Solving Decarbonization with Nuclear Energy

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By Ambassador Thomas Graham, Jr.

Since the beginning of recorded history, humanity has sought a means to warm itself during the cooler months of the year. For many thousands of years, the principal energy source was wood. Coal, which had been known for some 3,000 years but little used, first began to be used as a substitute for wood beginning in the 16th century. By the 18th century, coal use increased significantly as most of the forests near cities had been largely cut down for firewood and, as a result, wood was very expensive.

Because coal is quite efficient, it was used considerably in 18th century Europe for heating homes and buildings. Then came the Industrial Revolution: world energy demands skyrocketed, and coal was needed to run machines, steamboats, and railroads. After electricity was discovered in the 1880s, coal-fired plants could deliver power directly to commercial entities and private homes and other buildings. Petroleum, a vital source of power for transport, soon appeared and finally natural gas (which, like oil, is a mixture of hydrocarbons), to complete the principal sources of fossil fuel productive power. Then came petroleum-fueled automobiles, truck transport on improved highways, and airplanes. Thus, fossil fuels came to completely dominate the world economy, becoming to date 84% of world energy production (up from 60% in 2012).

There was just one problem—little understood for a long time: carbon discharges into the atmosphere.

Since the beginning of the Industrial Revolution humans have released in the range of 600 billion metric tons of carbon into the atmosphere, which convert to two trillion metric tons of carbon dioxide annual emissions released worldwide—now amounting to around 10.5 billion metric tons of carbon per year. More important than these production figures is the accumulation in the atmosphere of greenhouse gases, coming from the carbon and a very small percentage of other gases with similar effects, trapping heat and increasing world temperatures. As noted, carbon is convertible into CO2 and measured in that form. Except for the last two centuries of at least the most recent 10,000 years, carbon in the atmosphere has not exceeded 2.80 ppm (parts per million). It currently is at 414.45 ppm. It is estimated that this number is higher than at any other time in the last 650,000 years. (USAfacts.org)

In the last few decades, the global warming problem has changed from completely manageable to desperately critical; reports indicate that in just the last two decades, greenhouse gases in the atmosphere have increased by 30 ppm – the greatest increase in such short a time in the past 1,000 years.

The world community, beginning to understand it faced an existential danger, held the Paris Conference in 2015 at which the countries of the world pledged to work together to prevent increase in a world average temperature in excess of 2 degrees Celsius above pre-industrial levels in 1800 and to try to hold it below 1.5C. However, there appears no chance to limit this increase to 1.5C. The claimed current level may be plus 1.1C, but reportedly there have been readings by U.S. government monitoring installations of plus 1.3C. Holding the increase only to plus 2C appears impossible as well, as most of the guidelines of the Paris Agreement to keep the temperature down have not been met for seven years. The carbon level in the atmosphere is rising every year. In 2021 it was 414.45, a catastrophically high figure, and one that grows every year.

The Paris goals appear nowhere near achievable. Some organizations believe the earth will be at plus 3C by the late decades of this century. Some observers say that at plus 3.7C the damage from climate change will be so great that there would not be enough money in the world to repair it. By plus 4C many believe we would be irreversibly on the road to plus 6C—the level of the First Extinction, which 250 million years ago destroyed some 95% of marine life and 85% of earth's creatures in what has thus far been the greatest natural extinction. It took the earth 10,000 years of volcanic activity to reach this level and millions of years to recover. The earth today could reach this level in a little over two centuries rather than after 10,000 years.

We are already feeling the first effects of plus 2C (enormously destructive wildfires, huge killer storms, and expanding deserts). Those emissions come from fossil fuel power plants (about 40 percent); transportation—primarily cars and airplanes (approximately 40 percent); and commercial infrastructure of buildings, dairy farms, etc. (approximately 20%). These first two must be phased down significantly in the near future if we hope to save civilization.

We should start with the first category because the technology is in place to do this—nuclear power or renewable power backed up by nuclear power. Fossil fuel power plants (the principal cause of this calamitous situation) must be phased out and replaced by non-emitting sources—largely by nuclear power with renewable energy coupled with nuclear power to cover the substantial part of the day when the wind is not blowing or sun not shining—either not at all or insufficiently. There is also much research into new types of nuclear reactors, which for the most part will not come fast enough but can become part of the mix if the earth's situation is saved. Small Modular Reactors (SMRs) based on existing reactor technology can be deployed more quickly. As constituted today, the nuclear industry can make important contributions—in addition, of course, to saving civilization. For example, new types of nuclear fuels, based on newly designed metallic fuel rods, can provide nuclear energy at much improved economics, safety, and proliferation resistance, as well as better enable an SMR to vary the power level it provides.

Of note is the nuclear power program of the United Arab Emirates, the first entirely new program in the past 30 years. It is led by the UAE in cooperation with a South Korean consortium of companies, which provides the Korean APR1400, a proven reactor model that is also operating in South Korea. The UAE program offers a standard for the world with its strong emphasis on the five basic principles of safety, security, non-proliferation, transparency, and sustainability. All states could benefit from this example.

Lastly, in surveying the current scene, one must mention the vulnerability to attack of nuclear power reactors so unfortunately demonstrated by Russia in the war that it launched on Ukraine. Because nuclear power reactors are vulnerable to war, the United Nations made an attack on nuclear power reactors a major war crime in the Geneva Protocols over 50 years ago. Nuclear power reactors, like hospitals, are indeed vulnerable to attack. But both hospitals and nuclear power plants could be built underground, making them safer from long range weapons. No one wants this; everyone wants freedom from war. Everyone wants as much safety and as much safe power as they can get. We should work on peace, rather than always build for war.

Currently at both the Chernobyl and the Zaporizhzhia nuclear power plant in Ukraine, the pressure of the world community and the personal intervention of the Secretary General of the United Nations has kept the reactor sites relatively safe. But at the Zaporizhzhia plant, Russia has been guilty of war crimes.

So ends this brief account of the essential need for the widespread deployment of nuclear power reactors—in the nearest term needed to save our beleaguered but still culturally rich and beautiful earth from destruction by global warming.

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