Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society

	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
	Fourth Medium-Term Objectives for the 2022–2027 Period						Fifth Medium-Term Objectives for the 2028–2033 Period			

Decarbonization Unit

Goals for 2030:
To propose innovative technologies and a social vision for discontinuous innovation to achieve carbon neutrality

Goals and Vision
In order to achieve Japan's goal of complete carbon neutrality by 2050, it is necessary to foster entirely new, innovative technologies that will enable the decarbonization of society as a whole, rather than simply extending or optimizing conventional research and technologies, and to present a vision of the ideal future society and social design. At the core of the Decarbonization Unit is the Platform of Inter/Transdisciplinary Energy Research, uniting elemental research groups such as materials and devices research, systems research, and urban habitat research, with a view to social implementation of decarbonization. Kyushu University will work with the Fukuoka and Kyushu regions on carbon-neutrality initiatives as a Green Innovation Hub. We not only contribute to the creation innovative technologies, but also to recommendations on regional growth strategies, the construction of a social model for decarbonization, and the development of highly skilled professionals who will drive innovation.

Unit meetings held as necessary for goal sharing, strengthening cooperation, sharing issues, progress reports, etc.

Group for the Reduction of Energy Consumption Through Hydrogen

Goals for 2030:
Play a leading role in achieving a hydrogen-based society

- Group Initiatives
- Project Initiatives

Strengthen professional development across age groups, including among doctoral students, to facilitate the continued development of each facility and its activities	Further increase research project acquisitions to strengthen advanced research capabilities.	Strengthen the network of 1,000 alumni to make the university a truly global research hub in the hydrogen field.
Develop strategies for building a hydrogen-based society and have them adopted by national councils and other bodies.	Strengthen multidisciplinary collaboration within the university to accelerate the Kyushu University Hydrogen Project and the "Hydrogen Campus" concept.	Play a leading role in Japan's hydrogen implementation plan for 2030
Contribute to advanced research in the field of hydrogen materials by conducting large-scale funded research.	Acquire new large-scale funded research projects and contribute to the construction of key hydrogen infrastructure for the future.	Contribute to advanced research and international standardization in the field of hydrogen materials by increasing both funded and joint collaborative research.
Increase funded and joint collaborative research to enhance research and development capabilities and intellectual property assets.	Create an externalized research and development corporation through industry-academia joint ventures	Build an ecosystem for innovation both in and outside the center.
Continue to offer examinations for self-recommended candidates among students without engineering backgrounds to enhance the diversity of majors.	Further encourage students to enter doctoral programs by utilizing fellowships, among other measures, and collaborating with related departments.	Strengthen industry-academia-government networks to expand opportunities to use expertise acquired in the field to contribute to society.
Accelerate basic research in fields such as electrochemical energy conversion through international collaboration	Boost international joint collaborative research to accelerate basic hydrogen research that contributes to carbon neutrality.	Contribute to international collaboration in the hydrogen field as a hub for the international mobility among talented researchers, where English is the common language

Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society

	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
	Fourth Medium-Term Objectives for the 2022–2027 Period						Fifth Medium-Term Objectives for the 2028–2033 Period			

CO_2 Capture and Conversion

Goals for 2030:
Research, development, and social implementation of CO_2 capture, utilization, and conversion systems

- Establish efficient CO_2 capture and conversion technologies
  - Develop CO_2 capture and conversion systems
  - Research and development on the socioeconomic evaluation of CO_2 capture and conversion
  - Produce a social design that incorporates CO_2 capture and conversion systems
- Develop CO_2 separation membranes that facilitate direct air capture (DAC)
  - Develop systems for direct CO_2 capture from the atmosphere using separation membranes
  - Develop systems that integrate atmospheric CO_2 capture and utilization using separation membranes
  - Develop electrocatalysts for the highly selective conversion of CO_2 to valuable compounds
- Develop electrocatalysts for the highly selective conversion of CO_2 to valuable compounds
- Fabricate a reactor for the efficient production of valuable compounds from CO_2
- Develop and demonstrate equipment capable of recovering and utilizing the CO_2 in exhaust gas from the combustion of LNG and LPG
  - Develop and demonstrate equipment for the capture and utilization of CO_2 from exhaust gases produced in thermal treatment equipment and crewed space exploration vessels
  - Develop and demonstrate equipment capable of capturing and utilizing atmospheric CO_2
- Fabricate equipment for the capture and storage of CO_2 from the exhaust gas produced in heating greenhouse horticulture and agriculture facilities and develop systems for greenhouse horticulture and agriculture
- Develop a system to capture, reuse, and control the emission of CO_2 retained in the upper parts of horticultural facilities
- Achieve on-site underground biomethanation of geosequestered CO_2 using methanogens
- Achieve energy-saving CO_2 capture processes using new amine absorbents
- Develop oxygen dioxide-tolerant electrolytes through DX
- Develop active electrodes and catalysts through DX
- Develop fully solid-state devices for CO_2 resource conversion and the manufacture of high-value-added raw materials through DX
- Conduct economic evaluation of fully solid-state devices for CO_2 resource conversion and the manufacture of high-value-added raw materials and design a society that incorporates these devices

- Group Initiatives
- Project Initiatives

Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society

	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
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Group for New Urban Models

Goals for 2030:
Propose an energy-independent, recycling-oriented, sustainable city model utilizing urban and built environment technologies

- Internationally deploy BDE and built environment simulation tools, and design and construct ZEBs
- Internationally deploy BeCAT, a design center based on urban and built environment technology
- Develop optimal control and nudge systems for built environments and energy using IoT/AI for the era of Society 5.0
- Develop an urban energy supply and demand simulator and formulate a future energy plan for Fukuoka
- Plan infrastructure facilities and regional designs for future cities (targeting specific regions) to achieve a decarbonized society

- Group Initiatives
- Project Initiatives

- Develop built environment simulation tools and BDE (Building Data Exchange) network tools
  - Implement trials and international deployment of BDE and built environment simulation tools (for use in educational research and BeCAT)
    - Implement BDE and built environment simulation tools in society through industry-academia collaboration
    - Design and construct Zero Energy Buildings using BDE and built environment simulation
- Develop and implement the BeCAT Program to integrate urban and built environment technology with design
- Conceptualize environmental master plans and prototype designs suitable for the Asia-Oceania region and communicate them internationally
- Engage in practical design and social implementation based on urban and built environment technologies (in cooperation with local governments and companies)
- Form a center for urban and built environment design (social implementation of university resources)
- Develop an IoT data collection system using BEMS and sensing technology
- Create AI-based quantitative evaluation methods for the built environment and energy
  - Build IoT/AI systems for the collection of occupant environment data and building environment analysis
    - Develop optimal control and nudge systems for built environments and energy using IoT/AI
- Develop methods for forecasting the supply and demand of time-varying urban and building energy
  - Develop an urban energy supply and demand simulator that couples GIS with buildings and facilities
    - Create a platform to assess the impact of the introduction of elemental energy technologies
    - Develop a future urban energy plan to achieve carbon neutrality for Fukuoka City
- Conceptualize an energy-independent, recycling-oriented, future city model utilizing DER and Smart Grid
  - Design future cities (for specific regions) to achieve a carbon-neutral society
  - Develop energy infrastructure plans and ZEB specification standards appropriate for targeted regions
  - Plan and develop energy supply and demand plans for targeted regions based on energy conservation, creation, storage, and distribution technologies

Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society

	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
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Group for Remapping a Sustainable Energy Future

Goals for 2030:
Remap a Sustainable Energy Future

- Research and development of offshore wind power generation
- Research and development of a sustainability value assessment model for energy technologies
- Conduct R&D on the socioeconomic evaluation of energy conversion
- Research and development of geothermal power generation
- Research and development of new possibilities for nuclear energy

- Conduct research into wind energy science integrating atmospheric physics, ocean physics, and fluid dynamics
- Conduct research, development, and social implementation based on integrative knowledge to promote the widespread establishment of large-scale offshore wind farms

- Develop an ESG assessment framework that accounts for the life cycle of energy technologies
- Develop a model for evaluating the impact of energy technology on natural, artificial, and human capital using the Inclusive Wealth Index
- Evaluate domestic and international energy technologies, including new technologies such as direct air capture (DAC) for social implementation

- Clarify the impact of energy conversion on society and economic and environmental indicators
- Conduct Techno-economic evaluation (TEA) of future energy systems
- Elucidate the nexus of technology, people, and systems associated with energy conversion

- Develop investigative and evaluative technologies for supercritical geothermal systems
- Enhance the sustainability of conventional geothermal power generation
- Increase the social acceptability of geothermal power to increase generation capacity

