

Asia's Electric Grid

The Future of Nuclear Power in the Region's Energy Mix

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Economies require energy supplies to grow. Improvements in people's quality of life demand more stable energy supplies. The confluence of a growing economy and increasing standard of living are causing energy demands to increase throughout Asia. The urgency for secure energy supplies and a diversified energy mix are at the top of decision makers' agenda throughout the Asia-Pacific. In the aftermath of the Fukushima-Daiichi disaster there has been a great deal of uncertainty in the outlook for nuclear energy and by extension the future energy-mix of the region.

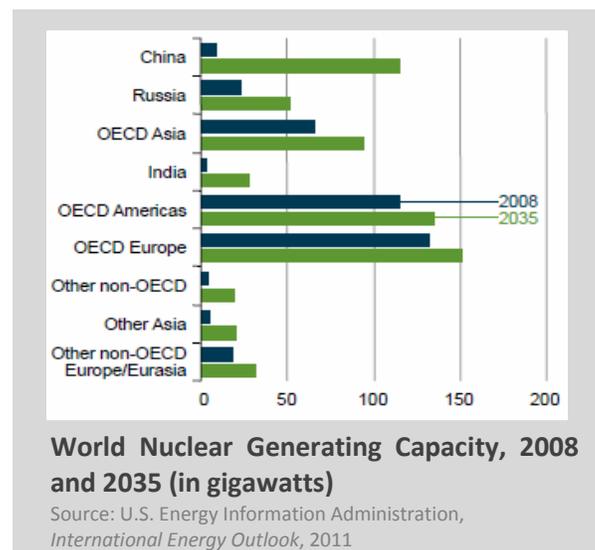
Governments develop, acquire, and produce energy on the basis of several criteria: security, efficiency, cost, and environmental standards.¹ Nuclear power has been one of the most sought after sources of energy in the Asia-Pacific region. The U.S. Energy Information Agency's (EIA) International Energy Outlook (IEO) 2011 projects that nuclear power will see its strongest growth in non-OECD Asia. This report attempts to fill the gap of current analysis by providing an overview on the impact of the nuclear crisis at Fukushima-Daichi on March 11 in Asia. The report focuses on Japan but also examines the future of nuclear power in India, Indonesia, Vietnam, and China post 3-11.²

Japan

Japan embraced nuclear energy, which until March 2011 made up 30 percent of Japan's energy mix.³ In the aftermath of the 3-11 earthquake and tsunami that

triggered radiation leaks at Tokyo Electric Power Company's (TEPCO) Fukushima Daiichi plant, Japanese public support for nuclear power plummeted. In a June public poll, *Asahi*

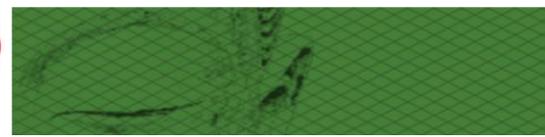
Shimbun, a prominent Japanese news media outlet, revealed that 74 percent of the Japanese public supports a policy to phase out nuclear power "with a goal to abandon it."⁴ Moreover, on September 19, 60,000 protestors gathered in Tokyo in one of the largest anti-nuclear rallies that Japan has ever seen.⁵ The Japanese Diet responded to the public's anti-nuclear sentiment and passed a renewable energy bill based on a feed in tariffs (FIT) mechanism.



FITs are financial incentives that encourage the adoption of renewable energy. Under a FIT, government legislation requires electric utilities to purchase electricity generated by geothermal, solar, and wind



Source: Getty Images



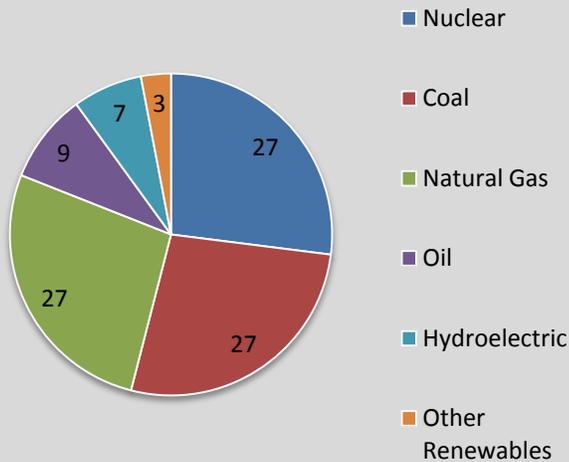
sources at higher than market rates. By setting a higher price, the government would assist renewable generators get a better return on investment despite higher costs. Moreover, it could foster an environment in which renewable energy can compete with conventional and well-established fossil fuel and nuclear power companies.⁶

