The Future of Japan's Energy Mix

Since the Fukushima nuclear disaster, Japan has been reviewing its energy policies. Whether nuclear energy will remain part of the country's energy mix depends on whether the government and the nuclear power industry can regain public trust.

Text: Hiroshi Takahashi Illustrations: Pascal Staub

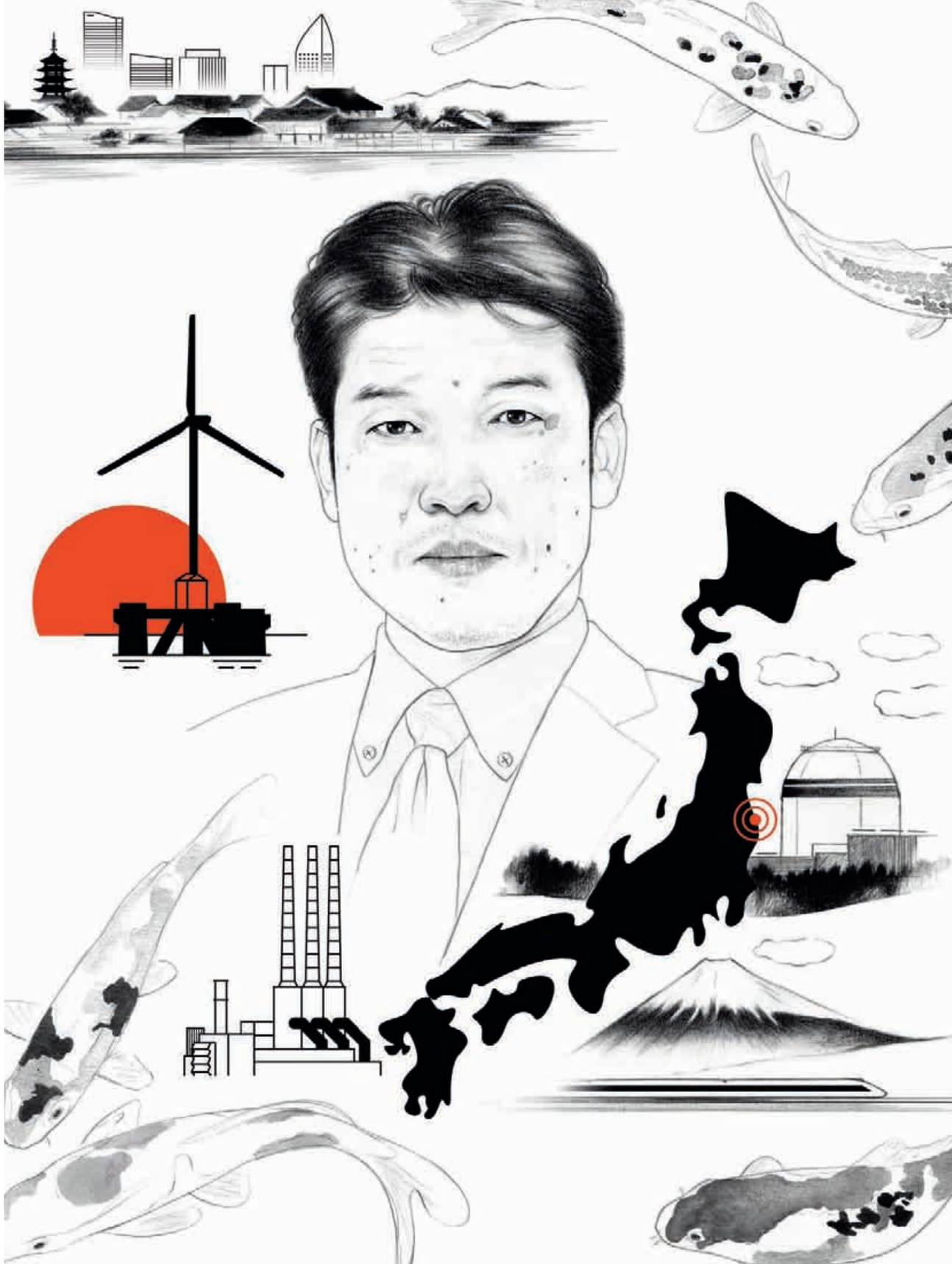
In the wake of the March 2011 accident at the Fukushima No. 1 nuclear power plant, the Japanese government has been rethinking its energy policies. To this end, it established a commission to discuss Japan's long-term energy targets, and deliberations began in January 2015.

