KOREA
INSTITUTE OF
ENERGY
RESEARCH

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KOREA INSTITUTE OF ENERGY RESEARCH

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KIER, CO_2 leading 2050 carbon neutrality to overcome the climate crisis

Hydrogen supply and utilization

Renewable energy innovation

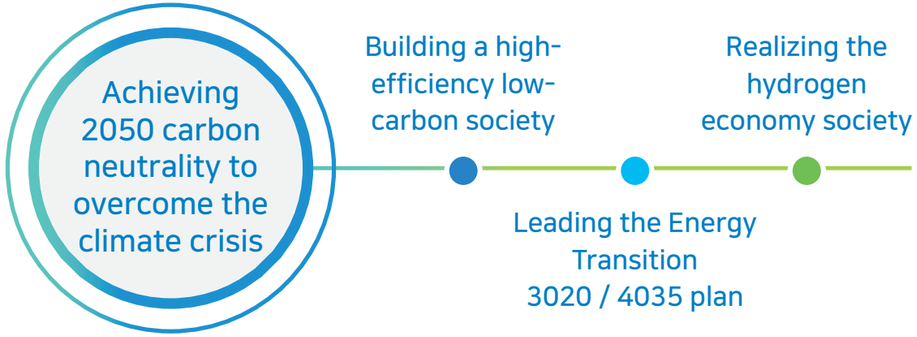
Smart energy

Clean utilization of carbon-based energy

Contents

The world's leading research institute that produces outstanding results through collaboration-based organizational culture

The Korea Institute of Energy Research (KIER) is a government-funded research institute that develops energy technology that can overcome the climate change crisis for a sustainable future for mankind. The strategic directions that KIER is pursuing to contribute to the country and humanity are as follows.



KIER is firmly determined and fully dedicated to achieving 2050 carbon neutrality by developing and disseminating technologies

1) to utilize natural energy such as photovoltaic, wind, and bio,
2) to minimize energy consumption,
3) to use fossil fuels more cleanly,
4) to produce, store, and utilize low-cost hydrogen,

hence opening the door to the sustainable future of humanity.

President, Korea Institute of Energy Research

MISSION

As a leading research institution in energy technology,
We improve the quality of human life and realize a sustainable future.

For a clearer Earth !
For a stronger economy !

Producing an outstanding **achievement**

Enhancing a corporate social **responsibility**

Building a **cooperative** culture

Men-centered, happiness management

History

2020 **A new leap forward to the world's best research institution**

2000 **Renamed Korea Institute of Energy Research (KIER)**
1991.11. KIER Separated into Korea Institute of Energy Research (KIER) and KIGAM
1986.09. Separated to Korea Energy Economics Institute

1981 **KERI and Korea institute of Geoscience and Mineral Resources (KIGAM) merged to Korea Institute of Energy and Resources (KIER)**
1980.03. Renamed Korea Energy Research Institute (KERI)
1979.11. Energy Economic Policy Division

