

Perspectivas Energéticas



Perspectivas y desafíos de la política energética de Japón

El Colegio de México - Centro de Estudios Internacionales
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Mtro. Alfredo Álvarez Pérez

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Perspectivas y desafíos de la política energética de Japón

Este número de *Perspectivas Energéticas* busca contribuir al debate presentando la perspectiva de una de las naciones asiáticas con uno de los sectores energéticos más dinámicos del mundo: Japón. Las circunstancias de Japón ofrecen un caso de estudio bastante interesante. Un país con una alta demanda energética y dependencia del extranjero, que busca mediante distintos mecanismos, como la diplomacia y el desarrollo tecnológico, contar con un suministro energético seguro, estable, económico y cada vez más limpio. En *Perspectivas Energéticas* creemos que el estudio de la experiencia japonesa puede contribuir al debate energético en México.

Para comprender la situación general, el profesor Gentaro Nakayama de la Universidad de Hokkaidō, presenta un resumen sobre algunos de los cambios más relevantes por los que la política energética japonesa ha atravesado después del desastre nuclear de Fukushima. Explica el proceso de liberalización de la industria eléctrica y los retos que enfrenta el sistema energético que transita hacia un modelo distribuido. Asimismo, da una cuenta de la situación de las industrias de la energía nuclear y de las renovables, y del papel que juegan tanto para aliviar la dependencia energética de Japón como para alcanzar el objetivo de neutralizar las emisiones de CO₂ para el año 2050.

Para ahondar un poco más en estos temas, tuvimos la oportunidad de entrevistar a expertos en la materia. El Sr. Yoshitaka Shimizu, de la empresa Osaka Gas y

con experiencia en la Agencia de Recursos Naturales y Energía del Ministerio de Economía, Comercio e Industria, contestó a preguntas sobre el estado actual de la industria nuclear a diez años del desastre nuclear, y sobre el proceso de elaboración de la política energética de Japón. El Dr. Ryo Eto, analista experto del Instituto de Economía Energética de Japón (IEEJ), sobre los retos que de ahora en adelante se presentan para la industria energética de Japón.

El artículo del Mtro. Alfredo Álvarez, trata sobre una de las apuestas tecnológicas que el gobierno de Japón ha impulsado para enfrentar los retos energéticos del futuro. El artículo expone algunas de las razones por las que utilizar hidrógeno –como un vector energético– tiene sentido para impulsar el crecimiento de las energías renovables, enfrentar el cambio climático y ampliar el portafolio de recursos energéticos y proveedores. Asimismo, presenta algunas de las estrategias que el gobierno de Japón está implementando, en conjunto con la iniciativa privada y la cooperación internacional, para superar los retos técnicos y económicos que aún limitan la viabilidad del uso de hidrógeno a gran escala.

Este número de *Perspectivas Energéticas* también recomienda un par de lecturas para profundizar en algunos de estos temas. La Mtra. María Cristina Godos reseña el libro de *Energy Security in Japan, Challenges after Fukushima*, de Vlado Vivoda, que trata a detalle los retos y las circunstancias que enfrenta la política

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energética japonesa en la actualidad. Finalmente, el Mtro. Alfredo Álvarez presenta el libro *5 Years After, Reassessing Japan's Responses to the Earthquake, Tsunami and Nuclear Disaster*, editado por Keiichi Tsunekawa, profesor emérito de la Universidad de Tokio. Una lectura indispensable para comprender las distintas dimensiones del triple desastre ocurrido hace diez años (11 de marzo de 2011) en el Noreste de Japón.

Esperamos que este número aporte a nuestros lectores y que sirva para enriquecer el debate energético en México.

Análisis

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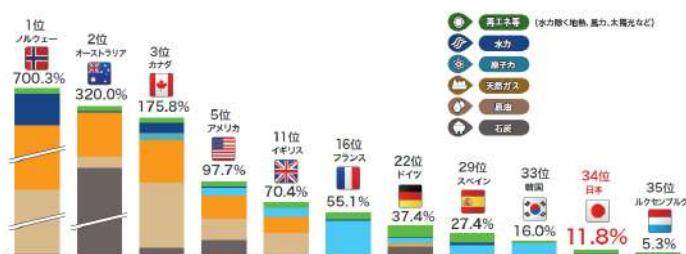
The Future of Japan's Energy policy by Prof. Gentaro Nakayama - Hokkaidō University.

Translation: Alfredo Álvarez Pérez

Introduction

Japan's energy policy is formulated with awareness of the problem that its extremely low energy self-sufficiency rate represents (11.8% as of FY2018). Fossil fuels account for 85.5% of the total primary energy, mostly imported from overseas. Japan has struggled with these issues for a long time to ensure a stable energy supply.

Figure 1. Comparison of primary energy self-sufficiency rates in major countries (2018)



Source: From the website of the Agency for Natural Resources and Energy, Ministry of Economy, Trade and Industry. https://www.enecho.meti.go.jp/about/special/johoteikyo/energyissue2020_1.html.

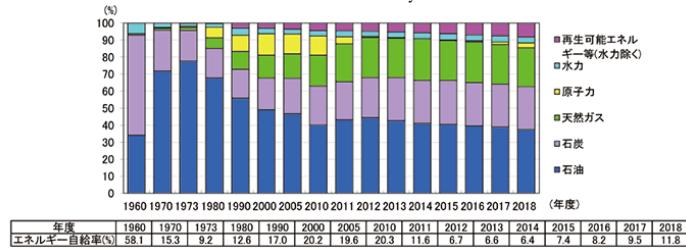
Until the 1950s, hydroelectric power supplied most of the electricity, and domestic coal covered the household and industrial heat demand. Since the beginning of the high economic growth period (from the late 1950s), Japan began to import coal and larger oil amounts, which became the main energy source. Under such circumstances, the 1970s oil shocks made apparent the risk of relying mostly on imported oil. In response, actions like energy savings, energy efficiency, and diversification of energy sources were promoted.

Furthermore, since the 1990s, reduction of greenhouse gas (GHG) emissions has been required as a measure against global warming (FEPC, 2021).

Japan strived to have an optimal mix of energy. For heat generation, thermal power sources like natural gas and coal have been promoted, and productive areas, including industries and households, were distributed strategically. Regarding power generation, nuclear power has been considered a good option as a domestic energy source because once uranium is imported, it can generate power for a long period of time. But the major nuclear accident (Fukushima Daiichi Nuclear Power Plant accident) on March 11, 2011, right after the Great East Japan Earthquake, increased the concerns about nuclear energy. Since then, nuclear power in Japan has plummeted, the nuclear industry regulations have tightened, and the proportion of natural gas, coal, and renewable energy has increased.

Indeed, after the Fukushima nuclear accident, major changes have affected the Japanese energy policy (JEP) regarding the electricity supply, including the goal of decarbonizing that supply. In this article, I would like to introduce some of the most relevant changes and a comprehensive outlook on the future of Japan's energy system. The main themes will be the electricity market liberalization, the current situation of the nuclear and renewables industries, and the thermoelectric sector.

Figure 2. Changes in domestic primary energy supply composition and self-sufficiency rate¹



Source: White Paper on Energy for the First Year of Reiwa: Created based on the IEA “World Energy Balances 2019 Edition” before 1989 and the “Comprehensive Energy Statistics” of the Agency for Natural Resources and Energy after 1990.

Changes due to global warming counteractions have been another driving force for JEP. Japan promised a 26% reduction of CO₂ emissions by 2030 in the 2015 Paris Agreement (from 2013's benchmark) and 80% by 2050. Under the 3E+s principle (Energy security, Economic efficiency, Environment, and Safety), the 2018 Basic Energy Plan (BEP) established directions for (1) a balanced energy mix (with 24% renewables and 22% nuclear by 2030), (2) energy savings, (3) prioritize renewable energies, (4) introduce high-efficiency thermal power generation, (5) reducing dependence on nuclear power as much as possible. Later, in 2020, Prime Minister Suga announced that Japan would be aiming for carbon neutrality by 2050. This goal is considered extremely difficult to achieve for a country with conditions like Japan's, but the newly elected President of the United States, Joe Biden, and the EU have announced similar compromises; thus, Japan must aim to have similar standards (METI, 2021b).

To this end, all efforts must be made to save energy and make every industry and society sector as efficient as possible. Even lifestyle changes are required. Electrification should continue advancing, and electricity should be carbon neutral. Where electrification is not possible, CO₂ emissions should be reduced and somehow neutralized. With such a future in mind, I would like to discuss some aspects of Japan's energy policy, focusing especially on electricity.

Liberalization of electricity markets

Japan's power supply system consisted of a set of regional monopolies of 10 Electric Power Companies (EPC) nationwide and a vertically integrated power supply system from power generation to power retailing. To be granted a regional monopoly, the condition was to provide a stable supply of electricity to every corner of the jurisdiction. The electricity fees were adjusted under the so-called Total Cost Method (総括原価方式), to cover the production costs and to ensure profits for the company. On the other hand, certain goals like the share of renewables on the energy mix, for example, could be negotiated with the government on a case-by-case basis to get close to the national targets. This system awoke many critics as it lacked the incentives to reduce electricity prices and seriously pursue other goals (FEPC, 2021).

