

H-UTokyo Lab.

**H-UTokyo Lab. 5th Industry-Academia Collaboration Forum
Toward Realizing of Energy Systems to Support Society 5.0**

Overview of Initiatives and Proposals by Hitachi-UTokyo Laboratory

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25 January 2023

1. Hitachi-UTokyo Laboratory Initiatives

Taking on the challenge in energy and urban development



- ◆ Creating the vision for the realization of Society 5.0 (Super Smart Society).
- ◆ Dissemination of models for solving social issues for the post-COVID-19 era (Technology development, policy recommendations).

[Hitachi's strengths] Build-up of advanced infrastructure technologies (Smart city business, etc.), OTxIT technologies.
 [UTokyo's strengths] Advanced research, humanities knowledge, diverse fields of research and demonstration, and policy collaborations with the national and local governments.

Jun 2016 - Theme: "Urban Development"

Nov 2016 - Theme: "Energy Systems"



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Habitat Innovation PJ

Building of data-driven, people-centric smart cities

- 【Ph1】**
 Vision dissemination in Japan and start of system development**【Ph2】**
- Implementation/Scaling (Kashiwanoha, Matsuyama)
 - Global dissemination

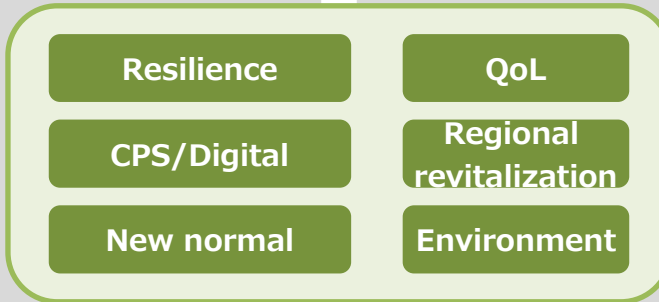
Joint research, forums, books

Energy PJ

Construction of a total energy system for the realization of a net-zero society

- 【Ph1】**
 Recommendations for next-generation grid systems
- 【Ph2】**
- Overall energy system design including non-electricity sources
 - Scenario planning
 - Global presence

Forums, recommendations



University of Tokyo

- Driving the economy through creation of new industries.
- Creation of new business models.

- ◆ Building of knowledge-based social system.
- ◆ Establishment of infrastructure for real-time data utilization.

- Fostering and utilizing the diverse knowledge and human resources of the university
- Generation of new academic research

1. Hitachi-UTokyo Laboratory Initiatives

Energy PJ: Summary of Phase 1 Activities (June 2016 to March 2020)



Hitachi-UTokyo Lab contributed in revitalization of discussions on future energy systems.

Hitachi-UTokyo Lab Proposed Vision

- ✓ 地域社会と基幹システムは、共存を前提として再構築
- ✓ 急増する分散リソースを統合する協調メカニズムの確立

社会全体の3E+Sを最適化



Initiatives at various agencies in Japan (example)

Revitalization of future-oriented discussions in various places toward the construction of the future vision for the energy system.

Global dissemination

- G20 Ministerial Meeting on Energy Transition and Global Environment for Sustainable Growth (Jun 2019) etc.

Ministry of Economy, Trade and Industry (METI)

- Round Table for Studying Energy Situations (Aug 2017-).
- Research Group on New Power Platforms Utilizing Next-Generation Technologies (Oct 2018 -). etc.

Articulation of the need to build assessment tools and share data

Refer to the "Energy Supply Resilience Act*" at the study stage

Japan Business Federation

- Rebuilding the energy system supporting Japan (Apr 2019) etc.

*エネルギー供給強靱化法：20年6月成立。制度詳細設計し22年4月以降で順次施行

1. Hitachi-UTokyo Laboratory Initiatives

Discussions with stakeholders (Initiatives for pioneering and original Open Innovation)



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Exploring the directions for next-generation systems through discussions with various stakeholders.