For some 50 years before the Fukushima accident, Japan's nuclear power industry had moved steadily forward under a supportive national policy. At the time of the 2011 tsunami, Japan's nuclear power plants had 54 reactors putting out 49 gigawatts of power and meeting roughly 30 percent of the nation's electricity demand. Japan was then the world's third-largest producer of nuclear power after France and the USA. Nuclear power was a mainstay in resource-poor Japan, and most Japanese people supported it. The basic national energy plan proposed by the Democratic Party of Japan (DPJ) administration in 2010 foresaw nuclear power accounting for some 50 percent of the national electricity supply by 2030, double the current output at the time. The plan aimed to reduce emissions of greenhouse gases significantly (25 percent below 1990 emissions) with zero-emission power sources supplying 70 percent of total needs. In addition to nuclear power, the plan called for 10 percent hydroelectric power and 10 percent other renewables. In short, nuclear power was the key to Japan's energy policy. One year later, the Fukushima accident caused an upheaval of the business environment and a reversal of feelings regarding nuclear energy.

A New Situation

First of all, Japan's Law on Compensation for Nuclear Damage stipulates that the power company involved in a nuclear accident is wholly responsible and faces unlimited liability. The Tokyo Electric Power Company (TEPCO) was unable to bear the financial burden of cleaning up after the accident, paying compensation, etc., and in July 2012, the company was, in essence, nationalized. Even though TEPCO was by far the largest electric power company in Japan with annual revenues of 5 trillion, it could not afford to shoulder this liability.

Second, Japanese society became anti-nuclear overnight. Some 160,000 people had to take refuge from nuclear fallout, and as the myth of "safe nuclear power" imploded, both the companies and the government agencies involved lost all credibility with the public. After Fukushima, unaffected nuclear power plants continued to operate, but when they shut down for required safety inspections every 13 months, public sentiment ran so deep that the DPJ administration would not authorize those plants to start up again after the inspections. Thus, May 2012 saw the complete shutdown of Japan's nuclear power plants. ▸



Third, this nationwide shutdown of nuclear plants threatened the stability of power supply. With zero nuclear power output and peak demand rapidly approaching with the summer months, power companies were hard pressed to supply sufficient electricity. In July, the government allowed the Kansai Electric Power Company to restart two nuclear reactors and operate them under provisional safety regulations, but in the end, due to significant conservation of energy by consumers, there was sufficient supply to meet demand without problems. The Oi nuclear plants operated until September 2013, but no other plants were allowed to restart. As of March 2015, "Zero Nuclear Energy" continues.