The first wave of liberalization came in 1995 when it became possible for the industry to sell energy produced by excess heat to the EPC. Retail sales were also allowed in some limited areas. These were designated as specific-scale electric power companies (SSEPC). Then, from 2000 to 2005, liberalization of electricity retailing to large consumers was gradually promoted, and to procure a more diversified energy supply, a wholesale electricity market was also developed. However, the ratio of the amount of power generated by specific-scale electric power companies to the electric power market was insignificant. Basically, the market monopoly of EPCs continued (Noguchi, 2013).

After the Fukushima Daiichi nuclear accident in 2011, criticism about the market monopoly and the close relationship between EPCs and the regulators was exacerbated. Under this pressure, in 2016, the electric power market was completely liberalized, and the distinction between EPCs and other businesses disappeared. Nonetheless, the EPCs continued applying the Total Cost Method to calculate the consumption fees and continued owning the transmission and distribution grids. It was until 2020 that the separation of power generation, transmission, and distribution was completed. Nowadays, the amount of power generated by the former EPCs still accounts for a large portion, but various companies are entering the market. Thus, the consumers now have different options to buy electricity and

¹ In top down order: [1] renewable energies (purple); [2] hydroelectric (turquoise); [3] nuclear (yellow); [4] natural gas (green); [5] coal (violet); [6] oil (blue). The table shows the self-sufficiency ratio for the given year.

gas, and the sources of that energy can also be chosen. The complete liberalization of the energy markets was achieved institutionally (METI, 2021).

These new circumstances bring other challenges. Mechanisms for matching the supply and demand of electricity have been constructed, i.e., mechanisms for generation business operators to make adjustments responsibly and mechanisms for the power transmission and distribution operators to make instant fine adjustments in response to the supply-demand situation in real time. Still, these mechanisms must be strengthened. At present, the former EPCs occupy a significant proportion of the adjustment ability, so they are largely responsible for the adjustments, but their share is expected to decrease as the business environment becomes more competitive. Thus, more effective adjustment mechanisms of the supply-demand balance and a very high-quality electricity supply are two issues that must be tackled in the future. Likewise, the power transmission and distribution business operators must fulfill their responsibilities to maintain every corner of the power network, especially in areas where power requirements decrease as the population declines. Financial support and the spread of smart meters and other IT technologies must be promoted to address these challenges. Another issue is that it might be more difficult for government agencies and electric power companies to achieve their global warming goals unless public awareness is further promoted.

Nuclear power

The Atomic Energy Basic Law was enacted in 1955, lifting the curtain on nuclear power generation in Japan. In 1966, the first nuclear power plant began commercial operation at the Tokai Power Station. After the oil shocks, the construction of nuclear power plants proceeded rapidly, and combined with a Fast Breeder Reactor (FBR), there were high expectations of nuclear power to supply most of Japan's electricity demand. Throughout the 2000s, it was also seen as a trump card for global warming prevention, and the third BEP (2010) aimed to build more than 14 units and improve the operating rate by 2030. The goal was for nuclear energy to provide 50% of Japan's demand. However, since the end of the 1970s, accidents related to nuclear power

generation inside and outside Japan raised doubts about nuclear power generation's safety. In Japan, for example, the "Monju" FBR was decommissioned in 2016 due to a series of accidents.

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On March 11, 2011, the Great East Japan Earthquake triggered the Fukushima Daiichi Nuclear Power Plant accident. The earthquake motion itself did not cause any major problems in the buildings (though further studies in situ have to be conducted when fuel debris is removed), and the nuclear reaction in the reactor was successfully stopped. However, the external power source was lost due to the collapse of transmission towers, and the tsunami caused many of the internal power sources to become unable to generate electricity. As a result, the ability to cool the reactor and spent fuel rods was lost, leading to major accidents such as core meltdowns. As a result, more than 160,000 residents had to evacuate (this number includes evacuees for other causes). More than 35,000 persons have not been able to return. In response, the regulations regarding nuclear power plants have been drastically tightened. Nationwide, nuclear power plants were eventually forced to shut down, and their restart was not permitted unless it was confirmed that they complied with the new regulations (Fukushima Prefecture, 2021).

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The Fukushima Daiichi nuclear accident was investigated by the parties concerned: TEPCO and the Government's External Investigation Committee, the Diet Accident Investigation Committee, and the Private Accident Investigation Committee. In particular, the Government Accident Investigation Commission and the Diet Accident Investigation Commission reports greatly influenced the subsequent state of the nuclear regulation administration. The reports of these investigations point out the following problems: (1) that the government had the Promotion Department and the Regulation Department of nuclear power generation in the same Ministry (the Ministry of Economy, Trade and Industry (METI)); (2)

that electric power companies could effectively control, at least to some extent, the government regulations and use them as a shield by stating that safety was ensured in compliance with those regulations. Furthermore, the reports state that these problems are also reflected in the nuclear power operator's (TEPCO) explanation, that an "unexpected" situation occurred during the Fukushima Daiichi nuclear accident. But the investigations show that they were not prepared to respond to serious accidents caused by unexpected situations. There were not enough on-site response manuals, and response policies and procedures had not been decided in advance between the government and electric power companies. As a result, a proper division of roles between experts and politicians was not carried out during the accident response. Based on this experience, the new Nuclear Regulation Authority (NRA) was established as an external bureau under the Ministry of the Environment, and strict efforts are being made to ensure its independence and transparency. In fact, the Minister of the Environment cannot intervene in the preparation of regulatory standards and individual examinations for the NRA. Personnel exchanges are severely restricted between the NRA and the Energy Agency of METI, especially for those with a certain authority level. Certain measures have been established for interviews with electric power companies and to ensure transparency in dialogues between the Regulatory Committee Members. Later, an organization in charge of evacuation in case of a nuclear accident was established in the Cabinet Office, and the roles of the organizations in case of a nuclear accident were clearly divided.

The regulations set by NRC in June 2012 are said to be the world strictest. Major changes include the strengthened standards of facilities and equipment related to large-scale natural disaster countermeasures and the response in the event of a natural disaster. Besides, the so-called "retrofit" approach was introduced. This means that the existing facilities must be modified based on applicable new knowledge. Also, a nuclear power plant's lifetime can be extended from 40 years to 60 years if approved. Based on the new regulatory standards, of the 54 commercial reactors that were operational when the Fukushima Daiichi accident occurred, decommissioning has been decided for 21 units, only 9 were approved to restart, and the construction plans for other 5 reactors were approved. As of January 15, 2021, only two nuclear power plants were in commercial operation, partly

due to the delay in responding to the subsequent tightening of regulations; other 2 units were in adjustment operations. Furthermore, compliance with the regulatory standards is no longer regarded as a sufficient condition to ensure safety; each operator's voluntary efforts are required.

Finally, some issues that remain to be addressed for the future. Regarding the nuclear fuel cycle, a nuclear fuel reprocessing plant is in the final stages, and its completion is expected for 2022. So far, most of the spent fuel reprocessing has been outsourced to France and other countries. Another major issue is securing a final disposal site for high-level radioactive waste. In Japan, studies have been conducted to solve this problem. However, due to the opposition of locals and the so-called NIMBY problem, it has not been possible to investigate whether a location is suitable for a final disposal site. In 2020, it was announced that several local governments in Hokkaido would accept the survey, but Hokkaido's prefectural government opposes it, and the future is uncertain. In particular, nuclear power plants are not currently operating in Hokkaido, and it may be politically difficult to accept them in such a situation.

Some opinions set the use of nuclear power generation as indispensable for the 2050 carbon neutrality target. But it can be said that the construction of new nuclear power plants is in a difficult situation due to the current social acceptance of nuclear energy. Assuming that all commercial reactors for which decommissioning has not been decided restart operations, the BEP target of 20 to 22% of nuclear energy could be reached. After those reactors end their lifecycle, they could be replaced, as there are various benefits associated with nuclear power plants for the local economies, and new technologies would bring higher safety standards. However, in any case, unless a final disposal site for nuclear waste is secured or a technology that significantly reduces the waste to be disposed of is developed, it can be expected that nuclear energy will get stuck at some point in the future.

Renewable energy

Renewable energies, as domestic energy sources, were largely promoted after the first oil crisis. An emphasis was put on solar energy, and the government provided subsidies for equipment installation and support for technolo-

gical development as part of the Sunshine Project. As a result, Japan took the leading position in the world markets. However, at that time, photovoltaic power (PVP) generation was mainly for households and buildings. Because the scale was small and the power generation cost was high, solar energy's share was insignificant. Since Japan specialized in small-scale, high-performance panels, we could not keep up with the movement to lower prices in the large-scale PVP markets, and Japanese companies lost their share to overseas companies (METI, 2021).

Wind power generation efforts started as initiatives of citizens for environmental conservation and companies that wanted to show Corporate Social Responsibility (CSR) to the outside world. There were also cases in which general electric power companies installed wind turbines near a nuclear power plant. However, due to the large seasonal fluctuations in wind direction and speed, it was difficult to connect large-scale wind power plants, and further measures were not promoted. As a result, Japanese companies lost market share and eventually withdrew from the market.

There were also other attempts with different sources. From the perspective of regional promotion of mountain villages, there were efforts to utilize woody biomass and small-scale hydroelectric power generation. Also, geothermal energy, an abundant source in Japan. But it competes with the tourism industry (for hot spring waters and mountain scenic views), and there are strict regulations when the source is in a national park.

