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The Road to Realization of a Carbon-Free Society

On October 26, 2020, Prime Minister Suga declared that Japan would become carbon-neutral by 2050 in his policy speech to Japan's Diet, clarifying his stance in relation to decarbonization. In this issue of *My Vision*, we explore the path towards realization of this goal.

About This Issue

The Many Challenges Towards the Realization of a Carbon-Neutral Society – Sketching Out Scenarios and Responding Steadily Along the Time Axis

Yuri Okina
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Keywords…Carbon-neutral 2050, green growth strategies, COP21 Paris Agreement, SDGs, European Green Deal, responses on the energy supply and demand fronts, technological innovation, reform of industrial structure and social systems, circular economies, scenarios for social transition

Expert Opinions

The Road to Realization of a Carbon-Free Society

What challenges face us in realizing net-zero CO2 emissions by 2050?
Are there paths towards the realization of this goal?

Realize Scenarios based on Decarbonized Thermal Power

Takeo Kikkawa
Professor, Graduate School of International Management, International University of Japan

Keywords…Social implementation of decarbonized thermal power, securing and reducing cost of ammonia, CCS, responses from non-electric power sectors, resource-rich Australia

Fulfillment of Our Responsibility for Decarbonization based on Realistic Approaches

Hisahide Okuda
Corporate Vice President / Managing Executive Officer, Chief Operating Officer, Corporate Strategy Department, JERA Co., Inc.

Keywords…Combination of renewable energy and zero emission thermal power, roadmaps tailored to national and regional circumstances, smooth transitions, power generation using ammonia, offshore wind power

It will be Vital to create Systems that allow Highly Cost-effective Measures to survive

Toshihiro Matsumura
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Keywords…Electrification scenarios, combination of strategies, mechanisms for natural selection of measures that most efficiently achieve net-zero emissions, carbon pricing

Governments Must Strengthen Policies Quickly to Achieve Climate Goals

Keisuke Sadamori
Director, Energy Markets and Security, International Energy Agency (IEA)

Keywords…IEA analysis, coal-intensive industrial sector, fuels used in long-distance transportation, rapid policy deployment throughout the world, pace of "one factory per hour," total mobilization of policy measures

Australia and Japan will enter a New Era of Energy Relations

David Lowe
Minister-Counsellor (Economic), Australian Embassy to Japan

Keywords…Signatories to Paris Agreement, focus on both economy and outcomes, innovation in low-emission technologies, strategic partnership between Australia and Japan, hydrogen strategies, COP26

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Interviewer：Kozue Sekijima（NIRA Research Coordinator, Researcher）

My Vision No.53
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– Sketching Out Scenarios and Responding Steadily Along the Time Axis

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In October 2020, in his policy speech to the Diet, Japan's Prime Minister Yoshihide Suga declared the goal of making Japan carbon neutral by 2050. Following this, the government formulated its "Green Growth Strategy." Prime Minister Suga's declaration was received favorably both within Japan and abroad. A number of trends lie behind this declaration, as discussed below.

First, under the Paris Agreement, reached by the 21st Conference of the Parties to the United Nations Framework Convention on Climate Change in 2015, signatories must "[Hold] the increase in the global average temperature to well below 2°C above pre-industrial levels and [pursue] efforts to limit the temperature increase to 1.5°C above pre-industrial levels." Japan has begun to move toward achieving a balance between greenhouse gas emissions and the use of carbon sinks. In international financial markets, there has been an increasing tendency towards the attempt to fulfill social responsibilities, for example in the fact that numerous institutional investors have recently signed the UN Principles for Responsible Investment (2006), and ESG investment has been expanding. Furthermore, the spread of COVID-19 since 2020 has significantly changed people's values. The awareness of biodiversity and the risk of climate change has increased even at the consumer level, and contributing to the achievement of the SDGs ("Sustainable Development Goals" set with a view towards 2030), adopted at the United Nations General Assembly in 2015, has attracted increased attention.

