

# Roadmap for the Decarbonization Unit

## Integrated Initiative for Designing Future Society

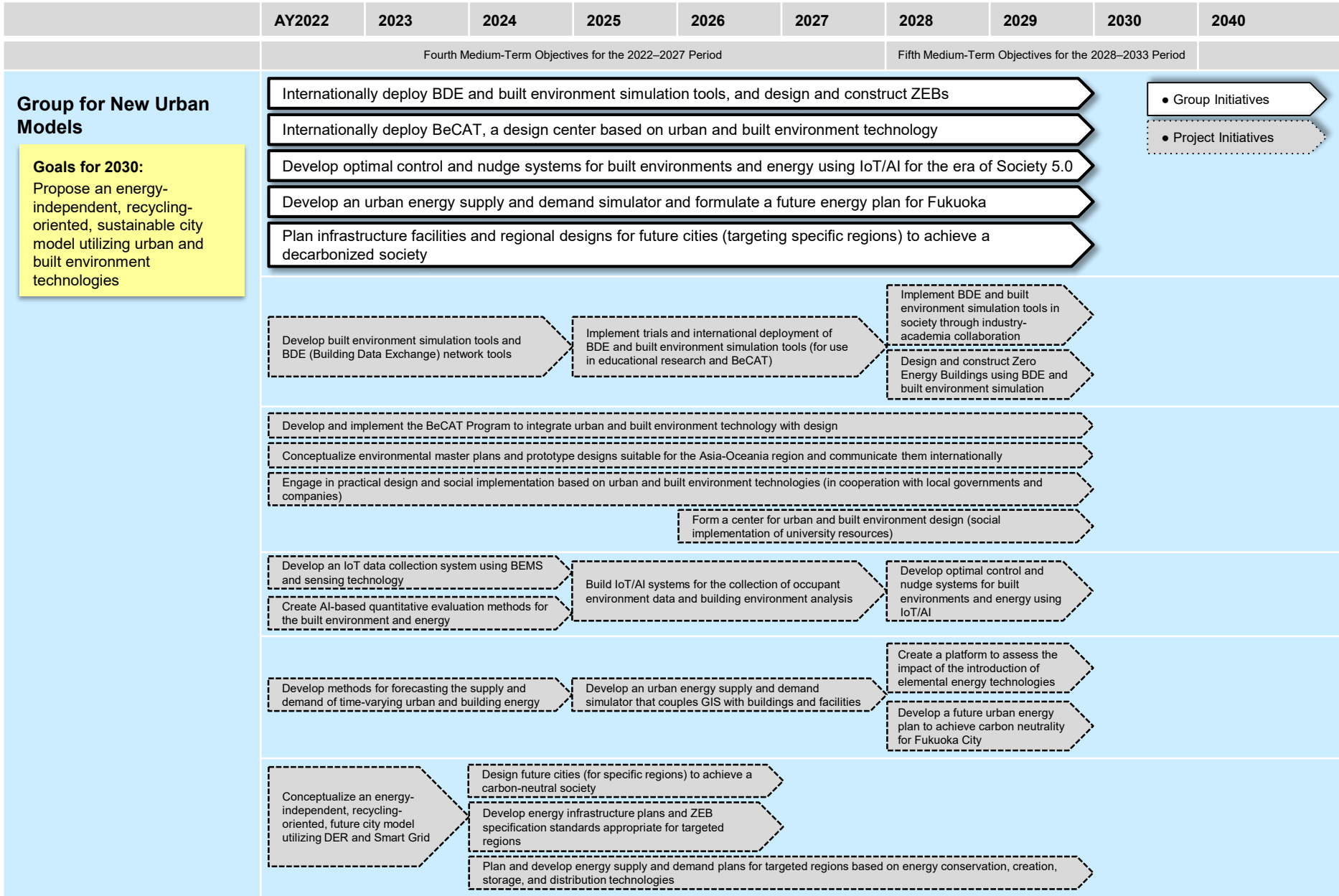
	AY2022	2023	2024	2025	2026	2027	2028	2029	2030	2040
	Fourth Medium-Term Objectives for the 2022–2027 Period						Fifth Medium-Term Objectives for the 2028–2033 Period			
<b>Decarbonization Unit</b>  <b>Goals for 2030:</b> To propose innovative technologies and a social vision for discontinuous innovation to achieve carbon neutrality	<b>Goals and Vision</b> 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.									
<b>Group for the Reduction of Energy Consumption Through Hydrogen</b>  <b>Goals for 2030:</b> 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			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.			<ul style="list-style-type: none"> <li>Group Initiatives</li> <li>Project Initiatives</li> </ul>
	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			
	Promoting innovative research and demonstrations of materials for hydrogen energy devices.			Promote materials development research to solve problems for implementation in devices			Accelerate joint research for implementation in hydrogen energy devices.			