- Develop characterization technology for advanced nuclear reactors (high-temperature gas-cooled reactors)
- Research the environmental impact of advanced nuclear reactors
- Explore new applications for advanced nuclear reactors

- Group Initiatives
- Project Initiatives

Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society

	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
	Fourth Medium-Term Objectives for the 2022–2027 Period						Fifth Medium-Term Objectives for the 2028–2033 Period			

Photochemical Technology Innovation Group

Goals for 2030:
Create photochemical technologies that will revolutionize the world

- Develop and elucidate the mechanism of CO_2 photoreduction catalysts that function harmoniously
- Pursue functional chemistry of the triplet state
- Develop CO_2 sensing and conversion technologies
- Develop energy-saving light sources utilizing organic optical materials
- Create organic devices that can be manufactured at a low cost

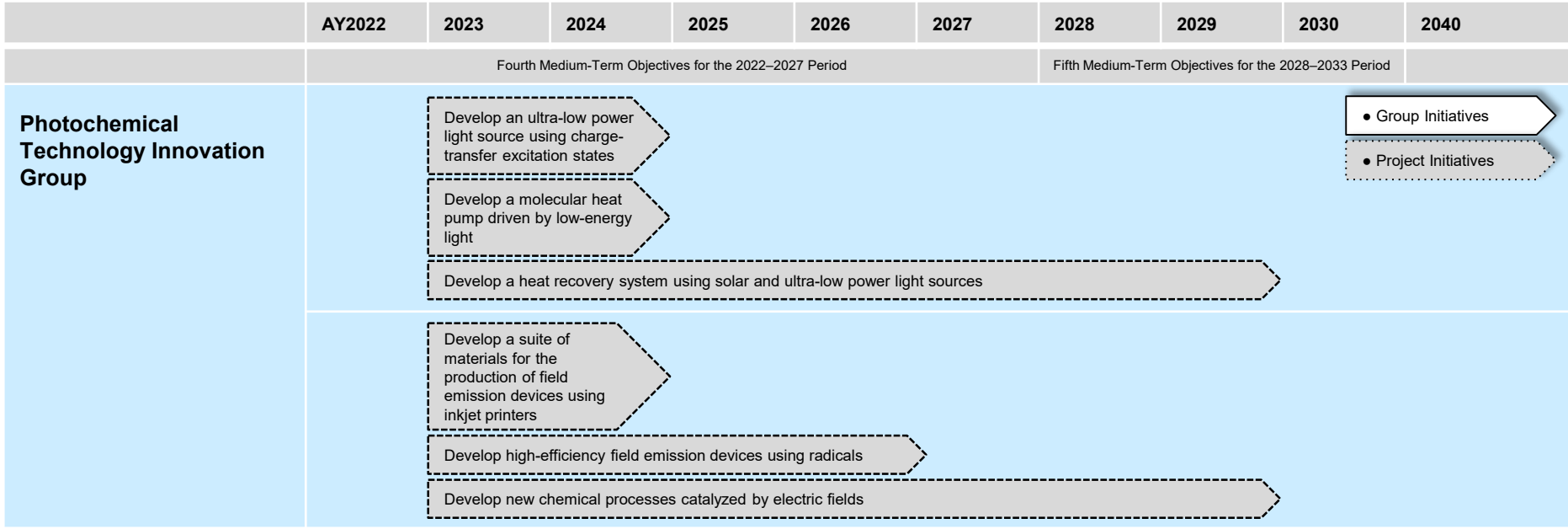
- Facilitate the tracing of the one-electron reduction process for artificial photosynthetic photocatalysts
- Develop spectroscopic techniques to observe the downstream effects of multi-electron transfer photoreactions
- Research highly efficient catalysts based on information on intermediates in the reaction process

- Harness unused sunlight through up-conversion
- Integrate up-conversion and artificial photosynthesis
- Replace thermal processes with optical ones through up-conversion
- Establish venture businesses to achieve social implementation of up-conversion

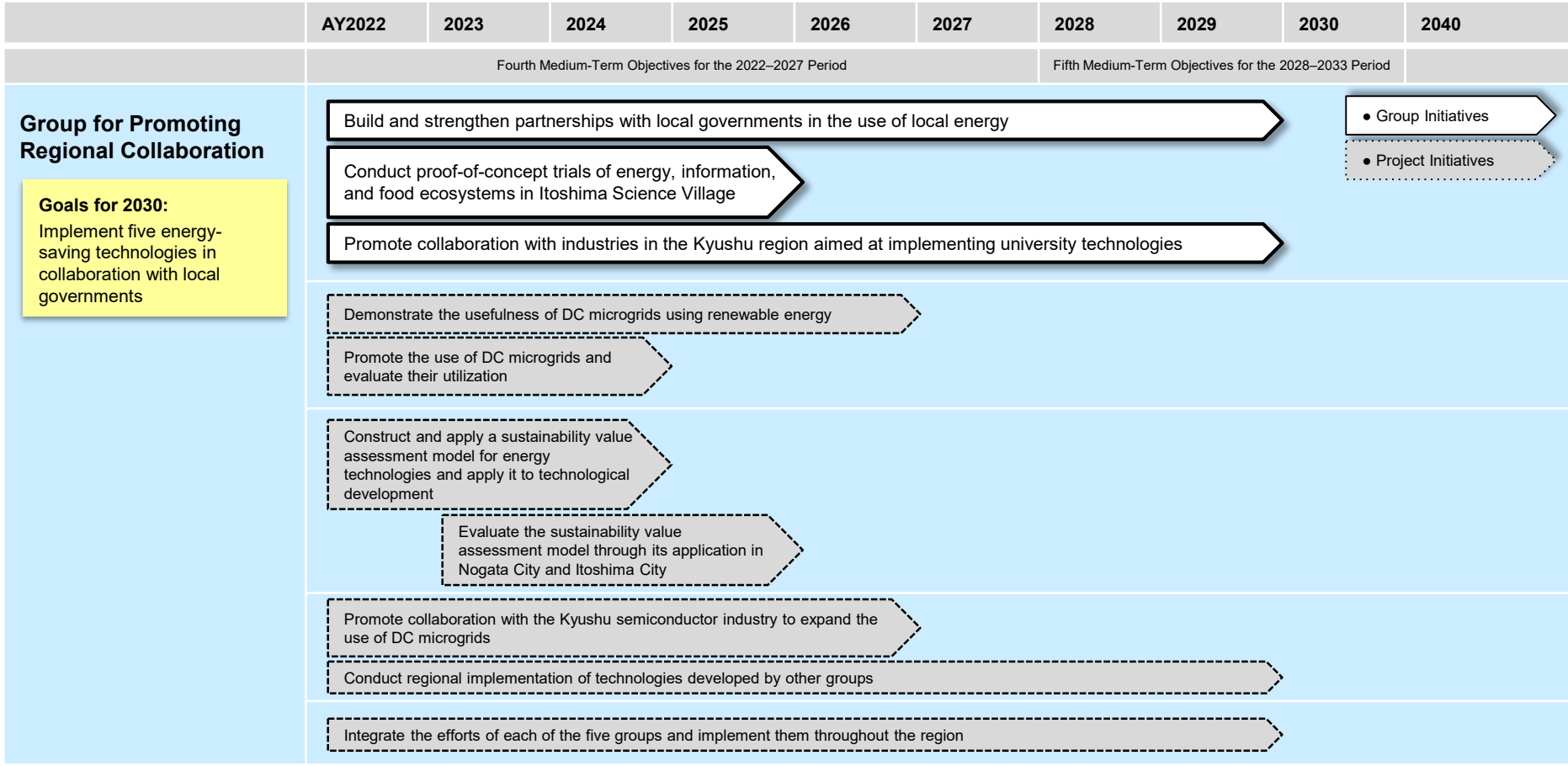
- Develop a fluorescent sensor to detect the concentration of CO_2 by utilizing photo-induced electron transfer
- Develop a hydrogel that facilitates fluorescent detection of CO_2 adsorption/desorption behavior
- Develop a biomimetic catalyst that absorbs CO_2, converts it to a C_1 source, and releases it

- Group Initiatives
- Project Initiatives

Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society



Roadmap for the Decarbonization Unit
Integrated Initiative for Designing Future Society