Europe accelerates decarbonization, the United States returns to the fold. It is now an irreversible movement

Against the background of the spread of COVID-19, the movement to balance the protection of the environment and growth through green recovery (a way of thinking that focuses on rebuilding the economy while controlling climate change) is further accelerating, in particular in Europe. The EU has already set a binding target of achieving a carbon-free society by 2050 in its "European Green Deal" of 2019, and has set this as a growth strategy. In 2020, the EU established the enormous EU Reconstruction Fund in order to further promote the strategy. In Europe, the shift to renewable energy such as solar power, hydropower, and wind power is already underway, but what is accelerating more recently is joint public-private efforts towards the realization of hydrogen energy that also utilizes renewable energy and other energy sources. China has also declared that it will achieve decarbonization by 2060. In addition, Joe Biden, the new President of the United States, has recommitted to the Paris Agreement, which the US left during the Trump administration, and plans to provide significant financial support. In Japan, the achievement of carbon neutrality has been a difficult goal, but the movement towards it is already irreversible. Given this, in this issue of *My Vision*, we asked Japanese and foreign experts with detailed knowledge of these issues how they view the path to achieving carbon neutrality and what challenges face its achievement.

Towards the supplementation of renewable energy by decarbonized thermal power, the electrification of industry and households, and the design of price mechanisms

In relation to Japan's next Energy Basic Plan, which is currently under discussion, Professor Takeo Kikkawa of the International University of Japan tells us that with regard to energy supply, the key to the realization of decarbonization will be whether it is possible to steadily increase the volume of decarbonized thermal power generated by the combustion of ammonia and thus compensate the

fluctuating output of renewable energy, which will become the main power source in the future. In order to achieve this, it will be essential to secure a supply of ammonia and reduce costs. Hisahide Okuda, an executive of JERA, Japan's largest power generation company, believes that this strategy is a realistic approach, and discusses in this issue the necessity for expanding the use of renewable energy while utilizing existing technologies and equipment, at the same time as ensuring a smooth changeover to the use of new technologies in response to technological advances. Although it is difficult to predict the progress of technological innovation in the future, with regard to the Basic Energy Plan, we can indicate the importance of establishing a rational plan for the year 2050, and strategically decarbonizing while modifying multiple scenarios in response to technological innovation.

Professor Toshihiro Matsumura of The University of Tokyo points out the importance of "electrification," a process in which electricity replaces other energy sources on the demand side, concurrent with the implementation of measures on the energy supply side. This will necessitate the promotion of electrification in the industrial and household sectors. Professor Matsumura emphasizes the importance of system design that ensures the natural survival of cost-effective measures in order to advance the utilization of a variety of forms of energy towards the reduction of CO2 emissions. He indicates that in addition to a transition from feed-in tariffs to market-linked prices for renewable energy, the introduction of carbon pricing, in which the entities responsible for carbon emissions bear the costs associated with them, will be the most important policy direction in the future. It might be said that the realization of carbon neutrality is dependent on determining how to design systems of the type suggested by Professor Matsumura at the same time as gaining the understanding of companies.

Mobilize all policy measures in order to achieve the goal

Keisuke Sadamori, Director of Energy Markets and Security for the International Energy Agency (IEA), points out that the number of countries announcing that they will seek to achieve net-zero CO2 emissions by 2050 is increasing together with dramatic declines in the cost of renewable energy, and the movement towards research and development in this area is extremely rapid throughout the world. Looking at these international trends, the fact that it will not be easy for Japan to achieve net-zero emissions without mobilizing all technologies and measures must sound an alarm, and it is necessary in particular to pay attention to Mr. Sadamori's emphasis on the importance of government support for technological development. David Lowe, Minister-Counsellor (Economic) of the Australian Embassy to Japan, tells us that while Australia has not yet declared a specific net-zero emissions target, the nation has a strong commitment to the Paris Agreement, and is steadily making efforts towards decarbonization while maintaining a balance with the national economy. Mr. Lowe anticipates that the cooperative relationship between Australia and Japan, for example in a hydrogen strategy that makes optimal use of the country's resources, will become even more important in the field of new energy in the future. Professor Kikkawa also emphasizes the importance of strengthening cooperation with Australia, a resource-rich country, for Japan's decarbonization. While there are issues regarding carbon border adjustments for each nation involved, it remains the case that Japan will be required to adopt more strategic measures internationally in the future.

We face many challenges in achieving carbon neutrality. It will be extremely important that we respond not only on the energy supply front, but also on the demand side, in the industry, transportation, and household sectors. What will be required is not only a national commitment to technological innovation, but also, in addition to the promotion of changes to the industrial structure and reform of social systems, the offering of attention and support to those affected. Furthermore, the public will be required to change its behavior, looking towards the realization of a circular economy through actions such as the reuse of resources. The government will be required to draw up scenarios for social transition towards carbon neutrality together with local governments and private companies, respond to issues along the time axis, and steadily realize a carbon-free society with the involvement of the public.