1977 **Korea Institute of Energy Conservation established**

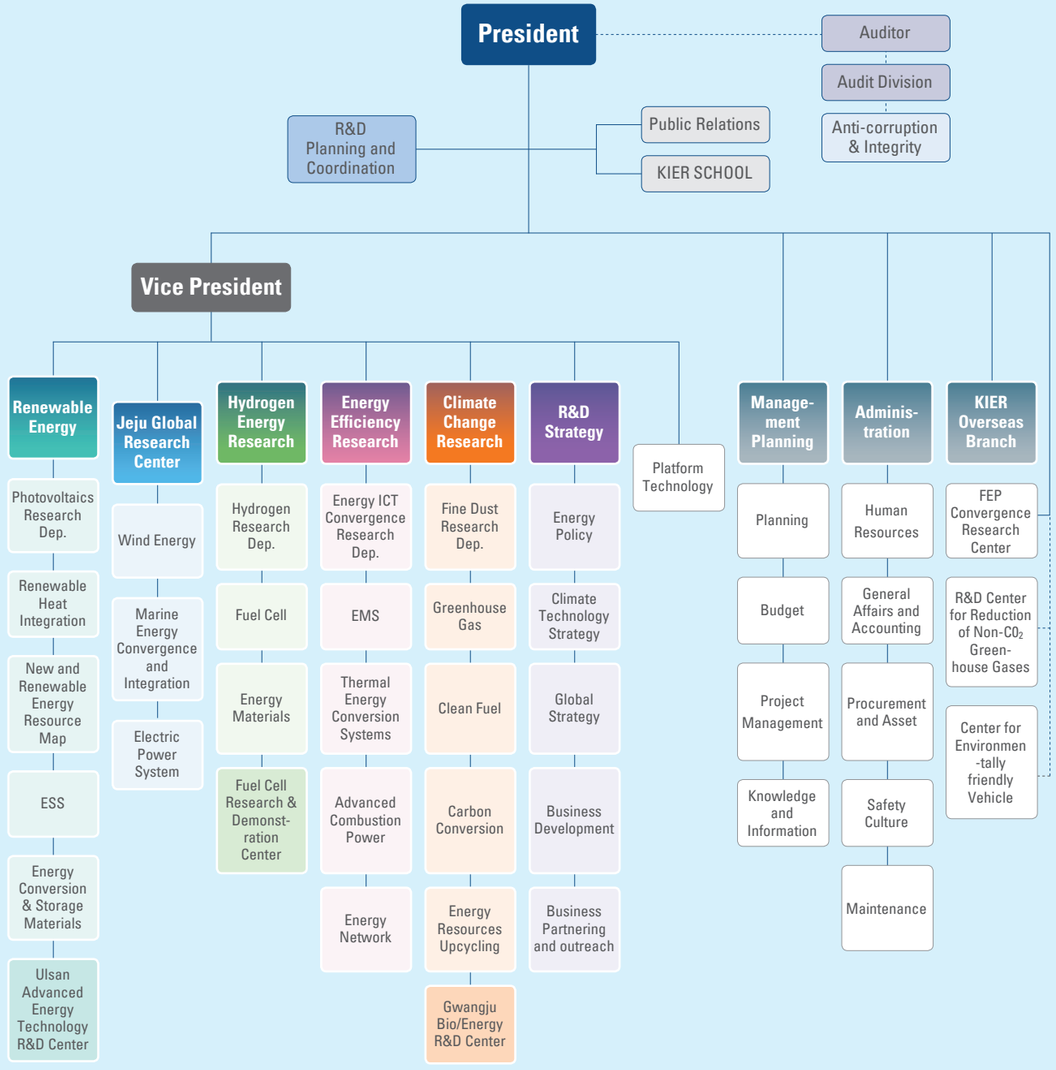
Strategic Goals

Renewable energy innovation technology
for realizing an energy transition 3020 / 4035 plan

Hydrogen supply and utilization technology
for leading the hydrogen economy society

Smart energy technology
for building a high-efficiency low-carbon society

Clean utilization technology of carbon-based energy
for greenhouse gas reduction and clean air



Personnel

571 persons (2021)

Researcher
331

Engineer
164

Administrative Staff
76

Budget

160,073,752 USD (2021)

(Headquarter) Korea Institute of Energy Research

Location : Yuseong-gu, Daejeon city
Main Research Areas
- New and renewable energy
- Energy efficiency
- Clean use of fossil energy
- CO_2 treatment and utilization

Tel : +82-42-860-3114
Webpage : https://www.kier.re.kr

Fuel Cell Research & Demonstration Center

Location : Buan county, Jeollabuk-do (province)
Main Research Areas
- Demonstration of hydrogen fuel cells
- Domestic largest and world-class hydrogen fuel cell infrastructure facility

TEL : +82-63-581-1671

Gwangju Bio/Energy R&D Center

Location : High-tech. science district, Gwang-ju city
Main Research Areas
- Bio energy
- Energy storage

TEL : +82-62-717-2411

Ulsan Advanced Energy Technology R&D Center

Location : Techno Industrial Complex, Ulsan city
Main Research Areas
- Battery industrialization system technology
- Development and demonstration of battery convergence technology

