

The Path to Green Growth - What Strategy Should Japan Adopt?

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Pivoting Between the Stable Supply of Energy and Security

Diverse initiatives are currently underway to establish a carbon neutral society, but a mountain of problems that require innovation lie in the way of achieving it. In the series, Listening to Key Persons, Tatsuya Yamada, a Hitachi, Ltd. official in charge of policy proposals and new business development, asks experts and workers in the field about how they view the current situation surrounding the issues that need to be overcome to build a carbon neutral society and how they are moving toward solutions to them.

In this second part of “Listening to Key Persons” series, we invited Sumiko Takeuchi, who serves as co-representative of U3 Innovations LLC and director at the International Environment and Economy Institute, as an expert in energy and measures to combat global warming. Ms. Takeuchi is active on numerous various expert panels, committees and other bodies related to carbon neutrality, including the Green Innovation Strategy Meeting promoted by the Japanese government, and has been extensively involved in research and advocacy in the field. Mr. Yamada asked Ms. Takeuchi wide-ranging questions about how we can promote green promotion, the strategies for achieving it, and the future roles of energy providers and the energy industry.

■ Energy policy needs to look decades ahead

Yamada: Right now, the stable supply of energy has become an urgent issue in light of sharply rising crude oil prices due to the situation in Ukraine, and the shift away from Russian energy sources. How should Japan tackle this going forward?

Takeuchi: Just the other day (July 27, 2022), the first

meeting of the GX Implementation Council¹ was held at the Prime Minister's Office, and I also took part as a member of the council. I noted that in order to promote GX, it is extremely important that we first rebuild the foundations of stable energy supply and energy security. Due to an uncertain outlook for the demand of electricity, climate change, electricity deregulation and other factors, it has become difficult for energy suppliers to make investment decisions. Since deregulation and policies to expand

renewable energy are being promoted simultaneously, issues such as the rapid shutdown of thermal power generation and prolonged shutdown of nuclear power generation have been neglected, but now those issues have come to the fore, and we have been undeniably ill-prepared to manage those risks.

Over the last dozen or so years, Japan and many other developed countries have pivoted too far towards the environment in the context of energy policy, on the premise that the policy structure of Western countries will continue in a stable fashion. While the environment is extremely important, a major issue to reflect on is how we have neglected to pay attention to stable supply, security and economics. Policies aimed at GX and carbon neutrality are themselves no longer sustainable.

However, GX is a major change that is even greater than the Industrial Revolution, and the transitional period will be longer than most people expect. In other words, initiatives need to be pursued on a timescale of decades. That is something that needs to be kept in mind.

Yamada : As you mentioned, we manufacturers often consider time on the scale of a fiscal year of the three years of a mid-term management plan, but electric power utilities and other energy suppliers consider decade-long capital investments, so they need to think in ten-year increments.

Takeuchi: That's right, and from the perspective of shifting infrastructure, a decade is not far into the future at all, it may as well be tomorrow.

Yamada: The government has declared its Nationally Determined Contribution (NDC) of reducing greenhouse gas emissions by 46% by the year 2030 from their fiscal 2013 level, and the goal of achieving carbon neutrality by 2050, but from the standpoint of electric power companies and other energy suppliers, if they can't see a path forward at this stage, it is going to be hard to achieve.

Takeuchi: The question is whether the power sources in 2030 are already in use now, or are under construction. Electricity accounts for around 30% of all energy, and while there are initiatives on the demand side, the NDCs aim to almost halve reduction of CO₂ emissions, something that has never been seen before.



Sumiko Takeuchi

Director, International Environment and Economy Institute / Specially Appointed Professor (Visiting), Tohoku University / Co-Representative, U3 Innovations LLC

Obtained doctorate (Engineering) from the School of Engineering, The University of Tokyo.

After graduating from the Faculty of Law, Keio University, she mainly worked in the environmental department of Tokyo Electric Power Company before going independent.

