

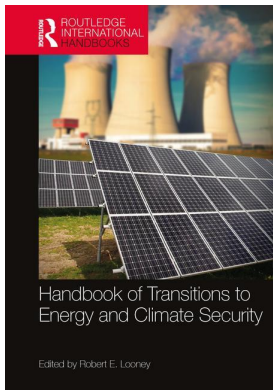
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Access details: *subscription number*

Publisher: *Routledge*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: 5 Howick Place, London SW1P 1WG, UK



Handbook of Transitions to Energy and Climate Security

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Publication details

<https://www.routledgehandbooks.com/doi/10.4324/9781315723617-19>

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Published online on: 29 Nov 2016

How to cite :- Julia Nesheiwat. 29 Nov 2016, *Japan's energy security from: Handbook of Transitions to Energy and Climate Security* Routledge

Accessed on: 08 Dec 2023

<https://www.routledgehandbooks.com/doi/10.4324/9781315723617-19>

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Japan's energy security

Challenges, prospects, and global implications

Julia Nesheiwat

Japan has been a global leader in energy and climate reform for decades. It is no accident that Japan hosted the Kyoto Protocol, which is currently the most significant framework for mitigating climate change. By consistently leading efforts towards a greener globe, Japan had been established as an exemplary energy model through its use of nuclear technology. However, its over-reliance on nuclear technology led to an alteration in this position in March 2011. The Great East Japan Earthquake, tsunami, and Fukushima nuclear disaster eventually resulted in a total shutdown of Japan's nuclear power, which constituted a large portion of its energy mix.¹ These events, known as 3/11 because they occurred on March 11, 2011, had a deleterious effect on Japan's energy situation, and highlighted areas of weakness in its energy planning. Outside of its nuclear program, Japan lacks self-sufficiency when it comes to energy. As a resource-poor island-nation, Japan depends heavily upon imports for the majority of its energy needs. Thus, despite boasting the world's third largest economy, Tokyo ranks among the frailest countries in the world when it comes to energy security. Due to Japan's global stature, after-shocks of the 3/11 disaster have extended beyond Japan to the international community, and Japan's resolve as a global leader in climate change and civil-nuclear energy has been shaken. However, recent positive steps have been taken by Tokyo to regain footing in the energy sector. Given the energy security challenges that Japan faces, it has been critical for Tokyo to reassess its energy objectives, and it is in the global landscape's best interest to support initiatives that strengthen Japan's energy future.

Challenges to Japan's energy security

Legacy of Fukushima

Registering at 9.0 MW, the Tohoku earthquake was the strongest on record to ever hit Japan. Due to its underwater placement, a tsunami occurred.² The after-effects of the earthquake and tsunami caused a loss of coolant accident. Subsequently, three nuclear meltdowns were triggered, causing a widespread release of radioactive materials.

Over a year after the disastrous events of 3/11, the Japanese Diet created the Fukushima Nuclear Accident Independent Investigative Committee (NAIIC). What the NAIIC found was

that the Fukushima Daiichi nuclear power plant catastrophe was due to human error. A failure in both public and private sectors to plan for foreseeable disasters and implement safety regulations and precautions in Fukushima created an otherwise avoidable situation.³ Fear of public backlash was given as a motivating factor for such negligence. TEPCO, the private sector company that owns Fukushima and powers Japan's eastern grid, felt that by addressing such issues they would be reaffirming anti-nuclear sentiment predicated on the notion that nuclear is unsafe and opening themselves to litigation.⁴ However, the events of 3/11 did far more damage to the image of nuclear power than implementing safety precautions could have.