TEL : +82-52-702-2500

Jeju Global Research Center

Location : Kimnyeong, Jeju island
Main Research Areas
- On/off shore technology convergence
- System convergence
- Wind energy

Tel : +82-64-800-2301

Renewable Energy Research

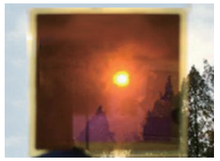
The Renewable Energy Institute conducts R&D activities focusing on solar energy and energy storage to provide technological solutions to energy security and environmental issues participating in 'Energy Transition', a global trend to overcome the climate crisis faced by mankind. 'Photovoltaics' including solar cells, 'Renewable-energy resource map', 'Zero-energy house' including solar thermal technologies, and 'Energy storage system (ESS) & materials' are the main research areas.

The Institute also seeks to improve the quality of human life by developing the government's policy-based public technologies, promoting economic growth through technology transfer to industries and commercialization, and contributing to renewable energy dissemination through renewable energy integration technology in cooperation with other divisions.

Photovoltaics Research

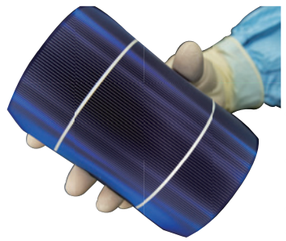
The Photovoltaic Research Department contributes to promoting new industries and advancing Korea as a leader in energy transition. The Department pursues research on cutting-edge photovoltaic technology through developing the original technology of silicon/thin-film/tandem solar cells and module; creating advanced technology in photovoltaic power system performance; achieving the global standardization of performance testing and evaluation techniques; and providing industrial support, human resources training support, etc.

Lightweight Flexible Substrate Thin Film Deposition Roll to Roll Equipment



Semitransparent CIGS Solar Cell

Ultra-thin Silicon Solar Cell



Major Research Fields

- Crystalline silicon solar cell technology
- Next generation solar cell technology based on various materials such as chalcogenide (CIGS, CZTS, CTS) compounds, thin film silicon, dye-sensitized and organic/inorganic hybrid compounds
- Photovoltaic module technology including building integrated photovoltaic (BIPV) modules
- PV power conversion system (PCS) technology
- Performance test and evaluation of PV materials, devices and components
- Development of test and evaluation methods for PV and international standardization
- Customized design of PV system and development of diagnosis technology
- Future microgrid and energy supply network technology
- Training program for PV professionals

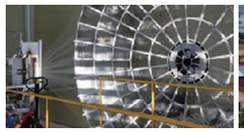
Renewable Heat Integration Research

The Renewable Heat Integration Laboratory focuses on research in solar thermal technology and heat integration with new and renewable energy sources, contributing to the development of energy technologies and dissemination of research outcomes. The Laboratory's main areas of research include the collection and storage of solar heat and related technologies and thermal integration based on new and renewable energy. Its key research topics encompass fundamental key technologies of solar thermal energy to increase cost efficiency, integration of various renewable thermal energy sources with high efficiency heat supply systems such as a heat pump, thermal management and thermal storage control of combined new and renewable energy systems, thermal supply technologies for zero energy (or plus energy) houses/buildings/communities/cities, thermal energy storage technologies for a stable new and renewable energy supply and energy demand management, renewable energy-based smart farms, seawater desalination, industrial process heat, solar thermal power stations, and thermochemical cycles for solar fuel. It also conducts performance testing on solar thermal collectors and solar water heaters for Korea Standard (KS) Certification.