She serves as a researcher at several think tanks and is also a member of many policy committees, including the Cabinet Office's Council for Regulatory Reform and GX Implementation Council. She has also long participated in international negotiations on climate change (COP), and continues to take a macro view of environmental and energy policies while making policy proposals that are grounded in reality and field-level insight. In October 2018, she co-founded U3 Innovations LLC with Takeshi Ito. U3 Innovations aims to collaborate with startups to realize Utility 3.0 as a new social system, and tackles its goals in terms of both policy recommendations and business.

Her major publications include "The Truth of Energy Policies" (Published by WEDGE), "Energy Industry in 2050 - Game Change to Utility 3.0" (Published by Nihon Keizai Shimbun), and "Energy Industry Strategy for 2030" (Published by Nihon Keizai Shimbun).

■ What is the role and vision of the GX Implementation Council?

Takeuchi: I think it is commendable that this council was given the name "GX" (green transformation). The aim of carbon neutrality and decarbonization is to reduce CO₂ emissions. But there is no direct line to CO₂ reductions making people feel happier. Undoubtedly we need to remedy the unfairness of the situation where emitters win by ignoring external diseconomies². However, to transition to a sustainable society, I think it is necessary to create added value.

*1 GX Implementation Council

A council tasked with transitioning the economic, social and industrial structure that has been focused on fossil fuels since the Industrial Revolution to one focused on green energy, and considering the measures needed to implement GX across economic and social systems as a whole. The council is chaired by the Prime Minister.

*2 External diseconomies

The situation where disadvantages occurring outside of the economic activity taking place through a market has an adverse impact on individuals or companies. Typical examples are pollution and CO₂ emissions.

Energy Highlights: Listening to Key Persons

I see the creation of added value as the main purpose of GX. Just as DX is not merely about using digital tools but instead seeks to make people happier by improve efficiency with IT, engaging in more productive work, transforming work and consequently giving people more free time to spend with their families, the purpose of GX should be to create a sustainable society in which people can live in happiness. I also mentioned at the GX Implementation Council that the creation of added value should be a focus.

To achieve that, the first thing we need to discuss is the rebuilding of energy, which is currently undergoing a liquefaction under our feet.

I think there are three powers that will propel us towards carbon neutrality.

The first is the power of regulation. Regulations that have coercive force are highly effective. For example, if you make a rule that only cars with odd-numbered license plates can drive on odd-numbered days, it would significantly contribute to lower CO₂ emissions, but would also be inconvenient and reduce productivity. Sometimes ill-conceived regulations can run counter to the efficient allocation of resources. As regulations can be a double-edged sword, we must be careful about using them.

The second is the power of capital. Funding is the lifeblood of society, and as exemplified by ESG investment and divestment by pulling funds away from thermal power generation, it can play a major role in social change. However, if you try to change society through the power of funding in the absence of alternative technologies it can cause distortions. For example, even though there are no

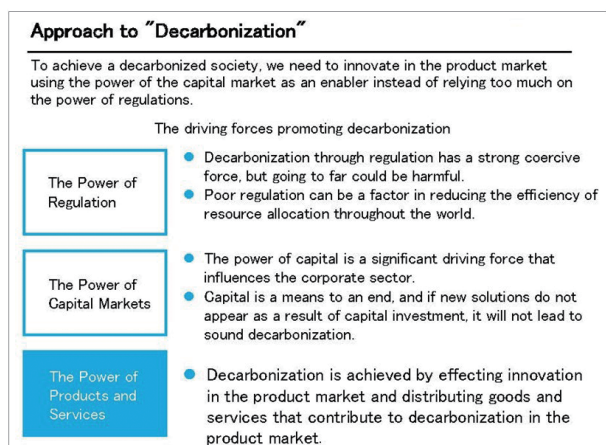


Figure 1: [Approach to Decarbonization]

Source: Materials submitted by U3 Innovations



Tatsuya Yamada

Division General Manager, Energy Business Administration Division and Business Planning & Strategy Division, Hitachi, Ltd.