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	Fourth Medium-Term Objectives for the 2022–2027 Period						Fifth Medium-Term Objectives for the 2028–2033 Period			
<p><b>CO<sub>2</sub> Capture and Conversion</b></p> <p><b>Goals for 2030:</b> Research, development, and social implementation of CO<sub>2</sub> capture, utilization, and conversion systems</p>	Establish efficient CO <sub>2</sub> capture and conversion technologies						<ul style="list-style-type: none"> <li>Group Initiatives</li> <li>Project Initiatives</li> </ul>			
	Develop CO <sub>2</sub> capture and conversion systems									
	Research and development on the socioeconomic evaluation of CO <sub>2</sub> capture and conversion									
	Produce a social design that incorporates CO <sub>2</sub> capture and conversion systems									
	Develop CO <sub>2</sub> separation membranes that facilitate direct air capture (DAC)									
	Develop systems for direct CO <sub>2</sub> capture from the atmosphere using separation membranes									
	Develop systems that integrate atmospheric CO <sub>2</sub> capture and utilization using separation membranes									
	Develop electrocatalysts for the highly selective conversion of CO <sub>2</sub> to valuable compounds									
	Develop electrocatalysts for the highly selective conversion of CO <sub>2</sub> to valuable compounds									
	Fabricate a reactor for the efficient production of valuable compounds from CO <sub>2</sub>									
	Develop and demonstrate equipment capable of recovering and utilizing the CO <sub>2</sub> in exhaust gas from the combustion of LNG and LPG									
	Develop and demonstrate equipment for the capture and utilization of CO <sub>2</sub> from exhaust gases produced in thermal treatment equipment and crewed space exploration vessels									
	Develop and demonstrate equipment capable of capturing and utilizing atmospheric CO <sub>2</sub>									
	Fabricate equipment for the capture and storage of CO <sub>2</sub> 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 <sub>2</sub> retained in the upper parts of horticultural facilities									
	Achieve on-site underground biomethanation of geosequestered CO <sub>2</sub> using methanogens									
	Achieve energy-saving CO <sub>2</sub> 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 <sub>2</sub> resource conversion and the manufacture of high-value-added raw materials through DX										
Conduct economic evaluation of fully solid-state devices for CO <sub>2</sub> resource conversion and the manufacture of high-value-added raw materials and design a society that incorporates these devices										

# Roadmap for the Decarbonization Unit Integrated Initiative for Designing Future Society



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<p><b>Group for Remapping a Sustainable Energy Future</b></p> <p><b>Goals for 2030:</b> Remap a Sustainable Energy Future</p>	<p>Research and development of offshore wind power generation</p> <p>Research and development of a sustainability value assessment model for energy technologies</p> <p>Conduct R&amp;D on the socioeconomic evaluation of energy conversion</p> <p>Research and development of geothermal power generation</p> <p>Research and development of new possibilities for nuclear energy</p>						<ul style="list-style-type: none"> <li>• Group Initiatives</li> <li>• Project Initiatives</li> </ul>			
	<p>Conduct research into wind energy science integrating atmospheric physics, ocean physics, and fluid dynamics</p>						<p>Conduct research, development, and social implementation based on integrative knowledge to promote the widespread establishment of large-scale offshore wind farms</p>			
	<p>Develop an ESG assessment framework that accounts for the life cycle of energy technologies</p>						<p>Develop a model for evaluating the impact of energy technology on natural, artificial, and human capital using the Inclusive Wealth Index</p>			
							<p>Evaluate domestic and international energy technologies, including new technologies such as direct air capture (DAC) for social implementation</p>			
	<p>Clarify the impact of energy conversion on society and economic and environmental indicators</p>						<p>Conduct Techno-economic evaluation (TEA) of future energy systems</p>			
	<p>Elucidate the nexus of technology, people, and systems associated with energy conversion</p>									
	<p>Develop investigative and evaluative technologies for supercritical geothermal systems</p>						<p>Enhance the sustainability of conventional geothermal power generation</p>			
	<p>Increase the social acceptability of geothermal power to increase generation capacity</p>									
	<p>Develop characterization technology for advanced nuclear reactors (high-temperature gas-cooled reactors)</p>						<p>Research the environmental impact of advanced nuclear reactors</p>			
	<p>Explore new applications for advanced nuclear reactors</p>									