While the renewable energy bill represents an unprecedented effort to boost the share of solar, wind, and hydropower in Japan’s energy mix, Tokyo’s rhetoric on nuclear power appears inconsistent with the goal of

Several reasons make nuclear power a compelling energy source for Japan. As a power source that can be domestically produced, nuclear energy is more secure than fossil fuels. The production cost is relatively low and stable (it rarely fluctuates).⁹ Nuclear energy is considered efficient and easily transportable. Lastly, it is environmentally favorable because it emits zero GHG emissions.

As a former finance minister, Prime Minister Noda is acutely aware of the financial burdens that higher energy costs and power outages could mean for Japan’s

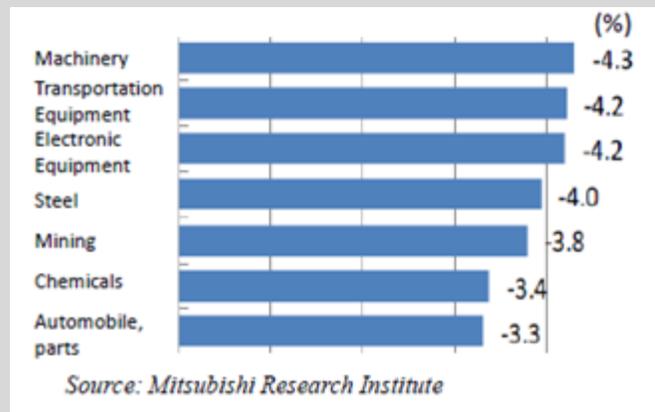
Japan’s Energy Mix 2009



Source: World Nuclear Association, “Nuclear Power in Japan.”

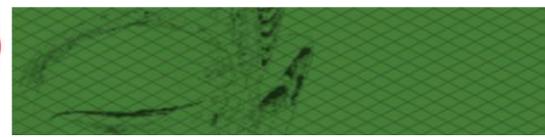
this initiative. Prime Minister Yoshihiko Noda stated that he wants to create a society that is less dependent on nuclear power but claimed that there is no viable alternative option other than nuclear power.⁷ Ostensibly with the hope that public scrutiny of the government’s mishandling of the nuclear crisis will fade over time, the current administration appears to be laying the foundation for Japan’s nuclear future. In September, Prime Minister Noda decisively set the timeline for restarting decommissioned nuclear power plants between the spring and summer of 2012.⁸

Impact of Nuclear Freeze on Production by Industries



economy.¹⁰ For energy-poor Japan, the most important driver of its energy-mix policy is the cost per unit of electricity.¹¹ If electricity rises by 10 percent, industrial production will contract by 2.4 percent.¹² Furthermore, if the nuclear freeze lasts for a year, it will cut GDP by an estimated 3.6 percent and take away almost 200,000 jobs.¹³

In spite of the public backlash, nuclear power seems poised to remain an important component in Japan’s overall energy mix. However, increasing concerns over plant safety, radioactive waste disposal, nuclear material proliferation, and anti-nuclear sentiment, will likely cause Japan to phase out nuclear energy in the



mid-to long term or at the very least maintain the status quo.