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.

alternate technologies with which to replace thermal power generation, if you simply pull funds away from that sector, you will only lose the means to produce electricity. If you accept that we cannot lead our lives without electricity, investments in thermal power generation could become risk money, and only have the effect of increasing costs for consumers. It is only when an alternative technology is in place that the way funds are provided becomes meaningful.

Given this, I believe the likely winner in this discussion is the third - the power of products and services. This could also be described as the power of technology, but when you use the word "technology," in Japan it immediately conjures up the image of "technological development," so I express it in terms of products and services. The balance between the environment and the economy will also become possible when we acquire cheap and stable low-carbon energy technologies instead of the energy we use now. Energy is always a means to an end, and CO₂ is the result of our activities. Just as few people decide on what to eat for dinner with concern for the waste it will generate, there are limits to what you can compel people to do even if you tell them to change their behavior with the resultant CO₂ emissions in mind. Instead, we need to create products and services with proper added value whose usage ends up reduces CO₂ emissions.

Yamada: So you mean that differs from technological innovation.

Takeuchi: Yes. It differs from the general impression we have of innovation. We don't need the kinds of technologies that appear in a fictional world like *Doraemon*. The things used in the infrastructure that supports people's lives are technologies that have been well used and verified, have lower costs and are both stable and reliable, and these are goods and services. While we often imagine technological development when we mention innovation, the process of tapping into existing technologies, thoroughly lowering costs and seriously improving convenience and stability are very important.

Yamada: At the first meeting of the GX Implementation Council, it was mentioned that within the year, a schedule for making investments to the tune of 150 trillion yen between the government and private sector over the next decade would be compiled. 20 trillion yen of this funding will come from newly established GX Economic Transition Bonds (provisional name), but how will the remaining 130 trillion yen of investments be invested from the private sector?

Takeuchi: That is a very difficult point, and also it has been raised, discussions about the specifics lay ahead of us. But in any case, with natural gas and other energy prices expected to remain high over the next several years against the backdrop of the situation in Russia and Ukraine, initiatives aimed at carbon neutrality to reduce our dependence on fossil fuels are something we must all do to protect ourselves, companies and households alike. Up to this point, things like ESG investment may have been seen as necessary from a social standpoint, but it is necessary to pursue carbon neutrality as a part of risk management, and in a sense, I think the current crisis will be a major impetus towards GX.

■ Electrification of Demand and Decarbonization of Power Generation as Essential Elements of GX

Yamada: Of course, to create products and services that contribute to GX, energy providers themselves will also need to change, won't they?

Takeuchi: That's right. But I get the impression that until now, discussion has been all about the issues faced by energy providers. GX is a major transformation of society

that will be bigger than the Industrial Revolution, and it is not something that can be accomplished with supply-side transformation alone. As I wrote in my own book^{*3}, GX needs to be tackled by multiplying the electrification of demand by the decarbonization of power generation (the supply side). In other words, we all (individuals and companies on the demand side) need to treat it as our problem as well. I also think that the electrification of demand will be the source of added value and the creation of new industries.

Incidentally, the creation of added value is not an area in which traditional energy providers excel. Instead, the better option might be to work across industry boundaries with new players such as venture companies that are good at creating value. Energy issues cannot be solved through the efforts of the energy industry alone. In fact, the publication of my book led to my speaking with people from a wide range of industries, from automotive and housing to home appliances and retail, so I was able to have conversations that spanned different industries. What I found was that an increasing number of companies are tackling carbon neutrality as their own problem, and transformation is accelerating.

Yamada: Hitachi's energy-related business units are also doing increased business related to renewable energy, and have been fielding more consultations regarding distributed energy sources including the use of hydrogen. Since the sharp rise in energy prices is also having a major impact on household finances, the general public's attitude is also changing.