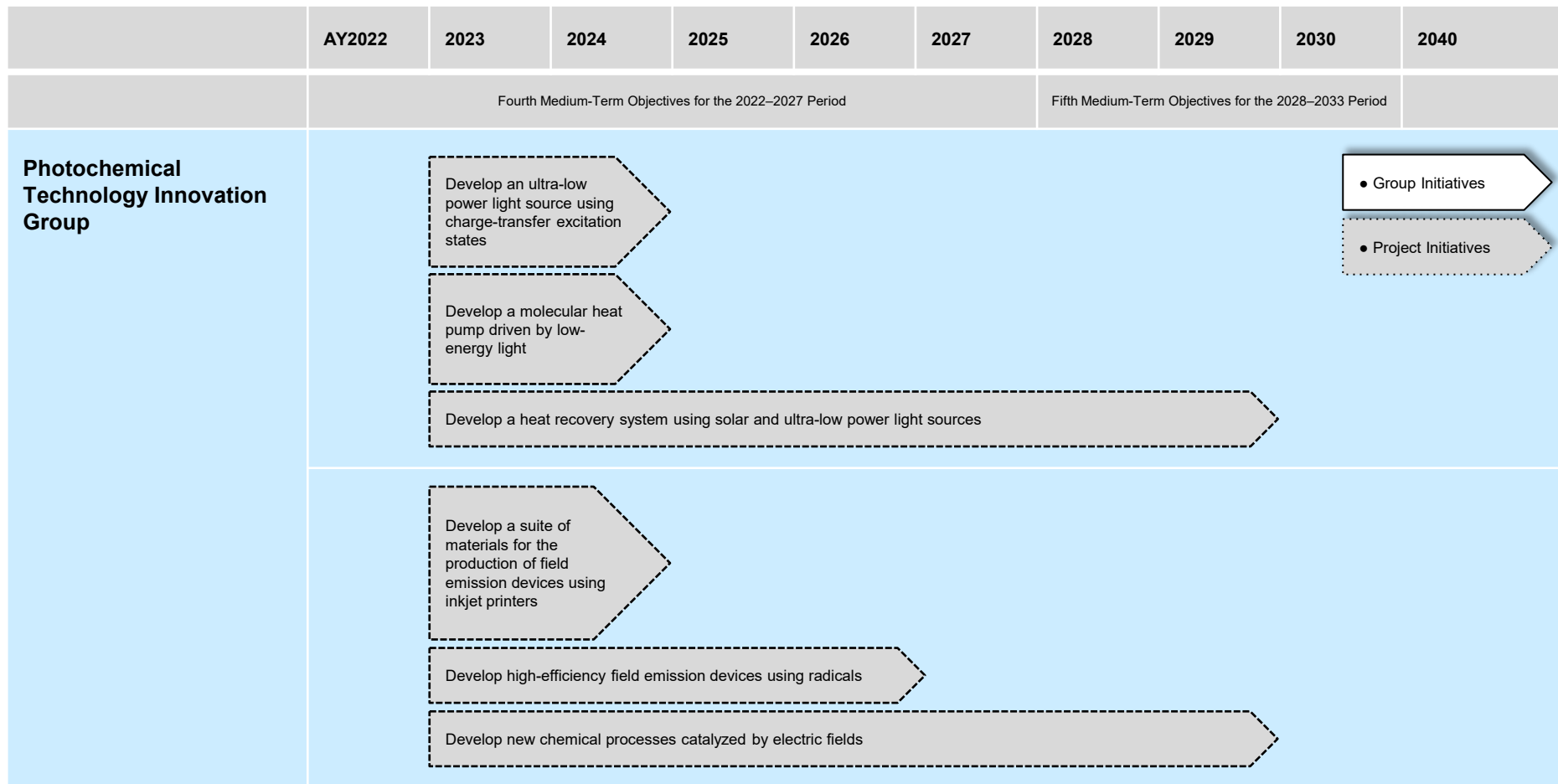
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<p><b>Photochemical Technology Innovation Group</b></p> <p><b>Goals for 2030:</b> Create photochemical technologies that will revolutionize the world</p>	<p>Develop and elucidate the mechanism of CO<sub>2</sub> photoreduction catalysts that function harmoniously</p> <p>Pursue functional chemistry of the triplet state</p> <p>Develop CO<sub>2</sub> sensing and conversion technologies</p> <p>Develop energy-saving light sources utilizing organic optical materials</p> <p>Create organic devices that can be manufactured at a low cost</p>						<p>• Group Initiatives</p> <p>• Project Initiatives</p>			
	<p>Facilitate the tracing of the one-electron reduction process for artificial photosynthetic photocatalysts</p> <p>Develop spectroscopic techniques to observe the downstream effects of multi-electron transfer photoreactions</p> <p>Research highly efficient catalysts based on information on intermediates in the reaction process</p>									
	<p>Develop a fluorescent sensor to detect the concentration of CO<sub>2</sub> by utilizing photo-induced electron transfer</p> <p>Develop a hydrogel that facilitates fluorescent detection of CO<sub>2</sub> adsorption/desorption behavior</p> <p>Develop a biomimetic catalyst that absorbs CO<sub>2</sub>, converts it to a C<sub>1</sub> source, and releases it</p>									