List of Group Initiatives

July 23, 2022

Unit Name: Decarbonization

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Kazunari Sasaki

Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
Reducing energy consumption with hydrogen	Group-wide: Goal for 2030: Play a leading role in achieving a hydrogen-based society				Strengthen professional development across age groups, including among doctoral students, to facilitate the continued development of each facility and its activities (Initiative Period: 2022–2024)	Further increase research project acquisitions to strengthen advanced research capabilities. (Initiative Period: 2025–2027)	Strengthen the network of 1,000 alumni to make the university a truly global research hub in the hydrogen field. (Initiative Period: 2028–2030)	–	–	Present the comprehensive efforts made since the university's relocation to Ito Campus as a leading model for the creation of a future society under the Platform of Inter/Transdisciplinary Energy Research.	Pamphlet: Kyushu University Center-of-Excellence for Hydrogen Energy https://h2.kyushu-u.ac.jp/english/index.html
	Research into Hydrogen Energy through Industry, Academia, Government and Local Community Cooperation: Goal for 2030: Continue to lead the way in promoting and educating the public about hydrogen energy.	International Hydrogen Energy Research Center	Director	Kazunari Sasaki	Develop strategies for building a hydrogen-based society and have them adopted by national councils and other bodies. (Initiative Period: 2022–2024)	Strengthen multidisciplinary collaboration within the university to accelerate the Kyushu University Hydrogen Project and the "Hydrogen Campus" concept. (Initiative Period: 2025–2027)	Play a leading role in Japan's hydrogen implementation plan for 2030. (Initiative Period: 2028–2030)	–	–	Drive collaboration with government agencies (Cabinet Office; Ministry of Education, Culture, Sports, Science and Technology; Ministry of Economy, Trade and Industry; Ministry of the Environment; NEDO; and JST) and the region (Kyushu; Fukuoka Prefecture; Fukuoka City).	https://h2.kyushu-u.ac.jp/english/index.html
	Research into Hydrogen Industrial Use and Storage: Goal for 2030: Develop a comprehensive range of hydrogen-resistant structural and elemental materials.	Research Center for Hydrogen Industrial Use and Storage (Hydrogenius)	Director	Joichi Sugimura	Contribute to advanced research in the field of hydrogen materials by conducting large-scale funded research. (Initiative Period: 2022–2024)	Acquire new large-scale funded research projects and contribute to the construction of key hydrogen infrastructure for the future. (Initiative Period: 2025–2027)	Contribute to advanced research and international standardization in the field of hydrogen materials by increasing both funded and joint collaborative research. (Initiative Period: 2028–2030)	–	–	Collaborate with other groups to build the infrastructure for a hydrogen-based society.	https://hydrogenius.kyushu-u.ac.jp/en/
	Joint Industry-Academia Research into Next-Generation Fuel Cells: Goal for 2030: Become an innovation hub for industry-academia co-creation in the hydrogen fuel cell field.	Next-Generation Fuel Cell Research Center (NEXT-FC)	Director	Kazunari Sasaki	Increase funded and joint collaborative research to enhance research and development capabilities and intellectual property assets. (Initiative Period: 2022–2024)	Create an externalized research and development corporation through industry-academia joint ventures. (Initiative Period: 2025–2027)	Build an ecosystem for innovation both in and outside the center. (Initiative Period: 2028–2030)	–	–	Work closely with the Open Innovation Platform (OIP) to establish the functions of a research and development company in the hydrogen field and play a leading part in industry-academia co-creation.	http://fc.kyushu-u.ac.jp/ (Japanese)
	Hydrogen Energy Systems Education: Goal for 2030: Produce a total of 1,000 master's and doctoral degree holders in fields related to hydrogen energy systems. (Ongoing since 2010)	Department of Hydrogen Energy Systems, Graduate School of Engineering	Head of Department	Shigeru Hamada	Continue to offer examinations for self-recommended candidates among students without engineering backgrounds to enhance the diversity of majors. (Initiative Period: 2022–2024)	Further encourage students to enter doctoral programs by utilizing fellowships and collaborating with related departments. (Initiative Period: 2025–2027)	Strengthen industry-academia-government networks to expand opportunities to use expertise acquired in the field to contribute to society. (Initiative Period: 2028–2030)	–	–	Collaborate with related departments to drive interdisciplinary education and professional development within the Decarbonization Unit.	https://www.eng.kyushu-u.ac.jp/e/
	Carbon Energy Research Goal for 2030: Encourage international academic collaboration in the field of hydrogen technology.	International Institute for Carbon-Neutral Energy Research (I²CNER)	Deputy Director	Hiroshige Matsumoto	Accelerate basic research in fields such as electrochemical energy conversion through international collaboration. (Initiative Period: 2022–2024)	Boost international joint collaborative research to accelerate basic hydrogen research that contributes to carbon neutrality. (Initiative Period: 2025–2027)	Contribute to international collaboration in the hydrogen field as a hub for global exchange among talented researchers, where English is the lingua franca (Initiative Period: 2028–2030)	–	–	Play a leading part in international interdisciplinary collaboration within the Decarbonization Unit.	https://i2cner.kyushu-u.ac.jp/en/

Decarbonization

Hydrogen Energy:

From Research and Education to Industry-Academia Collaboration, Demonstrations, and an Innovation Hub

Promoting comprehensive efforts from advanced research and education to industry-academia collaboration, demonstration, and social implementation

Research and Education

- **Hydrogen Energy Research**
  International Research Center for Hydrogen Energy

- **Hydrogen Materials Research**
  Research Center for Hydrogen Industrial Use and Storage (Hydrogenius)

- **Comprehensive Basic Research in the Field of Decarbonization**
  International Institute for Carbon-Neutral Energy Research (I²CNER)
- **Education Through Hydrogen-Specific Majors (A World-First)**
  Major in Hydrogen Energy Systems

Produce **1,000** doctoral and master's degree holders between 2010 and 2030

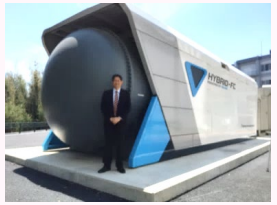
Industry-Academia Collaboration

- **Achieving a Future Society with Integrative Knowledge (led by the President)**
  Platform of Inter/Transdisciplinary Energy Research (Q-PIT)
  Q-Energy Innovator Fellowship
- **Industry-Academia Research Collaboration on Next-Generation Fuel Cells (A World First)**
  Next-Generation Fuel Cell Research Center (NEXT-FC)

- **Research Collaboration on Hydrogen Materials**
  HydroMate Committee (AIST-Kyushu University-Fukuoka University-Fukuoka Prefecture Collaborative Committee for Hydrogen Studies)
- **Support for Industrialization of Hydrogen Products (Fukuoka Prefecture)**
  Hydrogen Energy Test and Research Center (HyTRec)

Demonstration

Hydrogen Stations
Ito Campus



Fuel Cell Power Generation
Ito Campus

Demonstration Facility for Future Energies
Ito Campus

Hydrogen Town
Itoshima City

Implementation and Future Prospects

Strengthening Collaboration Inside and Outside the University

Creating an Innovation Hub for Decarbonization

Socially Implement Renewable Energy and Energy Storage Systems
(Utilizing fuel cells and water electrolysis)

Propose Low-Carbon and Decarbonized Models for Society
(Utilizing hydrogen, wind, geothermal, and other resources)

Contribute to Climate Crisis Response
(Achieving zero emissions and reducing greenhouse gas emissions)