Takeuchi: And due to those circumstances, the NDCs I mentioned earlier, which are essentially the government's targets, are also being updated. Back in 2017 when I wrote my first book, Japan's target was to reduce greenhouse

*3 Book

Energy Industry in 2050: - Game Change to Utility 3.0, by Sumiko Takeuchi, Takeshi Ito, Hiroshi Okamoto and Naoki Toda (Published by Nihon Keizai Shimbun, 2017) paints a picture of future electric power systems reform in the lead up to 2050, drew a large response from various circles. The sequel, Energy Industry Strategy for 2030, written and edited by Sumiko Takeuchi (Published by Nihon Keizai Shimbun, 2021) focuses on the next ten years and advocates specific measures for achieving a distributed energy-based society in the 2030s.

Energy Highlights: Listening to Key Persons

gas emissions by 80% by the year 2050. Given that, it was estimated that if all cars were made electric, all hot-water units used heat pumps and energy demand was thoroughly electrified, while adopting an energy source configuration of 50% renewable, 20% nuclear and 30% thermal, we could achieve reductions of a whopping 72%. Even with all that, we weren't able to reach 80%. But now that goal has become net-zero emissions, making the hurdles even higher.

However, we must not forget that Japan is a country that could face a serious predicament if it gets its energy policy wrong. Since Japan produces almost no fossil fuels, it would not be able to survive as a country if the procurement of energy resources was disrupted. Japan went through the very painful experience of the oil shock during the 1970s. In response, it stepped up the use of natural gas and increased nuclear power generation to shift away from its reliance on crude oil and Middle East. Japan has also pursued the development of renewable energy and energy conservation through the Sunshine Project⁴ and Moonlight Project⁵. It took a great deal of investment and effort to get where we are now, where we can enjoy our lives while taking it for granted that the lights will be on. If we say that nuclear is not good because it's scary, thermal is bad because it emits CO₂ and renewable energy is a nuisance because of the facilities it requires, we will be pulled in all directions. It is only when everyone understands the need for energy and the role of the transition that we can have constructive discussions about it.



■ The Need to Turn to Nuclear Power Generation Once More

Yamada: As I mentioned before, I asked you about the severe situation in which the Japanese energy environment finds itself. Under these conditions, and in response to the current energy crisis, the government has also begun moves to research nuclear power generation. Opinion polls show that 70% of the public support the restarting of nuclear reactors (polling by Nikkei Shimbun in August 2022).

If we turn our attention to the past, it was nuclear power that stably supported the increase in demand for electric power during Japan's high economic growth period. While renewable energy has great value in terms of being "green," there still remains serious challenges in terms of the burden on power grids and the adjustments that take place. In fact, before the Great East Japan Earthquake, Japan benefitted greatly from nuclear power. Towards achieving carbon neutrality, I think there is a need to reassess the value of

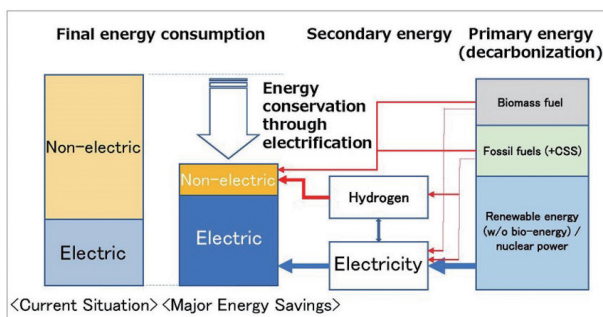


Figure 2: [Energy flow as a prerequisite for achieving zero emissions]

Source: Energy Industry in 2050: - Game Change to Utility 3.0

*4 Sunshine Project

A project to development new energy technologies such as solar power, geothermal, coal and hydrogen launched by the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry in 1974, in response to the first oil shock which had occurred the previous year. The project was later integrated with the Moonlight Project and carried on as the New Sunshine Project (from 1993 onwards), driving the development of technologies related to the global environment in Japan.

*5 Moonlight Project

An R&D project into energy conservation technologies started by the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry in 1978. In addition to new battery systems for storing electric power, the project promoted the development of fuel cell-based power generation, super heat pumps and integrated energy systems, etc.

nuclear power and utilize it, but I am interested in what you think about this.