India

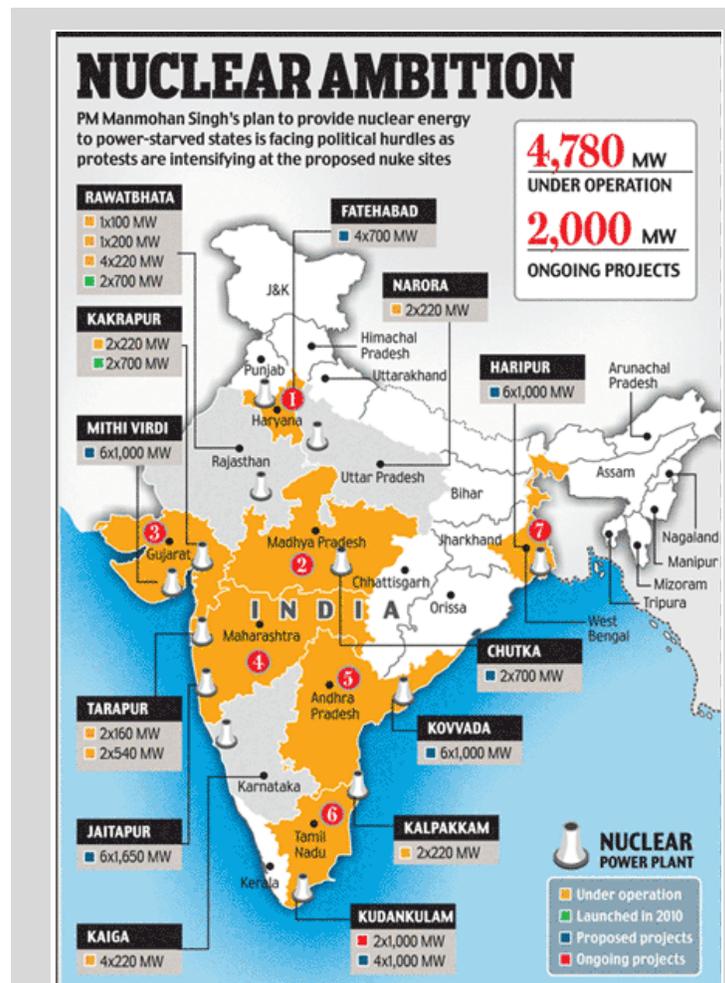
In December 2010, India signed a \$9.5 billion deal with Areva—the French nuclear power giant—to build two reactors for the Jaitapur Nuclear Power Project. The facility will be the world’s largest nuclear power generating station when it is completed in 2017.¹⁴ New Delhi’s interest in nuclear power is primarily due to its rapidly growing demand for electricity. In 2010, 56 percent of households or 400 million people had no access to electricity.¹⁵ Moreover, India is plagued by power shortages and relies heavily on diesel-fueled generators for power backup.¹⁶ India also seeks nuclear power because it strives toward cleaner energy sources.¹⁷ Coal comprises 68 percent of India’s electric energy-mix and nuclear makes up a mere 2.5 percent. The Indian government has set goals for nuclear to comprise 25 percent of the mix by 2050.

India’s reaction to nuclear power following 3-11 has been mixed. Following the incident, Prime Minister Manmohan Singh called for sweeping domestic nuclear safety reviews. He invited the International Atomic Energy Agency (IAEA) to conduct peer review safety missions and the Nuclear Power Council of India, Ltd. (NPCIL) to conduct comprehensive nuclear plant evaluations. The NPCIL has made recommendations for improving the safety of the Tarapur Boiling Water Reactors (BWRs) and Pressurized Heavy Water Reactors (PHWR). The two Tarapur BWRs have subsequently undergone upgrades to ensure continuous cooling of the reactors during prolonged station blackouts.

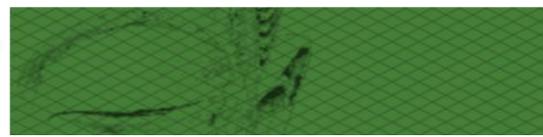
Despite these safety measures, Indian citizens from provinces across India have begun to protest the construction of new reactors. In Maharashtra state, villagers blocked food and water to laborers at the Jaitapur facility. In West Bengal, strong opposition led the local state government to forbid plant construction,

despite having initiated pre-project activities for 4-6 nuclear reactors.¹⁸ Protests are resonating loudest in Tamil Nadu—India’s southernmost state—and the site where the 2004 Indian Ocean Tsunami hit the hardest. Hundreds of villagers have gone on hunger strikes to demand a halt to the construction of the Kudankulam Plant, which is scheduled to come on line in December.¹⁹

The chief minister of Tamil Nadu, J. Jayalalithaa, has sided with local population by refusing to accept the reactor. However, the Indian prime minister is an ardent supporter of nuclear power and is unlikely to alter his stance.²⁰ Tamil Nadu’s nuclear dilemma has galvanized Indian non-governmental sectors. For example, in New Delhi, the Catholic Church has orchestrated hunger strikes protesting constructions of



Source: India Today



the Kudankulam nuclear facilities. Such debate has opened up a new opportunity for villagers, religious groups, business owners and scientists to voice their views on India's future energy mix.