Japanese anti-nuclear sentiment exploded in the aftermath of the Fukushima disaster and now stands as a significant challenge to Tokyo's energy security. Public opinion polls conducted by the *Asahi Shimbun* in 2012 and 2013 reveal that roughly 80% of Japanese citizens distrust the government's nuclear power plant safety measures, while 70% want nuclear power to be phased out completely.⁵

While strong nuclear opposition certainly hinders Japan's nuclear and energy policy at present, forces much stronger than public opinion are driving Tokyo's policy, and nuclear power will again be a part of the Japanese energy mix. In Japan's past nuclear accidents, similar public reactions have had limited staying power. Most notably, the 1999 Tokaimura reactor accident resulted in the death of two workers due to radiation exposure. Anti-nuclear sentiment soared in the wake of the accident but subsided within the decade and even gave way to growing favorable opinions of nuclear power.⁶ Moreover, when Democratic Party of Japan (DPJ) Prime Minister Noda, buoyed by public opinion in 2012, moved toward a policy of gradual nuclear phase-out, the plans were quickly abandoned over concerns voiced by the private sector.⁷ Now that the traditionally pro-nuclear Liberal Democratic Party (LDP) is firmly in power, they have already begun taking measures to reintegrate nuclear into Japan's energy mix. However, the proportion of nuclear energy will be less, which has forced Tokyo to grapple with the expansion of renewables. In the short-term, it must rely more heavily upon traditional thermal energy sources. Revisions of Japan's energy mix produce both challenges and opportunities for its future energy stability, and must be approached realistically.

Japan's current energy mix

Prior to the 3/11 disaster, nuclear power provided roughly 30% of Japan's electricity with plans to expand – making the sudden shutdown of all nuclear capacity a huge shock for Japan's energy security. Tokyo's energy self-sufficiency rate was as high as 19% with nuclear power prior to 3/11, but plummeted to a mere 4% in the wake of the disaster, climbing to a meager 6% in 2013.⁸ In the absence of nuclear, Japan's energy mix predominantly consists of oil, coal, liquefied natural gas (LNG), and a small but growing percentage of renewable energy sources.

Oil represented nearly half of Japan's total primary energy supply (TPES) in 2012, and is still vitally important for the country and its transportation sector.⁹ However, Tokyo is uncomfortably dependent on Middle Eastern countries for over 80% of its oil imports. The past few years have seen massive amounts of upheaval in the Middle East. Events from the Arab Spring have had widespread ramifications. Oil flow has been disrupted in some countries as a result, with unease over the future supply capabilities of others becoming a constant concern. Further, oil-field seizures by Daesh have moved significant amounts of oil from world markets to the black market. Even though Japan has expressed interest in Iran's reserves to counteract instability linked to portions of its supply in the region, current US sanctions create a barrier to substantial imports from Iran. While that could change, due to the US-Iran nuclear talks that have occurred, there is still much uncertainty. Further, over-reliance on any one country is

inadvisable, as it would tether Japan to that country's status quo, resulting in disruption if any shifts occur. Diversification is key to energy security. Yet, obstacles exist to diversification.

Costly infrastructure supports the well-developed Middle East trade routes and movement away from them comes with a significant price tag. Oil resources are finite, thereby creating a zero sum scenario when it comes to imports. China's economic power and energy appetite has produced competition with Japan for the world's supply. Further, as a close US ally, Japan cannot pursue oil from sanctioned countries, such as Sudan.¹⁰ Barriers to diversification present a major challenge to Japan's energy stability because oil will continue to be a critical part of Japan's energy needs. However, oil demand is modestly declining, thanks to higher fuel efficiencies and fuel-switching policies.¹¹ Long-term reduction goals for oil in Japan's energy mix will allow it greater international maneuverability, as well, by reducing dependence on foreign countries for its energy security.

Another foreign resource Japan heavily imports is coal. In 2013, coal accounted for 32% of Japan's electricity generation, second only to gas.¹² Additionally, Japan's continued need for coal, and its desire to contribute to climate change reform, have naturally led Tokyo to pursue a more efficient means to generate power from coal while cutting carbon emissions. Japanese companies such as Hitachi have made Japan a world leader in clean coal technologies, a position that also brings with it the potential of export earnings through technology sales.¹³ However, clean coal currently has limited capabilities and should not be viewed as an immediate remedy to Japan's energy issues. Much of the coal currently being used to cater to Japan's energy needs does not utilize clean coal technologies and greatly contributes to its carbon footprint.