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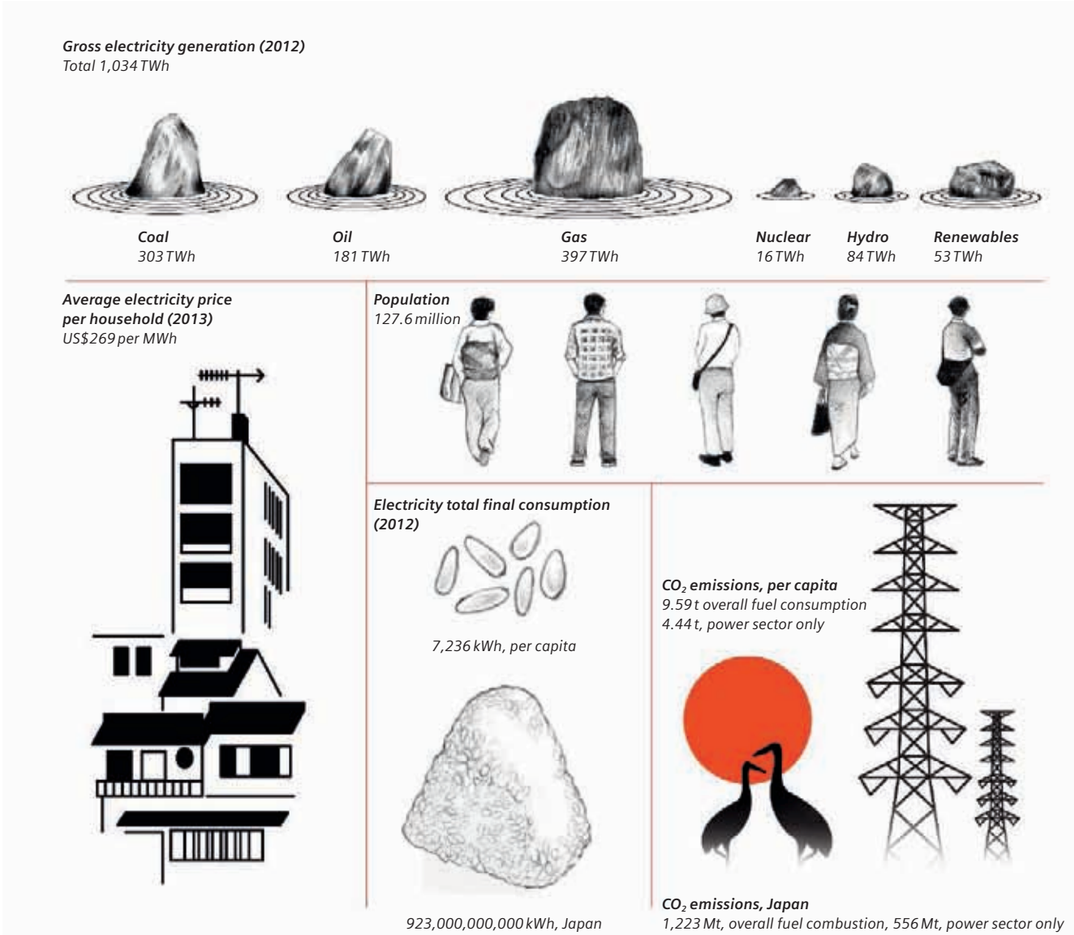
Shutting down all the nuclear reactors caused a fourth problem by putting a financial squeeze on power companies. Thermal power stations filled the hole left by the shutdown of nuclear plants, which had accounted for some 30 percent of the electric power mix. As a result, thermal power production approached 90 percent of the power supply, costs for fossil fuels rose sharply, and electric power companies posted tremendous losses. That led to rate increases and consumer complaints not only about nuclear power plants, but also about the monopolistic structure of the electric power industry itself.
In the meantime, nuclear power was largely replaced by fossil power, mainly gas-powered plants and oil-powered plants. The shift has had a dramatic impact on greenhouse gas emissions, which rose 4 percent in 2012 and 1.3 percent in 2013, raising Japan's emissions 10.6 percent above the 1990 rate. The International Energy Agency has expressed its concern about the dramatic switch toward fossil fuel and the impact on emissions, and Japan faces a tough road if it is to reduce its greenhouse gas emissions by 3.8 percent vis-à-vis 1990 by 2020.
In September 2012, the Nuclear Regulatory Authority was newly established by separation from the Agency for National Resources and Energy (ANRE), set new safety regulations, and began inspecting nuclear power plants. The Kyushu Electric Power Company's Sendai nuclear power plant passed inspection and is likely to restart in the summer of 2015. Electric companies simply cannot survive without nuclear power plants as base load.

The DPJ's Innovative Strategy

In parallel with short-term electricity supply issues, the DPJ administration began to review the country's mid- to long-term energy policies in May 2011. They focused on how to deal with the nuclear power industry and began investigating the potential of alternative, renewable energy sources such as wind and solar, even though those power sources were not used widely in Japan at that point. Further, combined cycle power plants and highly efficient gas turbines are among other technologies that play a role in the energy mix.
During its many decades in power, the Liberal Democratic Party (LDP) had been a consistent proponent of nuclear energy. When the LDP fell from power in 2009, the DPJ, riding a wave of public popularity, gained the leverage to make major changes in national policies. Still, both ANRE and the industry dragged their feet on measures to reduce dependence on nuclear power and pushed for very conservative action. They maintained that, considering the need for a stable supply of affordable electricity, resource-poor Japan could not turn away from nuclear power.
Finally, in September 2012, the DPJ administration announced its Innovative Energy and Environmental Strategy and called for a "nuclear phaseout by the 2030s." After conducting numerous public opinion polls and hearings, the DPJ concluded that "a majority of the people wants to live in a society without nuclear power." The government plans called for a combination of hydroelectric power and renewable power sources to supply 30 percent of Japan's energy needs by 2030. Electric power companies came out against the plan, and the opacity of the nuclear power industry peaked.
Less than three months after announcing the strategy, the DPJ lost the national election, and the LDP returned to power. The administration of Prime Minister Shinzo Abe said it would "rethink from scratch" the Innovative Energy and Environmental Strategy. The administration decided that survival of the nuclear power industry was critical to keeping electricity costs low and spurring an industrial recovery. Still, during the election, the LDP pledged to minimize dependence on nuclear power. The Abe administration fully appreciates the public's anti-nuclear sentiment and realizes that reconstruction of Japan's energy policy must be done over a considerable length of time.

