# Introduction: Nuclear energy in Asia

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The Fukushima nuclear disaster of March 2011 has raised serious questions about nuclear power. In our work since Fukushima, we have tried to answer two questions: What is the current status of nuclear energy in Asia? Does nuclear power have a future in East Asia? By answering those questions, we hope to contribute to the global debate about nuclear energy. To be sure, questions of such magnitude can rarely be answered with a simple 'yes' or 'no'. Decisions on energy are made at the national level, on the basis of both objective factors such as cost-effectiveness and notions of the national interest, and less objective ones, such as influence peddled by power plant operators, corruption, and bureaucratic self-interest. Nevertheless, by closely examining the status and probable future of nuclear power plants in specific countries, the authors come up with answers, albeit mostly of a negative nature.

At the start of 2017, 450 nuclear power reactors were operating in 30 countries, with 60 more under construction in 15 countries (Nuclear Energy Institute 2016).[1] Thirty-four reactors are under construction in Asia, including 21 in China (*Bulletin of the Atomic Scientists* 2017; see Figure I.1). The 'Fukushima effect' has clearly had an impact in Asia, however. In China, no new construction took place between 2011 and 2014, although since then there has been a slow increase of licences (*Bulletin of the Atomic Scientists* 2017). Nevertheless, the full story of China's embrace of nuclear power, as told here by M. V. Ramana and Amy King, is that the onset of a 'new normal' in economic growth aims

1 *Bulletin of the Atomic Scientists* (2017) reports 55 nuclear reactors under construction in 13 countries as of 1 January 2017.

and structural changes in the economy have led to a declining demand for electricity and the likelihood of far less interest in nuclear power than had once been predicted. On the other hand, in South Korea, which relies on nuclear power for about 31 per cent of its electricity, Lauren Richardson's chapter shows that the Fukushima disaster and strong civil society opposition have not deflected official support of nuclear power, not only for electricity but also for export.

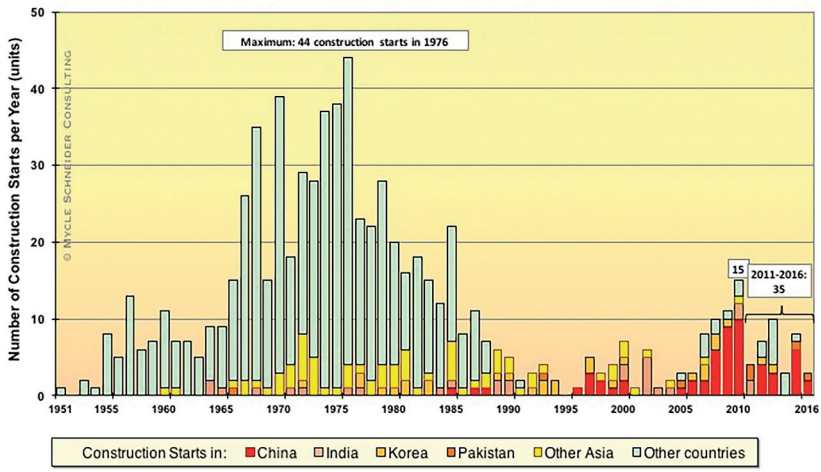


Figure I.1 Construction starts of nuclear reactors in the world by year, 1951–2016 (in units)

Source: Schneider et al. (2017). Reprinted with permission of the authors.

Meanwhile, the 10 countries that comprise the Association of Southeast Asian Nations (ASEAN) are divided about pursuing the nuclear-energy option, with Vietnam deciding to opt out in 2016, and Cambodia, Indonesia, Malaysia, and the Philippines at various stages of evaluation. Even so, the chapter by Mely Caballero-Anthony and Julius Cesar I. Trajano shows that only about 1 per cent of ASEAN's electricity will derive from nuclear power in 2035, whereas renewables will account for 22 per cent.

## Factors in the declining attractiveness of the nuclear option

How viable nuclear power is finally judged to be will depend primarily on the decisions of governments, but increasingly also on civil society. ASEAN has established a normative framework that emphasises safety, waste disposal, and non-proliferation; and civil society everywhere is increasingly alert to the dangers and costs, above-board and hidden, of nuclear power plants. As Doug Koplow's chapter shows, for example, the nuclear industry, like fossil fuels, benefits from many kinds of government subsidies that distort the energy market against renewable energy sources. Costs are politically as well as environmentally consequential: even if construction begins on a nuclear power plant, it will be cancelled and construction abandoned in 12 per cent of all cases. It is important to note that of the 754 reactors constructed since 1951, 90 have been abandoned and 143 plants permanently shut down. When construction does proceed, it takes between five to 10 years on average for completion (338 of 609), with some 15 per cent taking more than 10 years (*Bulletin of the Atomic Scientists* 2017). And, in the end, old and abandoned reactors will have to be decommissioned, as Kalman A. Robertson discusses, with costs that may double over the next 15–20 years. As Robertson points out, the problem of safe disposal of radioactive waste and the health risk posed by radiation released during decommissioning should be factored into the total price that cleanup crews and taxpayers will eventually pay. On top of all that, there isn't much experience worldwide in decommissioning.