Takeuchi: Japan's Atomic Energy Basic Act was established in 1955. The fact that Japan strengthened its resolve to utilize nuclear power just ten years after experiencing the horror of having two atomic bombs dropped on its cities speaks to its thirst for the cheap and abundant energy that nuclear power provides. Japan had been forced to launch the Pacific War because it was cut off from procuring oil, and I think Japan resolved that securing energy was essential for its survival. Other countries came to similar conclusions. When France initially pursued the introduction of nuclear power, it reflected the will of its people to leave the fate of the country in the hands of its scientists rather than Middle Eastern countries and their oil fields.

While there was a temporary lull in the development of nuclear power due to stagnating economic growth and power deregulation in Europe and the United States, the need for nuclear power has been reaffirmed due to policies to combat global warming. When the Great East Japan Earthquake struck, I was working at TEPCO, and at the time under the Democratic Party of Japan-led administration, there were national plans to expand nuclear

power as a part of efforts to combat climate change. Back in 2010, the government had set the goal of building 9 new reactors in 10 years, and 14 reactors within 20 years, but there was strong criticism of the plan as unrealistic from among the electric power companies that would be responsible for running those businesses. As you know, it takes a very long time to gain the understanding of local residents regarding the construction of nuclear power facilities. In fact, it took 45 years from the time the resolution was made to invite a company to construct a nuclear power plant until the Higashidori Nuclear Power Plant in Aomori Prefecture was completed.

But we have to stick with the global warming targets the Prime Minister declared at the United Nations. At the time of the earthquake, my job was to prepare a report on a Joint Crediting Mechanism⁶. This is based on the idea that if nuclear power plants were constructed overseas using Japanese nuclear power technologies, it would be necessary to determine how much CO₂ emissions would be

***6 Joint Crediting Mechanism (JCM)**

An initiative to implement projects using Japan's low-carbon technologies with partner countries to help reduce and absorb greenhouse gases, and quantitatively distribute the CO₂ reductions achieved as a result.

