

Achieving Carbon Neutrality

Kazuo Ishikawa

CEO, Institute for Industrial Growth and Social Security Policy (IIGSSP)

× Tatsuya Yamada

Division General Manager, Energy Business Administration Division and Business Planning & Management Division, Hitachi, Ltd., Vice President, The Institute of Electrical Engineers of Japan, and Regular Member, The Japan Society of Public Utility Economics

Part 1

Japan's Current Energy Mix and Issues for Achieving Carbon Neutrality

In this series of articles, under the theme of achieving carbon neutrality, we invite experts who are working on energy issues in various fields to engage in a discussion with Tatsuya Yamada—Division General Manager of Hitachi's Energy Business Administration Division, which is working on policy proposals relating to electric power and energy—and introduce trends in each industry. Through these discussions, we consider carbon neutrality from various angles, such as the formulation of a process and vision for achieving carbon neutrality, initiatives aimed at achieving it, and environmental development.

■ Although supply and demand is not tight, it is still risky to rely on thermal power

Yamada: Mr. Ishikawa, I had the pleasure of debating with you at Hitachi Social Innovation Forum (HSIF) 2023, held at Tokyo Big Sight last fall, on the topic of visions for power systems for creating a carbon neutral society. It was a short time, but you made some very interesting points without worrying about anyone's feelings, and it was a great success. Thank you very much for that.

Ishikawa: Yes, there was a lot of excitement from start to finish. (Laughs.)

Yamada: I was particularly impressed by your comments about the need to return Japan's electric power mix—that is

to say, its energy mix—to the state it was in before the (2011 Tohoku) earthquake and tsunami. Another thing you mentioned is the Japanese government's master plan for developing the national power grid based on the premise of further increasing the introduction of renewable energy, and how the amount of 6–7 trillion yen calculated by the government will not be enough to cover the cost. I believe that this is a very important perspective in relation to Japan's energy policy, and I would like to deepen our discussion on these points today.

First of all, as a starting point, please tell us how you view the current situation with regard to energy supply and demand, both in Japan and worldwide.

Ishikawa: Certainly, partly because we have had a warm winter this year, I don't think we will be hearing that the supply

and demand for electricity was tight. Rather than being due to the warm winter, though, I think a bigger factor was the fact that last summer, there was the prospect that thermal power generation—which had not been operating until now—might soon be able to operate. So, there is no problem from a supply and demand perspective. The point is, though, it is costing money. In the case of thermal power generation, as fuel costs continue to soar, subsidies—where the government covers part of electricity bills—have been introduced continually to reduce the burden on households and businesses. What I’m saying is, is it really okay to leave things as they are?

Yamada: As you say, from a stable supply perspective, this year we are experiencing a warm winter, and the government’s forecast is that we will be fine. Of course we don’t know what will happen in the future, but it is unlikely that there will be a request to save electricity like in 2022. In the background, though, households and businesses are also doing their best to save electricity in the face of soaring electricity prices. Electricity bills have risen by around 40% compared to last year, so of course people are trying to save electricity. The increase in solar power generation during the day also seems to be contributing to a stable supply.

Ishikawa: Only, in the case of solar power generation, it is fine during the day, but suddenly stops working in the evening and at night. In the end, it is thermal power generation that covers the supply and demand at night. I have solar panels on the roof of my house, too, so I’m in no position to talk big—but if the amount of solar power increases, then the utilization rate of thermal power will decrease accordingly. If that happens, then the incentive to invest in thermal power



Kazuo Ishikawa

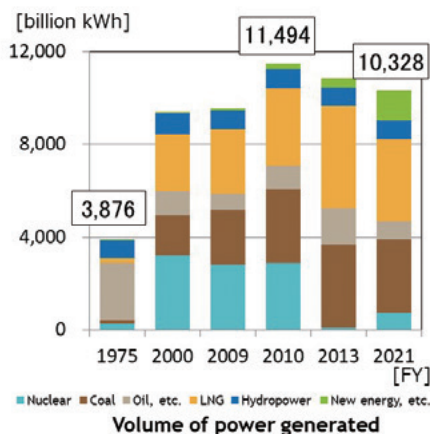
Policy analyst

1965: Born in Fukuoka
 1984–1989: Department of Resource Development Engineering, Faculty of Engineering, The University of Tokyo
 1989–2008: Ministry of International Trade and Industry (Ministry of Economy, Trade and Industry / METI)
 (In charge of electric power and gas market liberalization, renewable energy, environmental assessments, rationalization of domestic coal mining, industrial safety, industrial finance and SME finance, installment sales and credit, reform of the national civil service system, etc.)