LNG is another energy source imported to feed Japan's energy consumption. Japan is by far the world's leading importer of LNG, and increased LNG imports largely made up for the loss of nuclear power post-Fukushima.¹⁴ Unlike Tokyo's oil imports, LNG imports are well diversified. Australia, Qatar, and Malaysia are the largest suppliers. America has also increased its LNG exports to Japan, strengthening the bond between both countries. No single country provides more than 20% of total imports, though, allowing for more robust Japanese autonomy.¹⁵ For the foreseeable future, LNG will continue to play a critical role in Japan's energy mix.

Aside from nuclear energy and fossil fuels, Japan also has a growing percentage of renewables in its energy mix. In 2011, roughly 8% of Japan's electricity generation came from renewable sources – predominantly hydropower.¹⁶ By 2013, renewable electricity generation increased to about 13%, with gains primarily from solar, wind, and biofuels.¹⁷ With much of Japan's hydropower capacity already developed, continued gains in renewable energy will have to come from these other sources.¹⁸ By developing renewable alternatives, Japan can insure its long-term energy stability due to the greater amount of self-sufficiency such options provide it. Further, international technological developments have emerged that may allow renewables to take on a greater heft of the energy mix.

Japan's way forward

Energy policy

In April 2014, three years after the Fukushima disaster, Japan published its latest Strategic Energy Plan. It aimed to achieve progress on the (3E + S) framework: energy security, economic efficiency, environmental suitability, and safety.¹⁹ However, due to the unpopularity of nuclear at the time, the role of that resource remained uncertain. The Ministry of Economy, Trade and Industry (METI) followed the Basic Energy Plan with the "Long-Term Energy

Supply and Demand Outlook” for fiscal year 2030 in July 2015. METI’s proposed energy mix by 2030 to support the 3 Es entails 20–22% nuclear, 22–24% renewables, 27% LNG, 26% coal, and less than 5% oil.²⁰ From 2013 levels, this proposal cuts fossil fuel reliance by nearly 30%, while more than doubling renewable usage and restoring nuclear power to roughly two-thirds of its pre-Fukushima capacity.²¹

Critics have already assailed this plan as not truly working towards less nuclear dependency. However, given that pre-Fukushima plans called for 50% nuclear energy by 2030, the new target of 20–22% is a responsible goal. It represents a substantial decrease in nuclear power, while maintaining enough nuclear to keep electricity prices from soaring and simultaneously to make progress in reducing greenhouse gas emissions.²²

Reform

Japan’s energy policy has long been driven by tight government–business cooperation.²³ Its vertically integrated power market has resisted badly needed reforms. Yet, in spite of the vested interests of the METI, *Keidanren* (Japan Business Federation), *Denjiren* (Federation of Electric Power Companies), and the LDP, tangible steps are now being taken towards electricity system reform.²⁴ The Strategic Energy Plan maintains that the government’s hand will still work to ensure a desirable energy mix, but extensive reforms to promote competition and fully liberalize power generation mark a significant shift in Japanese policy.²⁵ As the Organization for Cross-regional Coordination of Transmission Operators (OCCTO) was created to more efficiently and economically manage the electricity supply nationwide, the first reforms were enacted in April 2015.²⁶ Full retail competition is scheduled to go into effect in April 2016, and further reforms and liberalization by 2020.²⁷

Increasing the share of renewables

To support its proposed goal of more than a 20% share of renewable energy by 2030, Tokyo instituted a feed-in-tariff (FIT) in July 2012 to help offset costs and encourage the introduction of more renewable power sources. Lifted by a surge in solar power production, Japan added roughly 10 GW of renewable energy capacity from July 2012 through March 2014.²⁸ Significant investments in solar and the government’s traditionally amenable stance towards solar power make recovering energy from the sun an important renewable energy source for Japan, yet rapid renewable expansion is constrained by the extra price burden on consumers and the economy, and the need for improved transmission and distribution systems and cross-regional power interconnections.²⁹