The case of India illustrates that nuclear power and by the extension energy security is becoming a highly political issue. The future of nuclear power may depend on the extent to which the federal government can command local government to pursue national policies and second, to the extent to which both governments can convince local peoples that nuclear power plants are indeed safe and regulated.

In spite of widespread protests, the outlook for nuclear energy in India is still on the rise. Nuclear power will continue to play a significant role in India's future energy mix. However, New Delhi's projected goal of 25 percent nuclear power will likely undergo reevaluation.

China

China has long been a proponent of nuclear power. Nuclear power would enable Beijing to meet increasing energy demands and reduce carbon emissions. Nuclear power is a relatively stable and secure energy source, especially when compared to oil. Imported oil must first transit through the Hormuz and Malacca Straits. Thus, the economic and security benefits of developing nuclear power make it invaluable to Beijing.

China has more than 27 nuclear plants currently under construction and a total of 106 gigawatts of new

capacity expected to be installed by 2035. However, even China slowed production



Jaitapur Nuclear Power Plant
Source: PravsiToday

of nuclear facilities following 3-11²¹ and has halted the approval of new reactors until new safeguard measures are met in 2012.²² As a result, the country may have to revise its goal of 80 gigawatts from nuclear power by 2020 (in 2010 China produced 10.8 gigawatts,)²³ but its plans for over 70 new reactors are still intact.

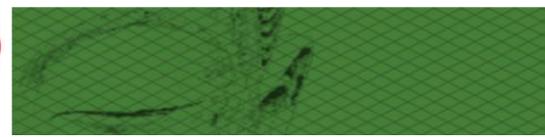
Fossil Fuels comprise 83 percent of China's energy mix (80 percent from coal, 2 percent from oil, 1 percent from gas in 2006.)²⁴ This overwhelming dependence on fossil fuels is not secure nor is it environmentally friendly. The World Bank estimates that pollution costs China approximately 5.8 percent of its annual GDP.²⁵ Apparently, the Fukushima crisis has not put a dent in China's long-term nuclear goals.²⁶ The government is likely to continue its pursuit of nuclear energy policies to benefit economic development, alleviate pollution, and meet the new energy demanded by a higher standard of living.

Indonesia

In contrast to China, the prospect for nuclear power in Indonesia in the short-term is grim. With its vulnerable location on the Pacific Rim of Fire, nuclear power plants are a hard sell to an Indonesian public wary of a Fukushima repeat.

Indonesia has been a nuclear aspirant since 1958 when it established the Atomic Energy Council and the Atomic Energy Institute, now called the Indonesian National Nuclear Energy Agency (BATAN.)²⁷ Nuclear power has been an attractive option for two reasons. First, it will provide an increased supply of energy that will mitigate frequent blackouts. Second, it will free up oil and gas, currently used to generate 45 percent of electricity, for exports.²⁸ Indonesia is already the world's largest exporter of thermal coal, and nuclear power will enable it to extend the title to its other energy sources.

The main proponent for Indonesia's nuclear future is BATAN. With its long history, and its large pool of well-educated nuclear scientists, BATAN is eager to put



current plans into action. Similarly to India, BATAN has not had much success in winning over local support for building reactors in “backyards.” Moreover, with President Susilo Bambang Yudhoyono’s reluctant support, nuclear power is unlikely to make any progress in the short term or at the very least until 2014, when President Yudhoyono’s second term ends. Nonetheless complete abandonment of nuclear plans is unlikely—the country still aims to meet 2 percent of its power demand through nuclear energy by 2017.²⁹

Vietnam

Vietnam is Southeast Asia’s most ardent “advancer” of nuclear power. Vietnam’s demand for nuclear energy sources derives from frequent power shortages and power rationing. Furthermore, its rapidly growing economy requires secure, low-cost energy sources. It currently has plans to develop two reactors at Phuoc Dinh and in Ninh Thuan, which will generate 2000 MWe by 2020.³⁰ Additionally, Vietnam has proposals for eight reactors and aims to generate a total of 15,000 MWe by 2030. In total, by 2030, nuclear power will comprise 8 percent of Vietnam’s energy mix.³¹