(Since his retirement, he has served as a member of the Cabinet Office Council for Regulatory Reform and Council for Administrative Reform work groups, a senior researcher at the Tokyo Foundation for Policy Research, a visiting professor at the National Graduate Institute for Policy Studies, a specially appointed professor at Tokyo Women’s Medical University, and a visiting professor at Senshu University.)
 2011: CEO, Institute for Industrial Growth and Social Security Policy (IIGSSP)
 (Since then, he has served as an officer and advisor to many companies and organizations.)
 September 2020–September 2022: Temporary Expert Advisor, Minister’s Secretariat, Ministry of Economy, Trade and Industry
 April 2021–: Regional Promotion Advisor, Suttu and Kamoenai, Hokkaido
 April 2022–: Presenter, *Canary (Kazuo Ishikawa’s Canary of Crisis)*, BS TV Tokyo

- Currently, he also appears on many other TV, radio, and online programs as a commentator and quiz show respondent.
- His business ventures include brain education for infants, elementary school students, and seniors, and various venture capital investments.
- He is also author of books such as *The Right Way to Stop Nuclear Power Plants (PHP Shinsho)*, etc.

will decrease. In the past, with the fully distributed cost method (rate-of-return regulation) it was possible to recover the cost of capital investment by reflecting it in electricity bills. But with the review of this system and the progress of liberal-



Fiscal year	Constituent ratio					[%]
	1975	2000	2009	2010	2013	
New energy	0.0	0.6	1.1	2.2	3.5	12.8
Hydropower	20.3	9.6	8.3	7.3	7.3	7.5
Coal	3.9	18.4	24.9	27.8	32.9	31.0
LNG	5.3	26.4	29.3	29.0	40.9	34.4
Oil	64.0	10.7	7.1	8.6	14.4	7.4
Nuclear	6.5	34.3	29.3	25.1	0.9	6.9

Changes in Japan’s Power Supply / Energy Mix
 Source: Based on Agency for Natural Resources and Energy (ANRE) statistics

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ization, investment in thermal power has grown weaker. Naturally, old equipment will no longer be maintained, and maintenance and management will become less thorough. So, things may be alright this winter, but in a few more years thermal power may become unsustainable. In other words, there it is possible that there will be a power shortage.

Furthermore, as you mentioned earlier, the progression of power saving efforts means there is a price restraint mechanism at work. Of course, we can say that this is a good thing in that we do not have to pay extra costs. But the downside is that productivity is also declining by that amount. Saving electricity is a good thing in terms of limiting the consumption of fossil fuels, but it also limits productivity, so the economy does not heat up. It would be a problem if corporate activities were to shrink as a result.

■ Nuclear power is the key to electricity prices

Yamada: Yes, you're right. What is your view of trends in the supply and demand for electricity around the world?

Ishikawa: In the EU, energy costs are rising, especially in Germany. But, the situation in the United Kingdom and France—where nuclear power plants are operating—is not as bad as in Germany. Electricity prices increased sharply for while, but this now seems to be calming down, except in Germany.

In Germany, after Russia's invasion of Ukraine, the supply of natural gas from the Nord Stream pipeline—which sends natural gas from Russia to Germany—was suspended. Germany also suspended the approval process for Nord Stream 2, which had already been completed, as a sanction against Russia. This is having quite a lingering effect. In addition, as Germany continue to move away from nuclear power, it can be said that the impact of stopping all nuclear power generation in early 2023 has also been significant. As a result, electricity prices have risen relatively.

However, all countries in Europe—including not only Germany but also the United Kingdom—are connected by international interconnecting grid, and power needs can be mutually accommodated. Electricity generated by thermal power, nuclear power, and renewable energy are all mutually interchangeable. So, even though the price of electricity in Germany is high, I think it is unlikely that there will be a blackout because it is possible to send power and receive power from other countries if necessary. In fact, Germany is also a coal producing country. Despite this, they are choosing not to use



Tatsuya Yamada

Division General Manager, Energy Business Planning & Management Division, Energy Business Division, Hitachi, Ltd.

Vice President, Institute of Electrical Engineers of Japan, and Regular Member, The Japan Society of Public Utility Economics.

Tatsuya Yamada joined Hokuriku Electric Power Company in 1987, and was seconded to The Institute of Energy Economics, Japan in 1998 before joining Hitachi, Ltd in 2002.

He has engaged in tasks involved in the planning of strategies for energy-related businesses, and became Director of the Management Planning Office, the Strategy Planning Division in 2014, Senior Manager of the Business Planning Division, the Energy Solution Business Unit in 2016, General Manager of the Business Planning Division, the New Age Energy Business Co-create Division in 2019, and assumed his present positions in 2020.

it due to decarbonization, and are focusing more on wind power instead, which is causing electricity bills to rise even more. It costs money to keep the current power supply configuration.

On the other hand, after the 2011 Tohoku earthquake and tsunami, Japan stopped all nuclear and relied only on thermal power for a while. Although some nuclear power plants have finally begun to be restarted, there are still very few. I think we need to think carefully about whether it is really okay to leave things as they are.