Workshops (Closed)

1st (Sep 19, 2017)	2nd (Oct 1, 2018)	3rd (Nov 18, 2019)	4th (Sep 10, 2021)	5th (Sep 22, 2022)
No. of participants: ca. 50 ANRE, electric power companies, CRIEPI, OCCTO, IEA, etc. 	No. of participants: ca. 80 ANRE, CRIEPI, MOE, electric power companies, OCCTO, JWPA, gas companies, manufacturers, etc. 	No. of participants: ca. 80 ANRE, MOE, electric power companies, CRIEPI, OCCTO, JWPA, transportation companies, new electric power companies, local governments, etc. 	No. of participants: ca. 100 ANRE, MOE, electric power companies, CRIEPI, OCCTO, transportation companies, local governments, etc. 	No. of participants: ca. 100 ANRE, MOE, MAFF, Keidanren, electric power companies, OCCTO, retailers, manufacturers, etc. 

Forums (Open)

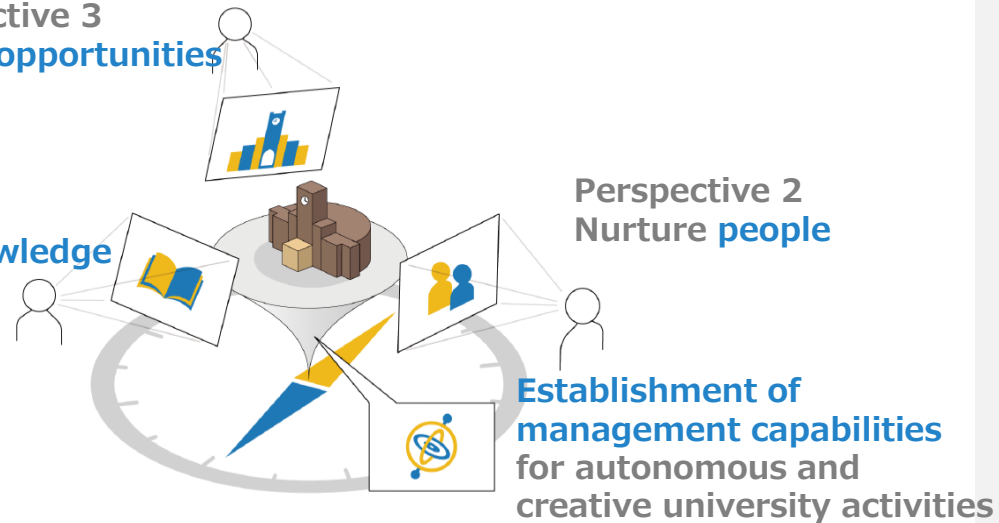
1st (Apr 18, 2018)	2nd (Apr 17, 2019)	3rd (Jan 18, 2021)	4th (Dec 1, 2021)	5th (Jan 25, 2023)
Ito Hall, No. of participants: ca. 400 ANRE, CRIEPI, electric power companies, OCCTO, Mitsui Fudosan, CIGRE, etc.  Publication of Proposal (Ver. 1)	Yasuda Auditorium, No. of participants: ca. 700 ANRE, MOE, electric power companies, CRIEPI, OCCTO, Sekisui House, JWPA, JR East, MIT, etc.  Publication of Proposal (Ver. 2)	Online, No. of participants: ca. 700 ANRE, MOE, electric power companies, Shimizu Corporation, Nissan, Renova, CPD Japan, etc.  Publication of Proposal (Ver. 3)	Online, No. of participants: ca. 600 ANRE, electric power companies, MUFG Bank, Nissan, Nippon Steel, Local Energy, NIES, etc.  Publication of Proposal (Ver. 4)	Yasuda Auditorium + online hybrid event No. of registrants: ca. 800 Publication of Proposal (Ver. 5) (Plan)