In the 2000s, an RPS system was introduced to promote the spread of renewable energies. However, the targets set for the general electric power companies to use renewable energies were not ambitious at all. As a result, renewable energies were not largely introduced, and a strong market was not developed. To address this, in 2009 a partial feed-in tariff (FIT) program was introduced to oblige general electric utilities to purchase the excess energy generated by PVP at fixed prices for a certain period of time (METI, 2021).

On the very day of the Great East Japan Earthquake (March 11th, 2011), the Government of Japan (GOJ) submitted to the Diet a law for introducing a general FIT system to buy all renewable power sources' excess energy

at fixed prices and periods of time. This system started in 2012. Initially, it was assumed that most of the PVP stations would be installed on rooftops, but the photovoltaic capacity expanded faster than expected due to the following reasons: (1) a relatively high purchase price was set in consideration of the actual price at that time, (2) unused lands were utilized for large-scale photovoltaic power generation, (3) installation cost reductions due to the global market expansion (4) shortened installation periods.

Wind power generation was initially regarded as the most promising, as there was a gradual increase of wind farms even before the FIT system. But the FIT introduction made the preliminary studies phase sluggish (wind and environmental assessments), and suitable land for wind farms is limited in Japan. The generation capacity has been steadily expanding mainly due to the increase of wind turbines size. In contrast, offshore wind power generation is up-and-coming in Japan. Demonstration projects are being carried out in several areas, and certain conditions, such as a system for usage rights and definition of time periods, are currently under revision. Biomass, geothermal, and small-scale hydroelectric power generation are gradually taking advantage of regional characteristics, but PVP and wind power generation are ahead.

Since the FIT system's introduction, the proportion of renewable energies has been steadily increasing, reaching about 10% (20% when large-scale hydropower generation is considered). However, this growth is not exempt from problems. Under the full purchase FIT system, the difference between the purchase price and the wholesale market price of electricity at the time of purchase must be paid by all consumers nationwide according to the amount of electricity consumed. As renewables become more widespread than initially expected, the levy is rising. Since the FIT system's final objective is to introduce a free market for each power generation method, the purchase price is reviewed on a time-to-time basis. Particularly for PVP, a shift to a feed-in premium (FIP) system, intended to reduce the subsidies and gradually open the market for competition, is being discussed.

The large amounts of wind and solar energy have come to a point where the infrastructure must be strengthened to introduce more renewables. The originally inde-

pendent regional grids require interconnections, especially the Eastern and Western regions of the country that operate with different frequencies. Eventually, an integrated operating system will become an issue to address. New infrastructure is also required to harvest renewable resources in remote regions and transmit large amounts of variable energy. Thermal power is used to adjust the fluctuations, but energy storage and demand adjustment systems are also required to further introduce renewable energies. Systems that sum up large batteries, electric vehicles, and later hydrogen are expected to contribute here, along with virtual power plants (VPP), to manage power transmission to microgrids and power grids. Other issues under review are the life span of large-scale PVP stations and waste disposal.

Remarks on Thermal power generation

To respond to the power shortages that occurred after the Fukushima Daiichi nuclear accident and after the shutdown of other nuclear power plants, inefficient thermal power plants no longer in use had to be restarted. As a result, CO₂ emissions raised considerably, as did electricity fees. This economic factor is a major reason for the former general electric utilities to push for the restart of existing nuclear power plants. Nonetheless, the GOJ cannot rely on nuclear energy, and there are currently certain limits for introducing more renewables. Therefore, natural gas and coal-fired thermal power are considered necessary. This policy has received worldwide criticism from the perspective of combating global warming. To respond, the inefficient thermoelectric facilities will be replaced with new ones, and hydrogen and CCUS technologies will be promoted and developed.

References

FEPC. (2021). 電力自由化の経緯. Retrieved from The Federation of Electric Power Companies of Japan: https://www.pref.fukushima.lg.jp/uploaded/life/539805_1458484_misc.pdf.

METI. (2021). Electricity Liberalization. Retrieved from Agency of Natural Resources and Energy: https://www.enecho.meti.go.jp/category/electricity_and_gas/electric/electricity_liberlization/what/

Noguchi, Takahiro. (2013). Discussion and Chronology of the Electric System Reform. Retrieved from National DIET Library: https://dl.ndl.go.jp/view/download/digidepo_8206692_po_074802.pdf?contentNo=1

Fukushima Prefecture. (2021). Evacuation Situation and Support to Evacuees. Retrieved from Fukushima Prefecture Webpage: <https://www.pref.fukushima.lg.jp/site/portal/list271.html>

METI. (2021b). Present Status and Promotion Measures for the Introduction of Renewable Energy in Japan. Retrieved from Ministry of Economy, Trade and Industry: https://www.meti.go.jp/english/policy/energy_environment/renewable/index.html



Colaboradores

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Interview with Mr. Yoshitaka Shimizu

Mr. Yoshitaka Shimizu works at Osaka Gas and worked for two years at the Agency of Natural Resources and Energy of the Minister of Economy, Trade and Industry.

Perspectivas Energéticas [PE].- Every energy plan review begins assessing the situation and progress of Fukushima. Almost 10 years have elapsed since the nuclear disaster, and some progress has been achieved, but there is still much to be done. In your opinion, what has been the hardest obstacle for the recovery of Fukushima?

Mr. Yoshikata Shimizu [YS].- One of the biggest challenges for the government and the industry has been recovering people's trust. There are many cases where it is difficult for the Japanese government to move without the people's consent. For example, a big problem right now is what to do with the water accumulating in tanks near the Fukushima Daiichi Nuclear Power Plant. This water is cleared off harmful radioactive materials, and even though it is safe to be poured into the sea, it has been stored in tanks because taking other actions requires the consent of the people who live in the locality. The problem now is that those tanks are reaching their limit capacity, and something must be done with that water. One feasible solution is to pour that water into the sea. In fact, there are standard procedures to do that in normal conditions. Still, in this case, the people's consent is necessary, and there is harsh opposition from the locals, especially from the fishermen, because they want to avoid a bad reputation for their products.

Another problem concerning people's trust is related to the disposition of the radioactive materials. To make possible the final disposal of radioactive waste, Japan

has launched "The International Roundtable on Final Disposal of High-level Radioactive Waste" to promote research cooperation between each country's relevant institutions, exchange of personnel, and share experiences and knowledge concerning the promotion of people's understanding. Japan also intends to hold a workshop with the OECD / NEA to strengthen the research and development activities and follow each country's progress. These activities are considered a step to pave the way for the realization of final disposal in Japan. But it will take some time to carry out the final disposal.

PE.- Recovering people's trust is a necessary condition to advance in many issues then, but the recovery plan has awoken doubts of people and experts. Do you think that the recovery plan could be carried out as it has been defined?

YS.- The roadmap for the recovery has been designed considering all the problems that have to be resolved. But of course, we cannot say that the plan will not be adjusted at some point. On the contrary, I think it is most likely that some adjustments will have to be made along the way. And this is normal if we consider that some of the technical challenges to be addressed have no precedent. For example, some operations have been affected by COVID-19, and it is just something that must be dealt with when it arises. This kind of things happen, but it is important to have a plan and a goal set in terms of time; otherwise, it is difficult to start moving in the first place.

PE.- Besides the final disposition of radioactive waste, another problem related to the back-end processes is Japan's fuel cycle model that intends to reprocess exhausted nuclear fuel. Do you think this model is the best option for the Japanese nuclear industry, given its current circumstances?

YS.- For Japan, this is a critical issue, and the main problem is the lack of resources in Japanese territory. For many years Japan relied on nuclear energy. This helped reduce the costs of energy because it is expensive to import energy resources from other countries. The greatest benefit from lower prices of energy was the industry's competitiveness, which is the main reason for promoting the use of nuclear power. Of course, today, we want to use renewable energies as much as possible, but some problems are also related to these energies. Therefore, the use of nuclear power is still considered important for Japan's energy mix. This is the idea behind the 3E+ principle. Even though there are downsides to nuclear power, economically and from the self-sufficiency point of view, it is important to be balanced. And for Japan, being a country that has struggled with energy constraints for a long time, it would be ideal to have an energy cycle.

PE.- Could you please explain how the decision-making process works in the case of the Japanese energy policy? Which are the main institutions involved, and how is the workflow of the decisions?

YS.- Roughly speaking, the revision process of the policy takes a long time. Sometimes more than one year. The main actor in the process is the Agency for Natural Resources and Energy. That Agency gathers all the relevant information and formulates the direction of the policy. Of course, the proposal is revised by other actors. There are many rounds of discussion and debates to have a final version to be sent to the DIET (Congress) for its approval. In these debates, various persons and institutions participate: private companies, bankers, universities, researchers, journalists, and so on. The idea is to refine the proposals of the Agency through discussions and with different perspectives. The names of the participants and the content of these debates are disclosed so that anyone can follow what is being said and considered. The participants are invited by the Agency and ratified by the DIET. And there is also a round open to the public opinion before the policy is approved. So, there are many steps, and it is an iterative process. That is why it takes a long time.

PE.- As a private actor, how is Osaka Gas contributing to Japan's energy policy goals?

In order to realize a decarbonized society by 2050, we are currently developing and selling fuel cells for household use (ENE-FARM), and hydrogen production equipment (HYSRVE) for hydrogen stations. Although those systems use gas to produce hydrogen, they play an important role in the expansion of hydrogen infrastructure. In Japan, 40,000 tons of hydrogen are used annually, and we are working to further develop hydrogen manufacturing technology and expand the introduction of renewable energy and green hydrogen. The existing gas infrastructure will also contribute when methanation technology is introduced to the system. Osaka Gas is already engaged in research and development of methanation technology, aiming for early commercialization.

