I²CNER

INTERNATIONAL INSTITUTE FOR CARBON-NEUTRAL ENERGY RESEARCH



2026

I²CNER

wpi World Premier International Research Center Initiative

KYUSHU UNIVERSITY

ILLINOIS

所長メッセージ

Message from the I²CNER Director

The International Institute for Carbon-Neutral Energy Research (I²CNER) was established in 2010 as a WPI institute. At the time, it was the only institute in the world with “Carbon-Neutral Energy” in its name. I²CNER later became a member of the WPI Academy in 2020. To date, I²CNER has promoted the societal value of basic research as part of WPI's “Values for the Future” mission.

Climate change issues, including global warming, have become increasingly serious in recent years, making the transition to a carbon-neutral society based on renewable energy an important and urgent global issue. There are still many difficult challenges to overcome in transitioning from the current energy system, which relies primarily on fossil fuels, to a society based on renewable energy and materials. Achieving this transition requires not only novel energy conversion technologies but also the overall design of social systems in which materials and energy are interconnected.

Renewable energy sources, such as solar and wind power, are available across the globe without significant regional disparities. However, renewable energy is characterized by large fluctuations and low energy density, making it necessary to develop effective methods for energy leveling and increasing power density. At I²CNER, we are developing innovative materials and processes, including solar cells that efficiently convert solar energy into electricity and steam electrolysis technologies that produce hydrogen as an energy carrier. We are also developing efficient processes for converting CO_2 into useful compounds by considering CO_2 as both a carbon resource and a hydrogen carrier. In particular, we are working to develop materials capable of separating dilute CO_2, such as that present in the atmosphere. At the same time, we are investigating new interdisciplinary approaches for developing innovative photocatalysts, including dye-modified and enzyme-based systems, that can directly convert solar energy into hydrogen. Finally, underground CO_2 storage will also be necessary to achieve a net reduction in CO_2 emissions. Therefore, we are further studying CO_2 storage technologies and the long-term stability of CO_2 stored underground.

Through a holistic approach, we aim to contribute to the realization of a carbon-neutral society by creating innovative science and engineering through interdisciplinary research across different temporal and spatial scales.

I²CNER has focused on the development of highly efficient conversion technologies. As the next step, we have added “rapid conversion” as a new keyword and are pioneering a new academic field through the integration of disciplines. We aim to contribute to the realization of a carbon-neutral energy society by promoting the social implementation of the basic research developed through our work as a WPI institute, as well as by proposing novel concepts, including scenarios and designs for a renewable energy-based society.





Professor Tatsumi Ishihara
Director, International Institute for Carbon-Neutral Energy Research (I²CNER)

カーボンニュートラル・エネルギー国際研究所（I²CNER）とは

About I²CNER

Contribute to the creation of a sustainable and environmentally-friendly society

Shifting to carbon-neutral energy society is globally required important subjects. I²CNER will contribute to realize carbon-neutral society by required novel sciences and also open new research field by interdisciplinary research. On the other hand, securing energy to support a prosperous life is an important global issue and I²CNER will propose social system which uses renewable energy by converting to hydrogen or hydrocarbon synthesized from CO_2 captured and lead to establish a carbon-neutral society.

世界トップレベル研究拠点プログラム（WPI）

World Premier International Research Center Initiative (WPI)

The World Premier International Research Center Initiative (WPI) was launched in FY 2007 by the Ministry of Education, Culture, Sports, Science and Technology (MEXT) in a drive to build within Japan "globally visible" research centers that boast a very high research standard and outstanding research environment, sufficiently attractive to prompt frontline researchers from around the world to want to work in them. I²CNER was selected as a WPI center in 2010.

In FY 2017, MEXT established the new WPI Academy to take the vanguard in internationalizing and further renovating Japan's research environment, making it place that expands and accelerates the international circulation of the world's best brains. The WPI centers that have achieved "world-premier status" will be the initial members of the WPI Academy. They may possibly be joined later by other Japanese research institutes that have amassed research results and created research environments of the very highest world standard.

I²CNER was certified as having achieved "World Premier" status by the Program Committee and was inducted into the WPI Academy in April 2020.

