ACTIVITIES 2

Hitachi-UTokyo Laboratory: Third Industry-Academia Collaboration Forum

Toward Realizing Energy Systems to Support Society 5.0

Creating Value by Developing Energy Systems and Sociotechnical Scenarios for Carbon Neutrality in 2050

Awareness of climate change has risen dramatically over recent years amid frequent instances of natural disasters and other abnormal weather events around the world, and with this has come an acceleration of efforts towards achieving carbon neutrality whereby emissions of greenhouse gases are in effect reduced to zero. Japan first announced a policy target of carbon neutrality by 2050 in a general policy speech by Prime Minister Yoshihide Suga in October 2020 and work on achieving this goal is now underway in earnest. Alongside this global trend, Hitachi-UTokyo Laboratory has been engaged in a project exploring future sustainable electricity and energy systems since it was established in 2016, with details of this work being widely published in proposal documents and by holding open forums. The third forum held online in January 2021 presented activity reports on electricity and energy systems and sociotechnical scenarios for achieving carbon neutrality. It also hosted a debate in which a variety of experts participated.

Hitachi-UTokyo Laboratory was established in June 2016 with the objective of forging a vision and creating innovations that can help realize Society 5.0. One of its main activities is the study of electricity and energy systems in which the bulk power system and local communities are in harmony, with the work of this project having been published in two previous proposal documents and through two open forums. Phase Two of the project commenced in April 2020 amid an acceleration in work on achieving carbon neutrality around the world. To address this challenge, an area where Japan has announced its own policy targets, Phase Two is studying sociotechnical scenarios for specific initiatives for getting Japan to where it wants to be in 2050.

The third forum held online in January 2021 included reports on the progress of this work, assessments of the suitability of these scenarios from technical and economic perspectives. It also hosted a debate by collaborative creation

Makoto Gonokami, President, the University of Tokyo

Hiroaki Nakanishi, Chairman, Hitachi, Ltd.

Professor Shinobu Yoshimura, Vice President of the University of Tokyo

Ayumu Morita, Deputy General Manager of Hitachi's Center for Technology Innovation

(co-creation) partners from industry, academia, and government and experts with a wide variety of knowledge, covering topics that included policies and systems and how the value that energy brings to people's lives is changing.

Welcoming Address

Global Debate as Driving Force behind Policy Implementation

The forum had an online audience of about 700 people. It commenced with a welcome from Hitachi-UTokyo Laboratory and from Makoto Gonokami, President of The University of Tokyo, and Hiroaki Nakanishi, Executive Chairman of Hitachi, Ltd., who were the initiators of the project.

President Gonokami commented on the growth in co-creation initiatives involving universities and companies, and how the Hitachi-UTokyo Lab serves as a model for such activities, having been established four and a half years ago as the first of a new program of industry-academia collaborations at the university. He also spoke about the work of the Center for Global Commons at the university that has been set up in response to the increasing interest internationally in carbon neutrality, expressing his hopes that the discussions held at the forum would extend beyond policy proposals and go on to become a driving force for societal reform. Executive Chairman Nakanishi emphasized that awareness of climate change, the global environment, and sustainability was evolving rapidly among corporate managers, commenting that while the targets announced in the general policy speech by Prime Minister Yoshihide Suga are extremely challenging, he looks forward to a wide-ranging and large-scale debate on how Japan can rally together as a nation and contribute to the world by working to achieve these targets.