In particular, since Osaka Gas provides gas to satisfy the heat demand of different sectors, we are working to decarbonize, or neutralize the CO₂ emissions of our product.



Colaboradores

Perspectivas Energéticas - Año 6 Número 10 Enero - Mayo 2021

Interview with Dr. Ryo Eto

Dr. Ryo Eto is an experienced energy system analyst at the Institute of Energy Economics, Japan (IEEJ).

Perspectivas Energéticas [PE].- Decarbonization is now an important goal for Japan's energy system. Could you explain which have been the greatest challenges for Japan's energy transition?

Dr. Ryo Eto [RE].- One of the main challenges is the cost of renewable energies because it is usually higher in Japan than in other countries due to the isolated electricity grid and the geographical conditions. First, Japan has no connection to other country's grid, unlike European countries or the United States, where they can interconnect their grids to bring power when generation is low. So, Japan must deal with these constraints with its own resources. Yet, to add complexity, Japan has two grids that operate with different frequencies. For historical reasons, the Eastern part of the country operates with 50 Hertz while the Western area with 60 Hertz. Therefore, the system requires more fossil-fired power plants or storage batteries to integrate intermittent energies.

Second, most of the territory is covered by mountains, so wind tends to be more unstable than in other countries or regions, and the largest potentials are located in remote places such as the Northern island of Hokkaidō, far from the urban areas of Tokyo or Osaka, where the demand is highly concentrated. Similar conditions apply to solar energy. Due to the many mountains, there is not as much suitable space as it is in countries like Mexico, and the large potential of the Southern island of Kyushu is far from the demanding urban areas. These factors lead to even higher intermittences of the energy produced by these sources and higher tariffs. To reduce these

costs, the actual feed-in tariffs (FIT) program will be replaced by a feed-in priority (FIP) program in FY2022.

PE.- Despite all these constraints, Japan has announced a commitment to become carbon neutral by 2050. Could you tell us about the strategy that would make this possible?

To begin with, in 2030, the share of renewables and nuclear power is expected to reach 24% and 22% of the power mix. One of the discussions today is about increasing those targets. Some say that renewables could grow faster, but there remains the cost problem that I mentioned before.

Another issue is that nuclear power is quite behind the target. But that is a problem that should be solved by recovering people's trust. Of course, other mechanisms and technologies, such as carbon capture and storage (CCS) or hydrogen, will also play a role in the future. That is just a general overview. The policy is under revision right now.

PE.- CCS is among those technologies that are gaining momentum in Japan and other countries. How much should Japan and other countries rely on such technologies to achieve the CO₂ reduction targets?

There are many issues and opinions on this topic. There are some pilot projects, and we are trying to introduce CCS elsewhere because it might not be that easy to do it in Japan because of the limited storage potential. So, we are trying to export CO₂ to other countries, like Saudi Arabia or Australia. One of the Middle East projects consists of the injection of CO₂ into an oil field

to recover oil that otherwise would be very expensive to do. Another project envisions recovering hydrogen from Australian coal and then inject the residual CO₂ underground. I am not sure when these projects will be economically feasible, but hopefully, for 2050, they will. These technologies are seen as a complement to other technologies. CCS and hydrogen technologies are expected to contribute as well, for renewable energies alone will not lead to zero-carbon emissions. As there are yet many uncertainties around technological innovation and cost reduction, we must use all the resources we have at hand, including nuclear power, to achieve carbon neutrality.

PE.- Another concept that would contribute to those goals is energy efficiency. Could you tell us about the strategies that have been effective to achieve greater energy efficiencies in Japan?

There have been programs that systematically look for energy efficiency gains since the 1970s. A very well-known program is the Top Runner. That program stimulates energy efficiency improvements of machinery, appliances, and devices in the household, transport, and commercial sectors. It is the biggest one. For the industry, there is a voluntary framework called a Low Carbon Society. Under this framework, each industrial association must set targets to increase their energy efficiency and reduce their CO₂ emissions by 2030. For example, the steel association must set its targets for energy consumption and CO₂ emissions per steel output unit. So, each association can choose the target and kind of energy source appropriate for its goals, like biomass or waste for energy production.

There is also the Global Warming Countermeasure Plan formulated by the government, which assigns the commitment of achieving a low carbon society a central role in leading the business community. Around the 1980s and 90s, many energy efficiency technologies were introduced in Japan after the oil shock, so a greater energy efficiency growth rate is harder and harder to achieve. Nonetheless, it is important to continue those efforts.

PE.- How does long-term factors like population degrowth will affect the energy sector and its goals? And how has the COVID-19 pandemic affected the energy sector in Japan?

Yes, Japan's population is growing smaller, and this trend is expected to continue for a long time. Other

long-term factors that may reduce the energy demand might be technological change and energy efficiency. On the other hand, GDP is expected to grow. So, the projections show that the energy demand will also continue growing. But it will not grow as fast as in previous periods, or as fast as in developing countries.

The pandemic affected the demand a lot, and as different policies are being under revision right now, many things have been changing very fast. We must rethink the targets for nuclear, renewables, CCS, and so on. Besides, sometimes experts' opinions and the results of the energy model estimations are not always the same. Right now, the environment is very challenging.

Análisis

Perspectivas Energéticas - Año 6 Número 10 Enero - Mayo 2021

Towards the Hydrogen Society

Mtro. Alfredo Álvarez Pérez

Hydrogen is the lightest and most abundant element in the universe. On Earth, it is found combined with other elements, forming compounds like water (H_2O) or methane (CH_4)¹. Once hydrogen is separated from other elements, it can be stored, transported, and used to produce heat (through a combustion reaction) or electricity (through a chemical reaction utilizing fuel cells). A combustion reaction, for example, can be achieved by mixing hydrogen with natural gas in combined cycle power plants. Fuel cells are mechanisms in which a chemical reaction between hydrogen and oxygen occurs, and energy (electricity) and water are produced. Fuel cells can power vehicles, airplanes, homes, and other electric appliances. Therefore, hydrogen could be a substitute for some fossil fuel applications, and a complement for renewable energies. Although there are many technical and economic challenges to overcome, hydrogen could play an important role in our energy systems.

The government of Japan (GOJ), especially the Ministry of Economy, Trade and Industry (METI) and the New Energy and Industrial Technology Development Organization (NEDO), along with the private sector, is pushing forward the use of hydrogen –as an energy carrier– to address some of the prime challenges that the Japanese energy system faces today: to secure a steady and reliable energy supply, and to achieve carbon neutrality by 2050 while preserving reasonable prices to keep its productive sectors com-

petitive². Furthermore, the development of hydrogen-related technologies (HRTs) is regarded as part of a strategy to lead the industry and set the standards, as this field gains the attention of new players and becomes increasingly competitive. Nonetheless, there are many challenges on the way to the realization of the so-called hydrogen society. This short article explores why hydrogen is gaining momentum in Japan, and more importantly, how the HRTs are being developed, notwithstanding the complex challenges and critics that it faces.

Why hydrogen?

The departure point, then, is to briefly look at the energy system's points where hydrogen use makes sense. First, the heavy energy dependence on foreign resources has afflicted the Japanese energy policy (JEP), especially since the 1970s oil shocks, and it has been considered a greater threat since the Fukushima nuclear disaster in 2011. One way to address this situation has been through securing access to a diversified portfolio of foreign resources and suppliers (Chart 1).

Since hydrogen can be produced from different sources and transported long distances, it could help make available unused foreign resources. For this reason, hydrogen is expected to further diversify the options for Japan. Another way to alleviate this energy dependence has been through the promotion of domestic (or semi-domestic) energy sources. Nuclear energy was the

1 Hydrogen accounts for barely 0.5 parts per million of Earth's atmosphere.

2 Following the 3E+s principle (Energy security, Economic efficiency, Environment and Safety).

preeminent source to this end. Still, since the Fukushima nuclear disaster, the nuclear industry has not been able to recover, and it is struggling to regain people's trust, which is essential to take off again. In contrast, the last decade witnessed a rapid growth of the renewable energy industry, especially solar energy (Chart 2).