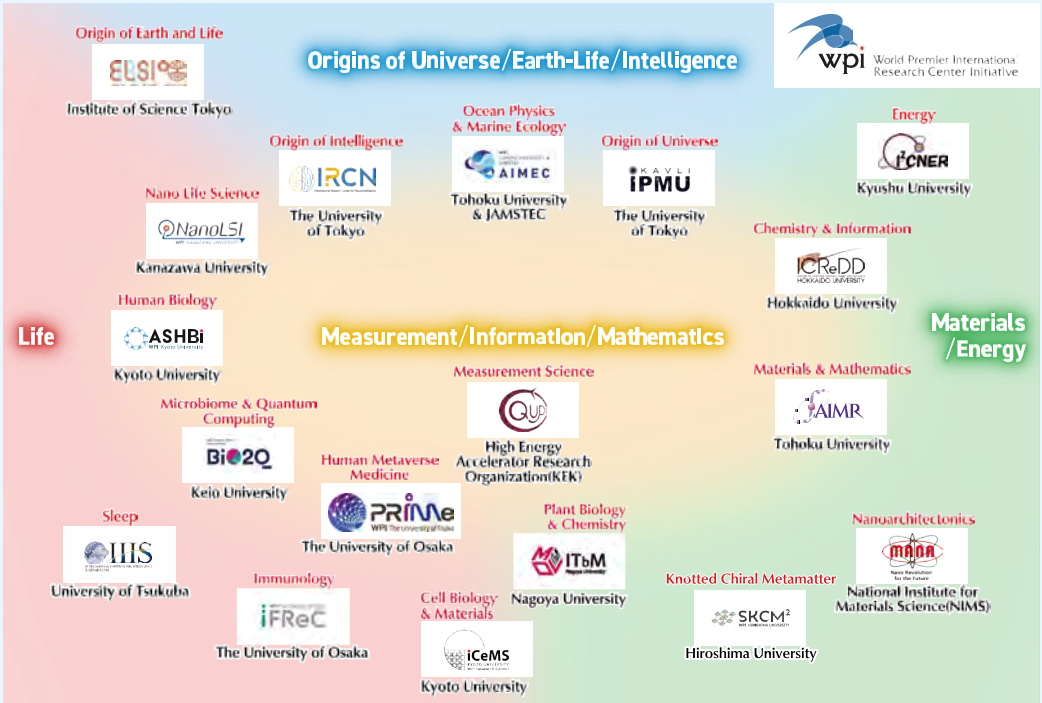
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WPI Mission