Then there is the issue of trust in those who make decisions. Tatsujiro Suzuki's chapter shows that in Japan, the chief legacy of Fukushima is public loss of trust in Japanese decision-makers and in the nuclear industry itself. Several years after the accident, costs continue to mount, a fact that pro-nuclear advocates elsewhere in Asia might want to consider.[2] They also need to consider the issue of transparency for, as Suzuki shows, the nuclear industry has consistently dodged the fairly obvious lessons of Fukushima with regard to costs, nuclear energy's future, and communication with the public. Similarly, in Taiwan, as Gloria Kuang-Jung Hsu's study

2 Six years after the Fukushima Daiichi accident, radiation readings at one of the three reactors being decommissioned were at their highest level. Estimated costs for decommissioning, decontamination, compensation to victims, and storage of radioactive waste now run over US$180 billion. See McCurry (2017).

shows, transparency about safety issues has been notoriously lacking, and a history of efforts to obfuscate nuclear weapon ambitions means that constant vigilance over nuclear regulators is necessary. Of course, if public opinion does not count in a country—say, in China and Vietnam—the issue of trust is muted. But we know that, even there, people are uneasy about having a nuclear power plant in their backyard.

Issues of hidden cost and public trust are also embedded in the biological and health threat posed by nuclear energy. Tilman A. Ruff, a long-time student of radiation effects on human health, demonstrates how these effects have been underestimated. He offers a detailed explanation of what exposure to different doses of radiation, such as from the Fukushima accident, means for cancer rates and effects on DNA. Timothy A. Mousseau and Anders P. Møller, who have undertaken field research for many years on the genetic effects of the Chernobyl accident, look at how nuclear plant accidents affect the health of humans and other species. Combined, these two chapters offer a potent, often overlooked, argument against the nuclear option.

## A sustainable future?

In all, these chapters put to rest many misconceptions about costs and investment risks of nuclear energy. The fact is, the economics of energy point to a declining future for nuclear power. Even in France, where (as Christina Stuart's chapter points out) nuclear energy accounts for 77 per cent of electrical output, the highest in the world, the 'French exception' is undergoing new scrutiny. Cost factors may finally neutralise the traditional argument that nuclear power is cheap, efficient, and *the* answer to global warming concerns. Andrew Blakers underscores that idea by closely examining sustainable energy options: namely, wind power, photovoltaics (PV), and hydro. He finds that wind and PV are already price-competitive with fossil fuels and increasingly outpacing them in rates of installation.[3]

3 In support of Blakers' view, the World Economic Forum (2016: 6) reports: 'the two major sources of non-hydro renewable energy have reached grid parity in a number of countries. In an increasingly larger number of countries, it has become more economical to install solar and wind capacity than coal capacity. It is estimated that more than 30 countries have already reached grid parity without subsidies, and around two thirds of the world should reach grid parity in the next couple of years'.

According to the World Economic Forum (2016: 4), '[r]enewable infrastructure has reached sufficient maturity to constitute a sound investment proposition and the best chance to reverse global warming'. The bad news is that worldwide investment in renewables is far below what it would take to arrest global warming.

Conclusions from the United Nations Framework Convention on Climate Change Conference of the Parties (COP) in December 2015 (COP21) highlight the need for an additional US$1 trillion in annual renewable infrastructure investment by 2030 to meet the goal of limiting global warming to 2 degrees Celsius. This need compares to a current annual average capacity investment of around US$200 billion. Furthermore, among the top 500 asset owners, including foundations, pensions, and endowments, only 0.4 per cent of total assets under management (AUM) have been identified as low-carbon investments (US$138 billion versus US$38 trillion AUM).

The overriding energy challenge in Asia, and elsewhere, is how to wean decision-makers away from reliance on nuclear power and fossil fuels, and into deep investments in wind, solar, and water power. The solution rests above all in politics much more than in science or economics, for otherwise the rational choice would be to abandon nuclear power, oil, and natural gas, whose short- and long-term costs are beyond excessive from a planetary point of view. Whether or not such a dramatic shift in understanding of the energy picture is possible at a time when all countries demand more energy for higher growth must be doubted.

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