The Fukushima crisis did not have a significant impact on Vietnam’s nuclear energy plans. Vietnam has not witnessed the protests in India and Japan. Instead the country’s leadership views Fukushima as a learning experience to improve future operability of its own nuclear plants. Recent deals with Russia and Japan for nuclear reactor projects further delineate Vietnam’s nuclear stance.³²

One group that has challenged the leadership’s unequivocal support for nuclear power is the Vietnamese scientific community. Scientists warn that Vietnam’s coast is vulnerable to tsunamis from the South China Sea.³³ Nonetheless, civil society is unlikely to have any influence on the matter. The only likely change in nuclear energy policy is a shift in the location

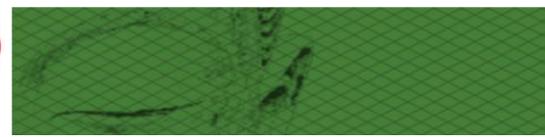
or design of nuclear reactors, but the overall nuclear energy strategy is very much intact.

Conclusion

The Fukushima crisis has spawned new debates on national energy mix strategies. This is particularly true in India and Japan. The incident requires governments to be more transparent in energy policies and it allows new voices (i.e. households) to enter the energy policy-making playing field. Second, it brings about energy efficiency and conservation awareness. While the benefits of nuclear power are well known, new discussions will shed light on some costs of nuclear power, namely: crisis cleanup costs, radiation waste disposal, maintenance and safety procedure expenditures, and human costs.

However, the Fukushima crisis has sparked a new wave of safety and maintenance procedures throughout Asia and particularly in India, China, and Japan. Prospects for the future of nuclear power depend on the effectiveness of the new safeguard measures in place. For example, do personnel know how to deal with large-scale natural disasters? Are there adequate protective shelters for workers on any given shift in the case of an accident? Are there transparent records of previous accidents? Has the risk of earthquakes been considered and addressed with automatic shutdown mechanisms?³⁴ These questions require immediate attention. Ultimately, the prospect for nuclear energy is largely a political concern that is contingent on the federal and local government’s influence over public opinion on nuclear power and their ability to verify that nuclear plants are indeed safe and regulated.³⁵

In the short-term, the crisis at Fukushima will slow plans for nuclear power in the Asia-Pacific region. Countries’ are reevaluating nuclear reactor site locations, plant safety features, and energy-mix options. Furthermore, in Japan and India, the region’s longest-standing democracies, the nuclear energy mix question is



increasingly a political issue. Conversely, in China and Vietnam, countries with closed-systems of governance, the nuclear agenda before 3-11 appears intact. In short, a German-type exodus from nuclear power is highly improbable in the Asia-Pacific.³⁶ This is largely because other energy sources are unable to compete with the benefits nuclear power provides. While concerns over

safety, nuclear proliferation, radiation, and nuclear waste have made renewable energy sources and natural gas more competitive with nuclear energy, the cost-benefit analysis by most governments in the region suggests that nuclear power will continue to play a major role in the region's energy mix

¹ Tokyo Electric Power Company, "Best Mix of Power Sources," <http://www.tepco.co.jp/en/challenge/csr/sustainability/best-e.html>.

² South Korea will be addressed in forthcoming reports.

³ World Nuclear Association, "Nuclear Power in Japan," 4 October 2011, <http://www.world-nuclear.org/info/inf79.html>.

⁴ Japan Atomic Industrial Forum (JAIF), Department of International Affairs, "Trends of Public Opinions on Nuclear Energy after Fukushima Accident (March 11) in Japan," 16 June 2011, http://www.jaif.or.jp/english/news_images/pdf/ENGNEWS02_1312778417P.pdf.

⁵ Kazuaki Nagata, "Masses turn out to protest nuclear power," The Japan Times Online, 19 September 2011, <http://www.japantimes.co.jp/text/nn20110919x1.html>.

⁶ U.S. Energy Information Administration, *International Energy Outlook 2011*, September 2011, pg 89, <http://www.eia.gov/forecasts/ieo/pdf/0484%282011%29.pdf>.