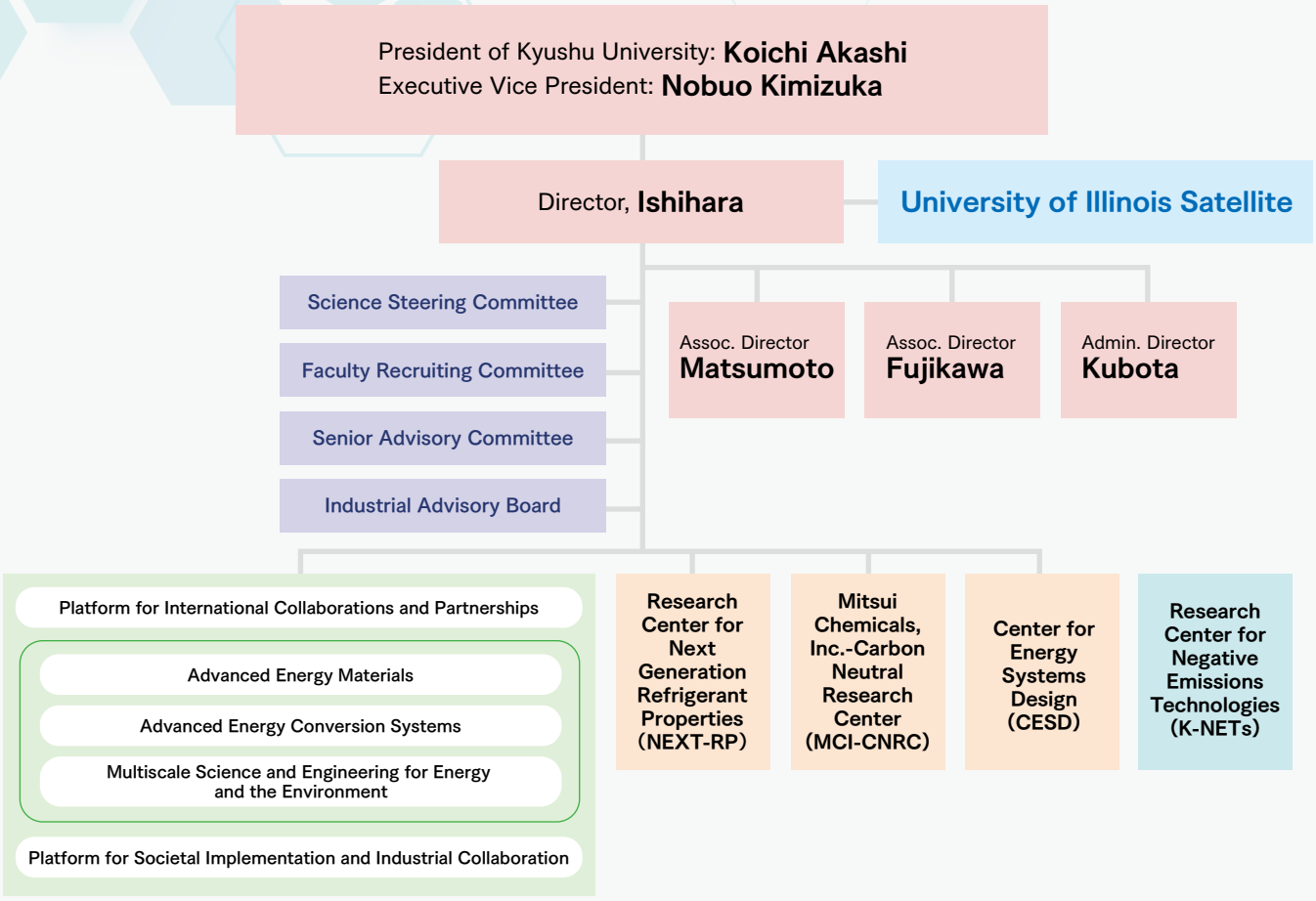
- World-Leading Scientific Excellence and Recognition
- Global Research Environment and System Reform
- Values for the Future

» WPI Science Map



組織

I²CNER Organizational Structure



Research Units

Advanced Energy Materials

Develop molecular, nano, and bulk materials based on new science of surfaces, interfaces, and microstructures for applications involving H_2, H_2O, and CO_2

Advanced Energy Conversion Systems

Development and evolution of systems which either lower carbon emissions, increase energy efficiency, or both

Multiscale Science and Engineering for Energy and the Environment

Pull together the range of challenges facing Japan and the world's energy transition, namely the transition from largely fossil fueled energy technology to a carbon-neutral or a carbon-free energy supply

Research Platforms

Platform for International Collaborations and Partnerships

This platform is intended to maintain and foster I²CNER's international identity. Because this platform and the three thrusts are interwoven and the members of this platform collaborate with researchers from the thrusts, this is an effective way to promote interdisciplinary collaborations across the Institute and around the world.

Platform for Societal Implementation and Industrial Collaboration

The three research thrusts contribute directly to the transition of future I²CNER scientific advances to applicable technology transfer through a large and growing network of I²CNER industrial interactions. With its strengths in both advanced energy science and energy analysis, I²CNER contributes to the achievement of the 2050 carbon reduction goals.

附属研究センター

Affiliated Research Institutes

Research Center for Next Generation Refrigerant Properties (NEXT-RP)

NEXT-RP

＜launched in April 2016＞

NEXT-RP is an international research center that develops and evaluates next-generation refrigerants to solve global environmental issues and future energy crises. Our essential duty is to find the following next generation refrigerants: (i) Lower ODP (Ozone Depletion Potential), (ii) Lower GWP (Global Warming Potential), (iii) Non-flammable or Mildly flammable, (iv) No toxicity or Lower toxicity.