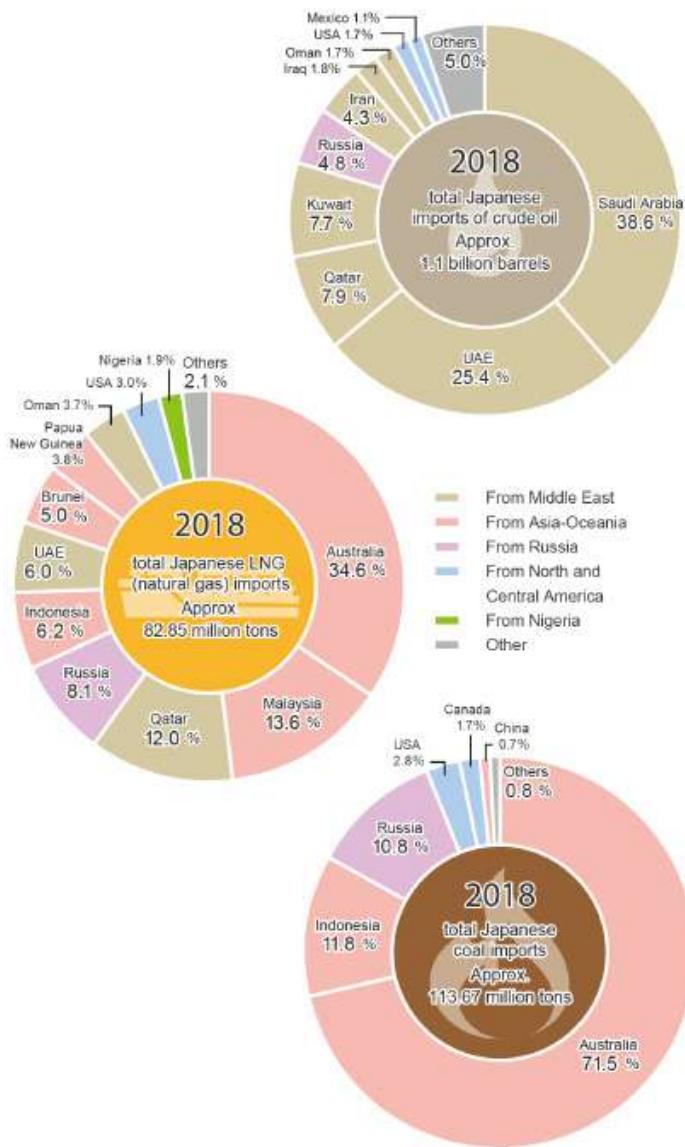


Chart 1. Resource procurement by source and country (Agency for Natural Resources and Energy, 2020). Totals in exa Joules and percentages of total primary energy supply in 2018. Crude oil: 7.41 (37.58%); natural gas: 4.51 (22.86%); coal: 4.95 (25.08%).

Nonetheless, many obstacles must be overcome to continue increasing the share of renewable energies. One of the greatest challenges is to attract large investments to

reinforce the electric grids where the amount of variable energy is already large and to build new infrastructure where there is huge potential to harvest renewable energy. The use of hydrogen is expected to reduce the costs of infrastructure, for it can be produced with the excess energy from renewable sources and then used as a back-up source. Also, by leveraging the renewable energy industry, hydrogen is expected to push the local economies and improve the energy system's resiliency to be better prepared for disasters or energy supply interruptions. Thus, hydrogen could be a good complement for renewable energies.

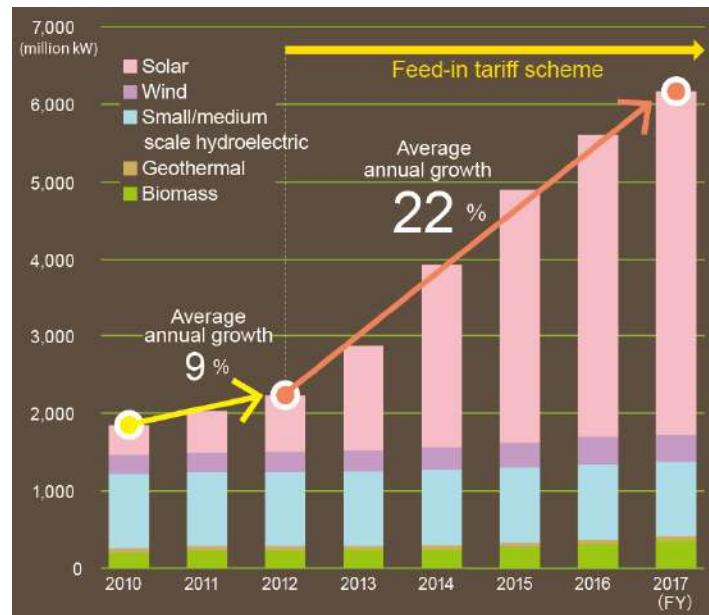


Chart 2. Changes in installed capacity resulting from renewable energy and other factors (Excluding large scale hydroelectric power). (Agency for Natural Resources and Energy, 2019).

Besides energy dependence, hydrogen is expected to contribute to addressing environmental issues and climate change. In October 2020, Japan's Prime Minister Yoshihide Suga pledged that Japan would become carbon neutral by 2050. Before this announcement, the goal was to reduce 80% CO₂ emissions by 2050. Since that announcement, policymakers have been revising policies and scenarios to figure out the pathways that would lead to that achievement. A new Basic Energy Plan (BEP) is expected for the coming months based on those revisions. The most direct way hydrogen can contribute here is through the use of green hydrogen, i.e., hydrogen produced by water electrolysis, utilizing renewable energy, a process

(almost) free of CO₂ emissions. However, another way this energy carrier (hydrogen) could be employed to this end is by offsetting CO₂ emissions to other countries. Today, most hydrogen is produced from fossil fuels, and the steam reforming³ or coal gasification processes through which hydrogen is obtained inevitably produce CO₂. Nonetheless, when hydrogen is employed to produce energy, no CO₂ emissions or other greenhouse gases (GHG) are generated. Thus, the country that uses that hydrogen can leave the CO₂ emissions “outside” on the country where it was produced.

The competition for decarbonizing energy systems worldwide is another good reason for technology exporting countries like Japan to stay avant-garde in such technological areas. For example, the Japanese exporting agenda has been pushing forward for building coal and gas power plants in developing countries. As this has raised criticism, one answer that has been considered is to include in the package other technologies such as Carbon Capture and Storage (CCS) and, of course, HRTs. Other countries might also apply these strategies, and the mindset is that setting the industry standards from its early stages will benefit the first comers. Moreover, it is not to be forgotten that the carbon neutrality announcement by Japan's Prime Minister came when other countries like China and Korea were announcing similar commitments.

Some of the Challenges

While hydrogen as an energy carrier is expected to add to Japan's energy security, and leverage up renewable energies and other industries, there are technical challenges to overcome and questions yet to be answered about the HRTs' feasibility. First and foremost, the price of hydrogen is not competitive with the mainstream energy sources. To begin with, hydrogen is a secondary energy source, like electricity, and it is produced (separated from larger molecules) utilizing energy from other sources in the process. In fact, obtaining hydrogen, whether through water electrolysis using renewable energy or steam reforming processes using fossil fuels, requires an energy-intensive process (EIA, 2021). Another problem is that for many applications, like efficient transport and storage, hydro-

gen has to be stored under very high pressures or extremely low temperatures to make it occupy a small volume, and this also requires energy. Therefore, even though a fuel cell can convert hydrogen to energy with very high efficiency, the processes behind that final step are highly energy-intensive. This translates into high costs for the whole system. Furthermore, the infrastructure required to use hydrogen massively is another costly obstacle in the way of the hydrogen society. It is said that a hydrogen station is 3 times more expensive than a normal gasoline station, and a fuel cell vehicle (FCV) is at least twice the price of that of an electric vehicle (EV) (METI, 2019).

These challenges are just some of the most important and to face them, the Government of Japan has set plans, money, and technology roadmaps to make the hydrogen society a reality. The key idea is to develop the demand and the supply sides of a new market simultaneously.

The Basic Strategy

The Japanese program on hydrogen is not new, it can be traced back to the 1970s Sunshine Project and other programs after that, but it is in the past few years that it has gained momentum. Japan's former Prime Minister, Shinzo Abe, instructed the elaboration of a basic strategy⁴ to make feasible in technical and economic terms the use of hydrogen as a significant energy source in Japan by 2050. In 2018, the first Hydrogen Energy Ministerial Meeting was celebrated in Tokyo, and the second one was held in 2020 [METI, 2020]. In these meetings held by METI and NEDO, the stakeholders and other international actors present their advances and plans to further develop the HRTs. Those events also aim to portray the Japanese leadership in this field. The intention of these events and of the basic strategy guidelines is to orchestrate the development of this new sociotechnical system and its inclusion in the energy system. Thus, the conceived basic strategy sets an approach that requires undertaking different projects and technological pathways simultaneously, both in the supply and demand ends.

In the supply end, the basic strategy conceived three large-scale demonstration projects to bring large amounts of hydrogen to Japan. These projects aim to develop technologies until the demonstration and commerciali-

³ Steam reform is a process in which methane reacts with water (steam) to produce hydrogen and carbon monoxide, then that carbon monoxide reacts with steam to produce hydrogen and carbon dioxide.

⁴ Basic Hydrogen Strategy [METI, 2017].

zation phases to deliver low-cost hydrogen. By 2030 the amount of hydrogen obtained from these sources is aimed to be 300,000 tons/year at the cost of 30 yen/Nm³ (\$0.3 USD/Nm³), as it is set in the basic strategy policy (METI, 2018). Then, this cost should be further reduced to increase hydrogen's competitiveness. These projects depend on the development of hydrogen supply chains inside and outside Japan; thus, international cooperation at different levels and the private and public sectors' participation are essential.

The first demonstration project is an international supply chain between Australia and Japan. This project is being carried out by HESC (Hydrogen Energy Supply Chain), an association of five large companies (Kawasaki, Marubeni, J-Power, Iwatani, and AGL) and funded by the governments of Japan and Australia. This project intends to extract hydrogen from Australian brown coal by gasification in the Gippsland region. That hydrogen would then be liquified and transported by ship (tanker) to Japan. It is expected for this project to conclude the demonstration phase in the early 2020s. One of the greatest technical challenges here is the transport of hydrogen in its liquid state.