Dr. Okina is an Executive Vice President of the Nippon Institute for Research Advancement (NIRA) and the Chairperson of The Japan Research Institute, Limited. She holds a Ph.D. in Economics from Kyoto University. Dr. Okina serves in numerous public positions, including as a member of the Industrial Structure Council of the Ministry of Economy, Trade and Industry.

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Expert Opinions

Realize Scenarios Based on Decarbonized Thermal Power

Takeo Kikkawa
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Prime Minister Suga's announcement on October 26 last year that Japan would seek to achieve net-zero CO2 emissions in 2050 was accepted as possessing a certain degree of persuasive power. This is because JERA, Japan's largest thermal power generation company, had recently declared its vision of "decarbonized thermal power," based on the burning of ammonia. With this, the social implementation of net-zero emissions in the “electric sector” became a realistic possibility at one fell swoop. If decarbonized thermal power can be incorporated in the energy system, there will be significant change in commonsense notions of power generation in Japan.

The issues in the case of decarbonized thermal power are securing a sufficient quantity of ammonia and reducing costs. If ammonia-fired thermal power is realized as indicated, a huge demand for ammonia will develop. The creation of a stable supply chain will be an important turning point in securing an adequate volume of supply. In addition, there are only four carbon dioxide capture and storage (CCS) facilities, by means of which CO2 generated in the ammonia production process would be captured and stored underground, in the world either in operation or planning, and there is also a problem in terms of cost. Furthermore, in Japan, the potential storage area for CO2 recovered by CCS is limited. If Japan were to rely on other countries for storage, the establishment of “bilateral credit,” determining how to allocate the amount of CO2 reduction achieved to one’s own country, would represent a significant hurdle.

In the power source composition of 2050, decarbonized thermal power can be considered to represent about 40% in relation to the main renewable energy. The government estimates that the total of thermal power and nuclear power will be 30 to 40%, but if the use of decarbonized thermal power grows and compensates for the volatility of the output of renewable energy, the use of renewable energy as a main power source will increase, and the proportion of nuclear power may decline. I do not think that this point represents a significant difference of opinion with the government.

On the other hand, the “non-electric sector,” which accounts for 60% of Japan's energy demand, does not even have a long-term outlook. This sector is yet to formulate its responses. While promoting the electrification of automobiles and household energy, the fuels employed will be changed to hydrogen and ammonia. The gas industry will use a technology called “methanation” that produces methane, which is the main component of natural gas, from hydrogen and CO2, and the petroleum industry will use “e-fuel,” a synthetic hydrogen and CO2 fuel, as an alternative to gasoline. In addition, how should we approach hydrogen power generation? These are important shifts towards decarbonization.

Relations with resource-rich countries, especially Australia, will be an important factor in procuring resources, using CCS, and utilizing abundant wind/solar and coal/natural gas resources. Geopolitically, Australia will become a key nation in the distribution of resources in the Indo-Pacific region given the context of the decoupling of the US and China. Cooperation between Japan and Australia will be indispensable in enabling Japan to make its decarbonization scenario a reality.

Professor Kikkawa specializes in Japanese business history and energy industry theory. He has held his current position since 2020, following terms as a Professor in The University of Tokyo’s Institute of Social Science, a Professor in the Hitotsubashi University Graduate School of Commerce and Management, and a Professor in the Tokyo University of Science’s Graduate School of Innovation Studies. Professor Kikkawa studies the Japanese energy industry from a business administration perspective, and has a deep knowledge of energy policy. He has served as a member of councils in the Agency for Natural Resources and Energy of the Ministry of Economy, Trade and Industry, and is a member of the Strategic Policy Committee of the Advisory Committee for Natural Resources and Energy. Professor Kikkawa holds a Ph.D. in Economics (The University of Tokyo).

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Expert Opinions

Fulfillment of Our Responsibility for Decarbonization Based on Realistic Approaches

Hisahide Okuda
Corporate Vice President / Managing Executive Officer, Chief Operating Officer, Corporate Strategy Department, JERA Co., Inc.