Mitsui Chemicals, Inc.-Carbon Neutral Research Center (MCI-CNRC)

MCI-CNRC
Mitsui Chemicals, Inc. – Carbon Neutral Research Center

＜launched in November 2021＞

MCI-CNRC, in collaboration with Mitsui Chemicals Inc., will develop and acquire cutting-edge environmental infrastructure technologies that will contribute to carbon neutrality, as well as pursue the practical use and commercialization of these technologies. By carrying out focused and efficient research into the elemental technologies needed to achieve carbon neutrality, the center will speed up the process of getting these technologies adopted in society.

Center for Energy Systems Design (CESD)

CESD Center for Energy System Design

＜launched in November 2022＞

CESD hopes to promote research on carbon-neutral technologies required for social implementation by collaborating with six research organizations (Hokkaido University, Tohoku University, Institute of Science Tokyo, Kumamoto University, RIKEN, and National Institute for Materials Science). This center consists of six research teams. The teams of “Light Energy Conversion”, “Electric Energy Conversion”, “Material Conversion”, and “Materials, Storage and Transport” conduct research to enable “high-speed conversion”. The “Energy Analysis” research team is responsible for the design of energy research by back-casting. The “Data Science” research team supports each research team by promoting data science, leading to discontinuous innovation. Not only achieving innovative outcomes, but the center also aims to foster the scientists of the future by making the center a field where young researchers can actively participate.

学内共同教育研究センター

Centers for Common Education and Research

Research Center for Negative Emissions Technologies (K-NETs)

K-NETs
Research Center for Negative Emissions Technologies

＜launched in April 2021＞

This center aims to develop negative emissions technologies of greenhouse gases, i.e., developing technologies for CO_2 capture directly from the atmosphere, conversion and storage of the captured CO_2, and utilization of renewable energy. CO_2 can be captured anywhere since air exists ubiquitously on the earth. This nature of ubiquitous existence will enable the construction of an energy-robust society through local production for local consumption of carbon resources and contribute to the control of global warming by underground storage of excess emissions. This research project is supported by the Moonshot Research and Development Program launched by the Cabinet Office of Japan.






主任研究員(PI)の体制

Principal Investigators (PIs)

Advanced Energy Materials


Masanobu KUBOTA


Miho YAMAUCHI


Brian P. SOMERDAY


Petros SOFRONIS


Seiji OGO


Toshihiro TSUCHIYAMA


Yoshinori SAWAE


Cynthia A. VOLKERT

Advanced Energy Conversion Systems


Hiroshige MATSUMOTO


Tatsumi ISHIHARA


Tsuyohiko FUJIGAYA


Chihaya ADACHI


Thomas LIPPERT


Aleksandar T. STAYKOV


Stephen SKINNER


Ainara AGUADERO


Toshinori MATSUSHIMA


Motonori WATANABE

Multiscale Science and Engineering for Energy and the Environment


Shigenori FUJIKAWA


Takeshi TSUJI


Bidyut Baran SAHA


Andrew J. CHAPMAN


Koji TAKAHASHI


Yuichi SUGAI


Paul J.A. KENIS


Anutosh CHAKRABORTY

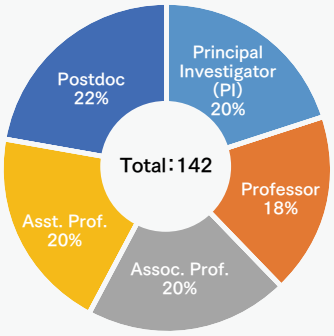

Jill A. ENGEL-COX


Shuntaro TSUBAKI

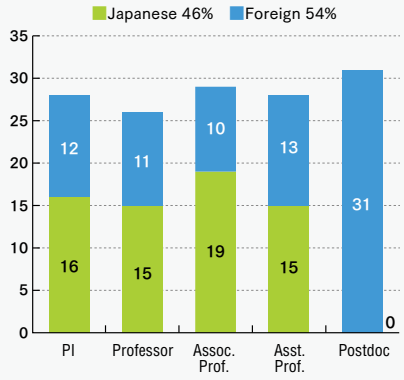
Non-Japanese PIs 12/28=43%

PERSONNEL

Researchers



Japanese/Non-Japanese Researchers



(as of September, 2026)

実績

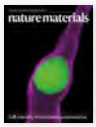
Achievements

Publications

Consistently published in internationally-reputed academic journals

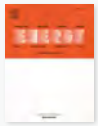
Example of papers published in internationally-reputed academic journals