The second project is also an international supply chain between Brunei and Japan. And it is being carried out by AHEAD (Advanced Hydrogen Energy Chain Association for Technology Development), an association of four large companies (Chiyoda Corp., Mitsubishi Corp., Mitsui & Co., and Nippon Yusen). In this project, hydrogen is obtained through steam reforming from natural gas at Negara, Brunei. It is then transported to Kawasaki city, Kanagawa, Japan, by ship (tanker), utilizing organic hydrates, such as Methylcyclohexane (MCH). This method allows transporting hydrogen at atmospheric pressure and temperature. At the dehydrogenation plant in Kawasaki, hydrogen is separated and set for commercial uses; the organic hydrate used as the medium to transport the hydrogen is taken back to Brunei to repeat the process. This project accomplished its first complete cycle in May 2020 [AHEAD, 2020].

The third project is a large-scale “power to gas” demonstration system that will produce green hydrogen from a 10 MW solar power plant at the Fukushima Hydrogen Research Field (FH2R) located in Namie City, Fukus-

hima, Japan. This is the largest pilot program for green hydrogen in Japan. The project is managed by Toshiba Energy Systems & Solutions Corp. This project aims to manufacture, store and supply hydrogen produced by renewable energy and balance the electric grid's supply and demand. This project's contribution should be reducing water electrolysis systems cost to about 50,000 yen/kW (USD 500/kW) (Toshiba, 2020).

The projects on the demand end (or the application end) can be categorized into three groups: (1) large-scale energy generation, (2) small-scale energy generation, and (3) mobility. In the large-scale energy generation category, the goal is to reach a generation capacity with hydrogen of 1GW by 2030. Hydrogen is expected to contribute as a back-up power source for balancing the variable energy input and to become as competitive as natural gas for power generation (METI, 2019). To achieve these goals, some projects that employ combined cycle turbines that enable hydrogen mixed with natural gas to generate power. One of these projects is located in Kobe, and it will be integrated into the Australia-Japan hydrogen supply chain. In the small-scale energy generation category, rapid expansion and improvement of ENE-FARM-like systems have occurred in the past few years. These systems can be installed in households, for example, to produce hydrogen from gas or even from excess photovoltaic energy, then it can be used to produce electricity or heat. Some projects interconnect thousands of these small-scale systems to feed the grid (Osaka Gas, 2019). In the mobility sector, fuel cell vehicles (FCV) and hydrogen stations in Japan are set to increase in the next years. The goal is to have 800,000 FCVs by 2030 and 320 hydrogen stations by 2025. Other goals for the transport sector have been set to increase hydrogen-powered trucks, busses, forklifts, and ships (METI, 2019).

Final remarks

Although these projects and roadmaps are part of a basic strategy, many others have been appearing in Japan and other countries in recent years. The realization of the so-called hydrogen society requires an orchestration of policies, institutions, private companies, and many other actors. The challenges that this sociotechnical system faces are enormous, and the whole venture is a risky one. Perhaps, it is too early to talk about a hydrogen socie-

ty, for even if the deadlines and goals for each project are met in time, hydrogen might not contribute but to a small share of Japan's energy mix by 2050. Nonetheless, more and more participants around the world are gradually getting into the hydrogen rush. By 2050 the hydrogen market is expected to be \$2.5 trillion USD worth (Hydrogen Council, 2017). The Japanese institutions behind this idea are putting great efforts and resources into achieving their goals. From the JEP's point of view, the possibility to reach new energy sources is of great significance for Japan's energy security. In geopolitical terms, this would alleviate the pressures and open new opportunities for the Japanese resource diplomacy. In terms of environmental issues, these technologies could provide tools to mitigate climate change and adapt to its consequences. Nevertheless, the extent until which HRTs will contribute is uncertain yet; and the downsides that could arise from the use of these technologies, such as the CO₂ emissions offsetting without real global reductions, the effect of increasing technological disparities between developed and developing countries, among others, should also be carefully observed. The consequences in economic, social and political terms that these technologies will bring are also to be watched and studied from the social sciences and other perspectives.

References

- Agency for Natural Resources and Energy. (2019, August 13). Created by Agency for Natural Resources and Energy based on JPEA solar batteries shipment statistics, NEDO wind power capacity/generation statistics, survey for potential water power, current status and trends of geothermal power generation, certified res: https://www.enecho.meti.go.jp/en/category/special/article/energyisue2019_01.html
- Agency for Natural Resources and Energy. (2020). Retrieved from Japan's Energy 2019. 10 Questions for Understanding the Current Energy Situation.: <https://www.enecho.meti.go.jp/en/category/brochures/#pamph>
- AHEAD. (2020). News. Retrieved from Advanced Hydrogen Energy Chain Association for Technology Development: <https://www.ahead.or.jp/en/>
- EIA. (Consulted in March 2021). Production of Hydrogen. Retrieved from U.S. Energy Information Administration: <https://www.eia.gov/energyexplained/hydrogen/production-of-hydrogen.php>
- Hydrogen Council. (2017, November). Hydrogen Scaling Up. Retrieved from Hydrogen Council: <https://hydrogencouncil.com/wp-content/uploads/2017/11/Hydrogen-scaling-up-Hydrogen-Council.pdf>
- METI. (2017, December 26). Ministerial Council on Renewable Energy, Hydrogen and Related Issues. Retrieved from Ministry of Economy, Trade and Industry: https://www.meti.go.jp/english/press/2017/1226_003.html
- METI. (2019, March 12). Formulation of a New Strategic Roadmap for Hydrogen and Fuel Cells. Retrieved from Ministry of Economy, Trade and Industry: https://www.meti.go.jp/english/press/2019/0312_002.html
- METI. (2020, October 15). Online Special Event of Hydrogen Energy Ministerial Meeting Held. Retrieved from Ministry of Economy, Trade and Industry: https://www.meti.go.jp/english/press/2020/1015_001.html
- Osaka Gas. (2019, March 13). Achievement of Accumulated Sales of 100,000 units of ENE-FARM Household Guel Cell System. Retrieved from Osaka Gas: https://www.osakagas.co.jp/en/whatsnew/__icsFiles/afieldfile/2019/03/20/190313.pdf
- Toshiba. (2020). The world's largest-class hydrogen production, Fukushima Hydrogen Energy Research Field (FH2R) now is completed at Namie town in Fukushima. Retrieved from Toshiba Energy Systems & Solutions Corporation: https://www.toshiba-energy.com/en/info/info2020_0307.htm

Seguimiento de la política energética de México

Perspectivas Energéticas - Año 6 Número 10 Enero - Mayo 2021

Camille Legrand

El periodo de noviembre 2020 a enero 2021 puede ser caracterizado por la realización de algunas propuestas que el presidente Andrés Manuel López Obrador (AMLO) había hecho en torno a la política energética del país. El comienzo de un nuevo año representa también la oportunidad de evaluar lo realizado, echando una mirada atrás sobre los eventos.

El año 2020 es descrito como “uno de los peores años para la industria petrolera”, y el valor de las ventas de gasolineras en México cayó 37%. El valor de las ventas a lo largo de 2020 alcanzó un monto de 284 mil 914 millones de pesos, en contraste con los 449 mil 558 millones reportados en 2019. Respecto al volumen promedio de venta que se tuvo a lo largo del año, Petróleos Mexicanos (Pemex) refirió que fue de 571 mil barriles diarios, una disminución de 20.6% en relación con 2019. En 2020, Pemex fue el contribuyente número uno del país: entregó al gobierno federal un total de 598 mil 323 millones de pesos. Sin embargo, eso representó el 31% menos que en el 2019, por la disminución de la carga fiscal a favor de la empresa petrolera. Asimismo, el presidente firmó un decreto que reducirá la carga fiscal de Pemex, con lo cual esta pagará menos impuestos por concepto de utilidad compartida, para permitirle “liberar recursos a Pemex para la inversión en exploración y extracción de hidrocarburos, lo que permitirá reponer las reservas e impulsar la producción de petróleo”.

Además, en 2020 los ingresos propios de las dos paraestatales, Pemex y la Comisión Federal de Electricidad (CFE), disminuyeron 18,2%. Pemex tuvo ingresos por 407,536 millones de pesos, una disminución de 24,7% en compa-

ración con el año anterior, mientras que la CFE tuvo ingresos por 397,494 millones de pesos, 10,3% menos que en 2019. El endeudamiento neto de Pemex y de la CFE creció casi ocho veces en relación con el monto reportado en el mismo periodo de 2019, alcanzando 221 mil 781,7 millones de pesos entre enero y noviembre, según datos de la Secretaría de Hacienda y Crédito Público (SHCP).

En el ámbito internacional, es importante destacar la elección del nuevo presidente de Estados Unidos, el demócrata Joseph Biden el 3 de noviembre de 2020, y los potenciales impactos que esta elección pudiera tener en la política energética de México. En efecto, el presidente Biden propone una agenda verde acompañada de un plan para “detonar la generación de electricidad producida con el viento y el Sol, con la inversión de 2 billones de dólares”. Además, quiere regresar al Acuerdo de París e impulsar la transición energética, una posición que es opuesta a la del presidente Lopez Obrador. Por otro lado, vale destacar que “la agenda ambiental y energética de ambos países norteamericanos está encaminada a ser cada vez más difícil”, lo que podría debilitar y aislar a México de la comunidad internacional.