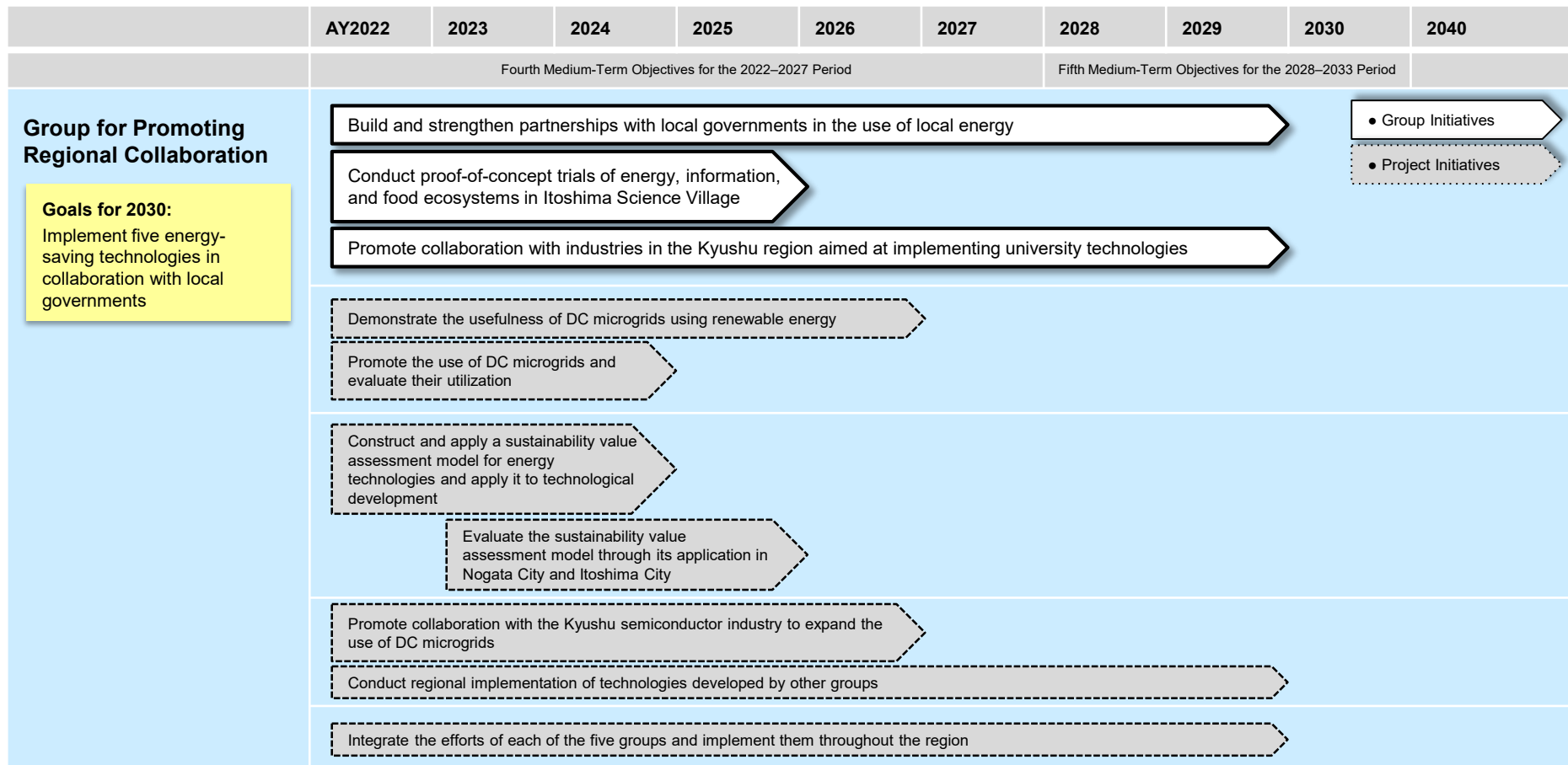
# Roadmap for the Decarbonization Unit

## Integrated Initiative for Designing Future Society



# Roadmap for the Decarbonization Unit

## Integrated Initiative for Designing Future Society



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 <sup>2</sup> )	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 <a href="https://h2.kyushu-u.ac.jp/english/index.html">https://h2.kyushu-u.ac.jp/english/index.html</a>
	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).	<a href="https://h2.kyushu-u.ac.jp/english/index.html">https://h2.kyushu-u.ac.jp/english/index.html</a>
	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.	<a href="https://hydrogenius.kyushu-u.ac.jp/en/">https://hydrogenius.kyushu-u.ac.jp/en/</a>
	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.	<a href="http://fc.kyushu-u.ac.jp/">http://fc.kyushu-u.ac.jp/</a> (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.	<a href="https://www.eng.kyushu-u.ac.jp/e/">https://www.eng.kyushu-u.ac.jp/e/</a>
	Carbon Energy Research  Goal for 2030: Encourage international academic collaboration in the field of hydrogen technology.	International Institute for Carbon-Neutral Energy Research (I <sup>2</sup> CNER)	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.	<a href="https://i2cner.kyushu-u.ac.jp/en/">https://i2cner.kyushu-u.ac.jp/en/</a>
	Hydrogen Energy Materials Research  Goal for 2030: Accelerate advanced research on materials for hydrogen energy devices	International Hydrogen Energy Research Center	Professor	Masamichi Nishihara	Advance innovative research for materials on hydrogen energy devices and their demonstration. (Initiative Period: 2024–2026)	Promote materials development research to solve problems for implementation in devices (Initiative Period: 2026–2028)	Accelerate joint research for implementation in hydrogen energy devices (Initiative Period: 2028–2030)	—	—	Promote collaboration with other units in materials research and promote joint industry-university research.	<a href="https://nishiharamasamichi.wixsite.com/nishihara-laboratory">https://nishiharamasamichi.wixsite.com/nishihara-laboratory</a>



# 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 (I<sup>2</sup>CNER)

- **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)

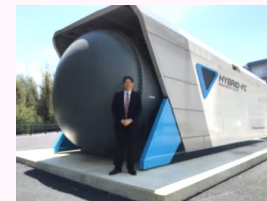


### Demonstration



- **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)

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

# Decarbonization

# Using CO<sub>2</sub> Capture and Conversion to Build a Carbon-Recycling Society

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

### Research

#### CO<sub>2</sub>-Related Research

#### Research Center for Negative Emissions Technologies

An organization specializing in research on CO<sub>2</sub> recycling starting with the capture of CO<sub>2</sub> from the atmosphere



#### 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



Research and development focused on CO<sub>2</sub>-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

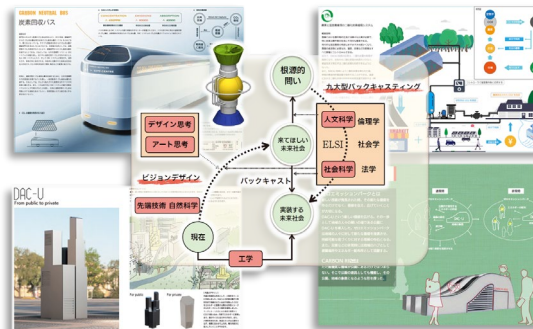


"Creating innovative proton-conducting inorganic compounds by combining experimental and computational science"