Yamada: While we can't simply compare our energy (mix) with other countries, there are many things we can learn from them about policy.

■ Japan's major issue in achieving carbon neutrality is cost

Yamada: How do you see the challenges facing Japan from the perspective of achieving a safe and sustainable balance of energy supply and demand, with a view to achieving carbon neutrality?

Ishikawa: One of the most common misconceptions, when talking about carbon neutrality, is that it means not emitting any CO₂ at all. This is not the case. We are also developing CO₂ absorbers—such as with forestry conservation and CO₂ fixation technologies—aiming to offset positive and negative emissions for overall zero emissions. Rather than aiming to phase out fossil fuels entirely, I think it is realistic to work to-

ward low-carbon emissions and CO₂ absorption and fixation as a set. This is because, currently, it is impossible to use no fossil fuels at all. Although there are seasonal fluctuations, around 80–90% of the world’s energy consumption—including transportation—currently depends on fossil fuels, and it is impossible to stop all of that.

In the case of Japan, though, restarting nuclear power plants can significantly reduce fossil fuel consumption. This alone can contribute significantly to creating a low-carbon society. China is the world’s largest CO₂ emitter, followed by the United States. In the case of the United States (North America), however, even though nuclear power accounts for almost 20% and renewable energy accounts for over 20% of the energy mix, CO₂ emissions amount to 4,817,720kt—just over 14% of total global emissions. (Total global emissions: 33,566,428 kt. Source: World Bank Open Data, 2020). Meanwhile, Japan’s CO₂ emissions are less than one-quarter those of the United States (1,014,065kt), so you can imagine how low they would be if Japan restarted (more of) its nuclear power plants. I think the fact that countries such as China and the United States have tremendous energy consumption is significant to begin with.

In the case of China, coal consumption accounts for nearly 60% of the energy mix, so I think that simply replacing this with high-performance Japanese thermal and nuclear power generation technologies will contribute greatly to reducing CO₂ emissions on our planet.

Yamada: Hitachi has transferred most of its thermal power generation business to other companies, but I think there is still great potential to contribute to the reduction of CO₂ emis-

sions around the world through technologies related to nuclear power generation.

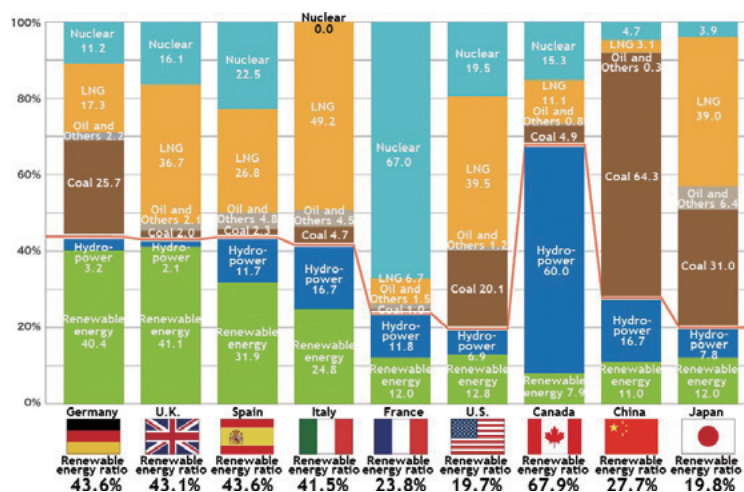
Incidentally, behind the progress of technological innovation in Japan is the history of Japan’s electric power companies and manufacturers teaming up to create high-quality technologies in the Japanese market, as demand grew along with industrial growth. Since it was possible to recover costs through with the fully distributed cost method, it was possible to create increasingly better technologies.

But as price competition intensified due to the liberalization of electric power, it became more difficult to do so. CO₂ absorption and fixation technologies are currently facing a bottleneck due to costs, and although various technologies exist, they are not widely used. Naturally, there are costs at the demonstration (proof-of-concept) stage, so I think the only way to overcome this is to ask the government to support us through subsidies and other means.

Ishikawa: Listed companies have shareholders, so naturally, from a business management perspective they have no choice but to withdraw from businesses where they cannot secure a return on their investment

■ Why we cannot be happy about allowing liberalization to run wild

Ishikawa: With regard to the fully distributed cost method that you just mentioned, there has been criticism that it makes companies too comfortable because it is a form of “rough accounting,” but as you said earlier, there are many positive aspects. Once, when I appeared as a guest on a news pro-



Volumes of electricity generated and percentages of power sources in the amount of electricity generated in major countries (2020)
Source: Agency for Natural Resources and Energy (ANRE), Ten Questions to Get to Know About Energy in Japan Now, February 2023

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gram, a head of local government who appeared with me said that the fully distributed cost method is the culprit. Then when I said, “No, that’s not right. It’s a mechanism to prevent electricity rates from rising,” the whole studio froze.” (Laughs.) As proof of this, electricity rate increases have never been approved for a price increase since 1980. In 1992, it was decided to incorporate fluctuations in fuel prices and exchange rates, but aside from that, neither electric power nor city gas rate increases have been approved. This was possible because electric power companies were able to continue their business—including capital investments—while maintaining their margin within the fully distributed cost method. But when I told the truth on TV like that, they stopped inviting me to appear on that station for a while... (Laughs.)