UTokyo Compass: Directions to aim for

Perspective 3
Create **opportunities**

Perspective 1
Ascertain **knowledge**

Perspective 2
Nurture **people**



New university model



Green transformation



Digital transformation



Education



Research



Diversity & Inclusion



Co-creation with society

ETI-CGC

Energy Transition Initiative - Center for Global Commons

1. **Protect the sustainability of the global environment, which is the Global Commons.** To this end, **draw up a pathway** to reduce Japan's greenhouse gas emissions to net zero by 2050.
2. **Based on the knowledge and scientific insights** from around the world and Japan, **seek pathways tailored to local circumstances to achieve carbon neutrality and to realize happiness and prosperity.**
3. Aim to make this pathway **a useful model for countries faced with diverse regional situations** and contribute to carbon neutrality worldwide.
4. Consider the process of realizing the pathway as **an opportunity to change** Japan's industrial structure, socio-economic system, and behavioral patterns for the future, and discuss how to leverage this opportunity.
5. **Exercise leadership** to widely promote discussions in Japan by making relevant policy proposals.



3. Hitachi-UTokyo Laboratory Initiatives

Phase 2 (April 2020-) Mission content

Social scenarios

WG3 Formulation of scenarios towards realizing a carbon neutral society



- Society 5.0 that incorporates the reduction of environmental and energy burdens.
- Identify and propose a variety of options that contribute to the realization of a carbon neutral society.
- Based on changes in the social and industrial structure and the impact of COVID-19, develop indicators to evaluate the degree of achievement and contribution.

Systems and policies

WG1 Bulk Energy CPS Construction



From the perspective of the environment and energy security, create a vision for the entire energy system, including electricity, hydrogen utilization, and carbon cycling.

- (1) Role and ideal form of bulk power systems in a carbon-neutral society.
- (2) Issues and measures in the electricity and non-electricity sectors.
- (3) Industrial development through collaboration and sector coupling between the two sectors.
- (4) Innovative technologies and their evaluation.
- (5) Systems and policies for realization.

WG2 Local Community CPS Construction



Study urban and rural energy systems based on QoL improvement, environment, regional revitalization, sector coupling, resilience, etc.

- (1) Role and diversity of local communities in a carbon-neutral, people-centered society.
- (2) Issues and measures in the electricity and non-electricity sectors.
- (3) Community and regional revitalization through co-creation in the electricity and non-electricity sectors.
- (4) Innovative technologies and their evaluation.
- (5) Systems and policies for realization.