### Interdisciplinary Industry-Academia Collaboration

#### 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

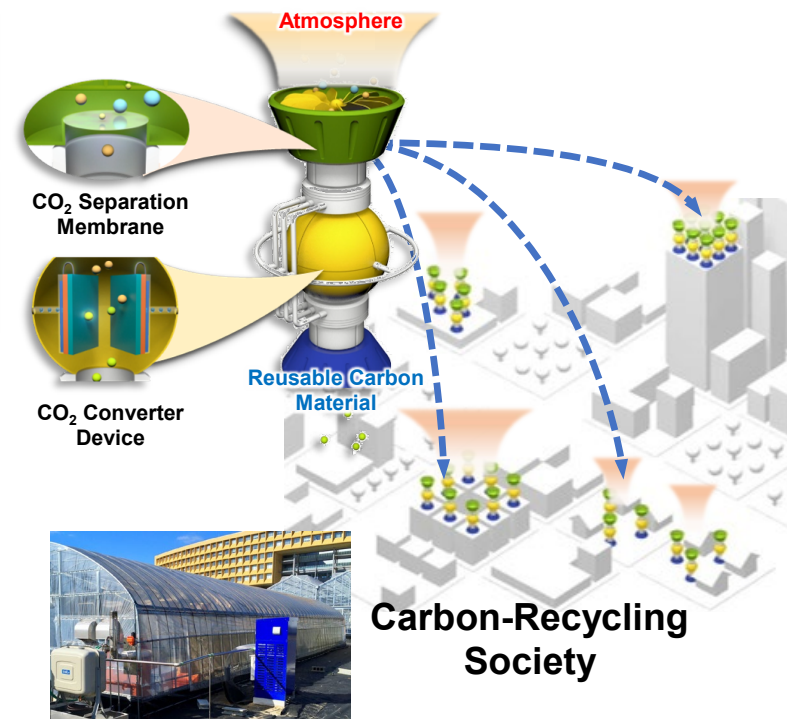


#### Consortium of Venture Businesses



### Social Implementation

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

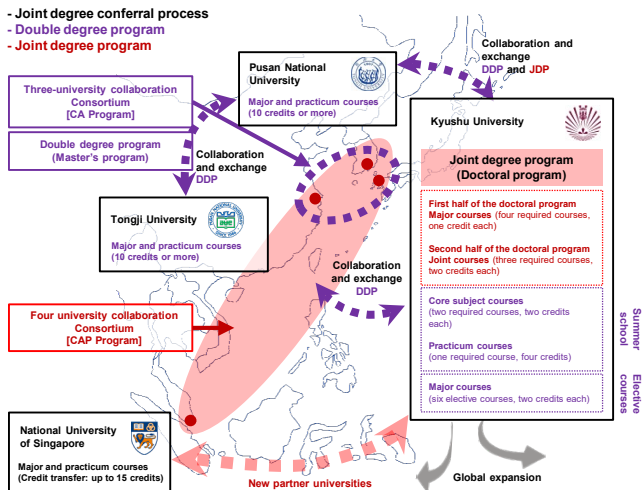
# Decarbonization

## 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

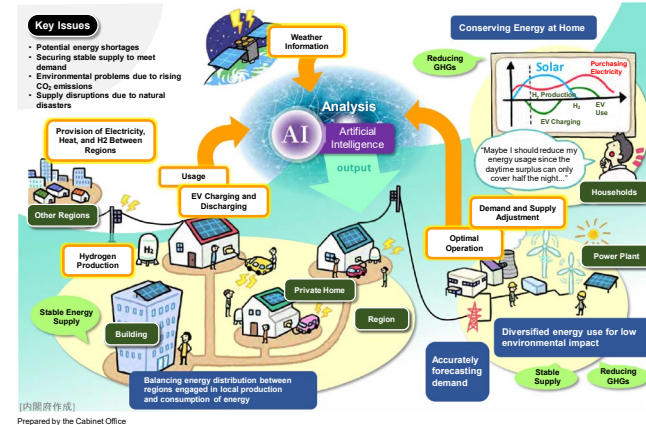


### Industry-Academia Collaboration

- 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 Minister 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

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

## 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

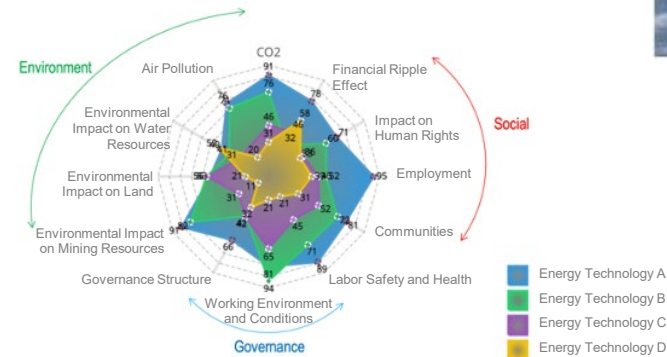
### Research and Education

- 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 (I<sup>2</sup>CNER), 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



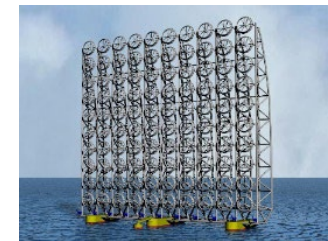
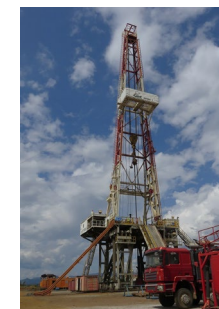
### Demonstration