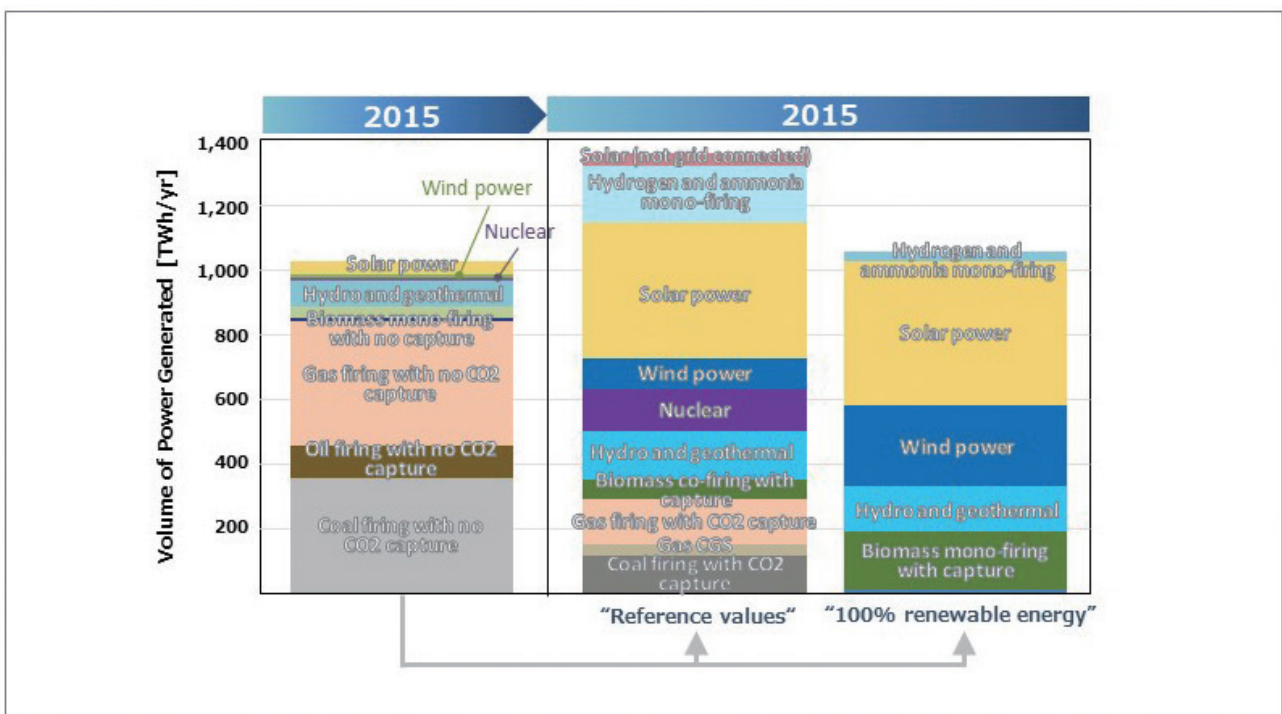


Figure 3: [Power source composition in Japan based on the RITE report: 2015 and 2050]

Source: H-U Tokyo Lab, "Proposal Toward Realizing Energy Systems to Support Society 5.0" (Version 4), March 24, 2022

Energy Highlights: Listening to Key Persons

reduced as a result, and to have as much as half of those reductions assigned to Japan.

Nuclear power efforts that were proceeding along those lines were abandoned all at once in the wake of the accident at the Fukushima nuclear power accident. Of course, since a serious accident of that magnitude had occurred, there was a need for serious reflection and policies had to be revised. However, nuclear energy was introduced in Japan because it was necessary for Japan to survive in the world. Nuclear power is hard work. It's hard work for policy officials, for business operators, and for the local residents near existing or proposed power plant sites. But we did it because it is necessary. A shift away from nuclear power can free us from the risks associated with the use of nuclear power, but on the other hand, that exposes us to the risks of not using nuclear power. I worry that discussion is taking place without adequately conveying those risks of going nuclear-free, and when I realized that someone needs to communicate those things, however reckless the decision may have been, I became an independent researcher.

Yamada: As simulations conducted by the H-U Tokyo Lab has revealed, nuclear power is essential to achieving



carbon neutrality by 2050, and even now we are falling short. There are also concerns about technological transfer with no development of young engineers in the field while nuclear power is paused.

Takeuchi: In the sense of passing on technologies and securing human rights, the timing is quite precarious at the moment. I think we have to face nuclear power once again in order to restart operations.