Technologies

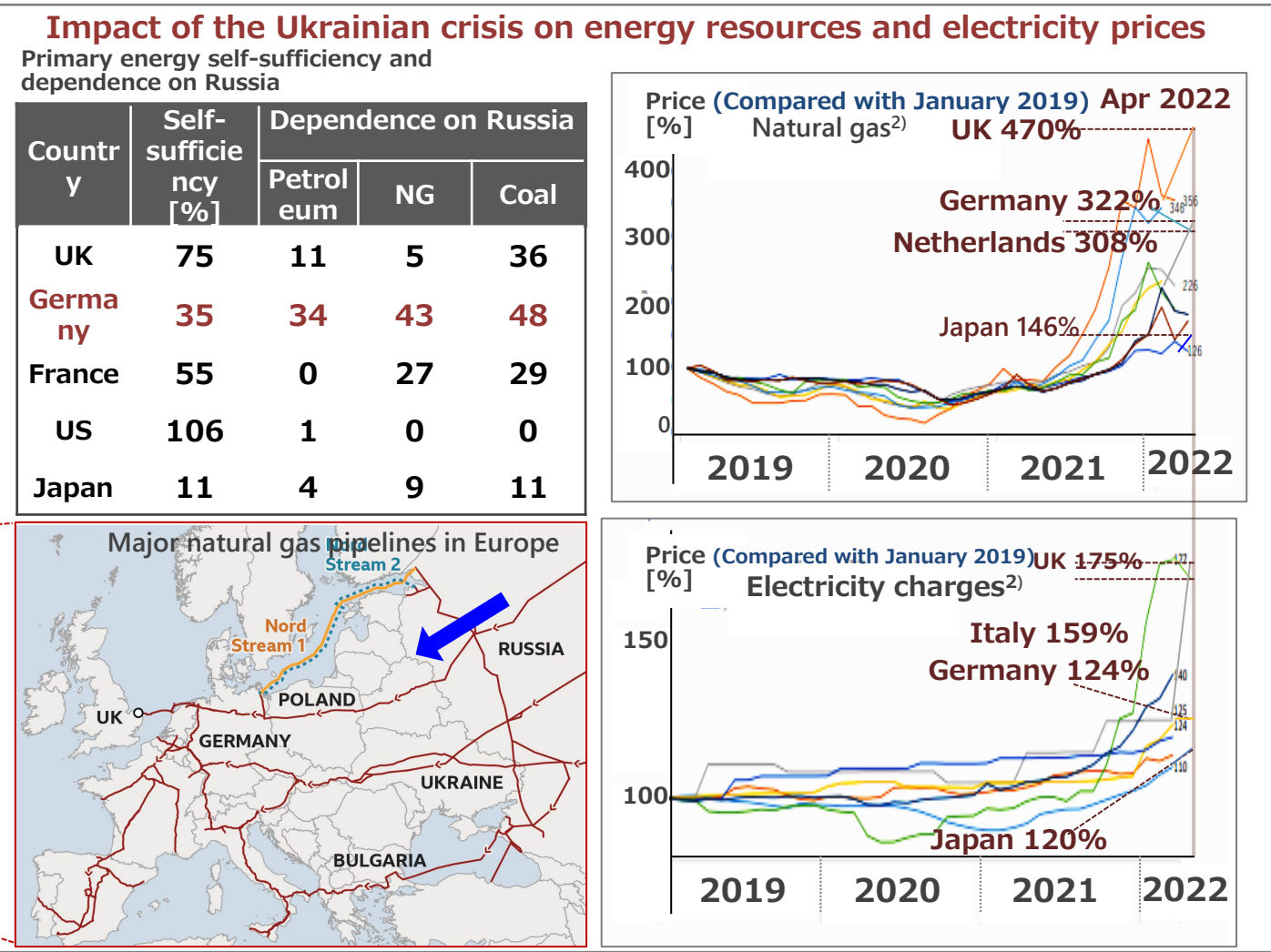
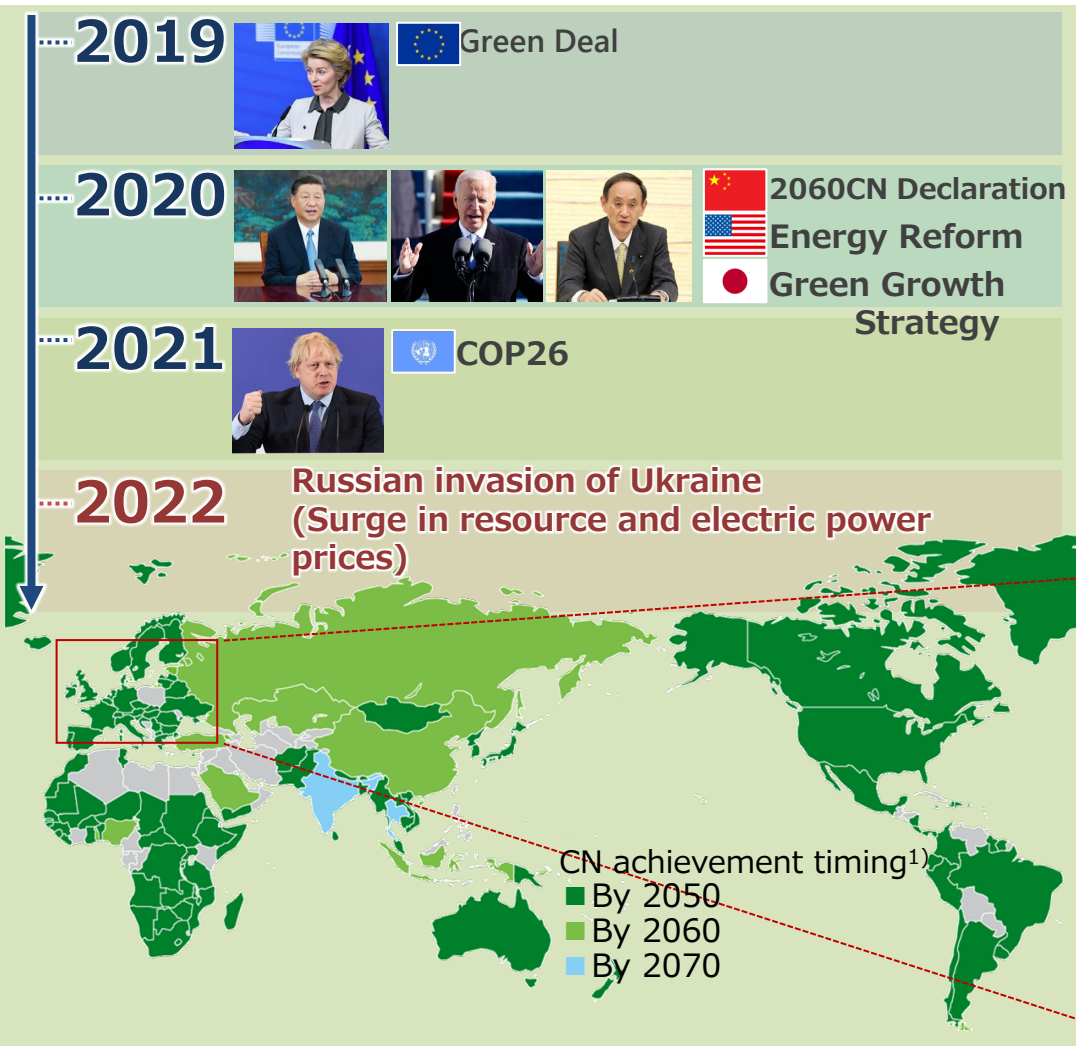
3. Hitachi-UTokyo Laboratory Initiatives