九州大学 KYUSHU UNIVERSITY

List of Group Initiatives

July 21, 2022

Unit Name: Decarbonization

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Shigenori Fujikawa

Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
CO_2 Capture and Conversion	Group-wide: Goal for 2030: Research, development, and social implementation of CO_2 capture, utilization, and conversion systems				Establish efficient CO_2 capture and conversion technologies (Initiative Period: 2022–2030)	Develop CO_2 capture and conversion systems (Initiative Period: 2025–2030)	Research and development on the socioeconomic evaluation of CO_2 capture and conversion (Initiative Period: 2025–2030)	Produce a social design that incorporates CO_2 capture and conversion systems (Initiative Period: 2025–2030)	—		
	Research and Development of CO_2 Capture and Conversion from the Atmosphere Using Membranes: Goals for 2030: Develop an atmospheric CO_2 capture system using membrane separation	International Institute for Carbon-Neutral Energy Research (I²CNER)	Professor	Shigenori Fujikawa	Develop CO_2 separation membranes that facilitate direct air capture (DAC) (Initiative Period: 2022–2030)	Develop systems for direct CO_2 capture from the atmosphere using separation membranes (Initiative Period: 2025–2030)	Develop systems that integrate atmospheric CO_2 capture and utilization using separation membranes (Initiative Period: 2025–2030)	Produce a social design that incorporates CO_2 capture and conversion systems (Initiative Period: 2025–2030)	—		https://k-nets.kyushu-u.ac.jp/en/ https://i2cner.kyushu-u.ac.jp/~fujikawa/en/ https://mozes.jp/en/
	Research and Development of CO_2 Conversion Using Recovered CO_2 and Renewable Resources: Goals for 2030: Synthesize valuable compounds from renewable resources and CO_2	Institute for Materials Chemistry and Engineering	Professor	Miho Yamauchi	Develop electrocatalysts for the highly selective conversion of CO_2 to valuable compounds (Initiative Period: 2022–2030)	Fabricate a reactor for the efficient production of valuable compounds from CO_2 (Initiative Period: 2022–2030)	—	—	—		https://yamauchi-lab.com/
	Research and Development of the Capture and Utilization of CO_2 from Various Emissions Sources: Goals for 2030: Demonstrate low-cost CO_2 capture and utilization technologies	Faculty of Engineering	Professor	Yu Hoshino	Develop and demonstrate equipment capable of recovering and utilizing the CO_2 in exhaust gas from the combustion of LNG and LPG (Initiative Period: 2022–2030)	Develop and demonstrate equipment for the capture and utilization of CO_2 from exhaust gases produced in thermal treatment equipment and crewed space exploration vessels (Initiative Period: 2025–2030)	Develop and demonstrate equipment capable of capturing and utilizing atmospheric CO_2 (Initiative Period: 2025–2030)	—	—		https://sites.google.com/view/hoshinolab-kyushu
	Research and Development of the Capture and Utilization of CO_2 in Greenhouse Horticulture and Agriculture: Goals for 2030: Launch trials of CO_2 capture and utilization systems and begin social implementation in greenhouse horticulture and agriculture	Faculty of Agriculture	Associate Professor	Daisuke Yasutake	Fabricate equipment for the capture and storage of CO2 from the exhaust gas produced in heating greenhouse horticulture and agriculture facilities and develop systems for greenhouse horticulture and agriculture (Initiative Period: 2022–2030)	Develop a system to capture, reuse, and control the emission of CO_2 retained in the upper parts of horticultural facilities (Initiative Period: 2022–2030)	—	—	—		
	Research and Development of the Biomethanation of Captured CO_2 Solutions and Geosequestered CO_2: Goals for 2030: Achieve underground biomethanation	Faculty of Engineering	Professor	Yuichi Sugai	Achieve on-site underground biomethanation of geosequestered CO_2 using methanogens (Initiative Period: 2022–2030)	Achieve energy-saving CO_2 capture processes using new amine absorbents (Initiative Period: 2022–2030)	—	—	—		
	Research and Development of CO_2 Resource Conversion and the Manufacture of High-Value-Added Raw Materials Through Renewable Energy and DX: Goals for 2030: Develop fully solid-state devices for CO_2 resource conversion and the manufacture of high-value-added raw materials	Platform of Inter/Transdisciplinary Energy Research	Professor	Yoshihiro Yamazaki	Develop oxygen dioxide-tolerant electrolytes through DX (Initiative Period: 2022–2030)	Develop active electrodes and catalysts through DX (Initiative Period: 2022–2030)	Develop fully solid-state devices for CO_2 resource conversion and the manufacture of high-value-added raw materials through DX (Initiative Period: 2022–2030)	Conduct economic evaluation of fully solid-state devices for CO_2 resource conversion and the manufacture of high-value-added raw materials and design a society that incorporates these devices (Initiative Period: 2022–2030)	—		https://q-pit.kyushu-u.ac.jp/yamazaki_en/index.html

Decarbonization

Using CO_2 Capture and Conversion to Build a Carbon-Recycling Society

Driving Cutting-Edge R&D and Social Implementation Through Interdisciplinary Industry-Academia Collaboration

Research → **Interdisciplinary Industry-Academia Collaboration** → **Social Implementation**

CO_2-Related Research

Research Center for Negative Emissions Technologies

An organization specializing in research on CO_2 recycling starting with the capture of CO_2 from the atmosphere

K-NETs
Research Center for Negative Emissions Technologies

Moonshot Research and Development Program, Cabinet Office

A large-scale national research program that aims to create disruptive innovations originating from Japan, promoting ambitious R&D (moonshots) that extend beyond conventional technologies

MOONSHOT
RESEARCH & DEVELOPMENT PROGRAM

Research and development focused on CO_2-recycling systems for a "beyond zero" society

JST Strategic Basic Research Programs

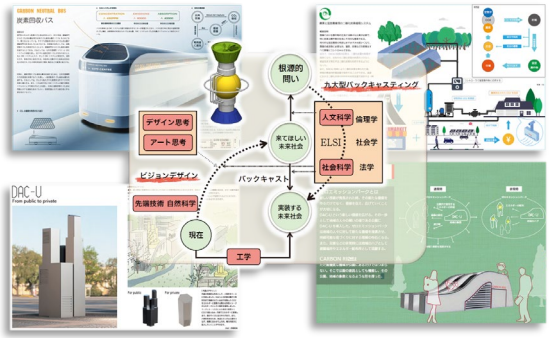
Programs for the creation of innovative technological seeds that will lead to scientific and technological innovations to transform society and the economy and overcome the critical challenges facing Japan

CREST

"Creating innovative proton-conducting inorganic compounds by combining experimental and computational science"

Designing Future Products Based on Research Technologies

Design and brand future products and systems, based on research technologies, in collaboration with the School of Design



System of Cooperation Among Companies for Social Implementation

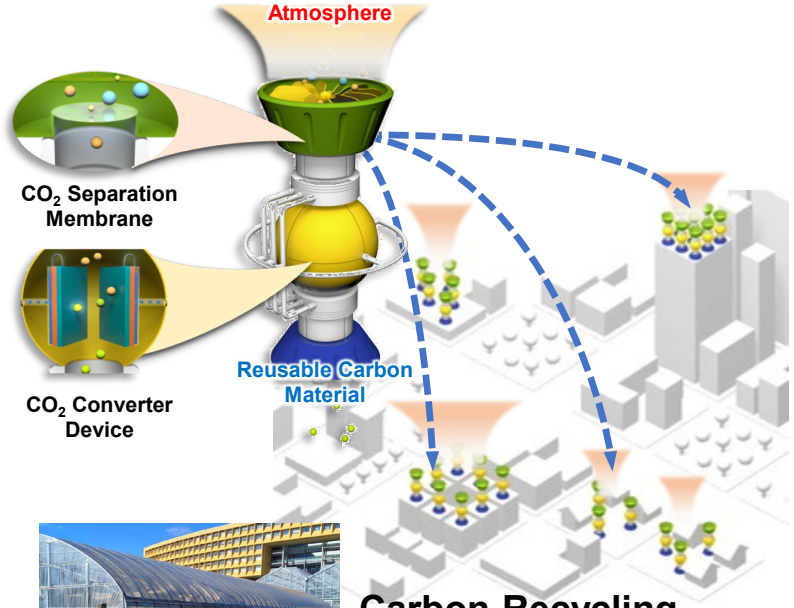
Build a system for industry-academia collaboration through coordination with general trading companies

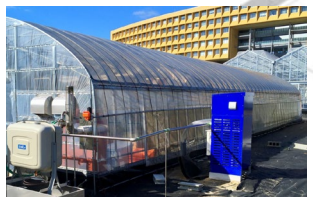
Consortium of Venture Businesses

JCCL
Japan Carbon Cycle Lab.

NanoMembrane Technologies, Inc.