- 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**



## List of Group Initiatives

February 14, 2025

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 <sup>2</sup> )	Project URL
		Affiliation	Position	Name							
Photochemical Technology Innovation Group	<u>Group-wide:</u>  Goal for 2030: Create photochemical technologies that will revolutionize the world				Develop and elucidate the mechanism of CO <sub>2</sub> photoreduction catalysts that function harmoniously (Initiative Period: 2023–2030)	Pursue functional chemistry of the triplet state (Initiative Period: 2023–2030)	<u>Develop CO<sub>2</sub> Sensing and Conversion Technologies:</u> (Initiative Period: 2023–2030)	Develop energy-saving light sources utilizing organic optical materials (Initiative Period: 2023–2030)	<u>Create Organic Devices that Can be Manufactured at a Low Cost:</u> (Initiative Period: 2023–2030)		—
	<u>Develop and Elucidate the Mechanism of CO<sub>2</sub> Photoreduction Catalysts that Function Harmoniously:</u>  Goal for 2030: Develop catalysts that produce a variety of useful compounds from CO <sub>2</sub>	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)			<ul style="list-style-type: none"> <li>Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research</li> <li>Engage in cooperative research with external parties in Grant-in-Aid Transformative Research Areas (B)</li> </ul>	<a href="http://www.chem.kyushu-univ.jp/Spectrochem/home-en/">http://www.chem.kyushu-univ.jp/Spectrochem/home-en/</a>
	<u>Develop CO<sub>2</sub> Sensing and Conversion Technologies:</u>  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 <sub>2</sub> by utilizing photo-induced electron transfer (Initiative Period: 2023–2025)	Develop a hydrogel that facilitates fluorescent detection of CO <sub>2</sub> adsorption/desorption behavior (Initiative Period: 2023–2025)	Develop a biomimetic catalyst that absorbs CO <sub>2</sub> , converts it to a C <sub>1</sub> source, and releases it (Initiative Period: 2023–2025)			<ul style="list-style-type: none"> <li>Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research</li> </ul>	<a href="https://www.chem.kyushu-u.ac.jp/~cstm/laboratory/laboratory_311.php">https://www.chem.kyushu-u.ac.jp/~cstm/laboratory/laboratory_311.php</a> (Japanese)
	<u>Develop Energy-Saving Light Sources:</u>  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)			<ul style="list-style-type: none"> <li>Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research</li> </ul>	<a href="https://www.cstf.kyushu-u.ac.jp/~adachilab/lab/?lang=en">https://www.cstf.kyushu-u.ac.jp/~adachilab/lab/?lang=en</a>
	<u>Create Organic Devices that Can be Manufactured at a Low Cost:</u>  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)			<ul style="list-style-type: none"> <li>Collaborate and cooperate with the Platform of Inter/Transdisciplinary Energy Research</li> </ul>	<a href="https://www.alken-lab.com/english.html">https://www.alken-lab.com/english.html</a>



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

*Collaboration Across Departments and Campuses*

*Collaboration Inside and Outside the University*



## Photomolecular Technology

目に見えない近赤外光  
より高エネルギーの青色発光



532 nm

**Functional Chemistry Using Triplets**

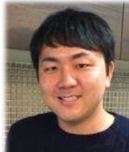
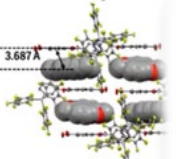


**Light-Vibration-Electricity Energy Conversion**

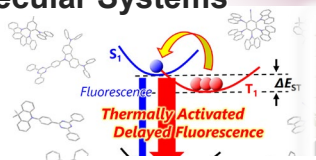


EOE > 30%  
LT95 ~ 20 hours

HDT-1  
v-DABNA

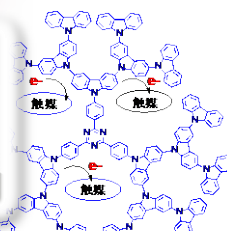




**Photofunctionality in Composite Molecular Systems**



Fluorescence  
Thermally Activated Delayed Fluorescence

**Advanced Spectroscopic Measurement**



**Material Synthesis Polymer Synthesis**

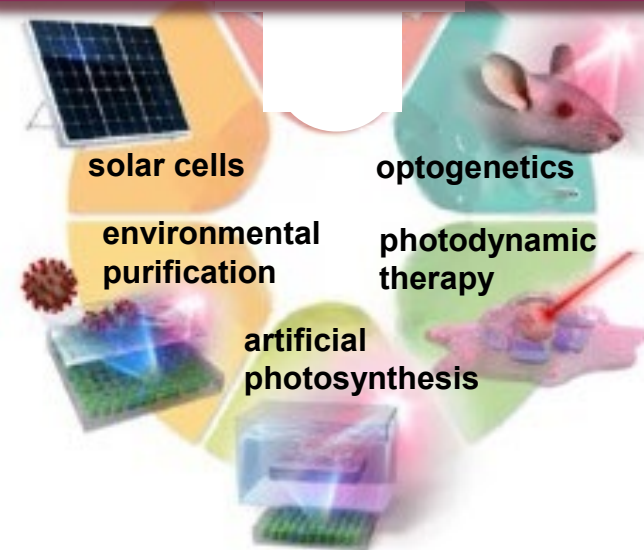
## Breakthroughs in Light Energy Utilization Enabled by Molecular Technology

- 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

## Solving Social Issues Toward Social Implementation



solar cells  
environmental purification  
artificial photosynthesis  
optogenetics  
photodynamic therapy