The LDP's Basic Energy Plan 2014

The LDP established a new committee of inquiry in March 2013, and started discussions aimed at creating a new basic energy plan. After the party had won the July election, discussions gained momentum, and the committee submitted its proposal in December 2013, leading to the Basic Energy Plan 2014 of April 2014.
In that plan, nuclear power was positioned as an "important base-load source of electricity," and the phrase "restart of nuclear plants" appeared in writing. While there was no numerical target stated, the plan became an important step in nuclear power recovery. In contrast, almost as a footnote to the committee's statement about the energy supply mix in 2030, the report said the push for renewable energy and hydroelectric energy should "strive to exceed the previous target" of 20 percent. This is in line with the basic plan of 2010, and is a significant retreat from the DPJ's Innovative Energy and Environmental Strategy.
With the Basic Energy Plan 2014 in hand, the Abe administration established commissions to review nuclear power and renewable energy sources, respectively. The first objective is to construct a stable business environment for nuclear power. Merely positioning nuclear power as an "important base-load power source" does not overcome the difficulties to the nuclear power industry posed by the Fukushima accident. For instance, media reports say more stringent safety regulations have already added at least 2.4 trillion in compliance costs. Besides, the new regulations limit nuclear reactors to a service life of 40 years. That will speed up decommissioning and bring additional expenses. It is also clear that the current no-fault, no-limit compensation ▸



Source for all data: IEA Statistics, Electricity Information 2014

Hiroshi Takahashi

"The fundamental problems facing the nuclear power industry cannot be eliminated with a few support programs."

Education

Hiroshi Takahashi has a BA in law and a PhD in social science from the University of Tokyo as well as an MA in law and diplomacy from the Fletcher School at Tufts University in the USA.

Career

Takahashi became a Professor at Tsuru University in 2015, where he teaches public administration and policy studies. Tsuru University is a public university in the City of Tsuru, a historic town located at the southeastern foot of Mount Fuji in Yamanashi Prefecture. Takahashi's recent research topics include electricity market reform and renewable energy policy. He started his career at Sony Corporation in 1993, served as Deputy Director of the IT Policy Office of the Cabinet Secretariat in 2000, and worked as an Assistant Professor at the University of Tokyo in 2007. While he was a Research Fellow at Fujitsu Research Institute from 2009 to 2015, he became a member of the Advisory Panel for the Basic Energy Plan as well as for Power System Reform at the Ministry of Economy, Trade and Industry. Takahashi was also a Special Adviser to Osaka City and Osaka Prefecture, and to the Cabinet Office. He wrote many books about Japan's contemporary politics and energy policy including *Electric Power Market Liberalization,* published by Nikkei Publishing Inc. in 2011.

requirements entail a risk no private electric power company can afford.
Thus, the mid-term adjustments proposed by the commission in December 2014 included proposals to support nuclear power companies, such as adopting the "contracts of difference" system used in Britain, in which the government guarantees higher electricity rates and compensates the supplier when consumer rates go lower. When a reactor is decommissioned, expenses remaining on the books should be written off as an extraordinary loss, but the accounting rules were changed to allow the loss to be amortized, which means it would ultimately be made up from electricity rates.

Rolling Back Renewables

The next goal is to shift the deployment of renewable energy sources into low gear. In July 2012, Japan adopted a feed-in tariff (FiT) system that obliged utilities to purchase power from renewable sources at a fixed price, which is similar to the German system. In the two following years, generation capacity of renewable power sources (not including hydroelectricity) grew from 20 to 32 gigawatts. Some 90 percent of that growth comes from solar cells, which have a very short lead time, and many more installations are waiting for grid connection. As the FiT for solar is high, and as the growth in variable generation sources may threaten the stability of supply, measures to slow down their deployment were demanded, especially by those who support nuclear power.
The government responded with a lower FiT for solar power and revised the power supply rules. In other words, it clarified that photovoltaic and wind power are subordinate to the base load, which is nuclear. It also set an upper limit on grid connections, and if that limit is exceeded, curtailment will be permitted without compensation. Before that, the rules said that if curtailment exceeded 30 days per year, the power company that controlled the grid had to compensate the renewable power provider. With this rule no longer in effect, power companies need not worry about stable power supply nor about paying compensation for curtailment. On the other hand, new companies coming into the renewables business face a greater risk of power sales declining.