A New Future of Recycling Carbon Resources





Use in Agriculture

Carbon-Recycling Society

九州大学
KYUSHU UNIVERSITY

List of Group Initiatives

July 21, 2022

Unit Name: Decarbonization Unit

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Akihito Ozaki

Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
Group for New Urban Models	Group-wide: Goal for 2030: Propose an energy-independent, recycling-oriented, sustainable city model utilizing urban and built environment technologies				Internationally deploy BDE and built environment simulation tools, and design and construct ZEBs (Initiative Period: 2022–2030)	Internationally deploy BeCAT, a design center based on urban and built environment technology (Initiative Period: 2022–2030)	Develop optimal control and nudge systems for built environments and energy using IoT/AI for the era of Society 5.0 (Initiative Period: 2022–2030)	Develop an Urban Energy Supply and Demand Simulator and Formulate a Future Energy Plan for Fukuoka (Initiative Period: 2022–2030)	Plan infrastructure facilities and regional designs for future cities (targeting specific regions) to achieve a carbon-neutral society (Initiative Period: 2022–2030)		http://suae-casia.arch.kyushu-u.ac.jp
	Design and Construct Zero Energy Buildings by Simulating the Built Environment Using Building Data Exchange Technology: Goal for 2030: Develop methods for estimating and designing built environments and energy performance	Faculty of Human-Environment Studies	Professor	Akihito Ozaki	Develop built environment simulation tools and BDE (Building Data Exchange) network tools (Initiative Period: 2022–2024)	Implement trials and international deployment of BDE and built environment simulation tools (for use in educational research and BeCAT) (Initiative Period: 2025–2027)	Implement BDE and built environment simulation tools in society through industry-academia collaboration (Initiative Period: 2028–2030)	Design and construct Zero Energy Buildings using BDE and built environment simulation (Initiative Period: 2028–2030)	–	Participate in the Fukuoka Green Innovation Challenge organized by the New Industrial Promotion Division of the Business Startup & Investment Promotion Department within the Economy, Tourism & Culture Bureau of Fukuoka City	https://www.city.fukuoka.lg.jp/keizai/kagakugijutsu/business/green-innovation_hojokin_2022.html
	Develop and Implement the BeCAT Program to Integrate Urban and Built Environment Technology with Design: Goal for 2030: Develop energy management for cities and buildings to achieve the required decarbonization performance	Faculty of Human-Environment Studies	Associate Professor	Hirokazu Suemitsu	Develop and Implement the BeCAT Program to Integrate Urban and Built Environment Technology with Design: (Initiative Period: 2022–2030)	Conceptualize environmental master plans and prototype designs suitable for the Asia-Oceania region and communicate them internationally (Initiative Period: 2022–2030)	Engage in practical design and social implementation based on urban and built environment technologies (in cooperation with local governments and companies) (Initiative Period: 2022–2030)	Form a center for urban and built environment design (social implementation of university resources) (Initiative Period: 2026–2030)	–	Collaborate with BeCAT (Built Environment Center with Art and Technology)	https://becat.kyushu-u.ac.jp/en/
	Develop Optimal Control and Nudge Systems for Built Environments and Energy Using IoT/AI for the Era of Society 5.0: Goal for 2030: Build IoT/AI systems for the collection of occupant environment data and building environment analysis	Faculty of Human-Environment Studies	Assistant Professor	Yusuke Arima	Develop an IoT data collection system using BEMS and sensing technology (Initiative Period: 2022–2024)	Create AI-based quantitative evaluation methods for the built environment and energy (Initiative Period: 2022–2024)	Build IoT/AI systems for the collection of occupant environment data and building environment analysis (Initiative Period: 2025–2027)	Develop optimal control and nudge systems for built environments and energy using IoT/AI (Initiative Period: 2028–2030)	–	Collaborate with the Department of Environmental Design, Faculty of Design Under implementation through the NEDO project.	https://wakasapo.nedo.go.jp/seeds/seeds-1883/ (Japanese)
	Develop an Urban Energy Supply and Demand Simulator and Formulate a Future Energy Plan for Fukuoka Goal for 2030: Develop an urban energy supply and demand simulator	Faculty of Human-Environment Studies	Professor	Daisuke Sumiyoshi	Develop methods for forecasting the supply and demand of time-varying urban and building energy (Initiative Period: 2022–2024)	Develop an urban energy supply and demand simulator that couples GIS with buildings and facilities (Initiative Period: 2025–2027)	Create a platform to assess the impact of the introduction of elemental energy technologies (Initiative Period: 2028–2030)	Develop a future urban energy plan to achieve carbon neutrality for Fukuoka City (Initiative Period: 2028–2030)	–	Collaborate with the Mechanical and Systems Engineering major of the Faculty of Science and Engineering Create a CO_2 reduction scenario for the Tenjin area in collaboration with the Meiji-dori Development Council	http://www.tenjin-mdc.org/wp-content/themes/mdc_2021renewal/pdf/activity/2026_action_plan.pdf (Japanese)
	Plan the Infrastructure of Future Cities and Conduct Regional Design to Achieve a Carbon-Neutral Society Goal for 2030: Propose an energy-independent, recycling-oriented, future city model utilizing DER and Smart Grid	New Campus Planning Office	Professor	Takeru Sakai	Conceptualize an energy-independent, recycling-oriented, future city model utilizing DER and Smart Grid (Initiative Period: 2022–2023)	Design future cities (for specific regions) to achieve a carbon-neutral society (Initiative Period: 2024–2026)	Develop energy infrastructure plans and ZEB specification standards appropriate for the targeted regions (Initiative Period: 2024–2026)	Plan and develop energy supply and demand plans for targeted regions based on energy conservation, creation, storage, and distribution technologies (Initiative Period: 2024–2030)	–	Seek to collaborate with FDC (Fukuoka Startup Consortium and FUKUOKA Smart EAST Promotion Consortium).	https://en.smartcity.fukuoka.jp

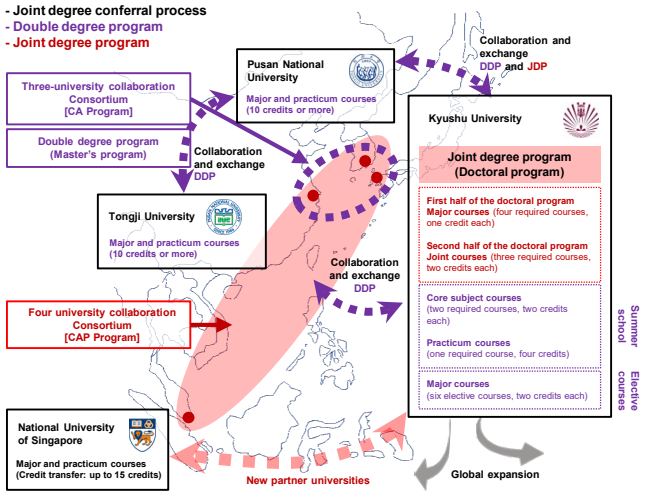
Decarbonization

New Urban Model Proposal: Research and Education, Industry-Academia Collaboration, Social Implementation and Future Prospects

Promoting comprehensive efforts from advanced research and education to industry-academia collaboration and social implementation

Research and Education

- **Project for Enhancing the Global Reach of Japanese Universities**
  Program for Fostering Human Resources to Lead Sustainable Development of Recycle-Based Zero-Emission Urban and Architectural Environment in Asia
  CAMPUS Asia Plus: A consortium of four universities (Kyushu University, Tongji University, Pusan National University, National University of Singapore) for international educational cooperation
- **Advanced research to create energy-independent, recycling-oriented cities and architecture**
  Development of urban and architectural environment energy technologies

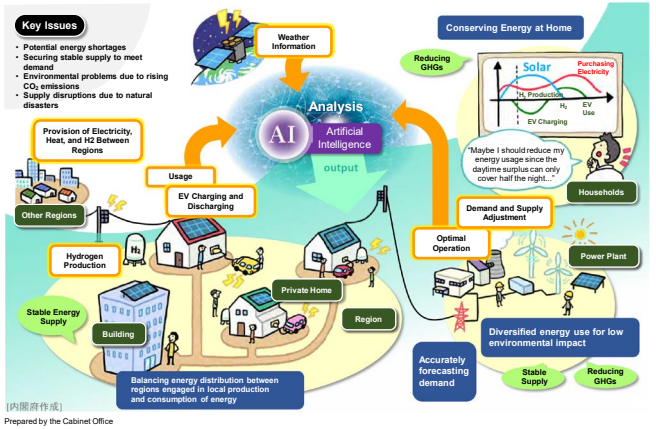


Industry-Academia Collaboration

- **Design and construction of zero-energy buildings by simulating the architectural environment using building data exchange technology**
- **Developing and implementing the BeCAT Program to integrate urban and architectural environment technology with design**
- **Developing optimal control and nudge systems for architectural environments and energy using IoT/AI for the Society 5.0 era**
- **Developing a municipal energy supply and demand simulator and formulating a future energy plan for Fukuoka**
- **Planning infrastructure facilities and regional designs for future cities (in specific regions) to achieve a decarbonized society**

Social Implementation

- **International expansion of BDE and architectural environment simulation technologies**
  Special evaluation methods as outlined in laws regarding the promotion of quality assurance (approved by the Minster of Land, Infrastructure, Transport and Tourism)
- **Design and construction of zero-energy buildings**
  Fukuoka Green Innovation Challenge, Itoshima City's new city hall
- **Planning, development, and creation of future city models to realize a decarbonized society**



Future Prospects

Strengthening collaboration both within and outside the university

Toward a Decarbonized Society
Urban and Architectural Environment Design Center

- **Implement technologies for the conservation, creation, storage, and distribution of energy in society**
  ZEB, BEMS, renewable energy, distributed energy, next-generation power grids, etc.
- **Propose a decarbonized city model**
  LCCM Smart City
- **Contribute to the response to the climate crisis**
  Zero-emission, sustainable recycling-based cities and architectural environment design 40% reduction in greenhouse gases produced by buildings