List of Group Initiatives

July 21, 2022

Unit Name: Decarbonization Unit

Unit Leader Name: Yoshio Hisaeda

Group Leader Name: Megumi Takata

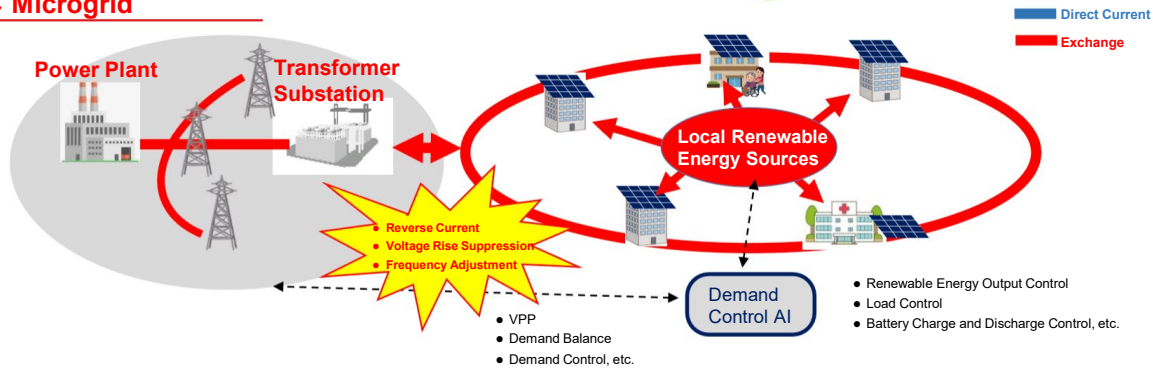
Group Name	Goal	Project Manager			Action Item 1	Action Item 2	Action Item 3	Action Item 4	Action Item 5	Collaborations (e.g., Other groups, other units, DDIn <sup>2</sup> )	Project URL
		Affiliation	Position	Name							
Promoting Regional Cooperation	<u>Group-wide:</u> Goal for 2030: Implement five energy-saving 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)	–	–		
	<u>Direct Current (DC) Microgrids:</u> Goal for 2030: Lower renewable energy output control to zero	<a href="#">Global Innovation Center</a>	Professor	<a href="#">Yuichi Harada</a>	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)		–	–	<ul style="list-style-type: none"> <li>Collaborate with companies connected to the GIC KOINE Project Division</li> <li>Collaborate with JEITA's Green IT Promotion Committee</li> </ul>	<a href="https://www.gic.kyushu-u.ac.jp/research/koine/coldtech.html">https://www.gic.kyushu-u.ac.jp/research/koine/coldtech.html</a>
	<u>Sustainability Assessment Model:</u> Goal for 2030: Establish a sustainability value assessment model for energy technologies	<a href="#">Global Innovation Center</a>	Professor	<a href="#">Yuichi Harada</a>	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)		–	–	<ul style="list-style-type: none"> <li>Collaborate with the Q-PIT Energy and Society Cluster</li> <li>Collaborate with Nogata City and Itoshima City</li> </ul>	
	<u>Implementation of University Technology:</u> Goal for 2030: Achieve multiple implementations of energy technology in collaboration with industries in the Kyushu region	<a href="#">Faculty of Economics</a>	Professor	<a href="#">Megumi Takata</a>	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)				<ul style="list-style-type: none"> <li>Collaborate with the Kyushu Semiconductor &amp; Electronics Technology Innovation Association (SIIQ)</li> </ul>	<a href="https://siiq.jp/en/index.html">https://siiq.jp/en/index.html</a>
	<u>Implementation Throughout the Region:</u> Goal for 2030: Develop and propose a strategy for the decarbonization of the entire Kyushu region	<a href="#">Platform of Inter/Transdisciplinary Energy Research</a>	Vice President	<a href="#">Kazunari Sasaki</a>	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	<a href="https://q-pit.kyushu-u.ac.jp/en/">https://q-pit.kyushu-u.ac.jp/en/</a>

# Achieve energy-saving technology implementations in collaboration with local governments

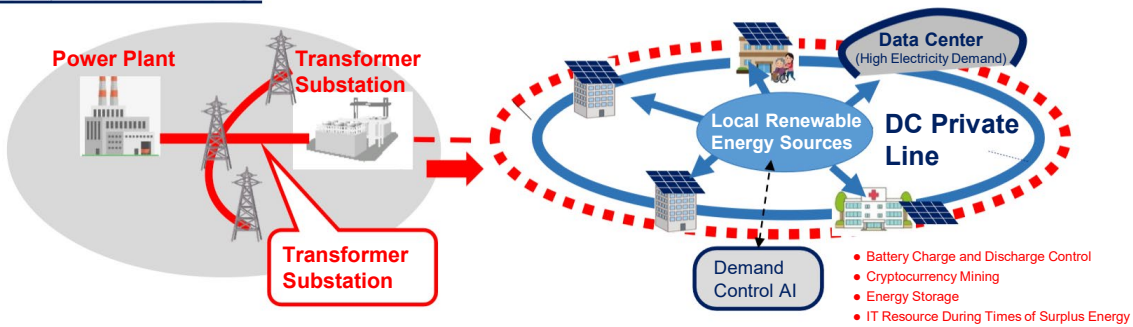
## Using DC Microgrids to Solve AC Grid Issues