Phase 2 (Apr 2020-) Organizational structure

WG	Mission	Organizational structure (Underlined: Leader)	
		The University of Tokyo	Hitachi
Coordinator		Shinobu Yoshimura (Vice President, Professor of Graduate School of Engineering)	Hideyuki Matsuoka (RDG, CER, Supervising Researcher)
WG0 Overall		Shinobu Yoshimura (Vice President, Professor of Graduate School of Engineering) Ichiro Sakata (Special Advisor to the President, Professor of Graduate School of Engineering) Hiroshi Esaki (Professor of Graduate School of Information Science and Technology)	Naohiro Kusumi (RDG, CSU, Department Manager) Atsushi Baba (RDG, ERL, General Manager) Tatsuya Yamada (EBA Division, SPD, Division Manager) Yasuhiro Ohata (EBA Division, SPD, Manager) Yasuo Sato (CSPD, ESD, Chief Engineer)
WG1 Bulk Power System CPS Construction	Based on a national perspective on the environment and energy security, examine the approach for the entire energy system in light of future technologies for hydrogen utilization, carbon cycling, etc.	Akihiko Yokoyama (Professor Emeritus) Hiroshi Ohashi (Vice President, Professor of GraSPP and Economics) Yasumasa Fujii (Professor of Graduate School of Engineering) Ryoichi Komiyama (Professor of Graduate School of Engineering)	Masahiro Watanabe (RDG, SRL, Chief Researcher) Akira Hibara (EBA Division, SPD, Manager) Naoki Yoshimoto (RDG, ERL, Senior Researcher) Ayumi Watanabe (RDG, ERL, Researcher) Yasuhiro Ohata (EBA Division, SPD, Manager)
WG2 Local Community CPS Construction	Examine the approach for energy systems in cities and rural areas based on keywords such as QoL improvement, environment, regional revitalization and self-reliance, sector coupling, and resilience.	Kazuhiko Ogimoto (Project Professor of Institute of Industrial Science) Yumiko Iwafune (Project Professor of Institute of Industrial Science) Jumpei Baba (Professor of Graduate School of Frontier Sciences) Kenji Takana (Associate Professor of Graduate School of Engineering)	Tomomichi Ito (RDG, ERL, Chief Researcher) Tsutomu Kawamura (RDG, SRL, Senior Researcher) Kunihiko Tsunedomi (RDG, SRL, Senior Researcher) Tomoyuki Hatakeyama (RDG, ERL, Senior Researcher) Yasuo Sato (CSPD, ESD, Chief Engineer) Naoki Yoshimoto (RDG, ERL, Senior Researcher)
WG3 Carbon-neutral Society Scenarios	Formulate vision and scenarios for Society 5.0 that incorporates the reduction of environmental and energy burdens.	Hideaki Shiroyama (Professor of Graduate School of Public Policy) Hisashi Yoshikawa (Project Professor of GraSPP) Masahiro Sugiyama (Associate Professor of Institute for Future Initiatives) Kensuke Yamaguchi (Project Assistant Professor of GraSPP) Chen Yi Chun (Project Researcher of Institute for Future Initiatives)	Tomoko Suzuki (RDG, Corporate Chief, CSU, PBPJ Leader) Hidehiro Iizuka (RDG, CSU, PBPJ Sub leader) Takashi Fukumoto (RDG, CSU, PBPJ Sub leader) Koji Sasaki (RDG, CSU, PBPJ Senior Researcher) Yukihide Inagaki (RDG, CSU, PBPJ Senior Researcher)