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List of Group Initiatives

November 15, 2022

Unit Name: Decarbonization Unit

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Kentaro Yoshida

Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
Remapping a Sustainable Energy Future	Group-wide: Goal for 2030: Remap a Sustainable Energy Future				Research and development of offshore wind power generation (Initiative Period: 2022–2030)	Research and development of a sustainability value assessment model for energy technologies (Initiative Period: 2022–2030)	Conduct R&D on the socioeconomic evaluation of energy conversion (Initiative Period: 2022–2030)	Research and development of geothermal power generation (Initiative Period: 2022–2030)	–	Collaborate with the Decarbonization Unit and other groups in the Integrated Initiative for Designing Future Society and the Environmental and Economic Policy Research Group in the Environment and Food Unit, among others	–
	Research and Develop Offshore Wind Power Generation: Goal for 2030: Research and develop offshore wind power generation	Research Institute for Applied Mechanics	Professor	Changhong Hu	Conduct research into wind energy science integrating atmospheric physics, ocean physics, and fluid dynamics (Initiative Period: 2022–2030)	Conduct research, development, and social implementation based on integrative knowledge to promote the widespread establishment of large-scale offshore wind farms (Initiative Period: 2025–2030)	–	–	–	Collaborate with OIP and the Kyushu University Research and Education Center for Offshore Wind	https://recow.kyushu-u.ac.jp/english/
	Research and Development of a Sustainability Value Assessment Model for Energy Technologies: Goal for 2030: Research and development of a sustainability value assessment model for energy technologies	Faculty of Engineering	Professor	Shunsuke Managi	Develop an ESG assessment framework that accounts for the life cycle of energy technologies (Initiative Period: 2022–2025)	Develop a model for evaluating the impact of energy technology on natural, artificial, and human capital using the Inclusive Wealth Index (Initiative Period: 2025–2027)	Evaluate domestic and international energy technologies, including new technologies such as direct air capture (DAC) for social implementation (Initiative Period: 2027–2030)	–	–	Collaborate with the Decarbonization Unit and other groups in the Integrated Initiative for Designing Future Society	https://urban-institute.kyushu-u.ac.jp/en/
	Research and Development of the Socioeconomic Evaluation of Energy Conversion Goal for 2030: Research and development of the socioeconomic evaluation of energy conversion	International Institute for Carbon-Neutral Energy Research (I²CNER)	Associate Professor	Andrew Chapman	Clarify the impact of energy conversion on societal, economic, and environmental indicators (Initiative Period: 2022–2030)	Conduct Techno-economic evaluation (TEA) of future energy systems (Initiative Period: 2022–2030)	Elucidate the nexus of technology, people, and systems associated with energy conversion (Initiative Period: 2022–2030)	–	–	Conduct research in cooperation with I²CNER and the Faculty of Economics	http://chapman-lab.com/
	Research and Development into Achieving Geothermal Goals under the Sixth Strategic Energy Plan: Goal for 2030: Research and development into achieving geothermal goals under the Sixth Strategic Energy Plan	Faculty of Engineering	Professor	Yasuhiro Fujimitsu	Develop investigative and evaluative technologies for supercritical geothermal systems (Initiative Period: 2022–2030)	Enhance the sustainability of conventional geothermal power generation (Initiative Period: 2022–2030)	Increase the social acceptability of geothermal power to increase generation capacity (Initiative Period: 2022–2030)	–	–	Collaborate with the Platform of Inter/Transdisciplinary Energy Research	https://geothermics.mine.kyushu-u.ac.jp/index_e.html
	Research and Development into Achieving Nuclear Power Generation Goals under the Sixth Strategic Energy Plan: Goals for 2030: Research and development on new possibilities for nuclear energy in the field of energy supply	Faculty of Engineering	Professor	Nozomu Fujimoto	Develop characterization technology for advanced nuclear reactors (high-temperature gas-cooled reactors) (Initiative Period: 2022–2030)	Research the environmental impact of advanced nuclear reactors (Initiative Period: 2022–2030)	Explore new applications for advanced nuclear reactors (Initiative Period: 2022–2030)	–	–	Collaborate with the Platform of Inter/Transdisciplinary Energy Research	https://www.qpn.kyushu-u.ac.jp/lab7/index.html (Japanese)

Decarbonization

Remapping a Sustainable Energy Future:

From Interdisciplinary Research and Education to Social Collaboration and Implementation

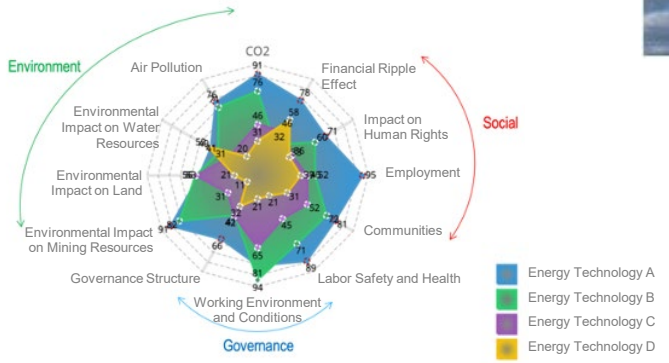
Applying Integrative Knowledge from the Natural and Social Sciences to Advanced Research and Education

Research and Education

- **Offshore Wind Power Generation**
  Research and Education Center for Offshore Wind
  Research Institute for Applied Mechanics, Faculty of Engineering
  Professional Development and Education for the Offshore Wind Power Industry
- **Geothermal Energy Research**
  Faculty of Engineering (Department of Earth Resources Engineering)
  JICA (Intensive Training for Geothermal Resource Engineers)
- **Nuclear Research**
  Faculty of Engineering (Department of Applied Quantum Physics and Nuclear Engineering)
- **Assessment of the Sustainability of Energy Technologies**
  Urban Institute
- **Socio-Economic Evaluation of Energy Conversion**
  International Institute for Carbon-Neutral Energy Research (I²CNER), Faculty of Economics

Interdisciplinary Industry-Academia-Government Collaboration

- **Consortiums with the Offshore Wind Power Industry**
  Training and Collaboration with New Domestic Industries
- **Joint Collaborative Research with Geothermal Power Companies**
  Collaboration with Major Domestic Companies as well as the National and Local Governments
- **Joint Collaborative Research with Nuclear Power-Related Companies**
  Collaboration with Major Domestic Companies as well as the National and Local Governments
- **Research on the Sustainability of Energy Technologies**
  International Collaboration with the United Nations, Inclusive Wealth Index, etc.
- **Socio-Economic Evaluation of Energy Conversion**
  Collaboration with Domestic and International Research Institutions

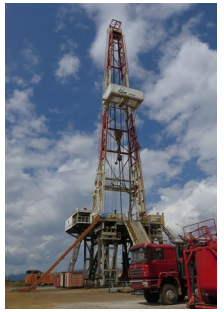


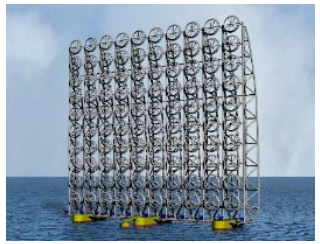
Demonstration

- **Offshore Wind Power-Related Facilities**
  Chikushi Campus, Ito Campus, Off-Campus Demonstration Facilities
- **Geothermal Power Generation**
  Ito Campus, Domestic and International Geothermal Demonstration Facilities
- **Nuclear Power-Related Facilities**
  Ito Campus
- **Sustainability Research**
  Ito Campus, Businesses, Local Governments, etc.
- **Socio-Economic Evaluation**
  Ito Campus

Implementation and Future Prospects

- **Promoting Renewable Energy and Decarbonization Toward Carbon Neutrality by 2050**
  (Expanding the use of renewable energy with growth potential, such as offshore wind power and geothermal energy, as well as new types of nuclear reactors)
- **Contributing to Domestic Industries and Professional Development**
  (Ensuring energy self-sufficiency by harnessing the university's strengths in renewable energy research, industry-academia-government collaboration, and professional development)
- **Making Recommendations for Sustainable Energy Technologies from a Socio-Economic Perspective**
  (Utilizing Life Cycle Assessment [LCA], Inclusive Wealth Index, etc.)
- **Making Recommendations for a Reconstructive Approach to Remapping a Sustainable Energy Future for Society that Leverages Integrative Knowledge**