◇ Stable Local Power Supply without Reverse Power Flow ◇

### 1. AC Microgrid



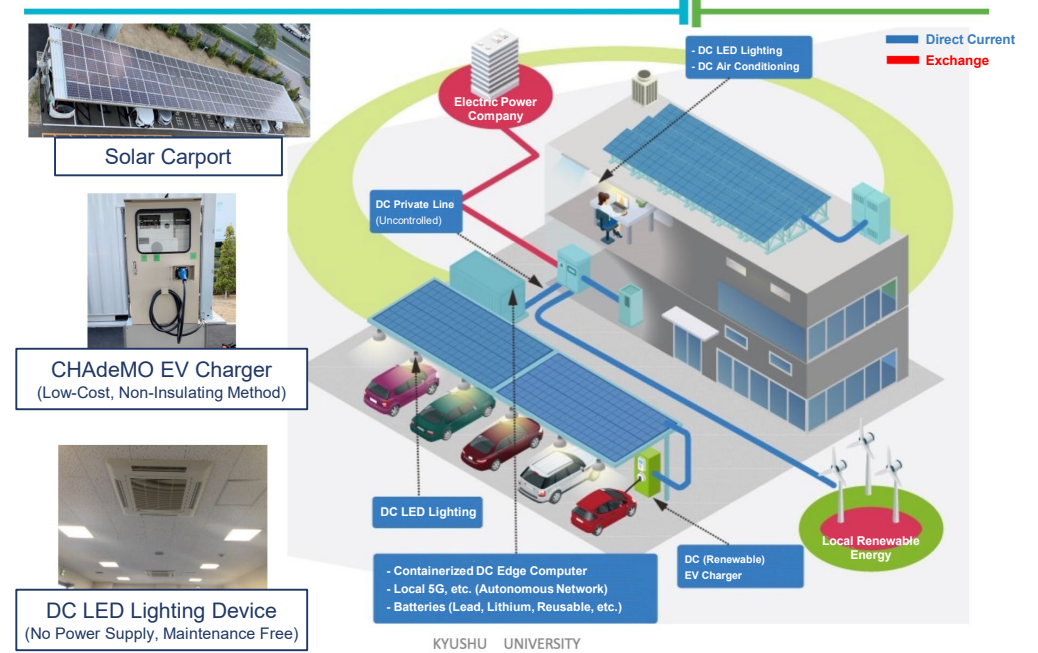
### 2. DC Microgrid



KYUSHU UNIVERSITY

## Concept Rendering

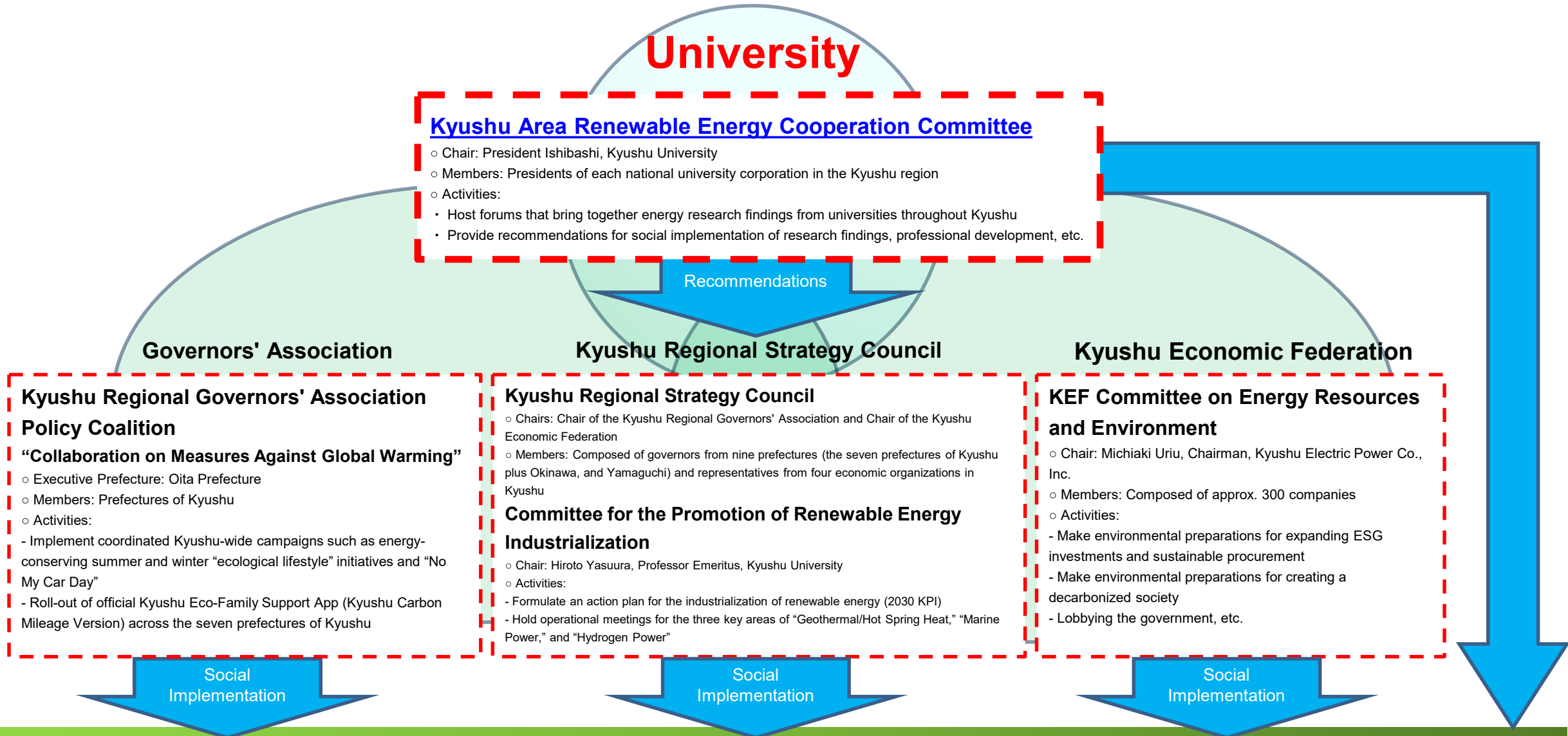
◇ DC Power Carport system ◇



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.

# 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



Promote decarbonization and socially implement renewable energy in Kyushu