium is abundant in the earth's crust, and the United States has enough readily available thorium to supply 100 percent of its energy needs for many millennia.**
5. **Many thorium deposits also contain valuable minerals, such as rare-earth elements, used in high-tech industrial processes.**
6. **The thorium-based fuel cycle has nuclear proliferation advantages resulting from its strong gamma emissions. This facilitates detection of stolen material and causes health problems to personnel near this material for prolonged times so that "would-be" nuclear states are less likely to use this material for weapons. Uranium-233 is equal to or superior to plutonium in some cases, therefore keeping weapons useable material out of the hands of terrorists and rogue states would remain a concern that requires safeguards.**
7. **The temperature of a MSR is self-regulating, so these reactors cannot "melt down" and are intrinsically safe.**
8. **MSRs operate at a much higher temperature than conventional reactors, and therefore produce electricity more efficiently and can be used for high**

temperature industrial processes such as large-scale desalinization and hydrogen fuel production for fuel cells and electric vehicles.

9. **The high temperature operation of MSRs, coupled to closed Brayton cycle turbines, permit the use of much smaller turbines and heat exchangers, significantly reducing the overall physical size and construction cost of the plant compared to a conventional nuclear plant.**

10. **MSRs operate at a pressure a hundred times lower than that of conventional light water reactors and are therefore safer and do not require extremely expensive concrete containment domes typically associated with nuclear plants.**

11. **The thorium isotope used to fuel a MSR is hundreds of times more abundant than is the uranium isotope comprising most of the fuel used in conventional reactors. This means that fueling a MSR would be orders of magnitude less expensive and would have much less environmental impact from mining operations.**

12. **The chemical reprocessing required for waste management of the liquid fuel in a MSR is much less challenging and expensive than for solid fuels, significantly reducing the demand for long-term storage repositories such as Yucca Mountain.**

13. **The chemical reprocessing step also provides the opportunity to extract valuable isotopes for medical and industrial use.**

14. **MSR plants can be used to convert existing nuclear waste into usable energy.**

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