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Time To Think About Nuclear Energy

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Synopsis

The growing turn to nuclear energy by Asia for a more assured supply of sustainable energy must be weighed against issues of the safety of nuclear power plants which the 2011 accident at Fukushima highlights. The planning and operation of a nuclear power plant is more than a national issue, as responding to any nuclear plant accident will involve the region. Singapore needs to prepare to engage in the emerging regional discussion on nuclear energy.

Commentary

Asia's growing demand for energy to power its economic development is causing a turn to nuclear energy as an affordable supply of sustainable source of energy. Japan is preparing to reactivate its nuclear energy plants which were shut down following the March 2011 meltdown of its Fukushima Daiichi reactors after they were hit by the Great Earthquake and Tsunami. China has plans for a major expansion of nuclear power in its evolving national energy mix. India is considering developing a nuclear energy capability. A number of ASEAN countries have also declared an interest in the nuclear energy option.

The critical issue in any turn to nuclear energy as a more affordable and sustainable energy source than oil and other fossil fuels is the safety and security of nuclear plants. An accident at a fossil fuel fired plant can be localized, but not that of an accident at a nuclear power plant, as the accident at the Fukushima Daiichi plants illustrates. The consequences of a nuclear power plant accident are region wide. The issues of the safety and security of any nuclear energy plant in ASEAN is therefore more than a national debate. It is a regional issue.

Singapore, if it is to participate in any regional discussion on nuclear energy, needs to build up its expertise on nuclear energy. The establishment of a Nuclear Safety Research and Education Programme is a step towards this end. It builds on earlier, but now forgotten, interest in nuclear energy in the 1960s in the Ministry of Science and Technology which sent one or two physicists in the old University of Singapore to study nuclear physics and energy.

Sustainable Energy Source

The major argument for turning to nuclear energy today are, first, that it is a much cleaner and equally affordable source of energy than burning oil and coal. Nuclear energy does not generate carbon dioxide which contributes to global warming and climate change. Second, the nuclear fuel cycle is perceived to be less susceptible to the economic fluctuations and geopolitical uncertainties and evolving technologies of extracting fossil fuels. Third is that although start up costs for a nuclear energy plant are higher than for a traditional plant,

over the long term nuclear energy makes for a competitive energy option compared to oil and gas.

This perception of the cost effectiveness of nuclear energy was the driving force for the first wave of nuclear energy in the 1960s and 1970s in America and Europe. Today France leads in deriving some 77% of its need for electricity from nuclear power and still generates a surplus for export to neighbouring countries.

However this initial confidence in nuclear power safety declined following accidents at Three Mile Island in the US (1979) and Chernobyl in the old Soviet Union (1986). High construction and operating costs, safety issues and accidents and controversy over security of nuclear waste disposal slowed global growth of nuclear power from the 1980's onwards. Today the uncertainties and complexity of fossil fuel futures has lead to a new interest in nuclear power.

Safety of Nuclear Reactors

This turn to nuclear power as a more sustainable energy source must be weighed against the safety of nuclear reactors. There are two key safety requirements. The first is to control the radioactivity emanating from the physics of fission which generates the heat in a nuclear reactor that drives the turbines of the electricity generator. All nuclear reactors, especially the third generation reactors today, have a series of safety components with back-up and design to accommodate human error. At the Fukushima Daiichi plants this was not an issue. The reactors were effectively shut down.

The second safety issue of a nuclear power reactor is maintenance of core cooling. This was the issue at Fukushima Daiichi plant. The reactors were shut down, but continued to generate heat, which could not be removed because the electric pumps to circulate the water to cool the reactors were disrupted. The reactors therefore melted-down.

As the Fukushima Daiichi catastrophe has shown, responding to a nuclear reactor accident is a regional issue. A regional approach to respond to external events such as earthquakes and floods, equipment failure such as breaks in coolant pipes and other problems which could lead to radioactivity releases into the environment affecting the region needs to be addressed as some in ASEAN think of going for the nuclear energy option.

Security of the Nuclear Fuel Cycle

Highly radioactive spent nuclear fuel must be regularly removed from operating reactors and stored in adjacent pools of water to cool for several years. This spent fuel then need to be moved to permanent storage for hundreds, if not thousands of years. According to the International Energy Agency, a 1000MW nuclear power plant (generating electricity for a city the size of Amsterdam) produces 30 tonnes of high level solid packed waste per year. In comparison, a similar coal plant produces 3000,000 tonnes of ash per year.

Safe disposal of this nuclear waste to ensure it does not leak and contaminate the environment has been and must continue to be a major issue in any decision to go for nuclear power. The problem is that no one wants this nuclear waste stored "in my backyard." The US has developed a large storage facility in the Yucca Mountain for the long term storage of its nuclear waste. But the Obama Administration has been forced to halt the project because of this "not in my backyard" mindset.

Accounting and safeguarding of nuclear waste to ensure it does not end up in a nuclear weapons programme is the other perennial issue of the security of the nuclear fuel cycle. International controls for the accounting of nuclear waste may be inadequate as more countries go for nuclear power.

The availability of uranium enrichment and spent nuclear fuel reprocessing technology to convert nuclear waste into weapons materials as well as more civilian nuclear fuel, increases the challenge of the security of the nuclear fuel cycle. Iran's uranium enrichment program is an example of the tension between peaceful and weapons uses of nuclear technology.

How do we balance the lure of nuclear power as an assured supply of sustainable energy against the risk of nuclear reactor accidents and lapses in the security of the nuclear fuel cycle? The work of the new research and education programme in nuclear safety, science and engineering appears to be cut out for it.

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