Yamada: It makes you think, doesn’t it?

Ishikawa: After all, investment is the cornerstone of development. But in the name of liberalization we stopped doing that, because we only saw the bad side—the “rough accounting”—of the fully distributed cost method. Since the liberalization of the electric power market began in 2016, some people may say that electricity prices have actually become cheaper. But they have only become cheaper for the rich. Although the number of options has increased due to the diversification of electricity rate plans, the electricity and gas bills of households on welfare and tax-exempt households have not decreased. Liberalization, in a sense, means that power companies can now choose their customers, as opposed to customers choosing their power companies. At the end of the day, the fact that the percentage burden placed on low-income groups has not decreased means that this policy has failed.

As stipulated in the Electricity Business Act, electric power

utilities are required to protect the interests of electricity users and ensure the safety of the public—that is, to conduct business for the welfare of the public. I think that it is extremely problematic, from the perspective of public welfare, that low-income groups are not benefiting from the liberalization of the electric power market at all. That’s why I’ve been opposed to the complete liberalization of electric power.

Yamada: Partial liberalization has its merits, but there are various issues with complete liberalization, aren’t there.

■ Restarting nuclear power to achieve carbon neutrality

Yamada: What policies and energy mix do you think Japan should aim for to achieve carbon neutrality? As we mentioned last time, Mr. Ishikawa, you were saying that Japan’s energy mix should be returned to the state it was in 2010.

Ishikawa: Yes, and nuclear power plays an important role in that. Firstly, it is essential to properly restart the 33 existing nuclear power plant reactors we already have in Japan. On top of that, the two new reactors that are currently under construction should be completed and put into operation. By the mid-2030s, some of the existing nuclear power plants will probably be decommissioned, so I think by then we should proceed with the development of innovative next-generation reactors incorporating new safety mechanisms.

If it is difficult to gain the understanding of the public to build new plants in Japan at present, I think that it would be better to first build up a track record overseas and then import them back, so to speak. If we can use nuclear power again as our base power supply in this way, I think it will be possible to increase the overall percentage in our energy mix to around



35%. In fact, from the 2000s up until 2010, we actually achieved that kind of ratio. If we can do that, then we should be able to reduce fossil fuels considerably.

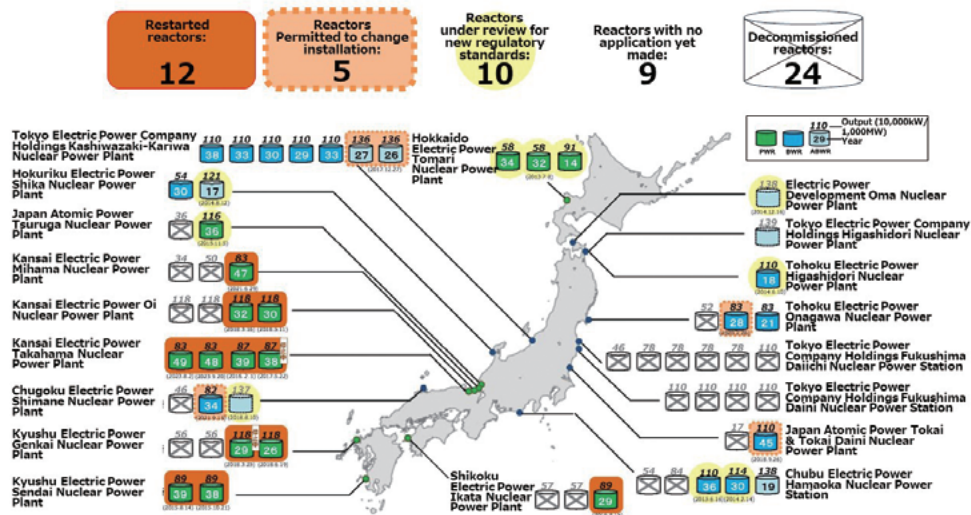
Yamada: So, the idea is that the amount of fossil fuels can be reduced by an increase in nuclear power. With regard to nuclear power, Russia's invasion of Ukraine has left the entire world facing energy security issues, and now Prime Minister Kishida has finally made it clear at the GX Executive Implementation Council that the Japanese government, too, will utilize nuclear power, in a break from its policy since the 2011 Tohoku earthquake and tsunami, and has started to act on it. But I feel that there is still no concrete movement at present. The public offering of the Long-Term Decarbonized Power Supply Auction system to encourage investment in long-term power sources—by promising to purchase 20 years' worth of electric power—could be called a step forward in itself. This system can also be used for nuclear power, but in reality many of the existing power plants have been stopped. With it not even possible to restart the plants at this point, it is unclear whether or not this scheme will lead to new construction...