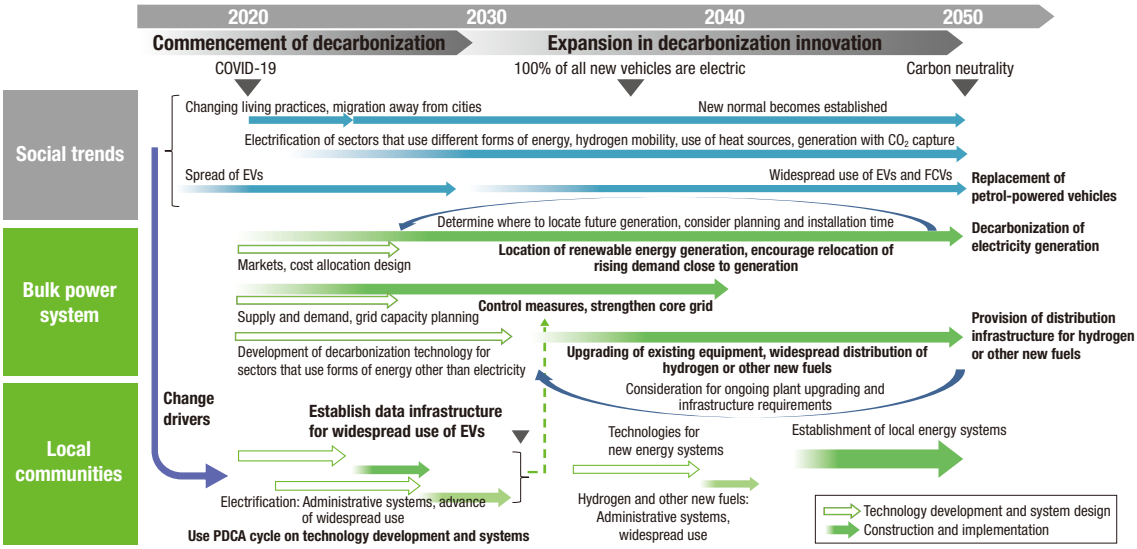
Report on Work by Hitachi-UTokyo Lab on Achieving Carbon Neutrality

The first session of the forum was taken up with activity reports from university and Hitachi laboratory staff that presented the work being done at the Hitachi-UTokyo Laboratory on achieving carbon neutrality in Phase Two of its project on electricity and energy systems in which the bulk power system and local communities are in harmony. The presenters included Professor Shinobu Yoshimura, Vice President of the University of Tokyo and head of the Hitachi-UTokyo Laboratory, and Ayumu Morita, Deputy General Manager, Center for Technology Innovation, Research & Development Group, Hitachi, Ltd., who is the project leader.

Phase Two of the project defines its mission of achieving carbon neutrality in terms of the three layers of social scenarios, systems and policies, and technology, involving a comprehensive investigation by three working groups. Two of these were also included in Phase One, namely the working group on the core cyber-physical systems (CPSs) for energy and another on the development of community CPSs. To these has been added a third group dealing with the formulation of scenarios for creating a society that has net-zero carbon emissions, an important topic when it comes to reforming society from a more all-encompassing perspective.

As various countries are stepping up measures such as carbon neutrality and green growth strategies in response to the worldwide rise over recent years of concern about climate change and other global environmental problems, the prerequisite conditions for thinking about sustainable electricity and energy systems have changed significantly. Achieving the targets will demand a transformation in the

Innovation by Backcasting from 2050



EV: electric vehicle FCV: fuel cell vehicle PDCA: plan, do, check, and act CO_2: carbon dioxide

structure of industry and multifaceted behavioral changes that encompass the general public as well as those sectors and industries that deal with electricity and other forms of energy. In anticipation of these changes coming in the near future, this session of the forum presented work by Hitachi-UTokyo Laboratory on the following four topics.

(1) Scenarios

- Transition scenario in which all sectors of society participate in working toward 2050
- New value in energy systems that takes account of rising diversity in people's values

(2) Bulk power system

- Energy value chains that incorporate international coordination and also allow for hydrogen and other new fuels as well as electricity
- Integrated operation and evaluation platforms for these value chains

(3) Local communities

- Emergence of new players and stakeholders arising from decarbonization and allocation of new value under the specific circumstances of each community
- Consensus, security, and trust to enable data sharing that generates value

(4) Systems and policies

- Development of performance-driven policies to help implement green growth strategies
- International frameworks for carbon pricing or other market-based mechanisms for reducing emissions

While the detailed reports are beyond the scope of this article, the "Toward Realizing Electricity Systems to Support Society 5.0" (third edition) proposal document can be accessed from the Hitachi-UTokyo Laboratory website*.

Panel Discussion (1)

Challenges Ahead for Achieving Carbon Neutrality in 2050

The Hitachi-UTokyo Laboratory activity reports were followed up in the second half of the forum by two panel discussions with invited experts and participants from co-creation partners discussing how carbon neutrality can be achieved.

In the first session, participants from industry, academia, and government who are closely involved in electricity and energy systems came together to share their views on wide-ranging topics. These ranged from what has been happening in the international community and other countries to what is the right energy policy for Japan, implications for business management, private sector initiatives, the required technical innovations, and behavioral change by the public and wider society. The discussion was moderated by Professor Yoshimura and Naohiro Kusumi, General Manager, Center for Technology Innovation – Energy, Research & Development Group, Hitachi, Ltd.