The Outlook for Japan's Power Mix Target in 2030

In January 2015, as mentioned above, the LDP government set up the Long-Term Energy Supply and Demand Outlook Subcommittee, which initiated discussions on numerical targets for each power source, based on the findings of the above commissions on nuclear and renewable power. The subcommittee is to submit its final report sometime in June 2015, but the government made its proposal in late April. That proposal puts nuclear power sources at 20 to 22 percent, renewable power sources including hydroelectric power at 22 to 24 percent, and the remaining 55 percent would come from thermal power sources.
To ensure a stable power supply and to hold electricity charges down, base-load power sources (nuclear, hydroelectric, thermal power, etc.) need to account for some 60 percent of the whole. Further, to keep electric power rates down, nuclear power, which is alleged to have the lowest running cost, needs to supply about 20 percent. While emphasizing the need for nuclear power generation, the subcommittee points out the high initial cost of renewables, and further says that the fluctuating nature of renewable supplies would entail even higher costs to deal with that fluctuation. Therefore, the renewable power supply percentage target is lower than those of many other advanced countries.
These estimates are most likely in agreement with the LDP government's thinking. In other words, the ANRE officials chose the committee members based on the desired results. But it remains unclear whether the nuclear power supply can reach 20 percent of the whole.
Therefore, the mix of power sources forecast for 15 years from now corresponds to the government's wish list. Undoubtedly, the electric power establishment is aiming for that target as well, but the fundamental problems facing the nuclear power industry cannot be eliminated with a few support programs.

The Future of the Nuclear Power Industry

The key issue is that people have lost trust in the nuclear power industry. Four years after the Fukushima accident, there is no sign of the industry regaining that trust. Opinion polls suggest that 10 percent of the people don't want the plants to start up again, while 50 percent support phasing out nuclear power over time, and there is no hint that these numbers will go down. After three national elections, the LDP still enjoys high approval ratings, but those ratings don't translate into support for its energy policies.
The Abe administration wants to take its time in getting the nuclear power industry going again, but opinion polls still show at least half of the citizenry is against restarting any nuclear plants. It is highly likely that restarting of the nuclear plants will begin in 2015, but if the government makes even the smallest mistake, the citizenry's anti-nuclear sentiment may very well explode.
Second, even if the plants are restarted, it won't be easy for nuclear power to deliver even 20 percent of the power supply. As nuclear plants must principally be decommissioned after 40 years as stipulated under the law, by the end of 2030, there will be no more than 18 active reactors putting out 19 gigawatts. Even if all of them operate at the capacity factor of 70 percent, they will produce some 116 terawatt-hours, about 11.6 percent of Japan's total annual power consumption of 1,000 terawatt-hours. Even if overall power consumption could be reduced by 20 percent due to conservation efforts, power from nuclear plants would account for only 14.5 percent of the total. Further, the number of nuclear plants will probably fall to nine in 2040, with a combined output of 10 gigawatts due to additional decommissioning. So unless new plants are built, the nuclear power industry will become unsustainable. A more realistic target for nuclear power would appear to be around 10 percent in 2030.

Public Opinion: the Unknown Quantity

Still, the Abe administration will certainly maintain that nuclear power should supply 20 percent of total power needs, and it will announce that decision in the summer of 2015. On the surface, the decision is billed as one necessitated by climate change and the need to set a numerical target for reducing greenhouse gases. A more important factor, however, is the need to create a favorable environment for nuclear power. This will require many different kinds of support systems, and ratepayers are certain to bear the cost of those systems. That said, retail will be completely deregulated in 2016, and it is anybody's guess how the public will view these energy policies. Will putting nuclear energy first slow down the introduction of renewable energy and the development of smart cities?
Considering the public's mood, the strategy seems to be to move ahead with no sense of haste; at some point, the population will suddenly be faced with a fait accompli. The energy policy of the Abe administration appears to be so realistic and well considered that the nuclear industry, which the government believes to be indispensable, may be revivable. But that will not happen in full view of the public, and it may turn out to be a short-term approach. Will the government be able to convince the citizens that the nuclear industry is absolutely necessary? Can the government, nuclear power, and the electric power companies regain public trust? That is what will ultimately determine what energy policies Japan needs in the middle to long term. ■