Ishikawa: That's right. Certainly, it will take time to make use of the new system, so I think we should first restore things to the way they were and restart (the plants). However, I believe that new reforms will be needed to achieve this. After the 2011 Tohoku earthquake and tsunami, in response to the accident at the Fukushima Daiichi Nuclear Power Plant, an organization called the Nuclear Regulation Authority (NRA) was created, and very strict new regulatory standards were

established for restarting plants. There are currently around 12 reactors that have cleared this review and have been able to restart operations. The review process has dragged on, and not a single reactor is yet able to operate in eastern Japan. How should we view this? The restart of Reactor 7 at the Kashiwazaki-Kariwa Nuclear Power Plant—which was scheduled to start operation in October 2023—has also been delayed by the NRA, and the restart has now been postponed to 2024 or later. Despite the government's approval of a rate increase in anticipation of the restart, the postponement of the restart represents yet another betrayal for TEPCO's shareholders. This cools their attitude toward investment.

Yamada: Looking overseas, there are high expectations for nuclear power, as shown by the pledge made at UNFCCC COP28 (28th Conference of the Parties to the United Nations Framework Convention on Climate Change) to triple the world's nuclear capacity by 2050. In particular, I think it will be a boost for the advancement of nuclear power in China and other Asian countries where there is growing demand for electricity.

Ishikawa: Yes, I agree. In particular, the small modular light-water reactor that Hitachi is working on with GE is highly safe and economical, and I think it is a very promising technology that can contribute to the realization of carbon neutrality. It can be installed on a small site area, or can be added to the site of an existing nuclear power plant. Originally there is a need for this technology in Japan, but regulations are still a barrier to the construction of new nuclear plants. I think we need to change this.



Current State of Nuclear Power Plants in Japan

Source: Agency for Natural Resources and Energy (ANRE), State of Nuclear Power Policy, Nuclear Power in Japan

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■ The key to increasing renewable energy is energy storage

Yamada: What are your thoughts on renewable energy in the energy mix?

Ishikawa: I think it would be good to have a total of around 20% domestically generated power. Then we would cover the rest with fossil fuels. In terms of the breakdown, I think that hydroelectric power will stabilize at just under 8%. But even if solar power increases in the future, it will only generate electricity for around 8 hours during the daytime, so the remaining 12 hours will have to be covered by adjustment with thermal power sources. It is therefore necessary to properly introduce a method of recovering the costs of maintaining thermal power generation. The same is true for nuclear energy, and there is a need to establish legislation that allows for the recovery of investment costs. In other words, I think there is a need to reestablish a mechanism for stable investment in nuclear and thermal power generation, rather than the current measures.

As you know, such a mechanism has already been established for renewable energy through the Feed-in Tariff (FIT) scheme for renewable energy. Now that the purchase price has dropped it is not as much of a tasty incentive as it used to be, but at the time of its introduction FIT was a strong incentive, and helped to accelerate investment. But even now, it is still possible to recoup on new investments even with the lower purchase price.

There are often people who say that it is better to abandon FIT—but I think that if we liberalize renewable energy, too, then some companies will go bankrupt right away, and their willingness to invest will decrease. Another 20 years from now, solar panels will deteriorate, and it would be a problem if they were left as they are, right? If there is no similar way to recoup on investments after the expiration of the FIT purchase price period, we may end up seeing environmental damage due to solar panels left unmanaged. There is also a risk of spontaneous combustion, so these panels are potentially dangerous if left as they are.

Yamada: There are many issues to be addressed with regard to renewal energy.

Ishikawa: The first problem is that if we increase the amount of renewable energy, the amount of electricity generated during the day will exceed the amount of demand, meaning

that a large amount of surplus power will be generated. The amount of demand will be exceeded, so—under current conditions—the excess would be discarded. I think that would be a massive waste, so I am hopeful about EV batteries as an alternative to storage cells and gasoline in the future. If EV batteries become more quickly rechargeable and light-weight, then they will become a very good market, and will contribute greatly to humanity. If we can increase the number of local storage batteries, we can store the excess power generated by renewable energy, and sometimes the surplus power generated by nuclear power plants. We can create a stockpile, so to speak. I expect the range of technologies relating to electricity stockpiling and storage to expand.