Advanced Science (Yamauchi et. al)


Nature Materials (Hyodo et. al)


Applied Catalysis B: Environment and Energy (Edalati et. al)

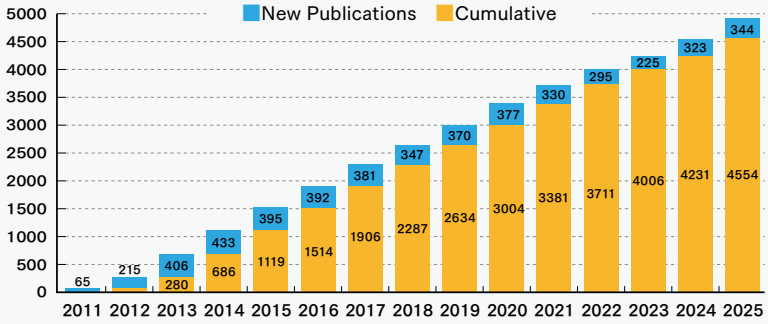

Advanced Materials (Matsushima and Guo et. al)


Energy (Saha and Karmaker et. al)

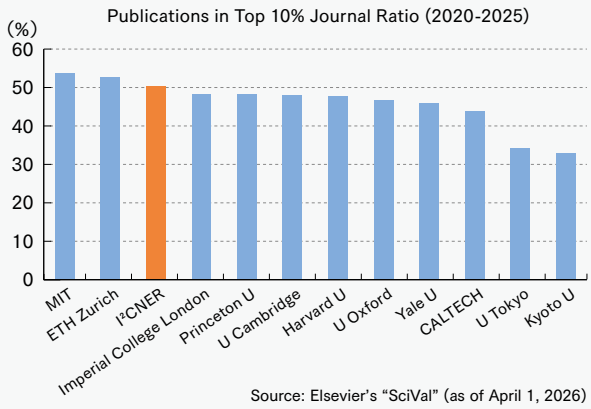
And more

- Energy Economics
- ACS Nano
- Energy & Environmental Science etc.

WPI-I²CNER Affiliated Publications

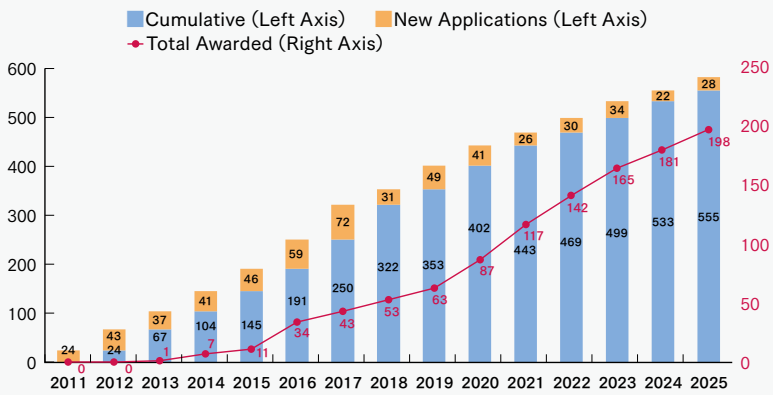


Publications in Top 10% Journal Ratio



Source: Elsevier's "SciVal" (as of April 1, 2026)

