American Nuclear Industry Quakes at News from South Korea

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Op-Ed by Llewellyn King

"Et tu, Brute?" is the sentence from Shakespeare's tragedy "Julius Caesar." In Latin it means, "Even you, Brutus?" Caesar utters these words as he is being stabbed to death, having recognized his friend Marcus Brutus among the assassins.

Such might have been the response of the U.S. nuclear establishment to an announcement of plans towards a "nuclear-free era" in South Korea, following the permanent shutdown of Korea's first ever commercial power reactor, Kori-1, on June 19.

It is one of an accumulation of blows that have rained on the U.S. nuclear establishment since the tsunami hit the Fukushima Daiichi Power Plant on March 11, 2011. Its members -- including the nuclear navy, the national laboratories, the universities, many government agencies, and the regulators had hoped that South Korea would continue to hold the nuclear torch for at least these four reasons:

1. It is a friendly, open nation.
2. It needs nuclear because it is energy poor.
3. The new plant under construction in Abu Dhabi puts South Korea in a driving position as another global vendor. Otherwise new reactor construction will be dominated by just two countries: China and Russia.
4. Some are asking what will become of the evolving light water technology of Korea Electric Power Corporation?

With the French vendor AREVA plagued with problems -- financial and organizational -- and Westinghouse in bankruptcy, the world nuclear community has been looking to South Korea for balance against the predominance of China and Russia as vendors.

To this point in time, the most dramatic nuclear withdrawal has been in Germany where, after Fukushima, Chancellor Angela Merkel announced the country would give up nuclear power, resulting in a number of adverse consequences. More coal is being burned and air pollution has increased. Escalating reliance on renewables has created severe challenges for the

European grid, which has been destabilized from vacillating supply from Germany. "The grid is stressed," said Marc Boillot, senior vice president at EDF for Regional Actions, on a visit to Washington, D.C.

Once the most constant of the nuclear nations, France under its new president, Emmanuel Macron, also says it is cutting back on nuclear. French nuclear energy has been a huge success: France derives about 75 percent of its electricity from nuclear. In France, as well as elsewhere, the opposition has not been founded in either experience or science. It is purely political. Nuclear, even considering Chernobyl and Fukushima, remains the safest way to generate electricity -- safe and getting even safer as new reactors include more passive features, fewer moving parts.

Perversely, blows like that from South Korea are coming at a time when nuclear should be enjoying global approval. It is the only way to make enormous amounts of power without releasing any carbon or other greenhouse gasses. France, Germany, Japan, and South Korea have two things in common: They are industrial countries in a competitive world where they are or are going to be damaged by higher electricity prices. They are also nations with large ocean frontages that will suffer considerably with sea level rise.

Unlike these other commercial giants, the United States is well off. It has some of the cheapest electricity in the industrial world, and an abundance of natural gas -- which is so cheap that, in the short term, it is damaging the nuclear market and forcing the closure of well-run, high-producing plants.

Nuclear is alive and well in India and China, which are both building plants because they need big increases in their electric supply and because they face serious air pollution problems.

Should politicians and people from all over the world be soothed by the idea that renewables, in the form of wind and solar, can replace nuclear? No.

Consider the land-use issue. It takes about 200 acres of land for a 1,300-megawatt nuclear plant. To generate the same power with wind would take turbines stretched over 84,000 acres. Not many countries have that kind of land available, much less South Korea. Even the United States may find the land demands of wind and solar too high as more and more land is devoted to them.

Then there is the question of availability. Absent some storage system -- pumped hydro or backup gas reciprocating engines, like those offered by Wartsila, the Finnish company -- the grid is vulnerable to disruption: too much power at the wrong time.

In the United States, the heaviest electric load is in the evening, when air conditioning and an array of domestic appliances are switched on. It also is the time when the wind drops and the sun is setting.

In Germany, which decided to shut down 17 nuclear power plants -- its entire fleet -- by 2022, significant issues have emerged as a result of changes to energy policy. The price of electricity is three times what it is in the United States and rising. With increasing penetration of renewables -- which had a 29.5 percent share of the total power mix, there have been challenges in maintaining grid stability, and the perturbations in supply are affecting the entire continental grid.

The truth is that not only is nuclear the safest and mostly cheapest power supply on earth, but it also can be installed with a 100-year horizon. Even if renewables get battery or other

storage, linked to supercomputer controls, they will never rival nuclear for being compact, for long time horizons, and for certain availability.

New plant construction in the United States may be on hold, but that will not keep the nation from being a leading intellectual force in nuclear evolution. The deep position of nuclear and nuclear science in the United States is assured because of the nuclear weapons program and the nuclear navy, with its nuclear-powered ships and submarines.

But this grounding in nuclear science does not mean that civilian nuclear power will blossom soon in the United States. With the availability of a large land mass for renewables and an excess of natural gas, it will be some time -- maybe two decades -- before the nuclear option is again embraced in the United States. New reactors will have to come from overseas; and there are geopolitical reasons for thinking that the government would not want new reactors and their attendant supply chain to come from China or Russia. It has been an unspoken assumption that South Korea would be a possible source of reactor supply when they are again needed.

Worldwide, the need for nuclear is pervasive. By 2050, electricity demand will have doubled from today. According to Verdigris Capital, LLC, a McLean, Va.-based consultancy, this will be driven by the growth of megacities (with populations of 20 million or more) in Africa, Asia, and Latin America. Megacities need electricity and many do not have the land to expect sufficient supply from wind or solar, and pollution sidelines coal.

The solution for the world is nuclear. Its extreme efficiency puts it far in front of any other way of making electricity. A nuclear reactor engineer describes this advantage of energy density: an enormous amount of electricity can be made from a very small amount of nuclear material. The average land-based windmill being installed today generates 2 megawatts of electricity. A nuclear power plant, depending on design, can generate up to 1,600 megawatts, 24/7.

This is a calculation that needs political recognition where politicians are talking renewables. Solar is limited to the amount of space available for it when the sun shines. The second law of thermodynamics dictates that solar cannot generate more power than the energy contained in the sunlight that falls on a panel. That is absolute. Politicians need to know that wind and solar can be part of an energy mix, but they are not substitutes for certain, compact nuclear generation.

In Shakespeare's "Julius Caesar," Brutus said:

There is a tide in the affairs of men.
Which, taken at the flood, leads on to fortune;
Omitted, all the voyage of their life
Is bound in shallows and in miseries.
On such a full sea are we now afloat,
And we must take the current when it serves,
Or lose our ventures.

South Korea, if it chooses, could take the present situation and let it lead on to fortune with cheap electricity at home and strong sales abroad.

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