⁷ "Noda Wants Nuclear Reactors Back up by Next Summer," Asia Japan Watch, *The Asahi Shimbun*, 21 September 2011, http://ajw.asahi.com/article/behind_news/politics/AJ2011092111460.

⁸ Ibid.

⁹ Recent publications suggest that actual cost per kWh is higher than originally estimated. See: Son Masayoshi and Andrew DeWit, "Creating a Solar Belt in East Japan: The Energy Future," *The Asia-Pacific Journal*, Vol. 9, Issue 38, No. 2, 19 September 2011, <http://japanfocus.org/-Andrew-DeWit/3603>.

¹⁰ Prime Minister Noda stated that "Energy is the lifeblood of the economy" and Japan must "mobilize science and technology" to decide on rationally grounded next steps for nuclear power. See: United Nation High-Level Meeting on Nuclear Safety and Security, "Address by H.E. Mr. Yoshihiko Noda, Prime Minister of Japan," *Kantei*, 22 September 2011, http://www.kantei.go.jp/foreign/noda/statement/201109/22speech_e.html.

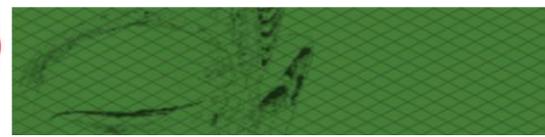
¹¹ In September 2011, Panasonic cancelled plans to expand a domestic lithium-ion battery factory in Osaka, despite already beginning a 100 billion yen investment plan. Panasonic will move production to Sichuan, China. Its Chief Financial Officer attributed the transfer to high corporate taxes, the yen's strength, and concerns over high electricity costs following the Fukushima Daiichi nuclear crisis. See: "Panasonic Scraps Plan to Expand Osaka Battery Plant," *The Wall Street Journal*, 29 September 2011, <http://online.wsj.com/article/BT-CO-20110929-704335.html>.

¹² Hironori Kawauchi, "What Comes After the Great Eastern Japan Earthquake? Implications on the Japanese and East Asian Economy, as well as Global Energy Security and Nuclear Policy" (powerpoint presented at U.S.-Japan Research Institute Seminar, Washington, D.C., October 18, 2011), http://www.us-jpri.org/en/reports/seminar/kawauchi_20111018.pdf.

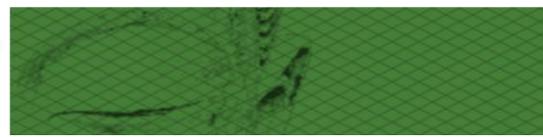
¹³ "Bright Ideas Needed," *The Economist*, 17 September 2011, <http://www.economist.com/node/21529037>.

¹⁴ World Nuclear Association, "Nuclear Power in India," 30 September 2011, <http://www.world-nuclear.org/info/inf53.html>.

¹⁵ United Nations Development Programme, "Environment and Energy," 2010, http://www.undp.org.in/whatwedo/environ-ment_and_energy.