3. Changes in Social Conditions Following the Invasion of Ukraine

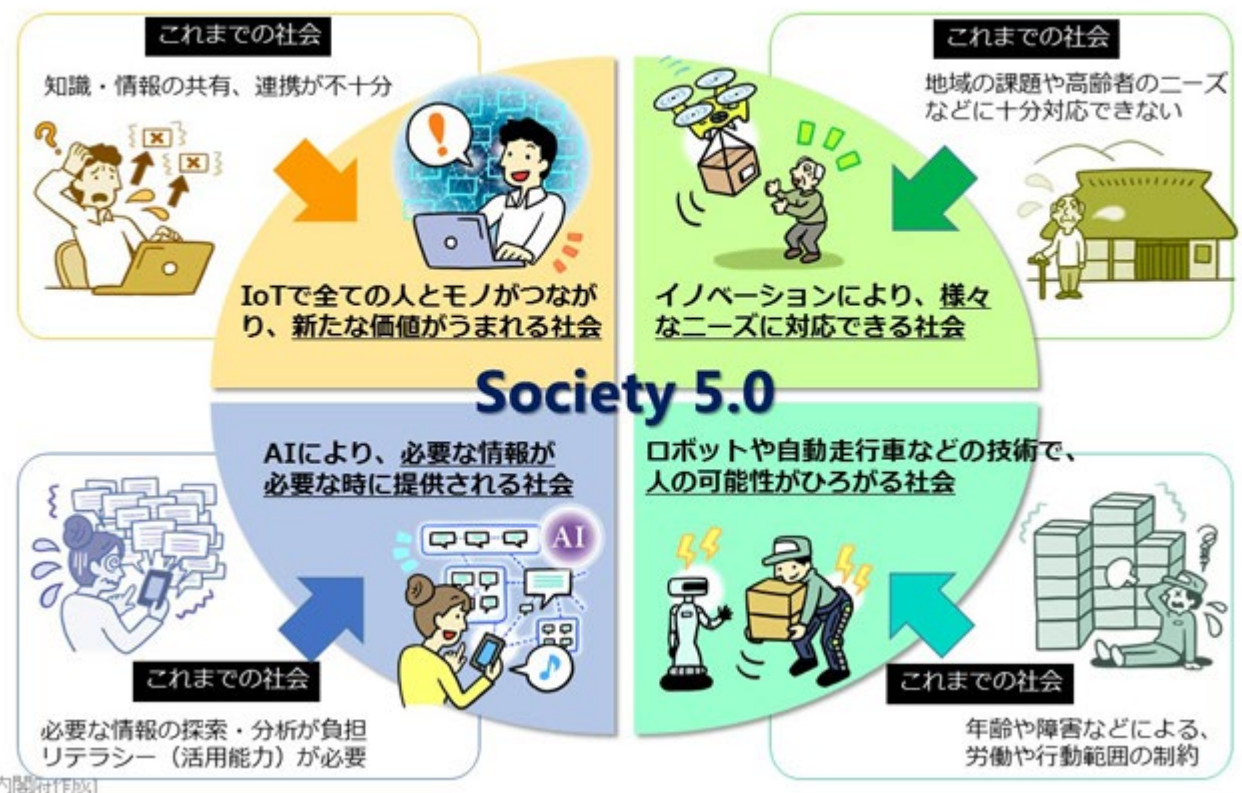
Soaring price of energy resources has made it necessary to revise the strategy to achieve both energy S+3E and CN.