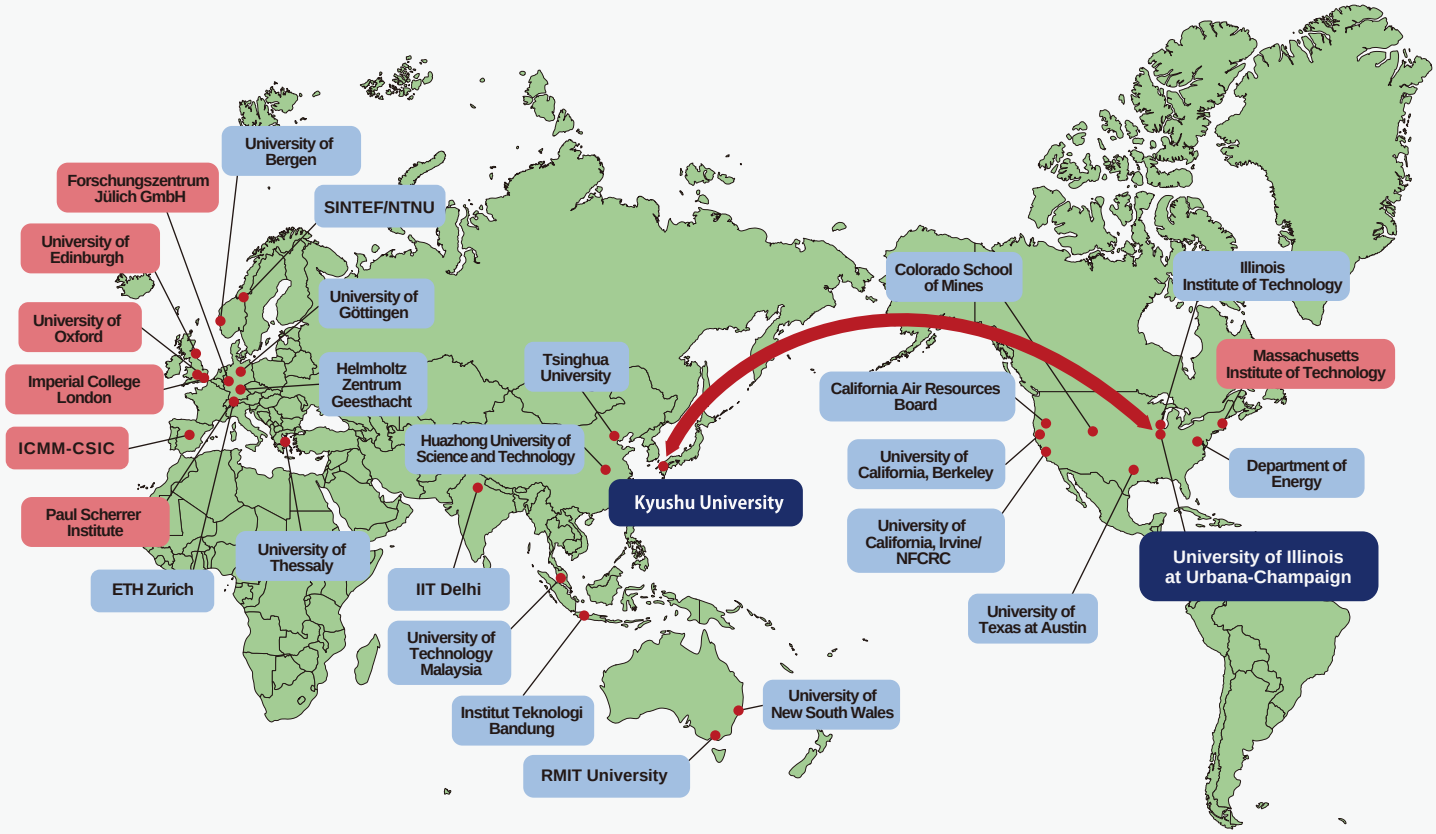
Patents: *Evidence of Technology Transfer*



I²CNERの国際連携ネットワーク

I²CNER's Network of International Collaborations

To carry out its mission, the Institute established collaborations with internationally recognized research centers and universities. These collaborations involve and promote research interactions and researcher exchanges and visits between the institutions.



イリノイ大学アーバナ・シャンペーン校との連携

International Strategic Partnership

The I²CNER satellite was established at the University of Illinois Urbana-Champaign (UIUC) in March 2011 to promote the WPI Program. Since then, Kyushu University and UIUC have advanced research collaborations centered around I²CNER. In 2014, the two universities signed an inter-university exchange agreement (student and academic exchange), and in 2019, they formalized their relationship as "strategic partners". This agreement was renewed in November 2024, further strengthening the strategic partnership between Kyushu and UIUC.

KYUSHU UNIVERSITY



ILLINOIS



I²CNER's Facilities

Each building was designed to create an environment where researchers can come together under one roof to engage in interdisciplinary research.