- ¹⁶ Rebecca Byerly, "India Maps Out a Nuclear Power Future, Amid Opposition," *National Geographic Daily News*, 22 July 2011, <http://news.nationalgeographic.com/news/energy/2011/07/110722-india-nuclear-jaitapur/>.
- ¹⁷ India's global emissions will increase when it surpasses China as the world's most populous nation by 2025. India's GHG emissions will triple within the next 20 years. See: Sam Roberts, "In 2025, India to Pass China in Population, U.S. Estimates," *The New York Times*, 15 December 2009, <http://www.nytimes.com/2009/12/16/world/asia/16census.html>. See also: Sanjoy Majumder, "India Emissions 'Triple by 2030'", *BBC News*, 2 September 2009, http://news.bbc.co.uk/2/hi/south_asia/8234822.stm.
- ¹⁸ World Nuclear Association, "Nuclear Power in India," 30 September 2011, <http://www.world-nuclear.org/info/inf53.html>.
- ¹⁹ "Tamil Nadu: Koodankulam Nuclear Power Plant Protests Called off Temporarily," *India Today*, 16 October 2011, <http://indiatoday.intoday.in/story/tamil-nadu-koodankulam-nuclear-power-plant-protests-called-off-temporarily/1/155166.html>.
- ²⁰ Pushing for atomic power, Prime Minister Manmohan Singh wrote to Jayalalitha: "For a large and fast growing economy like ours, and given the volatility and uncertainty of international energy markets, it is in our national interest that we tap all sources of energy, and diversify our energy mix." See: Charles Kennedy, "Indian Protesters Ask for Closure Tamil Nadu Nuclear Power Plant," *OilPrice*, 11 October 2011, <http://oilprice.com/Latest-Energy-News/World-News/Indian-Protesters-Ask-for-Closure-Tamil-Nadu-Nuclear-Power-Plant.html>.
- ²¹ V. Lauerman, "Japan: Energy Mix Fallout," *Energy Compass*, Vol. 22, No. 12 (March 25, 2011), website www.energyintel.com/PublicationHomePage.asp?publication_id=1 (subscription site).
- ²² "China to Restart Nuclear Projects in 2012: Report," *Asia Pacific News*, 21 September 2011, http://www.channelnewsasia.com/stories/afp_asiapacific/view/1154543/1/.html.
- ²³ World Nuclear Association, "Nuclear Power in China," 22 September 2011, <http://www.world-nuclear.org/info/inf63.html#FurtherUnitsTable>.
- ²⁴ World Nuclear Association, "Nuclear Power in China," October 2011, <http://www.world-nuclear.org/info/inf63.html>.
- ²⁵ "Cost of Pollution in China: Economic Estimates of Physical Damages," The World Bank, State Environmental Protection Administration, P.R. China, February 2007, <http://go.worldbank.org/FFCJVBT40>.
- ²⁶ China's energy mix will be covered in greater detail in forthcoming reports.
- ²⁷ BATAN, "BATAN Profile" <http://www.batan.go.id/en2008/profil.php>.
- ²⁸ U.S. Energy Information Administration, *International Energy Outlook 2011*, September 2011, pg 85, <http://www.eia.gov/forecasts/ieo/pdf/0484%282011%29.pdf>.
- ²⁹ World Nuclear Association, "Emerging Nuclear Energy Countries," 3 October 2011, <http://www.world-nuclear.org/info/inf102.html>.
- ³⁰ Chester Dawson and Vu Trong Khanh, "Tokyo Nuclear Firms Sign Deal with Vietnam," 29 September 2011, http://online.wsj.com/article/SB10001424052970204138204576598164235317774.html?mod=googlenews_wsj.
- ³¹ World Nuclear Association, "Nuclear Power in Vietnam," 6 October 2011, http://www.world-nuclear.org/info/vietnam_inf131.html.
- ³² Ibid.
- ³³ Hanan AlKiswany, Lizette Damons, et. Al. "The Nuclear Power Plans that Have Survived Fukushima," 30 September 2011, <http://www.guardian.co.uk/environment/2011/sep/30/nuclear-power-fukushima?newsfeed=true>.
- ³⁴ Praful Bidwai, "Perils of Promoting Nuclear Power," *Financial Chronicle*, 21 September 2011, <http://www.mydigitalfc.com/op-ed/perils-promoting-nuclear-power-368>.
- ³⁵ After visiting the venue of a mass protest near the Kudankulam project site, V. Narayanasamy, minister of state in the Prime Minister's Office (PMO) said "The Centre is ready to reconsider the project. People's safety comes first. Power comes later." But, this apparent assurance failed to mollify the people of the region. Locals want Chief Minister Jayalalitha to pass a one-line resolution in the (state) assembly to press for its closure.



See: M.C. Rajan and Dinesh C. Sharma, "Tamil Nadu: People Power Nukes Koodankulam Nuclear Power Project, *India Today*, 21 September 2011 <http://indiatoday.intoday.in/story/anti-nuclear-plant-protesters-in-tamil-nadu-stall-pms-n-power-dream/1/152074.html>.

³⁶ Germany plans to close all nuclear reactors by 2022. Switzerland will phase out nuclear power by 2034, and Italy will no longer build new power plants. See: U.S. Energy Information Administration, *International Energy Outlook 2011*, September 2011, pg 13, <http://www.eia.gov/forecasts/ieo/pdf/0484%282011%29.pdf>.