A nivel regional, algunos países empiezan a expresar sus inquietudes sobre el camino que está tomando la política iniciada por AMLO, sentimiento reforzado por el freno a inversiones en energías verdes y los anuncios de una potencial Reforma Energética por AMLO, punto que detallaremos más adelante. En noviembre, la Cámara de Comercio de Canadá en México (Cancham) emitió un comunicado exigiendo que México se “comporte como un socio comercial serio y confiable” para poder sostener

una visión a largo plazo que permita atraer inversiones dentro del tratado trilateral T-MEC. Además, los especialistas apuntan que el camino tomado por el presidente mexicano en el sector energético va en contra del Acuerdo de París, firmado en abril de 2016. En efecto, fue apuntado que las políticas energéticas de la 4T violan las metas ecológicas para frenar el desarrollo de proyectos renovables. Además, México se ubica en el lugar 51 del listado sobre países en desarrollo que son más atractivos para una transición a las energías limpias, de acuerdo con el reporte *Climatescope 2020* de BloombergNEF. Ocupaba hace dos años el octavo lugar.

Sector eléctrico

Muchas entidades expresaron su inquietud ante la política del presidente López Obrador en el sector energético, especialmente hacia las acciones tomadas para reducir los ámbitos de acción del sector privado. Además, la CFE declaró que iba a seguir revisando los contratos de infraestructura firmados en administraciones pasadas, para evitar causar daño a la empresa estatal. Esto tuvo el efecto de dejar “en el limbo” a 200 proyectos privados, dentro de ellos parques eólicos, plantas de gas natural o paneles solares.

Sin embargo, la Secretaría de Energía (Sener) se enfrentó a un revés importante cuando, en noviembre pasado, un juez federal, Juan Pablo Gómez Fierro, declaró constitucional la Política de Confiabilidad expedida por la Sener, el pasado 15 de mayo. Esto se suma a una serie de reveses que han tenido los intentos regulatorios del gobierno del presidente López Obrador para sacar del sistema eléctrico nacional la energía producida por centrales privadas, en particular, de energía solar fotovoltaica y eólica. Dos semanas antes de este evento la Suprema Corte de Justicia de la Nación (SCJN) había otorgado por unanimidad la suspensión por tiempo indefinido de esta política, hasta una decisión sobre el fondo de las controversias constitucionales. El golpe final se dió en febrero, cuando la SCJN avaló el proyecto presentado por el ministro Luis María Aguilar Morales, e invalidó la Política de confiabilidad de Sener, con cuatro votos a favor y uno en contra. Se anularon entonces 22 disposiciones del acuerdo impulsado por Rocío Nahle, titular de la Sener. Se habla del “revés más importante que ha otorgado el máximo tribunal a la política energética”. En el sector eléctrico, en enero de

2021, el presidente reiteró su deseo de rehabilitar las hidroeléctricas que ya existen en el país, bajo la tutela de la CFE, “para garantizar el abasto de energía y, de paso, cumplir con los compromisos asumidos por México en el Acuerdo de París”. La modernización de las plantas en operación sigue siendo el pilar principal de la política de renovables del presidente, para producir energía limpia y a bajo costo. Se dice que, en 2021, la CFE estima inyectar a las centrales 6,096 millones de pesos, una cifra más alta que la que fue destinada a esas centrales en años pasados. En particular, se está estudiando el potencial en unidades hidroeléctricas con capacidad menor o igual a 30 MW, cuyo potencial es del orden de 14,500 MW.

En este mismo mes, el gobierno publicó el Plan de Desarrollo para el Sector Energético 2020-2034 (PRODES-EN), que detalla la planificación anual con un horizonte a quince años de la política energética en materia de electricidad. La meta de México sería alcanzar 35% de participación mínima de energías limpias en la generación de energía eléctrica para el 2024, con metas intermedias de 30 por ciento en el 2021. La Sener, es encargada de conducir y coordinar la transición energética del país con base en un “nuevo modelo energético”.

Este periodo fue marcado por un par de apagones en el país. Uno en diciembre, debido a un desbalance en el Sistema Interconectado Nacional, dejó sin energía eléctrica a alrededor de 10 millones de usuarios en todo el país. En el mes de febrero, casi el 1% de los usuarios del país fueron afectados por un apagón en el norte del país, a causa de una tormenta invernal afectando a Texas. Esto provocó un desbalance por la salida de centrales eléctricas de generación a causa de una falta de gas natural. Este evento puso bajo la luz la “enorme dependencia que la generación eléctrica nacional tiene al gas de Estados Unidos” de donde se importa el 95% del hidrocarburo.

Reforma energética

Tal vez la noticia más importante de esos meses es la “contra-reforma energética”. El primero de febrero de 2021, en la Gaceta Parlamentaria salió publicada la Iniciativa Preferente del presidente, que fue entregada a la Cámara de Diputados. Esta iniciativa tiene por meta modificar y adicionar diversas disposiciones a la Ley de la

Industria Eléctrica (LIE). Dentro de esas modificaciones, se pueden destacar algunos puntos:

1. Cambiar el despacho económico por un despacho de tipo “administrativo”.
2. Establecer la obligación de permisos sujetos a los criterios de planeación del sistema eléctrico nacional.
3. Establecer que el otorgamiento de los Certificados de Energía Limpia (CEL) no dependa de la propiedad o la fecha de inicio de las operaciones.
4. Eliminar la obligatoriedad de comprar por subastas para el suministro básico.
5. Obligar a la Comisión Reguladora de Energía (CRE) a revocar premisas de autoabastecimiento, así como sus modificaciones, en caso de que hayan sido obtenidos mediante actos constitutivos de fraude, así como revisar la legalidad y rentabilidad de los contratos al amparo de la Ley del Servicio Público de Energía Eléctrico (LSPEE).

El presidente aseguró que “debe pasarse del esquema de Despacho Económico, que prioriza la energía más barata, independientemente de la tecnología de generación, por el Despacho por Entrega Física de las Centrales Eléctricas en el Contrato Legado de la CFE”. Además, otro punto es que el otorgamiento de permisos para la construcción de nuevas centrales eléctricas está sujeto a la planeación del SEN por parte de la Sener. La iniciativa tuvo el respaldo público de los diputados y senadores de Morena.

Muchas entidades se opusieron a esta reforma: el Consejo Coordinador Empresarial (CCE) mencionó que son “puertas a la expropiación indirecta de plantas privadas”; miembros de la Iniciativa Privada (IP) apuntaron que la reforma iba a encarecer la electricidad. El Instituto Mexicano de Ejecutivo de Finanzas señaló que la reforma representaría “un retroceso en el desarrollo de un mercado competitivo en materia de electricidad”. La American Chambers (AmCham) señaló que esta reforma violará al T-MEC, y las empresas de energías renovables en México describen esta reforma como “la más devastadora para el país por sus posibles impactos a la economía”.

La reforma fue avalada por la Comisión de Energía de la Cámara de diputados a finales de enero, y el dictamen fue sometido a debate y votación en sesión plenaria el martes 23 de febrero de 2021. Fue aprobada con 289 votos a favor, 152 en contra y 1 abstención, sin ningunos cambios. Ahora pasa al Senado de la República para su discusión y votación, con un plazo de máximo 30 días. Algunas voces se elevan para denunciar la inconstitucionalidad de esta reforma, “en la medida de que no se está modificando el principio de la Constitución de abrir la libre competencia a las oportunidades de generación y comercialización de electricidad”. Dicen que esta iniciativa deberá llegar hasta la SCJN, que debería decidir su constitucionalidad y desde ahí ver si se abren controversias dentro del T-MEC.

Perspectivas recomienda

Perspectivas Energéticas - Año 6 Número 10 Enero - Mayo 2021

Vivoda, Vlado, *Energy Security in Japan. Challenges after Fukushima*, Ashgate Publishing Limited, Griffith University, Australia, 2014. **Por:** Mtra. María Cristina Godos González.

La seguridad energética ha sido sin duda un tema de suma importancia en la historia japonesa. Japón ocupa el quinto lugar como consumidor de energía en el mundo y por sus características geográficas no tiene los suficientes recursos energéticos para cubrir la demanda que requiere su desarrollo industrial y su economía. La búsqueda constante de un suministro energético disponible, suficiente y asequible, es vital para Japón. Después del accidente nuclear ocurrido en Fukushima en marzo de 2011, Japón no volvió a ser el mismo, lo cual es precisamente el centro del estudio de Vlado Vivoda. El autor analiza los efectos del desastre nuclear acontecido en el noreste de la costa de la isla principal japonesa (Honshū), donde se sitúa el complejo de la planta nuclear Fukushima Daiichi en la prefectura de Fukushima. De acuerdo con los objetivos del libro y con la intención de hacer énfasis en cuestiones medioambientales, el autor muestra mediante su análisis la ausencia de políticas públicas adecuadas para actuar en tiempo y forma frente a un accidente provocado en un primer plano por la naturaleza, y en un segundo plano por el descontrol político y la falta de transparencia en la rendición de cuentas. Asimismo, el autor presenta un análisis de la situación energética de Japón tomando como referencia los principales recursos que han abastecido el sistema energético japonés en las últimas décadas.