1) Timing for achieving CN (ANRE)
 2) Trends in natural gas and electricity rates (April figures added to Energy White Paper 2022)

5. Accelerate Society 5.0 with the COVID-19 Pandemic as the Change Point

Improvement of the telework environment and expansion of digital services are changing lifestyles, advancing the use of data.



Expansion of digital utilization triggered by the COVID-19 pandemic

Adoption of telework



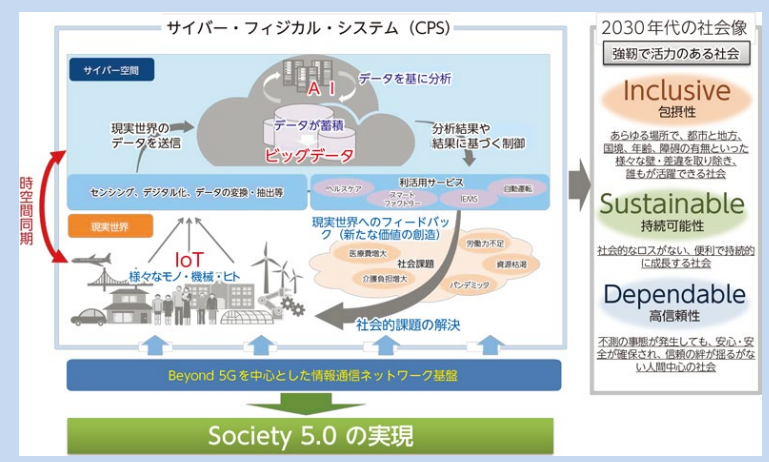
Expansion of digital services



Online tours by travel agencies

Source:
<https://www.soumu.go.jp/johotsusintokei/whitepaper/ja/r03/pdf/n2100000.pdf>