JERA, Japan's largest power generation company, has a considerable responsibility for the achievement of zero CO2 emissions. It owns approximately half of Japan's thermal power plants and supplies 30% of the nation's electricity. The company's CO2 emissions represent 10% of total emissions in Japan. Last year, we presented three approaches to the realization of decarbonization by 2050 in order to clarify our stance on this goal.

The first approach is to combine renewable energy with "zero-emission thermal power." Zero-emission thermal power is thermal power generation that does not emit CO2. Because current thermal power generation uses fossil fuels such as coal and natural gas for power generation, it produces CO2. The fuel for power generation will gradually be replaced with ammonia and hydrogen. The second approach is to implement roadmaps that match the circumstances of the specific country or region, such as its stage of economic growth, geographical conditions, and infrastructure status. For example, emerging Asian nations in which electricity demand is growing will find it difficult to accept the European model of 100% renewable energy due to the existence of newly-built coal-fired power generation facilities. The third approach is to achieve smooth transitions according to the technological level. While making the best use of existing equipment and technology, we would rapidly move to the next step as soon as technological development progresses.

The Japanese roadmap offers a path for implementation based on these assumptions. First, technology for co-firing ammonia, which does not emit CO2 during combustion, with fossil fuels will be put into full-scale operation by the latter half of the 2020s. The technology is currently at the demonstration stage, and we will gradually increase the co-firing rate, aiming to generate electricity using only ammonia by 2050. At the same time, this thermal power will be combined with renewable energy. The output of renewable energy is affected by natural conditions such as sunshine and wind, but its supplementation with thermal power will allow a smooth expansion of the use of these energy sources. Even if fossil fuels are replaced with ammonia, it will be possible to use existing assets such as power plants and power transmission lines, enabling the achievement of low-carbonization and decarbonization at an early stage at low cost. Furthermore, we will proceed with the study of "floating" offshore wind power facilities that can be installed at sea even close to Japan. This type is more suited to Japan than the bottom-fixed type that is fixed to the seabed, because the nation has few shallow waters. We will also seek to reduce costs by mass producing equipment.

There is more than one prescription for achieving decarbonization by 2050. Many European businesses are aiming towards operation using 100% renewable energy. However, we believe that the strategy of combined use of renewable energy and thermal technologies is optimal for Japan. This is a realistic scenario, and will certainly reduce CO2 emissions. That is our approach to decarbonization.

Mr. Okuda has led the business strategy behind the Decarbonization Declaration announced by JERA in advance of the government's declaration, including the formulation of "JERA Zero CO2 Emissions 2050." After joining Chubu Electric Power Co., Inc., he served in positions including Manager of the Business Strategy Group, Corporate Strategy Headquarters, Manager of the Alliance Promotion Office, Corporate Headquarters, and Director of the Corporate Strategy Department and Managing Executive Officer for JERA Co., Inc. JERA was established in 2015 via investment by Tokyo Electric Power Co., Inc. (as the company was known at that time) and Chubu Electric Power Co., Inc., and is engaged in energy business in Japan and overseas. Mr. Okuda is one of the key persons on the Chubu Electric Power side who was instrumental in establishing JERA. He is a graduate of the Waseda University Faculty of Political Science and Economics.

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Expert Opinions

It Will Be Vital to Create Systems That Allow Highly Cost-Effective Measures to Survive

Toshihiro Matsumura
Professor, Institute of Social Science, The University of Tokyo

The achievement of net-zero CO2 emissions by 2050 is certainly not merely a pipe dream. The most feasible scenario is the "electrification scenario". What this means is that our source of energy will be changed to electricity to the greatest extent possible, and that electricity will be produced by a zero-emission power source such as renewable energy. In addition to this, power demand that cannot be satisfied by electricity will use sources including zero-emission hydrogen and bioenergy. Carbon capture, storage and utilization (CCSU), a process which recovers the CO2 that is generated and either stores it or utilizes it as a raw material, is also a powerful means of achieving zero emissions. Even if CO2 is still emitted in certain fields, these emissions will be able to be offset by negative emissions produced by activities such as forest conservation and afforestation, the capture of CO2 from the atmosphere, and a combination of zero-emission biopower generation and CCSU, among other approaches. Combinations of these strategies will enable net-zero CO2 emissions to be achieved.