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List of Group Initiatives

April 14, 2023

Unit Name: Decarbonization Unit

Unit Leader Name: Yoshimi Sonoda

Group Leader Name: Kiyoshi Miyata

Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
Photochemical Technology Innovation Group	Group-wide: Goal for 2030: Create photochemical technologies that will revolutionize the world				Develop and elucidate the mechanism of CO_2 photoreduction catalysts that function harmoniously (Initiative Period: 2023–2030)	Pursue functional chemistry of the triplet state (Initiative Period: 2023–2030)	Develop CO_2 Sensing and Conversion Technologies: (Initiative Period: 2023–2030)	Develop energy-saving light sources utilizing organic optical materials (Initiative Period: 2023–2030)	Create Organic Devices that Can be Manufactured at a Low Cost: (Initiative Period: 2023–2030)		–
	Develop and Elucidate the Mechanism of CO_2 Photoreduction Catalysts that Function Harmoniously: Goal for 2030: Develop catalysts that produce a variety of useful compounds from CO_2	Faculty of Science	Associate Professor	Kiyoshi Miyata	Facilitate the tracing of the one-electron reduction process for artificial photosynthetic photocatalysts (Initiative Period: 2023–2025)	Develop spectroscopic techniques to observe the downstream effects of multi-electron transfer photoreactions (Initiative Period: 2023–2030)	Research highly efficient catalysts based on information on intermediates in the reaction process (Initiative Period: 2023–2030)			・ Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research ・ Engage in cooperative research with external parties in Grant-in-Aid Transformative Research Areas (B)	http://www.chem.kyushu-univ.jp/Spectrochem/home-en/
	Research Functional Chemistry of the Triplet State: Goal for 2030: Create quantum technologies utilizing photo-excited molecules	Faculty of Engineering	Associate Professor	Nobuhiro Yanai	Harness unused sunlight through up-conversion (Initiative Period: 2023–2028)	Integrate up-conversion and artificial photosynthesis (Initiative Period: 2023–2030)	Replace thermal processes with optical ones through up-conversion (Initiative Period: 2023–2030)	Establish venture businesses to achieve social implementation of up-conversion (Initiative Period: 2025–2030)		・ Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research	https://www.chem.kyushu-u.ac.jp/~cstm/laboratory/laboratory_353.php (Japanese)
	Develop CO_2 Sensing and Conversion Technologies: Goal for 2030: Conduct research on innovative molecular conversion	Faculty of Engineering	Associate Professor	Toshikazu Ono	Develop a fluorescent sensor to detect the concentration of CO_2 by utilizing photo-induced electron transfer (Initiative Period: 2023–2025)	Develop a hydrogel that facilitates fluorescent detection of CO_2 adsorption/desorption behavior (Initiative Period: 2023–2025)	Develop a biomimetic catalyst that absorbs CO_2, converts it to a C_1 source, and releases it (Initiative Period: 2023–2025)			・ Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research	https://www.chem.kyushu-u.ac.jp/~cstm/laboratory/laboratory_311.php (Japanese)
	Develop Energy-Saving Light Sources: Goal by 2030: Develop energy-saving light sources utilizing organic optical materials	Faculty of Engineering	Associate Professor	Hajime Nakanotani	Develop an ultra-low power light source using charge-transfer excitation states (Initiative Period: 2023–2025)	Develop a molecular heat pump driven by low-energy light (Initiative Period: 2023–2025)	Develop a heat recovery system using solar and ultra-low power light sources (Initiative Period: 2023–2030)			・ Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research	https://www.cstf.kyushu-u.ac.jp/~adachilab/lab/?lang=en
	Create Organic Devices that Can be Manufactured at a Low Cost: Goal for 2030: Conduct research on low-cost devices through coating processes	Institute for Materials Chemistry and Engineering	Associate Professor	Ken Albrecht	Develop a suite of materials for the production of field emission devices using inkjet printers (Initiative Period: 2023–2025)	Develop high-efficiency field emission devices using radicals (Initiative Period: 2023–2027)	Develop new chemical processes catalyzed by electric fields (Initiative Period: 2023–2030)			・ Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research	https://www.alken-lab.com/english.html

Decarbonization

Solving Decarbonization and Energy Issues through the Creation of New Photochemical Technologies

Collaboration Across Departments and Campuses

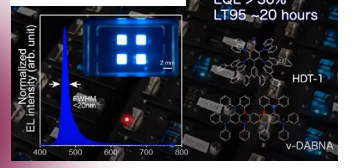
Collaboration Inside and Outside the University

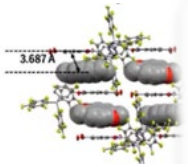
Solving Social Issues Toward Social Implementation

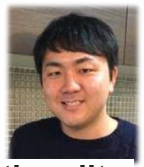
Photomolecular Technology

Functional Chemistry Using Triplets

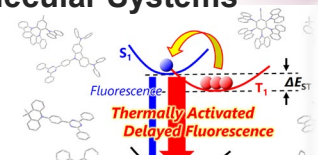
Light-Vibration-Electricity Energy Conversion



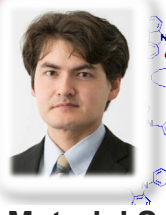


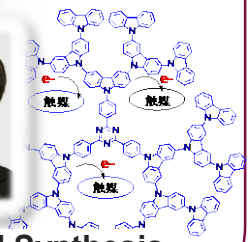


Photofunctionality in Composite Molecular Systems



Advanced Spectroscopic Measurement





Material Synthesis Polymer Synthesis

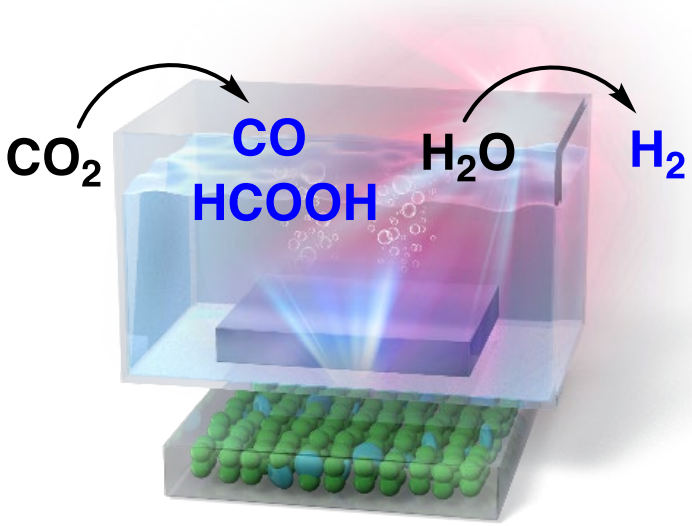
Breakthroughs in Light Energy Utilization Enabled by Molecular Technology

- High-Energy Light Production through Photon Upconversion for Artificial Photosynthesis and Solar Cells
- Near-Infrared Low-Energy Light OLED for Composite Molecular Materials
- Energy Conversion Molecular Materials for Low-Cost, Fully-Coated Devices
- High-Order Photofunctional Molecules for Cutting-Edge Spectroscopic Analysis

Challenges Posed by Energy Issues:

- Inefficiency of Low-Energy Light Utilization
- High Cost of Device Manufacturing Process
- Lack of Transparency in the Energy Conversion Process

Example:
Development of Solar Energy Utilization for Comprehensive Artificial Photosynthesis Systems