■ DX and the Design of Schemes Hold the Key to Green Growth

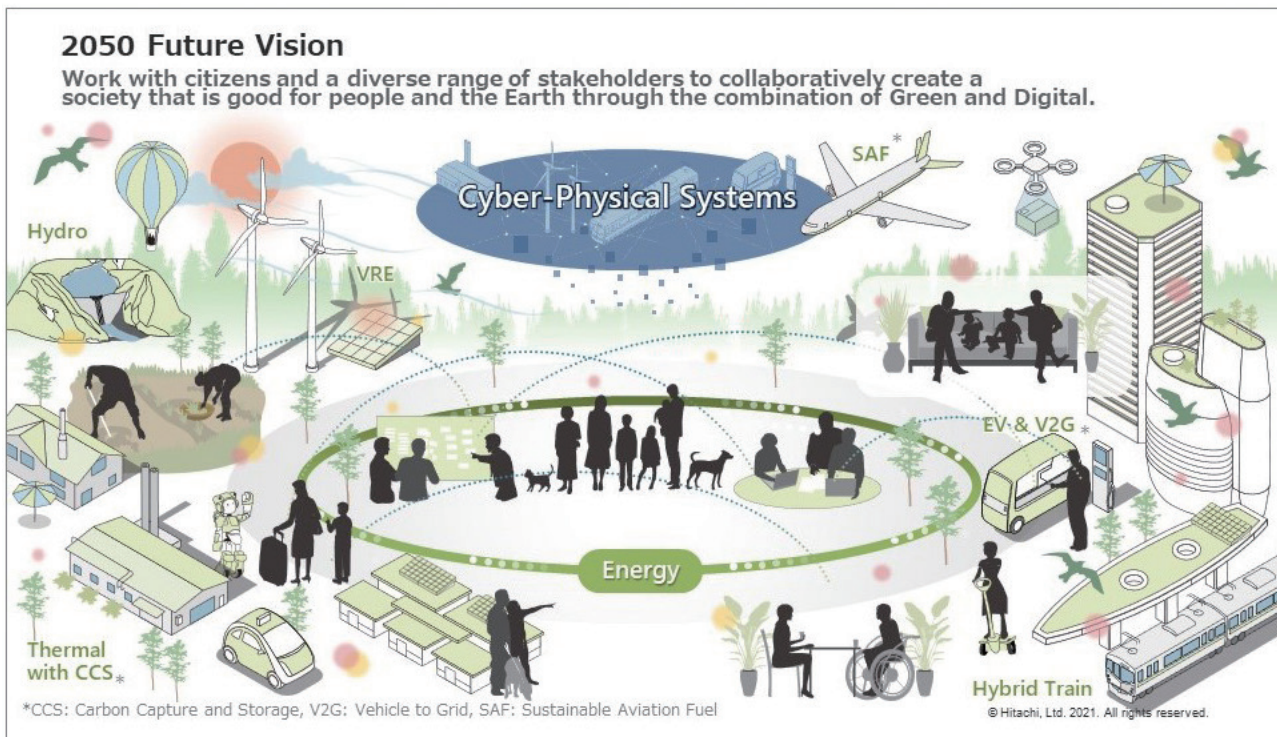


Figure 4: [2050 Future Vision]

Source: Hitachi Social Innovation Forum 2021 JAPAN Expert Session - Energy Systems for Carbon Neutrality and Hitachi's Vision of a Sustainable Future

Takeuchi: However, at the moment it is extremely hard for the energy supply side to make investment decisions. Particularly in the deregulated market, starting up a nuclear power investment project is unfeasible due to financing cost issues. One of the reasons it is difficult to make energy supply-side investment decisions is the uncertainty in the outlook for electricity demand. Electricity demand is proportional to economic growth and population. At the current rate of electrification, electricity demand will fall by 20% by 2050. But if progress is made in the electrification of energy demand as a measure to combat global warming, then more vehicles and hot water systems will be run by electricity, and electricity demand will increase. Although it depends on the intensity of global warming measures, the Research Institute of Innovative Technology for the Earth (RITE) estimates that demand could increase by up to 1.5 times. Depending on the strength of policies implemented, demand could be 0.8 times or 1.5 times of what it is now. That's a gap where the former is roughly half of the latter possibility.

Renewable energy is related to the role of national land use. Land suitable for solar power is limited, and while there are high hopes for offshore wind, wind conditions (its direction, speed and other characteristics) are not as favorable in Japan as Europe. The topography of the seabed is another factor that makes it considerably difficult to reduce costs. Nuclear power is essential for achieving decarbonization, and it is clear that we can't have it both ways in achieving decarbonization and shifting away from nuclear power at the same time.

Yamada: As you say, the paths available to Japan are limited. Perhaps what remains is the combination of digital technology and the energy industry. In the sense of pursuing businesses that could be winning strategies for Japan, I believe it will be necessary to utilize smart meters installed in nearly every household to implement proper energy management and build wide-area network infrastructure. I think utilizing those advancements will enable the development of various services, such as energy conservation programs and demand response mechanisms.

Takeuchi: That is an important thing to point out. To link those services with the decarbonization of power generation, the use of storage batteries and hydrogen will

be essential. The winning factors in those endeavors will be cost and ease of use.

