America Needs to Reestablish Its World-Leading Manifestation of Nuclear Generated Electricity

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Insight into today's worldwide development of nuclear power is provided from the history of nuclear generated electricity.

American ingenuity advanced nuclear technology to a world-class innovation to benefit all. Interestingly, the methods used in the rest of the world are copies of the American innovations.

Now, America seems to be fading into the wallpaper of greed and propaganda. It slinks to massive subsidies to support ancient power generated from breezes and sunshine, like wind and solar. America needs to reestablish its world-leading manifestation of this technology through our secret weapon called free enterprise.

To meet increasing demands for electricity, China, Russia, Japan, and Poland are building additional nuclear power generated electricity, while the USA focuses on weather dependent wind and solar.

Russia and China are currently leading the world in nuclear electricity generation and account for 70 per cent of additional nuclear power capacity. Today, about 60 reactors

are under construction across the world. A further 110 are planned.

Today, nuclear power generated electricity is being added around the world:

- The nuclear power systems developed for the Navy have functioned well for over seven decades. All U.S. Navy submarines, and aircraft carriers are nuclear powered.
- France has more than 50 nuclear power reactors producing more than 70% of France's electricity.
- Japan / New Energy Policy Will Set Nuclear Share Target Of 20% By 2040 Japan's industry ministry is making final amendments to a policy that will significantly increase nuclear power from the estimated 8.5% that the reactor fleet provides today. Fourteen nuclear power plants have restarted in Japan since the 2011 Fukushima disaster.

Today, about 440 nuclear power reactors are in operation in 32 countries and Taiwan, with 62 new reactors under construction. As of August 1, 2023, the United States had 54 nuclear power plants with 93 operating commercial nuclear reactors in 28 states.

Nuclear power has the competitive advantage of being the only reliable, available, and clean power source that can accommodate the desired expansion of a clean electricity supply to the end users. In fact, nuclear power could supply all the capacity the US needs.

The United States invented and perfected nuclear power as early as the late 1940s. Are we willing to regress while other countries progress? To understand this concept better, let's review the US nuclear energy development through the years.

As Nazi Germany began to eat away at civilization, the discovery of nuclear fission, the powerhouse of nuclear reactors, was coming of age. Like the uranium born from

stardust as the ultimate energy storage, the secret to unlimited electric power for the world exploded upon the scientific community. You have heard of the heroes of this miracle: Curie, Einstein, Meitner, Hahn, Frisch, Bohr, Teller, Fermi, Oppenheimer, and many more. In a strange quirk of fate, the first use of nuclear fission came in the form of a bomb. As bad as war can be, it spurred the invention of radar, jet engines, and nuclear fission devices which all went on to make life better for humans. Nuclear fission became the flowers that grew after the thunderstorms of WWII.

After WWII, President Truman transferred the wartime Manhattan Project bomb design efforts into the genesis of peacetime development of nuclear power by creating the Atomic Energy Commission (AEC). President Eisenhower and President Kennedy continued the rapid development of "Atoms for Peace" to produce the first nuclear reactors in conjunction with private enterprise.

Hyman Rickover was another visionary to promote the development of what came to be known as light water reactors because they used the slowing down, or "moderating" of neutrons to produce energy by using the element uranium in an altered or "enriched" form. This program was incredibly successful because the advantage of nuclear power for propulsion was so overpowering. First used in submarines, this technology promised to advance US strategic naval advantage unsurpassed in the world. These submarines were orders of magnitude quieter than diesel models and would not need to be refueled for the entire 30-year life of the submarine consuming uranium the size of a baseball. The first nuclear sub, named the Nautilus after Jules Verne's famous fictional "underwater home for its crew", was launched in 1954. Today, the Navy employs a fleet of more than 100 nuclear-powered vessels, including submarines and aircraft carriers.

Meanwhile, the civilian effort to produce commercial nuclear

power followed two basic paths. While they were developing the light water reactors for the Navy, a different type of reactor, called the fast reactor, had the edge in the commercial power arena. These are called "fast" reactors because they employed more energetic neutrons by using sodium or molten salt as a coolant instead of water. Some may know these reactors as "breeder reactors". However, Admiral Rickover chose the light water reactor, famously saying "I would use sodium as a coolant if the oceans were made of sodium". Since light water reactors were at a more advanced engineering level, it made sense to use this design for the electricity-generating nuclear power plants. The first such reactor went into commercial power production in Shippingport, New York on December 23, 1957. In the next 30 years, more than 100 nuclear power plants came online and provided 19.5% of the electricity in the United States.

Everything went well, and many dozens of reactors were being ordered by utility companies, until 1979. On March 28th, a series of events caused the reactor core at Three Mile Island number 2 to overheat and began to melt down. Even though the reactor's safety features prevented any injuries to the public, the media fear-factor kicked into gear. Many people became nervous about nuclear power, and the political world amplified this fear to the point that almost all the reactor orders evaporated. No more reactors were built after 1988 when Palo Verde near Phoenix came online. Other than two reactors which started construction and were finished in the early 2000s, the next reactors to come online, did so in 2022 and 2023 in Vogtle, Georgia. Even though there were 18 reactors closed before their design life, the efficiency (capacity factor) of the electricity production was increased (now better than 90%) such that the percentage of US power supplied by nuclear reactors remains close to 19.5%. Today, 94 commercial reactors are online. Of the 18 reactors closed, 12 of them are in a condition called safe store (SAFSTOR), meaning that they can be brought back on line with some

modifications.

More recently, we find that our demand for electricity will go up rapidly. Just like the price of eggs has gone up rapidly because disease has caused the egg production to tank, the price of electricity will go up as other customers bid in the face of rising demand. Many of us can do without eggs, but nobody can do without electricity. When you combine the rising demand with a clamor among media outlets demanding that we do away with natural gas and coal to produce electricity, I guess the prevailing anti-nuclear power opinion is that we all should move into caves and cook with firewood. I guess that would "conserve" electricity, but it would certainly not be the quality of life I would like to devolve to. The obvious conclusion is that people simply will not tolerate such a situation.

We do not have to wait until the market for cave dwellings explode, however. Technology has already come to the rescue. Remember, the Navy still uses 100% nuclear power on their submarines and aircraft carriers. The Army and Air Force are getting into the swing of nuclear power through their project (Project Pele) to migrate to small modular reactor microgrids to power their bases. So, why does US policy so consistently fight against the one innovation in the last century that can provide renewable, clean energy, essentially, forever and certainly until we commercialize a better idea? That is certainly one of the unanswered mysteries of our age.

It appears that the Army and Air Force will inspire the commercial market for small modular reactors just like the Navy did for light water reactors. If you add the fast reactor recycling of the spent nuclear fuel, you can, essentially, create a supply of electricity that is too massive for us to use. The past has shown promise for nuclear power, the military is certainly pleased with it, and it looks to be the only way to out-produce our demand. Toss in recycling in fast reactors, and we can see prices on a fair

market approach a penny per kWh. Isn't that better than the dollar per kWh we are headed for as big business outbids consumers and small business for electricity? We are at a tipping point, but the customer always wins in a free enterprise system, right?

While nuclear power generation is proliferating around the world in China, Russia, and Japan with about 60 new nuclear power plants under construction and a further 110 planned, nuclear power design and construction came to an abrupt end in America in the early 1980's due to the propaganda of the anti-nuclear movement and a Nuclear Regulatory Commission that seems unable to approve any nuclear reactor designs, despite the sterling proven safety record over 7 decades.

What will it take to stimulate American interest to recapture our leadership in nuclear power implementation and innovation?

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