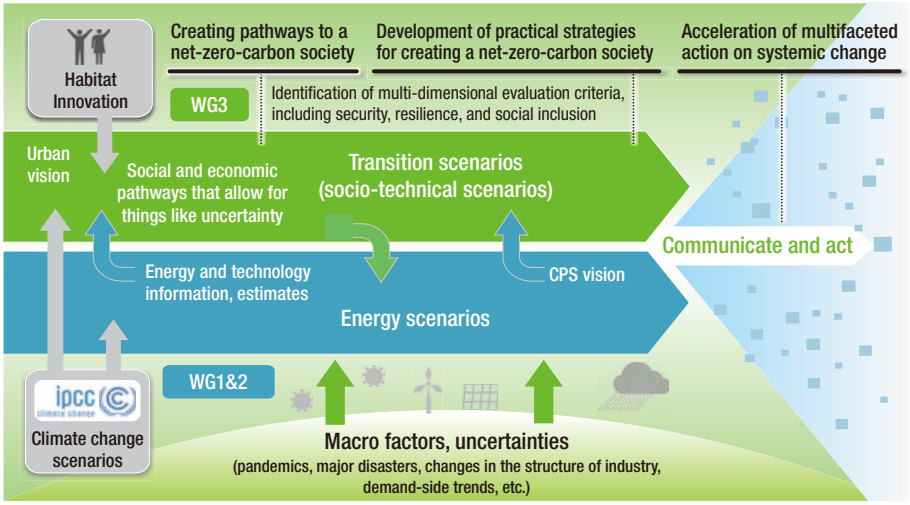
* http://www.ht-lab.ducr.u-tokyo.ac.jp/2020/11/06/news22/ (in Japanese)

The session started with Takashi Sekiya, Director of the Policy Planning Division at the Global Environment Bureau of the Ministry of the Environment, talking about action by government agencies that are expediting work on establishing an organization and legal framework in response to Prime Minister Yoshihide Suga's carbon neutrality declaration in October 2020, also making reference to what other nations have been doing. He made the point that, although the target is for 2050, much is riding on the initial period with the next five to 10 years up to 2030 being crucial to the outcome. Next, Masashi Morimoto, Director of the Office for Electricity Supply Policy at the Electricity and Gas Industry Department of the Agency of Natural Resources and Energy, made the case that innovation is the key to turning this urgent global issue into a source of significant growth rather than becoming a constraint, and that it is essential that the investment needed to achieve this is ongoing. Tokunari Anai, a manager at Tokyo Electric Power Company Holdings, Inc. (appearing on behalf of Hiroshi Okamoto, Vice President of TEPCO Power Grid, Inc.), noted the importance of ongoing investigation without ruling out any options, such as the use of new carbon removal technologies or restructuring demand, given that the 2050 target has been raised from 80% to 100%. He was followed by Toru Yamaji, Executive Vice President and Representative Director of Shimizu Corporation, who talked about urban developments for buildings, neighborhoods, and areas that combine improved resilience, smarter technology, and decarbonization; about projects dealing with energy services, renewable energy, and other new forms of energy; and about the research and development being done on the use of hydrogen. Following from these comments, Tatsuya Yamada, General Manager at the Planning & Strategy Division, Energy Business Administration Division, Hitachi, Ltd. called for breakthroughs in digital technology and the use of data, emphasizing how important it is for a manufacturing business to engage in dialogue and co-creation with a wide variety of stakeholders.

Achieving carbon neutrality in 2050 will require all industries to work toward decarbonization, including the electricity, transportation, industry, and commercial and residential property sectors. Meanwhile, reforming society at the same time as issues such as the regions, depopulation, and aging continue to mount up poses a major challenge that is unprecedented in terms both of technology and of policies and systems, with a consensus having emerged that it will be essential to have a combination of diverse

From top left: Shinobu Yoshimura, Naohiro Kusumi, and Takashi Sekiya.
From middle left: Masashi Morimoto, Tokunari Anai, and Toru Yamaji.
From bottom left: Tatsuya Yamada and Kazuhiko Ogimoto.

Scenario Development by Hitachi-UTokyo Laboratory



WG: working group CPS: cyber-physical system

technologies and ongoing co-creation bringing in government, finance, industry, and other sectors. Project Professor Kazuhiko Ogimoto of the Institute of Industrial Science, the University of Tokyo commented that, if we are to maintain a virtuous cycle of investment, positive outcomes, and reinvestment over an extended 30-year period then we will need to continue making good choices, and it is vital that we have the flexibility to act quickly to correct any mistakes made along the way.