The way to move forward will not be to set out detailed target values for the future electrification rate, power source types, or ratio of renewable energy and other sources. The correct path towards the realization of net-zero emissions will be to create mechanisms by means of which those numerical figures that most efficiently realize net-zero emissions are selected naturally in response to the outcomes of future innovation. It will be essential to create electric power and energy systems in which optimal combinations are naturally selected, by developing mechanisms that allow entities which perform desirable functions such as stably supplying electricity and energy to attract remuneration commensurate with their social value, and in which, in addition, those which can supply this value at low cost survive based on competition. If we decide on specific numbers and continually implement policies that are doomed not to achieve them, it is unclear as to how much the burden on the public will increase. Subsidies and other government support should be provided only to those entities which respond to social values such as external economies, rather than targeting specific power sources, etc. After clarifying the nature of externalities, we should provide fair support to those entities which satisfy them, and thus realize an efficient society through fair competition.

From this perspective, the transition from feed-in tariffs (FIT) to a market-linked approach (feed-in premiums, or FIP) represents a step forward. FIP, which adds a premium unit price (as support from the government) to market prices which fluctuate depending on the social value of electricity, is a system of remuneration that is more commensurate with social value, more transparent, and fairer than FIT.

The most important policy towards the realization of an ultra-low carbon society is "carbon pricing," which makes the entities responsible for carbon emissions bear the social costs associated with emissions. Even if there is strong resistance from various sectors, this is the fundamental requirement for the realization of such a society. We must consider bold reforms for the radical redesign of the energy tax system, such as unifying the existing distorted energy taxes into a carbon tax.

Professor Matsumura specializes in the study of industrial organizations and public economics. He has held his current position since 2008, following terms in positions including Associate Professor in the Department of Social Engineering of the Tokyo Institute of Technology, and Associate Professor in the Institute of Social Science of The University of Tokyo. While analyzing the governing principles of public enterprises in mixed oligopolistic markets and their relationship with regulatory reform, Professor Matsumura also conducts research on energy markets such as the electricity and city gas markets. He is a member of official bodies including the Procurement Price Calculation Committee of the Ministry of Economy, Trade and Industry, the Strategic Policy Committee of the Advisory Committee for Natural Resources and Energy, and the Specialized Meeting for Policy Design of the Electricity and Gas Market Surveillance Commission. Professor Matsumura holds a Ph.D. in economics from The University of Tokyo.

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Expert Opinions

Governments Must Strengthen Policies Quickly to Achieve Climate Goals

Keisuke Sadamori
Director, Energy Markets and Security, International Energy Agency (IEA)

In the eight years since I joined the IEA, policy development has been rapid in the fields of energy and response to climate change throughout the world. An increasing number of countries, including Japan, have set the goal of achieving net-zero CO2 emissions by 2050.

The decarbonization of the electricity sector has become realistic due to the declining cost of renewable energy. However, IEA analysis shows that the existing and announced policies of governments throughout the world are far from the level required in order to achieve the goals of the Paris Agreement. In fact, the COVID-19 crisis led to a 6% decline in CO2 emissions in 2020 compared to the previous year, but CO2 emissions recorded a 2% year-on-year increase in December 2020 as a result of economic recovery. It is particularly difficult to decarbonize sectors other than electricity. These sectors account for 60% of the world's CO2 emissions. No viable methods or technologies for decarbonization have been fully developed for industry sectors such as steelmaking, which uses blast furnaces requiring an enormous amount of coal, and for modes of long-distance transportation such as airplanes and ships, which use oil-based fuels. Half of the emission reductions required to achieve net-zero emissions by 2050 would have to come from technologies that have not yet been commercially deployed.

In addition, if existing elements of energy infrastructure such as factories, buildings, and power plants continue to operate as they have in the past, it would lock in sufficient emissions to cause a temperature rise of 1.65 degrees.

It will be essential for governments to be actively involved in driving technological innovation and ease the risks of research and development for private sector companies. One area for such government support is “Green hydrogen,” which is hydrogen produced by splitting water using renewable electricity. The world's largest factory for the production of green hydrogen is located in Fukushima Prefecture. A production facility of this scale needs to be added every hour until 2050 to reach the volume of low-carbon hydrogen required to achieve the target for 2050. The role of governments will be to establish policies to facilitate deployment of these new technologies in the market. The IEA plans to publish a roadmap for achieving net-zero emissions worldwide by 2050 in May 2021, and will support governments’ efforts to accelerate decarbonization of their economies.