Cyber-Physical System Development



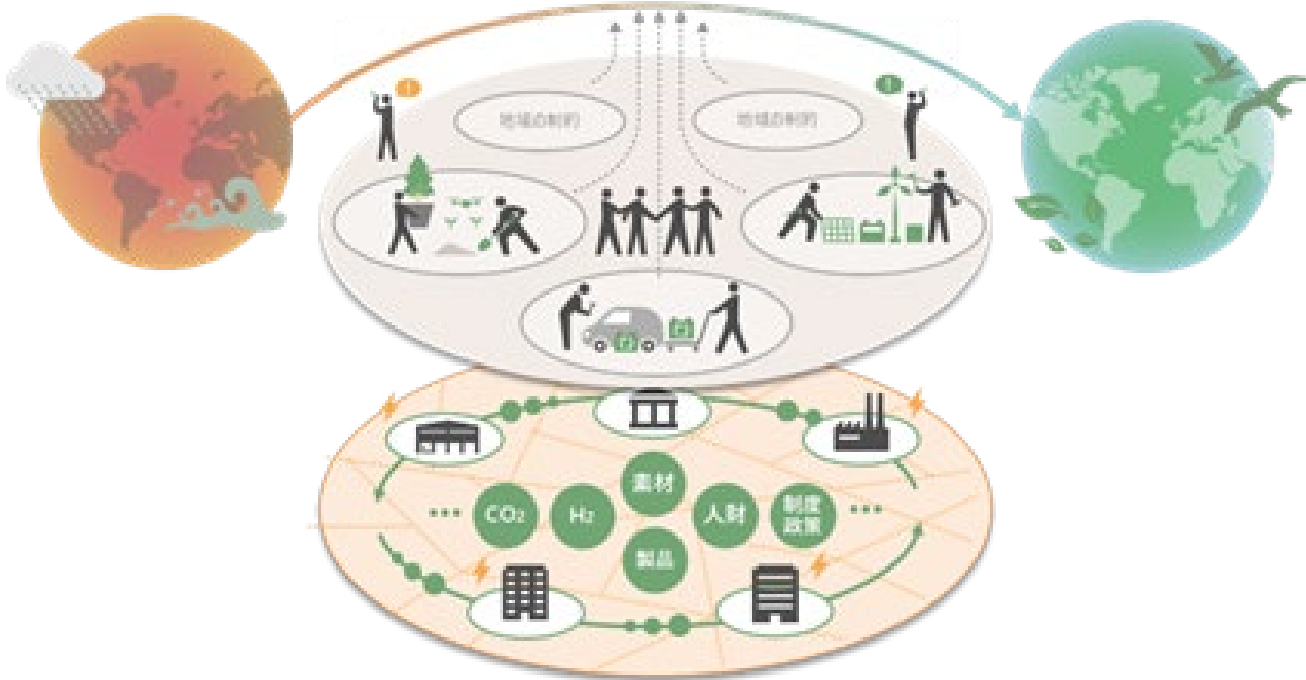
Creating new value from data

Source: MIC, Beyond 5G Promotion Strategy (2020)

Hitachi-UTokyo Lab Proposed Vision

Collaboration for transitioning to a sustainable society

Carbon neutrality created by society, industry, and community using data



Formulation and quantification of energy scenarios with a view to international cooperation and regional consensus building.

- Regional consensus building on international cooperation and energy supply, mainly in the Asia-Pacific region.
- Quantitative evaluation of feasible energy scenarios leading to the realization of carbon neutrality.

Challenges and measures for securing stable energy supply accompanying the expansion of variable renewable energy.

- Technological innovation and rulemaking for quality maintenance of frequency, etc, in addition to power supply and demand balance.
- Cooperative management that minimizes the social burden through smart energy use while taking into account the utilization of existing energy assets.

Achieving balance between carbon-neutral transition and growth Dealing with uncertainties due to data utilization.

- Digital quantification of system congestion analysis and storage energy verification.
- Trial on linking simulations aimed at achieving both the city's ideal state and carbon neutrality.

Toward Realizing Energy Systems to Support Society 5.0

Report from
Hitachi-
UTokyo
Laboratory

Energy Transition

Professor Hideaki Shiroyama, the University of Tokyo; Chief Engineer Tomoko Suzuki of Hitachi, Ltd.

Energy Systems to Support Society 5.0

Akihiko Yokoyama, Emeritus Professor, the University of Tokyo; Kazuhiko Ogimoto, Project Professor, the University of Tokyo; Tomomichi Ito, Senior Research, Hitachi, Ltd.

Innovation in Energy and Society Driven by Digitalization

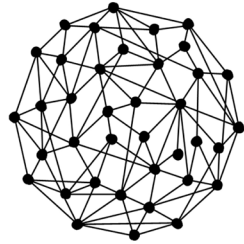
Ryoichi Komiyama, Professor, the University of Tokyo; Naoki Yoshimoto, Senior Research Scientist, Hitachi, Ltd.; and Hiroshi Ohashi, Vice President, the University of Tokyo

Panel
Discussion

"Value Creation through Energy and Regional Innovation Driven by Data Utilization"

Kaname Ogawa, Director, ANRE; Yasushi Motojima, Office Manager, Aizuwakamatsu City Hall; Hiroshi Ohashi, Vice President, the University of Tokyo;
Tokunari Anai, General Manager, Tokyo Electric Power Company Holdings, Inc.; Yuji Inoue, General Manager, Tokuyama Inc.;
Mari Yoshitaka, Fellow, Mitsubishi UFJ Research and Consulting

**Based on the discussions at today's forum,
Version 5 of the Proposal will be published on
the Hitachi-UTokyo Lab website at a later date.**



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