And on the regulatory side, carbon taxes and carbon pricing should be introduced. Those schemes put a price on external diseconomies. However in that case, I think we would need to introduce large-scale carbon taxes after reviewing the existing tax schemes and systems in place, including the feed-in tariff system for renewable energy.

■ The Respective Roles of Energy Providers and Startups

Yamada: As I mentioned before, you were saying that creating added value is an important factor whether GX will be achieved or not, and that new players such as startups are essential.

Takeuchi: I think that there should be a division of roles between energy providers and general electronics manufacturers like Hitachi, who have supported the energy industry for many years, and entities such as venture companies and startups. That's because in the energy sector is a world in which even one mistake out of 100,000 is not tolerated. On the other hand, startups are characterized by their mobility, and by improving accuracy through trial and error, the development of products and services can be sped up. Therefore, there are extremely high hurdles standing in the way of startups entering the energy industry. In even, the public listing of an energy-related startup occurs around once every two or three years.

But to make GX a major revolution that raises people's level of wellbeing, added value must be created, and that means the participation of new players is essential. I think we can create a new industry itself by doing that.

In conjunction with my work to make policy recommendations as a researcher, I founded U3 Innovations LLC to shape a Utility 3.0 world. U3 Innovations, working on a joint basis with LIFULL Co., Ltd., has currently established Off-grid Living Lab Yatsugatake, a facility in Hokuto-city, Yamanashi Prefecture for conducting living demonstration activities towards realizing a completely off-grid living environment, and demonstration testing has been underway since March 2022. We hope to find solutions to climate change and provide alternate means for infrastructure associated with

Energy Highlights: Listening to Key Persons

the decline in regional populations. In terms of specifics, we have built instant homes at the foot of Mt. Yatsugatake and are utilizing a complete water recycling system apart from drinking water, solar power generation, storage batteries and other technologies to identify the issues for off-grid living. Honestly, the elemental technologies are already available. We are packaging all the technologies from the standpoint of supporting daily life, and then refining the operations. That makes it very difficult to create something that is comparable to existing infrastructure in terms of ease of use and cost.

Yamada: That's the kind of forward-thinking challenge that venture companies are known for.

Takeuchi: Yes, it is. As for energy producers, I think they will consider entering the infrastructure market. But it is not possible to enter the infrastructure market with technologies that are still in the process of being hammered out. It is necessary to find a market in which the technology at hand can be refined. For our part, we will start by entering the glamping^{*7} market, and then expand into other markets like holiday homes and disaster preparedness, in order to gradually develop our offerings as goods and services that contribute to distributed energy.



Off-grid Living Lab Yatsugatake
(Hokuto-city, Yamanashi Prefecture)

Yamada: Large corporations including energy providers engage in excessive risk management and are not good at taking on new challenges quickly.

Takeuchi: Indeed. It took only 3-4 months from when we first starting talking with LIFULL to the opening of the demonstration site at Yatsugatake (*laughs*).

However, energy providers still need to be responsible for large and centralized power sources, and we will expand the possibilities of distributed energy sources. This is truly a division of roles. Within that context, what we ask of Hitachi is to break away from a self-sufficient approach and collaborate with startups and other partners. If you are interested, we encourage you to take a bite and get on board. The reliable technologies and trust that has been built up over many years should be used to benefit the development of distributed energy in addition to large-scale centralized energy.

And lastly, I hope that in its capacity as a nuclear power generation manufacturer that contributes to the world, that Hitachi will continue to pass on its technologies while supporting GX.

Yamada: We will keep that in mind. Today we spoke about everything from government policy to the potential for next-generation distributed energy, and I was able to gain all kinds of insight. Thank you for spending time with us today.

*7 Glamping

A portmanteau of "glamorous" and "camping," glamping involves camps that provide hotel-like facilities to free visitors from the hassles of setting up tents and preparing meals.

● This article is published on Hitachi, Ltd.'s energy portal site.

■ (Chapter 1)

https://www.hitachi.com/products/energy/portal/case_studies/case_014.html



■ (Chapter 2)

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