This represents a significant technological challenge, but research and development in this area is progressing at a tremendous pace throughout the world. This should be seen as an opportunity for Japan, which lacks oil and gas resources. Net-zero emissions involve technologies for energy efficiency, renewable energy, CCUS, hydrogen, nuclear power, and technologies for enabling stable supply of electricity. All technologies and measures must be mobilized in order to achieve net zero emissions. We do not have the luxury to choose which one to use.

Mr. Sadamori has held his current position since October 2012. He is responsible for the analysis of energy market trends in areas including oil, gas, coal, electricity, renewable energy and energy efficiency, in addition to energy security. After entering the Ministry of International Trade and Industry (now the Ministry of Economy, Trade and Industry), he held various positions in the Government of Japan, not only in METI but also in the Japanese Embassy to the United States and the Cabinet Secretariat, among others. He served as one of the direct assistants to the Prime Minister when the Great East Japan Earthquake happened, and worked on the response to the Fukushima Daiichi Nuclear Power Plant accident. Mr. Sadamori is a graduate of the Faculty of Law, The University of Tokyo.

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Expert Opinions

Australia and Japan Will Enter a New Era of Energy Relations

David Lowe
Minister-Counsellor (Economic),
Australian Embassy to Japan

Australia is a country at the frontline of climate change, as can be seen for example from the enormous bushfires that occurred last year. The nation's commitment as a signatory to the Paris Agreement is unwavering, and reflecting this agreement, Australia is committed to achieving zero CO2 emissions by the latter half of the 21st century. The issue of energy and CO2 emission reduction is not an ideological one. It will be important to make steady progress balancing both the economy and achieving emissions reduction outcomes. Australia will continue to achieve results despite not having declared a specific net-zero emissions target.

Fossil fuels continue to occupy an important position in Australia's economy, and Australia is focusing its efforts on innovation in low-emissions technologies. In addition to expanding the utilization of existing technologies, we will support the creation of new technologies with a high level of practicality, expandability, and commercial viability. If we can continue to innovate on low-emissions technology over the next 30 years, we can expect great results. In the 15 years from 2005 to last year, Australia has already reduced emissions by a little less than 17 per cent. Our investment in new renewable energy per capita is progressing 10 times faster than the world average.

Australia and Japan have a special strategic partnership in which our nations share fundamental values, and our two nations have deepened cooperation in a diverse range of areas over the course of many decades. In the case of mining and energy, Japanese investment in coal and iron ore in the 1960s and 1970s, and in LNG in the 1980s, contributed significantly to the development of Australia's export industries. Australia provides a stable supply of resources for Japan, and the two countries have an extremely complementary relationship. Building on this, I believe that a new era of energy cooperation between our two nations will soon begin.

Australia has a considerable untapped potential to generate renewable energy, including wind and solar. Furthermore, cooperation between Australia and Japan is already underway to develop technology to utilize the nation's resources. In particular, an increasing number of governments and companies are developing hydrogen strategies, and a project to build a hydrogen energy supply chain from the state of Victoria to Japan is at the demonstration stage. Plans for CO2 capture and storage in Victoria are also underway. In the future, we have great expectations that investment from and offtake agreements with Japan for green hydrogen and green ammonia will grow in prominence.

If you look globally, much of the increase in CO2 emissions from here on will come from China and other emerging and developing nations. Collaboration between Australia and Japan in international discussions such as COP26 this fall will be important in ensuring that these nations become more involved in emission reduction efforts. I believe that Australia-Japan relations will continue to be very important in a variety of ways as we work to achieve decarbonization.

Mr. Lowe has held his current position since January 2019, after serving as a policy economist with Australia's Treasury. He also serves as the representative of the Australian Treasury in Japan. He has also served as an economist at the Department of Foreign Affairs and Trade and the Australian Productivity Commission. Across those roles, he has been involved in areas including tax policy, R&D policy, international economic analysis, medium- to long-term economic and fiscal projections, screening of inbound foreign investment, trade policy, and competition policy. Since first arriving in Japan to study at the age of 17, he has had the desire to become a bridge between Australia and Japan in the areas of both the economy and society. Mr. Lowe holds a bachelor's degree in Economics from Yokohama National University and a master's degree in Economics from the Australian National University.

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