【I²CNER Building 1】 Completion: January 2013

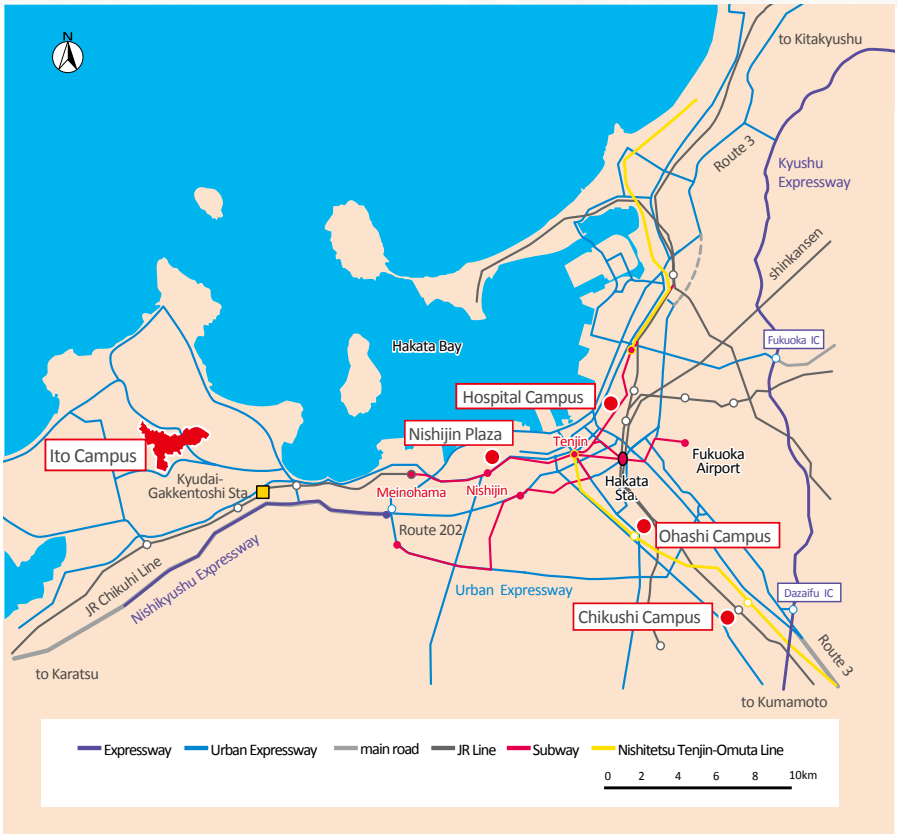
The building extends from east to west and features a unique sweeping curve. To minimize its environmental impact, it incorporates photovoltaics, solar radiation control, and natural ventilation systems. The east side of the building portrays the Keeling Curve, which shows the rising atmospheric CO_2 concentration over time to indicate that I²CNER's research will eventually contribute to the downward turn of this curve.

【I²CNER Building 2】 Completion: February 2015

To facilitate collaboration in an open environment where researchers from Japan and abroad can come together, open offices and laboratories with minimal partitions and the capacity to accommodate large equipment have been established.



Left: I²CNER building 2, Right: I²CNER building 1



Access Map

Fukuoka Airport

5min.

Hakata Station

5min.

Tenjin Station

14min.

Meinohama Station

10min.

Kyudaigakkentoshi Station

15min.

Kyudai Big Orange-mae/Central Library

34min.

From Fukuoka Airport,Hakata Station, or Tenjin Station:
Take a train on the Fukuoka City Subway bound for "Meinohama" or "Chikuzen-Maebaru/Karatsu/Nishi-Karatsu."

At Meinohama Station:
If your train's destination is "Meinohama," transfer to a JR Kyushu train bound for "Chikuzen-Maebaru/Karatsu/Nishi-Karatsu."
If your train's destination is "Chikuzen-Maebaru/Karatsu/Nishi-Karatsu," no transfer is requierd at Meinohama Sta.

At Kyudaigakkentoshi Station:
Transfer to Showa bus bound for Kyushu University's Ito Campus.

15min.

Contact us

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Research Seeds Collection
Summary of research at I²CNER

Request for Support
I²CNER has established the fund for carbon-neutral energy research to contribute to realize carbon-neutral society. We highly appreciate your continued support and cooperation.

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