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List of Group Initiatives

July 21, 2022

Unit Name: Decarbonization Unit

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Megumi Takata

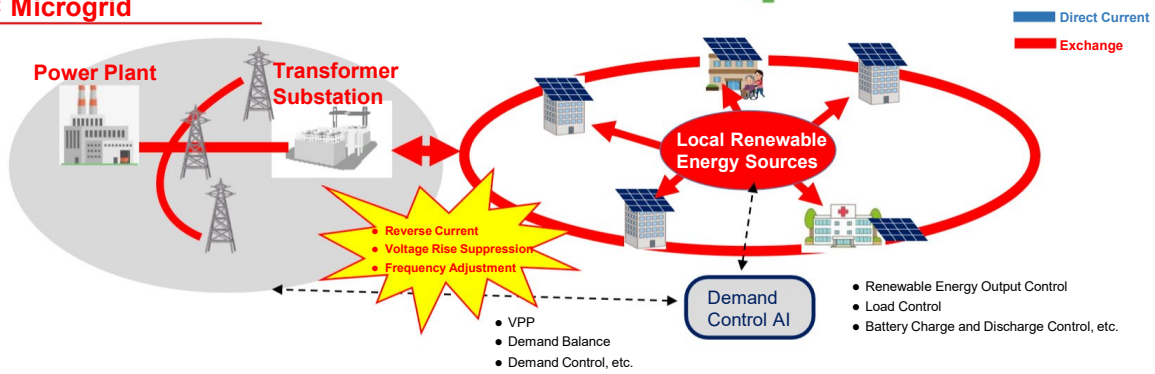
Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn[2])	Project URL
		Affiliation	Position	Name							
Promoting Regional Cooperation	Group-wide: Goal for 2030: Implement five energy-saving technologies in collaboration with local governments				Build and strengthen partnerships with local governments in the use of local energy (Initiative Period: 2022–2030)	Conduct proof-of-concept trials of energy, information, and food ecosystems in Itoshima Science Village (Initiative Period: 2022–2025)	Promote collaboration with industries in the Kyushu region aimed at implementing university technologies (Initiative Period: 2022–2030)	–	–		
	Direct Current (DC) Microgrids: Goal for 2030: Lower renewable energy output control to zero	Global Innovation Center	Professor	Yuichi Harada	Demonstrate the usefulness of DC microgrids using renewable energy (Initiative Period: 2022–2026)	Promote the use of DC microgrids and evaluate their utilization (Initiative Period: 2022–2024)		–	–	・ Collaborate with companies connected to the GIC KOINE Project Division ・ Collaborate with JEITA's Green IT Promotion Committee	https://www.gic.kyushu-u.ac.jp/j/research/koine/coldtech.html
	Sustainability Assessment Model: Goal for 2030: Establish a sustainability value assessment model for energy technologies	Global Innovation Center	Professor	Yuichi Harada	Construct and apply a sustainability value assessment model for energy technologies and apply it to technological development (Initiative Period: 2022–2024)	Evaluate the sustainability value assessment model through its application in Nogata City and Itoshima City (Initiative Period: 2023–2025)	–	–	–	・ Collaborate with the Q-PIT Energy and Society Cluster ・ Collaborate with Nogata City and Itoshima City	
	Implementation of University Technology: Goal for 2030: Achieve multiple implementations of energy technology in collaboration with industries in the Kyushu region	Faculty of Economics	Professor	Megumi Takata	Promote collaboration with the Kyushu semiconductor industry to expand the use of DC microgrids (Initiative Period: 2022–2026)	Conduct regional implementation of technologies developed by other groups (Initiative Period: 2022–2030)				・ Collaborate with the Kyushu Semiconductor & Electronics Technology Innovation Association (SIIQ)	https://siiq.jp/en/index.html
	Implementation Throughout the Region: Goal for 2030: Develop and propose a strategy for the decarbonization of the entire Kyushu region	Platform of Inter/Transdisciplinary Energy Research	Vice President	Kazunari Sasaki	Integrate the efforts of each of the five groups and implement them throughout the region (Initiative Period: 2022–2030)					Collaborate with the relevant external organizations, such as the Kyushu Area Renewable Energy Collaboration Committee of the Japan Association of National Universities, the Renewable Energy Cooperation Committee of the Kyushu Regional Strategy Council, and the Fukuoka Prefecture Hydrogen Green Growth Strategy Conference	https://q-pit.kyushu-u.ac.jp/en/

Achieve energy-saving technology implementations in collaboration with local governments

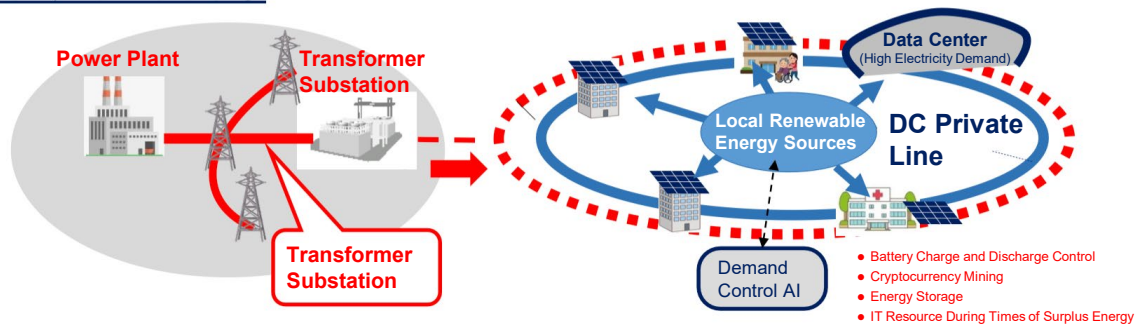
Using DC Microgrids to Solve AC Grid Issues

◇ Stable Local Power Supply without Reverse Power Flow ◇

1. AC Microgrid



2. DC Microgrid



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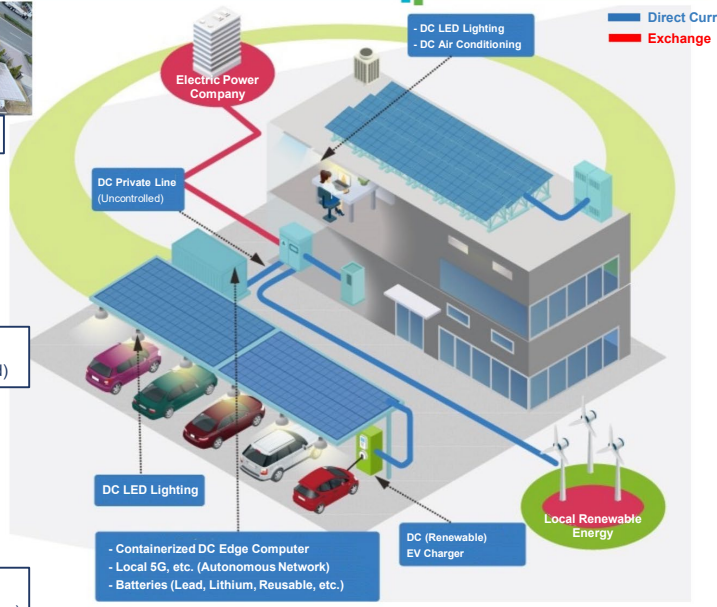
Concept Rendering

◇ DC Power Carport system ◇

Solar Carport

CHAdeMO EV Charger
(Low-Cost, Non-Insulating Method)

DC LED Lighting Device
(No Power Supply, Maintenance Free)



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Power semiconductors play a key role in facilitating the control needed to expand DC microgrids. We will accelerate implementation by collaborating with the semiconductor industry in the Kyushu region.

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Contributions of the National Universities in Kyushu:
Relationship between the Governors' Association, Strategy Council, Kyushu Economic Federation and the "Committee for the Promotion of Renewable Energy Industrialization" of the Association of National Universities' Kyushu Branch

University

Kyushu Area Renewable Energy Cooperation Committee

○ Chair: President Ishibashi, Kyushu University
○ Members: Presidents of each national university corporation in the Kyushu region
○ Activities:
- Host forums that bring together energy research findings from universities throughout Kyushu
- Provide recommendations for social implementation of research findings, professional development, etc.

Recommendations

Governors' Association

Kyushu Regional Governors' Association Policy Coalition

"Collaboration on Measures Against Global Warming"

○ Executive Prefecture: Oita Prefecture
○ Members: Prefectures of Kyushu
○ Activities:
- Implement coordinated Kyushu-wide campaigns such as energy-conserving summer and winter "ecological lifestyle" initiatives and "No My Car Day"
- Roll-out of official Kyushu Eco-Family Support App (Kyushu Carbon Mileage Version) across the seven prefectures of Kyushu

Social Implementation

Kyushu Regional Strategy Council

Kyushu Regional Strategy Council

○ Chairs: Chair of the Kyushu Regional Governors' Association and Chair of the Kyushu Economic Federation
○ Members: Composed of governors from nine prefectures (the seven prefectures of Kyushu plus Okinawa, and Yamaguchi) and representatives from four economic organizations in Kyushu

Committee for the Promotion of Renewable Energy Industrialization

○ Chair: Hiroto Yasuura, Professor Emeritus, Kyushu University
○ Activities:
- Formulate an action plan for the industrialization of renewable energy (2030 KPI)
- Hold operational meetings for the three key areas of "Geothermal/Hot Spring Heat," "Marine Power," and "Hydrogen Power"

Social Implementation

Kyushu Economic Federation

KEF Committee on Energy Resources and Environment

○ Chair: Michiaki Uriu, Chairman, Kyushu Electric Power Co., Inc.
○ Members: Composed of approx. 300 companies
○ Activities:
- Make environmental preparations for expanding ESG investments and sustainable procurement
- Make environmental preparations for creating a decarbonized society
- Lobbying the government, etc.

Social Implementation

Promote decarbonization and socially implement renewable energy in Kyushu