Climate change mitigation efforts

Once a global leader in climate change mitigation efforts and broker of the 1997 Kyoto Protocol agreements, Tokyo’s commitment has faltered since the 3/11 disaster.³⁰ However, its recent prominent role in the twenty-first session of the Conference of the Parties (COP21), a major international climate change initiative, has signaled its willingness to regain footing in the global arena. In its Intended Nationally Determined Contribution (INDC), a pledge submitted prior to the conference, Japan lays out its plan to hold climate change increase to no more than the 2 degrees Celsius objective. Specifically, it aims to reduce its greenhouse gas (GHG) emissions by a minimum of 50% by 2050 through the development of low carbon technologies and other forward minded actions.³¹

Of Japan's current GHG emissions, 90% originate from energy based CO₂. As such, most of Japan's reductive efforts must come from the energy sector. The INDC states that they hope for a 25% reduction of energy-originated CO₂ by 2030 when compared to 2013. Japan's energy mix for 2030 as listed in the INDC is ambitious. Oil drops to an ambitious 3%, while renewables increase their share to between 22% and 24%.³² Nuclear represents a symmetrical portion, in line with Japan's long-term nuclear goals. Japan has already begun making headway on its nuclear aspirations, and hopes to increase its renewables through its Joint Crediting Mechanism (JCM). Japan's JCM invests in the development of carbon reducing technology and allows for the diffusion of such technology to developing countries. Concurrently, it quantitatively tracks Japan's overall contribution to GHG reduction through these technologies and their diffusion and adds it to their overall reduction number.³³ The prominence of the JCM in Japan's INDC, as well as Japan's pursuance of it during the COP21, signal that it will continue to be a key part of Tokyo's climate change mitigation efforts.

Even more remarkable was Japan's willingness to exceed its initial pledge by accepting the final COP21 terms, which aim to hold world temperature change to no more than 1.5 degrees Celsius beyond postindustrial levels. The results of the COP21, which saw all 195 participating countries accept ambitious climate change goals, cement it as one of the major climate change reform efforts in history. Japan's significant role in the COP21 demonstrates its commitment to moving beyond Fukushima and reintegrating into the international energy sphere.³⁴

Technological developments

A global leader in energy technologies, Japan's continued investment in energy research and development aims to bolster energy security while generating cleaner, more efficient power. For the long term, Japan is working to further diversify its energy options with potential domestic options. Technological advancements may allow hydrogen and methane hydrates to become important energy sources, the latter of which is recoverable in substantial amounts off Japan's coast.³⁵

Energy conservation

Japan is a world leader in energy conservation efforts, and continually increasing energy efficiency undergirds Tokyo's plans for the future. Since the oil crisis of the 1970s, Japan has increased its energy efficiency, measured as primary energy used per GDP, by roughly 40%.³⁶ Looking forward, by 2030 Japan aims to reduce energy consumption by 10% from 2013 levels by legislating building efficiency standards, promoting LED lighting and energy-saving appliances, and improving automobile gas mileage.³⁷

Global implications

Global aftershocks of Fukushima

The effects of the 3/11 disaster were not confined to Japan alone, but impacted global energy markets and security. Largely as a result of Japan's increased appetite for (NG, investment in global LNG projects dramatically expanded.³⁸ Dramatic increases in demand lead to volatility in any market, and energy markets are no exception. Favorable public perceptions of nuclear power also dropped 5–10% in most countries and strengthened the already simmering nuclear opposition in Germany to prompt Chancellor Merkel to commit to phasing out nuclear power by

2022.³⁹ The delay in nuclear technologies globally only caused countries to remain reliant on traditional energy resources, such as oil, leaving them beholden to the political developments of oil exporting countries. In the case of Germany, this is especially significant as it is widely speculated that their reliance on Russian oil neutered their response to Russia's actions in Ukraine. Global public safety concerns have also led to extra costs and delays in the construction of nuclear power plants as many countries have adopted more stringent safety regulations.⁴⁰

While the disaster may not significantly alter global nuclear energy projects in the long term, delays and fears in the short term will result in countries turning to high-carbon emitting fossil fuels, as the development and wide-scale implementation of affordable renewable sources is still premature.⁴¹ Not only does this negatively impact climate change efforts, but it leads to a global reliance on finite resources. When it comes to resources such as oil, this is especially problematic given the fragile political situations of many oil exporting regions. Black market oil, which largely supports organized crime and terrorist organizations, could be seen as an attractive option to certain nations in such a scenario, as well.