La obra de Vivoda inicia con la frase “Japón enfrenta un serio predicamento y dilema para el futuro de su política energética” (p. 5). Esta frase esboza la problemática en

torno a la seguridad energética de Japón debida a la alta dependencia de energéticos importados. El libro ofrece una clara exposición de los intereses y las instituciones en el entramado de la política energética japonesa y muestra una panorámica detallada de los actores involucrados en la toma de decisiones, comenzando con el tema de la complejidad del Triángulo de Hierro (burocracia, industria y políticos), la triada de poder político que sostiene el modelo japonés de toma de decisiones. Con esto en mente, el autor describe el comportamiento de estas instituciones frente a la dependencia energética de Japón, y trata de explicar cómo desde las crisis petroleras de los años 70 Japón ha pasado por procesos de adaptación frente a sus necesidades energéticas. El común denominador en estos procesos, o el gran proyecto de largo plazo, ha sido la constante búsqueda por minimizar la dependencia energética y por transitar hacia una mezcla energética que le permita mantener un balance entre el uso de energéticos tradicionales y de otras energías, como las renovables.

En torno a la dependencia del petróleo, Vivoda explica la importancia que este energético ha representado para el desarrollo económico de Japón, y para las grandes empresas japonesas. También aquí, hace notar el entramado de intereses que gira en torno al uso del petróleo, y usa como ejemplo los compromisos en materia de eficiencia energética que no han cumplido las empresas de este ramo y la condescendencia de las autoridades en ciertas ocasiones. Otra cuestión en torno a este hidrocarburo es la necesidad de mantener relaciones cercanas con Medio Oriente, y la creciente competencia por este recurso en aquella región, en particular con el surgimiento de China como alto consumidor de energía.

Sobre el gas natural en Japón, el autor argumenta que este insumo fue considerado como auxiliar al consumo del petróleo, pero paulatinamente fue cobrando mayor importancia. Convenientemente, buena parte del suministro de gas ha sido cubierto por Estados Unidos, un aliado estratégico de Japón, y sus precios han sido altamente competitivos en la región Asia Pacífico. Asimismo, después del desastre nuclear de Fukushima, el gas natural representó una buena opción para reemplazar la energía nuclear. Por otra parte, la creciente demanda de este energético en la región agrega presión al contexto energético generado después del accidente nuclear.

Respecto al consumo de carbón, Vivoda también trata la importancia que en su momento tuvo para el desarrollo de Japón, y el papel que ha jugado con respecto a la relación con su principal proveedor, Australia. El desarrollo de tecnologías más eficientes para generar energía con carbón aclara Vivoda, ha sido otra de las estrategias para enfrentar la crisis post-Fukushima, atender el cambio climático y las necesidades del desarrollo económico.

En cuanto al tema de la energía nuclear, el texto relata cómo se expandió el uso de esta fuente de energía y las causas por las que fue considerada una opción viable para atender las necesidades de consumo energético en Japón. Asimismo, ahonda en la complejidad que representa la relación entre la dependencia energética, las consideraciones medioambientales, la percepción social del riesgo y la creciente influencia que fue adquiriendo la muy nombrada villa nuclear, formada por las grandes empresas eléctricas que antes del accidente acaparaban el control del abasto de energía en todo el país.

En referencia a las energías renovables, el autor explica cómo éstas cobraron relevancia en los años 90, pero resalta la falta de soporte político para impulsar el desarrollo de este tipo de energías. Sin embargo, esta situación cambió cuando el sistema eléctrico japonés se vio obligado a prescindir de la energía nuclear. En este contexto, las energías renovables encontraron un espacio para desarrollar su potencial mediante la aplicación de programas de tarifas preferenciales.

Después del análisis sobre los diferentes tipos de energía que utiliza Japón, Vivoda explora escenarios con las opciones energéticas a futuro, y presenta la postura de diferentes estudiosos del tema. En la visión del autor, Ja-

pón no tiene opciones para hallar una solución definitiva a la crisis post-Fukushima, por lo menos hasta el año de publicación de esta obra (2014). El autor afirma que parte de la crisis es una problemática generacional y no se resolverá en el corto plazo, y aunque dicha crisis ha servido como elemento catalizador para cristalizar el debate entre continuar o no con el uso de la energía nuclear, no existe una fuerza de cambio por sí misma. Sin embargo, según el autor, quedan algunas oportunidades para realizar un cambio desde las instituciones, romper con la inercia de ciertos intereses con el fin de que los tomadores de decisiones tengan mayor flexibilidad para llegar a acuerdos. Vivoda sugiere mirar hacia un escenario con una gobernanza más clara, utilizar la democracia y la transparencia para que la energía nuclear, en su caso, pueda permanecer en la mezcla energética. La investigación de Vivoda analiza las opciones inmediatas que tiene el gobierno japonés para el aseguramiento de su política energética, para promover la reducción de los costos de la energía, para velar por el cuidado del medio ambiente reduciendo las emisiones de carbono, y para procurar consensos y una reconciliación entre las diferentes instancias involucradas.

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Tsunekawa Keiichi, editor. *5 Years After, Reassessing Japan's Responses to the Earthquake, Tsunami and Nuclear Disaster*. University of Tokyo Press. 2016.

Por: Mtro. Alfredo Álvarez Pérez

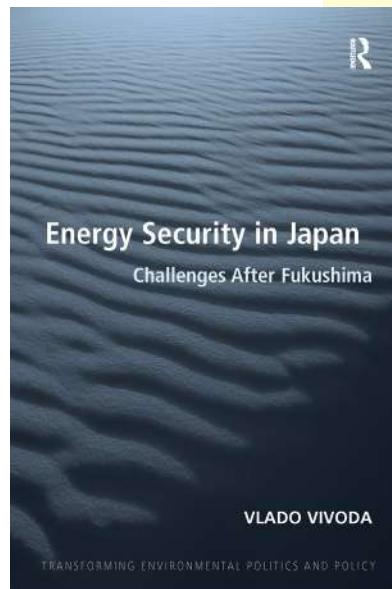
Este libro está conformado por una compilación de estudios acerca de las respuestas que ofrecieron los distintos actores involucrados en el manejo de las crisis que se desataron después del triple desastre del 11 de marzo de 2011 en el Noreste de Japón . Estos estudios forman parte de un compendio mayor, coordinado por comités especializados, establecidos por la Sociedad Japonesa de Promoción de la Ciencia . El objetivo de este esfuerzo fue derivar lecciones, mediante investigaciones científicas, de la multiplicidad de experiencias vividas y del resultado de las decisiones y acciones que se tomaron bajo aquellas circunstancias. La traducción y publicación de algunos

de estos estudios tiene como propósito ofrecer al lector angloparlante una comprensión detallada del 3.11 y una visión contrastante con algunos de los análisis más influyentes de la literatura en inglés.

Los estudios brindan las pautas para comprender los aciertos y los errores de las decisiones tomadas por un cúmulo de actores en situaciones de contingencia, y para entender estas decisiones en el marco de tres distintos desastres (terremoto, tsunami y desastre nuclear). Los resultados de aquellas respuestas se analizan tomando en cuenta no solo las decisiones y las causas directas, sino también los contextos en los que tuvieron cabida, i.e., las relaciones institucionales e informales, los marcos jurídicos, la preparación y la experiencia con otros desastres naturales, etc. De esta manera, el lector tiene la oportunidad de percibir la complejidad de las circunstancias que se presentaron en cada momento y comprender tanto la racionalidad de las respuestas como los resultados de cada una de ellas.

Los estudios analizan, por ejemplo, las operaciones de rescate por parte de las Fuerzas de Autodefensa y de otros cuerpos de auxilio en una vasta región de Tōhoku (Nordeste), el papel y la forma de las relaciones interinstitucionales entre distintos niveles de gobierno y organizaciones civiles, el establecimiento de comités especializados para atender las distintas emergencias, los esfuerzos por recuperar vías de comunicación y el alcance de los grupos de voluntarios, entre otras acciones que tomaron los actores involucrados. Por otra parte, se estudian las causas que finalmente condujeron al desastre nuclear, tales como los problemas de coordinación entre los operadores de la planta nuclear y las autoridades, el papel de las estructuras organizacionales y los marcos regulatorios, y la falta de preparación del personal de TEPCO para atender la crisis, entre otras. Además, los análisis ponen en relieve muchos otros matices y la complejidad de las distintas problemáticas que se enfrentaron en aquellos momentos y a lo largo de meses y años. Los estudios también abordan en temas como las políticas para la reconstrucción de viviendas, el restablecimiento del sistema de educación, la cooperación internacional, el papel de los medios de comunicación y las redes sociales, y evalúan las respuestas que hubo que improvisar ante situaciones que no estaban previstas ni por los sistemas de respuesta ni por las leyes.

Una de las conclusiones generales es que, en aquellas áreas donde existían mecanismos listos para actuar en caso de emergencia, los resultados fueron bastante buenos, considerando la magnitud de los desastres. Mientras que, donde hubo falta de preparación, los resultados fueron pobres, y en algunos casos catastróficos. Las experiencias y lecciones analizadas en este libro deben servir para prevenir accidentes y preparar mejor los sistemas de respuesta, no solo de Japón. Una de las lecciones es no dar por hecho ni la seguridad ni la capacidad de respuesta para enfrentar desastres y contingencias.



FIVE YEARS AFTER
Reassessing Japan's Responses to the Earthquake,
Tsunami, and the Nuclear Disaster
Keiichi Tsunekawa, Editor



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Publicación Cuatrimestral

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