Finally, Professor Yoshimura summed up by saying that "We are at an important phase for getting different people to share a common vision so that society as a whole can take up the challenge. How can such a shared vision be put into practice? I hope that today's discussions can help achieve this cooperative endeavor."

Panel Discussion (2)

Society 5.0 Energy Systems and New Value

The second session sought to reset the transition to carbon neutrality in a wider social context, discussing the new value that would be required for future energy systems with a focus on topics such as the changing lifestyles of urban residents and how city people can participate on the basis of data; supply chain decarbonization and changes to the structure of industry against a background of changes in finance; and how to go about promoting social acceptance and decision making in relation to energy. The moderators were Professor Hideaki Shiroyama, Vice Director of Institute for Future Initiatives, the University of Tokyo and Tomoko Suzuki, Corporate Chief Scientist, Research & Development Group, Hitachi, Ltd.

The discussion started by introducing the panelists who were from a wide range of fields relevant to the future of energy. The first was the architect Yuji Yoshimura, a Project Associate Professor at the Research Center for Advanced Science and Technology, the University of Tokyo, who noted the importance of consensus-building to the operation of cities and used the example of a leading-edge project in Barcelona, Spain intended to expand pedestrian spaces to promote the new possibilities of participatory, bottom-up urban development based on use of data. He was followed by Kae Takase, a Senior Manager at CDP Worldwide-Japan, an organization whose activities include rating the performance of companies on societal challenges such as climate change. She talked about recent investment trends that prioritize long-term profitability amid the rising incidence of abnormal weather events and other disasters, emphasizing that carbon neutrality will be a prerequisite for doing business globally.

Yosuke Kiminami, President and CEO of Renova Inc., a company that develops and operates renewable energy power plants, described how the renewable energy business is deeply rooted in the regions and that having a positive relationship with local communities is a prerequisite, noting that the business environment is rapidly being put in place in response to the international trend toward concern for sustainability. Next, Mikio Matsumoto, Expert Leader,

From top left: Hideaki Shiroyama, Tomoko Suzuki, and Yuji Yoshimura.
From bottom left: Kae Takase, Yosuke Kiminami, and Mikio Matsumoto

Electric Vehicle System Laboratory, Research Center, Nissan Motor Co., Ltd. raised a number of specific points, including the changing role of mobility and how this sets the scene for electric vehicles (EVs) becoming part of the social infrastructure, their integration into the electricity system, and prospects for use of digital technologies.

From this point, the panelists moved on to address the subjects of urbanization, finance and the supply chain, and building consensus in the community and social decision making. The core of the discussion revolved around the consensus-building process of reaching a common understanding with a diverse range of people and working with them to achieve structural change, with hope being placed on the role of technologies such as big data analytics and digital techniques for visualizing the issues. In the global debate, meanwhile, transparency is seen as the top priority, with the opinion being expressed that awareness-raising rooted in the community is essential if everyone is to see it as something that involves them personally.

Summing up this wide-ranging debate, Professor Shiroyama concluded with a call for ongoing discussion on how to design processes for deciding how to proceed that feature participation by local residents, including continued work on new initiatives through trial and error.

Closing Address

Challenge of Innovation Starts Now

The four-and-a-half-hour program concluded with a message from Teruo Fujii, Executive Vice President of the University of Tokyo, that was given on his behalf by Professor Yoshimura due to the former being unavailable. This was followed by closing remarks from Norihiro Suzuki, Vice President and Executive Officer, Chief Technology Officer, and General Manager of the Research & Development Group at Hitachi, Ltd., who expressed his hope that, inspired by today's discussions, companies and universities will pool their strengths to accelerate work on carbon neutrality innovations that can contribute globally, also deepening their coordination and co-creation efforts with government and the community.

Achieving the lofty goal of carbon neutrality will require the relentless pursuit of innovation, transcending the thinking and structures of the past, with all sectors of society coming together to contribute their collective wisdom and enthusiasm. Essential to this will be venues for debating visions of the future that can foster widespread awareness and understanding of the challenges. Hitachi is using the discussions and proposals from Hitachi-UTokyo Laboratory as a catalyst to lead societal reforms directed toward carbon neutrality.

Norihiro Suzuki, Vice President and Executive Officer at Hitachi, Ltd.