Japan's domestic nuclear issues negatively affect US interests through its widespread global implications. Tokyo has been a key US partner and global leader in civil nuclear energy research and development (R&D), promotion of nuclear safety, and climate change mitigation efforts.⁴² Emerging economies across the globe are expressing interest in nuclear energy, Without Japan-US leadership in enumerating technology and safety standards in the civil-nuclear sector, those bridge building opportunities will be missed. Other countries may step in to fill the void, but likely with less concern for nonproliferation of nuclear weapons.⁴³ In such a situation, it could shift regional power dynamics away from Tokyo, leading to even more dramatic global consequences. Accordingly, a non-nuclear Japan is a big loss for the international community. Minimal nuclear power has forced Japan to rely heavily on fossil fuels and revise and delay its goals for greenhouse gas emissions reduction. Until Tokyo regains its nuclear footing, it will contribute far less to critical global initiatives for civil nuclear energy technology, nonproliferation, and safety and climate change issues. However, Japan's inclusion of nuclear energy in its energy mix for long-term planning signals that it is on the road to recovery.

Japan's recent progress in securing its energy future is a welcome global development. An energy insecure Japan would be a fragile state, struggling to address national security and geopolitical issues. As a major US ally and regional pole, a reduction in stature for Japan would significantly alter global power dynamics. Its long-term objectives underscoring self-sufficiency seek to correct the vulnerability Japan has experienced in the past few years.

Fossil fuels were used by Japan heavily in the wake of Fukushima to supplement energy needs. To accommodate this, Japan has turned to countries such as Russia to supply them with the resources necessary for their energy consumption.⁴⁴ Japan has reluctantly complied with US-led sanctions against Russia, but Tokyo has long been a major importer of Russian natural gas and crude oil, and Prime Minister Shinzo Abe is understandably warming to the idea of restoring Russian relations and investing further in Russian energy development.⁴⁵ METI's report even advocated strengthening relations with Russia.⁴⁶ While regional cooperation can be a positive in certain respects, using Russian oil as a crutch diminishes Japan's ability to stand on its own. In turn, it provides developing energy sectors in Asia with a more narrow set of choices for growing their energy infrastructure. Importantly, it also complicates an otherwise strong relationship between the US and Japan.

Given the desire to build stronger security ties within the Asia-Pacific region and counter-balance China's rise, the US-Japan alliance is of great importance. Although Tokyo has been beholden to America for its security provisions, Japan is likewise beholden to its energy needs, and therefore further attention to Japan's energy insecurity is important. To that end, plans are

already in the works to export LNG from the continental United States to Japan starting in 2017.⁴⁷ A more energy-secure Japan is not only a stronger US ally, but an important regional leader. And a more energy-secure Japan is a stronger leader within the international community on critical global issues like civil-nuclear energy and climate change. As many global conflicts center on resource scarcity, especially in the context of energy, this is also a welcome development in the international security landscape. Japan's re-emergence on the world stage at COP21 is an important global development. To ensure that Japan maintains its position in energy, there are steps the international community should take to aid its recovery.

Global investment in Japan's energy sector should be a priority. Japan has been a long time producer of green technology, and it benefits everyone to encourage its further development and diffusion. Additionally, efforts should be undertaken to aid Japan in diversifying its current energy mix, especially in the fossil fuel sector. Incentivizing Japan's regional energy coordination, through its JCM programs, as well as helping it track such mechanisms successfully, is another way in which the international community can strengthen Japan's energy security.

Conclusion

Energy security is a global issue. An energy insecure Japan has too many negative ramifications for the international community for it to go unaddressed. Recent steps taken by Japan will allow for progress in its post-Fukushima recovery, and its participation in the historic COP21 is a massive step forward. However, it is in the world's interest to continue supporting Japan's path to regaining its role in the global energy landscape, as it still needs help on its road to rehabilitation.

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