■ Characteristics and challenges of various types of renewable energy

Yamada: I'd like to take a closer look at renewable energy. What do you think about the roles and percentage ratios for each type?

Ishikawa: Japan already boasts the world's third largest amount of solar power generation, after China and the United States. But it has already become very difficult to build new solar power plants on inexpensive land where there is low demand. Since solar power has become subject to speculative investment due to the FIT scheme, and this has led to environmental destruction, it will be more difficult to build new solar power plants on land in the future.

If perovskite solar cells—which use technology originally developed in Japan and are expected to be the next-generation solar power generation system—achieve more widespread adoption, they will be installed on the roofs, walls, and windows, etc., of existing office buildings, public facilities, and homes. Perovskite solar cells are thin and light-weight, so they can be easily installed anywhere. They can therefore also be used for mega solar installations even after the end of the FIT scheme by attachment to the surface of existing panels. They are currently still in the development stages, but are expected to be put into practical use by around 2028. For reasons such as this, I believe that Japan will continue to be one of the top countries in the world in terms of solar power generation.

Wind power, on the other hand, is difficult to deploy on land. The building we are in now has over 20 floors, but the wind power turbines being built in Europe and China are even taller than this building. Due to noise issues, there are few plac-

es where they can be built on land. There are hopes for offshore wind farms, and the development of one such farm has already begun at Noshiro Port in Akita Prefecture. The utilization rate does not seem bad at all. However, since the wind turbine blades are manufactured in China or Europe, the equipment that converts the energy will use foreign products. In other words, it is necessary to clear the issue of ensuring economic security. It's the same story with solar panels at the moment.

Biomass is essentially waste-to-energy generation, which ultimately means that waste is being used as a fuel for thermal power generation. It is very good to be able to generate electricity by local production for local consumption, since the fuel is available in Japan, but the high cost is a bottleneck. The development of furnaces that can burn any kind of waste is the key. With regard to biomass, though, I am worried that the EU will eventually treat biomass as a form of thermal power generation. In other words, there is a possibility that it will be subject to reduction.

Additionally, the current situation with large-scale hydroelectric power will be maintained, but although small-scale hydroelectric power is covered by FIT, there are few sites where plants can be installed, and the amount is limited. As for geothermal energy, if it is binary power generation that uses surplus hot water in hot spring areas, it will be possible to introduce it on a local production for local consumption basis, but it must be on a small scale. Where new ground has to be dug, the risks are high, and it is not easy to attract investment. If digging is not done well, there will be trouble in coordinating with hot spring areas. Japan is said to be a country that is rich in geothermal resources, but if these resources cannot be used effectively then it is essentially the same as

not having any.

As I have said many times, it is currently thermal power that compensates for the instability of power sources such as solar and wind power. New thermal power stations using oil as a fuel will not be built in the future, so we have no choice but to use and maintain those we already have. The remaining options are natural gas and coal, but natural gas is expensive in terms of procurement costs. Coal has a bad reputation from the perspective of global warming, but Japan's current combustion technologies are at the very highest level, and we will surely continue to use and maintain our coal-fired power plants. After all, remaining oil and natural gas reserves are expected to last for another 50 years, but coal is expected to last for another 130 years. In reality, the amount of these reserves will be much larger, so it would be a waste to simply abandon this technology. I think that maintaining Japan's highly efficient, high-performance technological capabilities will ultimately contribute to a sustainable future for humanity.

In any case, I think it is very important to keep sites and front-line personnel for the maintenance and improvement of coal-fired thermal power generation and natural gas technologies. Germany has stopped its nuclear plants. But if the plant personnel are gone then there will be no one to provide support even if they eventually try to restart them. If there is no one to work these sites, there is nothing that can be done with the facilities alone.

Yamada: In fact, without new design, construction, and operation going on, it is impossible to gain experience. Even if you train in a simulator, it is still only training, so it is still different from gaining real experience in the field. It is very import-



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ant to continue these operations to maintain human resources, technologies, and know-how.

■ Achieving the best energy mix for the system as a whole

Yamada: Listening to what you have said so far, I feel that each type of energy comes with its own characteristics and challenges, and that it is very important to mix them well, considering the best mix ratio, and optimize the system as a whole, including the power grid. But that is also the hardest part.

Ishikawa: Yes, that's right. People often say that, if we go to 100% renewable energy, then we don't need fossil fuels, or we don't need nuclear power. But that's not realistic. The same goes for those who say that with nuclear power we don't need fossil fuels anymore.

When I first joined the Ministry of International Trade and Industry (now the Ministry of Economy, Trade and Industry), I was actually assigned to the Coal Department. So, I was well aware of the advantages of coal. But on the other hand, I didn't think that coal would be enough to cover Japan's energy needs. For one thing, cars don't run on coal. (Laughs) I think we need to make a calm and collected decision on this, and search for the best energy mix.

Yamada: In the case of solar power, too, there is a prospect of increasing it in the future, but it is very difficult to make adjustments, because we don't want to produce too much, and the amount of power generated is unstable to begin with.

Ishikawa: In the future, I think it would be better to store and

use solar power locally, rather than putting it on the grid. In industry parlance, it's called "ironing out the wrinkles" (shiwatori)—but it's not easy to make adjustments for the unstable amounts of power generated by solar and wind power. If it is difficult to funnel solar power from tens of thousands of households onto the grid. It would be more efficient to store all of that electricity in batteries.

Yamada: In order to achieve such a thing as an energy system, the power of political policy is essential. The problem now is that, while the ratio of renewable energy is increasing due to the market mechanism, more and more of it is flowing onto the grid. Naturally, the amount fluctuates greatly because it is renewable energy, but the more the ratio of these power sources increases, the more difficult it will be to control. In other words, from the perspective of stable supply and security of electric power, it is not enough to simply be cheap at that time. Hitachi also has the technology to control this electricity well and contribute to a stable supply, but there are currently no rules, so there is nothing that we can do about it.

Ishikawa: I think it would be a good idea to create a (policy) system and delegate full authority to the transmission divisions of the ten major electric power companies that own the grid. It works best to leave it to people who properly understand the situation on the ground. In addition, policy-making committees should include the companies that are developing these technologies and companies that are operating electric power facilities. It will be more efficient and less likely to cause accidents if the people who create and operate these technologies on the ground take a leading role in determining the rules. I think it is very problematic that is not the case at present.



■ Stabilize power generation business by improving the business environment

Yamada: In that sense, I think it is now more necessary than ever to improve the environment for the power generation business. In other words, even if rules are established for the restart and expansion of nuclear power plants, the technology is in place, and public sentiment follows, I am concerned about whether it will be possible to properly recoup investments as a business. I think that the viewpoint of improving the business environment for stable management of power generation businesses in the liberalized market has not been discussed much so far.

For example, in the future, if we start with cheap power supplies and gradually put incorporate them into the grid at that time, it may become difficult to operate nuclear power plants even if the restart proceeds. Nuclear power is a kind of power supply that is suitable for stable operation at a constant output, but power generation cannot be stopped simply because it is not necessary at that time. I believe that it is essential to have a system that utilizes market mechanisms while also making good use of nuclear power for stable supply.

Ishikawa: I think it is necessary to properly decide—by law—how to improve the business environment, including how to handle nuclear power generation. It is also very important to stand on economic principles. Japan has to rely on nuclear energy because it is a fossil fuel importer. If the US and China can produce natural gas and coal in their territories and territorial waters, there is no need to rush ahead with nuclear energy in terms of price. In Japan’s case, nuclear energy can

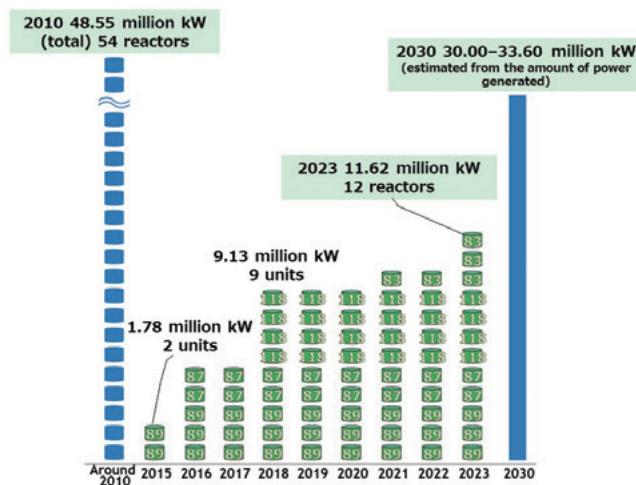
be considered relatively cheaper in terms of security and procurement costs. So, in actual fact, in the Kansai Electric Power and Kyushu Electric Power areas, where nuclear plants have already been restarted and are operating at full capacity, electricity rates are already lower than in other areas.

Yamada: There are many misunderstandings about economic efficiency.

Ishikawa: It is true that there are high hopes for solar and wind power, but as I have said many times, these are unstable power sources that fluctuate, and it is difficult to use them as the main source of power. If you really want to increase renewable energy, you have to be serious enough to put all the electricity obtained from renewable energy sources into storage batteries. Otherwise, I don’t think that things will progress.

Yamada: Currently, pumped-storage hydroelectric power has the highest energy storage capacity. It can cover about the power output of one nuclear reactor.

Ishikawa: As an aside, it was actually pumped-storage hydroelectric power generation that saved us in the electricity supply and demand crunch on March 22, 2022. Due to the earthquake off the coast of Fukushima Prefecture on March 16, the operation of thermal power plants in the Tohoku and Tokyo areas was temporarily suspended, and there were concerns about power outages due to the drop in temperature. But (power companies) were able to overcome the situ-



Power generation capacity of nuclear power plants in operation

Source: Created based on the Sixth Basic Energy Plan, materials from the Agency for Natural Resources and Energy (ANRE), estimated capacity is assumed to be 70% of nuclear power plant capacity utilization rates

Energy Highlights: Listening to Key Persons

ation using pumped-storage hydroelectric power generation. You only realize that spare capacity is important when you don't have any.

Yamada: Also, in order to utilize renewable energy, it is essential to invest in the development of wide-area power grids, which I mentioned at the beginning of this discussion. A scenario has been drawn up in which an investment of 6–7 trillion yen is required to expand the grid, but you think that this is not enough, right?

Ishikawa: It depends on the price of materials, but as you can see from examples such as the Olympics and Expo 2025, I think it will be a certain percentage more than that estimate. Government budgets always have a tendency to be underestimated. (Laughs.) Well, there is an aspect that by keeping estimates low, we can make our policies more flexible. In any case, I believe that it is essential to approach energy policy in a balanced manner, including security and spare capacity, while standing firmly on sound economic principles.

■ The balance between nuclear, thermal, and renewable energy is important

Yamada: In terms of solving energy problems and achieving carbon neutrality, I felt (from our discussion) that it is not enough to simply apply technologies, but that it is also important for us to stand on economic principles and play a major role in policymaking.

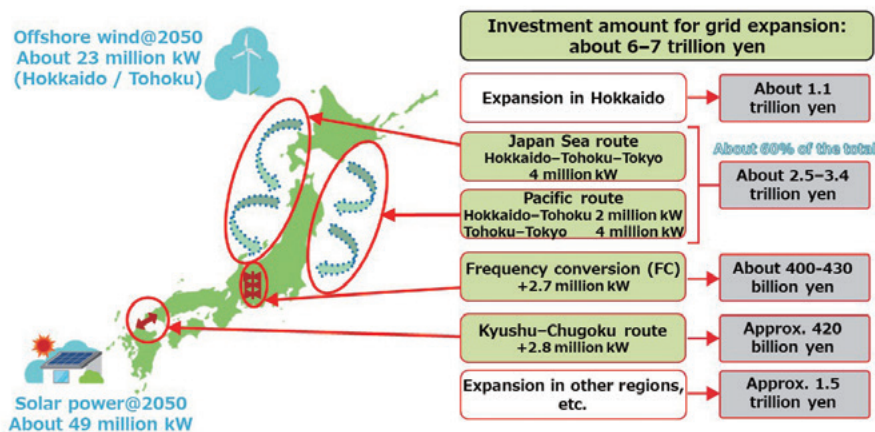
Ishikawa: Well, carbon neutrality is a slogan for promoting both technological innovation and economic growth. Simply reducing CO₂ emissions is not enough to achieve that dream. And if we going to achieve carbon neutrality while standing on economic principles, there are nuclear power plants that are ready to be restarted at any time, so there is no reason not to restart them.

I don't think it's enough to throw it all at the NRA, and it won't work unless the national government and municipalities where these nuclear power plants are located take the lead in getting them restarted. Ultimately, the Prime Minister's decision will be crucial. In fact, it was then Prime Minister Yoshihiko Noda who restarted Reactors 3 and 4 at Oi Nuclear Power Plant in Fukui Prefecture in 2012.

Another complaint I would like to make is that there is a difference between "regulation" and "control." Regulatory bodies are supposed to be the ones that get things moving. Control, on the other hand, is to show that something should not be done, as illustrated by various control laws. That's why I think it's strange that regulations are acting as a hindrance, and that things that should be getting restarted are not.

Yamada: Even if you have good technologies, there are many cases in Japan where you will fall behind in business due to regulations.

Ishikawa: Well, that's because Japan is precedent-oriented, so we don't try to be the first to do anything. In the case of France, they do it because no one else does it. (Laughs) This is a phrase I heard directly from a French person when I was an official. I would like Japan to learn from France.



Long-term outlook for wide-area grid development (base scenario)

Source: Created based on Organization for Cross-regional Coordination of Transmission Operators, Japan (OCCTO) long-term policy for wide-area grid system (master plan for wide-area grid)

Also, Japan tends to be biased toward idealism, but I think we should put cost theory at the forefront. I hope that the Japanese public will support politics that make judgements based on that without ridiculing them. On the other hand, it is the role of politicians to explain the need for nuclear power and persuade the public to go along with it. Japan can only develop through a balanced use of nuclear power, renewable energy, and thermal power generation. I would like as many people as possible to learn that having all three of these working together will make normal life possible.

Yamada: Today, we had a discussion that went right to the heart of energy policy. Thank you for spending time with us today.



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