Zero Energy Solar Thermal Demonstration Research House

Major Research Fields

- Solar thermal collectors and hybrid solar photovoltaic thermal collectors
- High efficient hot water storage and next generation thermal storage technology
- Renewable heat integrated thermal storage and system utilization technology
- Zero energy house/building, town and city level renewable heat integrated system technology
- Renewable heat energy such as solar heat integrated seawater desalination and industrial process heat
- Renewable heat such as solar heat integrated eco-friendly next generation cooling
- Solar concentrating system and power plant
- Biomethane decomposition hydrogen production technology using solar heat



400kWt-class KIER Solar Furnace (Biomethane Decomposition Hydrogen Production Experiment)

View of Energy Independent Village (Gochang)

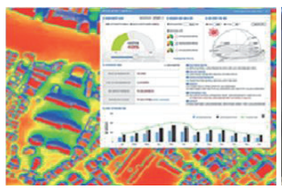
New and Renewable Energy Resource Map Research

The New and Renewable Energy Resource Map Laboratory, designated as the National Center for Standard Reference Data (NCSRD) in the New & Renewable Energy (NRE) field, performs core and fundamental R&D such as the NRE Big Data platform, the digital NRE resource map and NRE's support potential map in determining the nation's NRE policy and relevant national NRE projects.

Major Research Fields

- Satellite-based renewable resource measurement and national reference standardization
- Renewable resource assessment and mapping for the Great Korea
- Evaluation of renewable potential and policy research for renewable energy dissemination
- Development of e-Great Korea Atlas platform for variable renewable power forecasting
- Cultivation of human resources in renewable energy field through international cooperation and technical collaboration

Web Service (New and Renewable Energy Resource Map)



Interactive Solar Resource Map of Daejeon

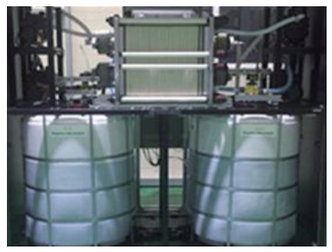
New and Renewable Energy Resource Map Laboratory

Energy Storage System Research

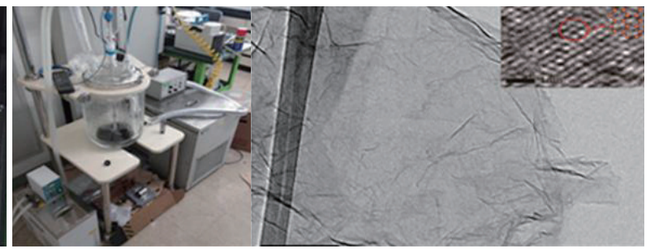
The ESS Laboratory conducts activities for the development, standardization, testing and certification of rechargeable batteries with a large capacity for the storage of electricity as well as demonstration research related to new and renewable energy for the purpose of the commercialization of large-scale energy storage technologies. To secure the core technologies essential for the paradigm shift of conventional batteries, it carries out research on materials, cells, and systems for next-generation batteries.

Major Research Fields

- Development of large-scale storage redox flow battery technology
- Development of lithium ion battery technology
- Development of carbon (0D, 1D, 2D, 3D) based energy storage technology
- Test and evaluation of rechargeable battery and capacitor



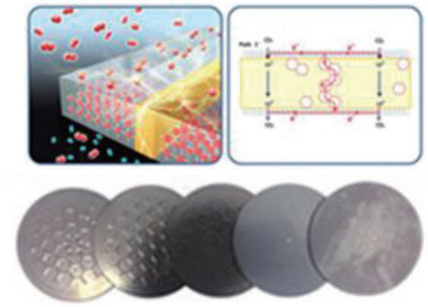
Redox Flow Battery System



Large-scale Graphene Synthesis Reactor and KIERPHENE

Energy Conversion and Storage Materials Research

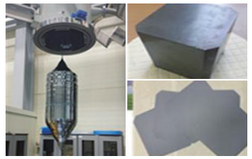
The Energy Conversion and Storage Materials Research Laboratory develops energy conversion and storage technologies, targeting research and development in promising materials and devices for secondary batteries, flow batteries, super-capacitors, and advanced energy storage devices. The Laboratory's current R&D activities include the materials and components needed for the recycling/remanufacturing of energy components; the utilization for salinity power generation; and advancing membranes, catalysts, and fuel cells and the performance estimation under actual operating conditions.



Ceramic Oxygen Transport Membranes

Major Research Fields

- High permselective Pd-based multilayer/composite membranes for hydrogen production
- Oxygen permeable ceramic membranes
- Membrane processes for post-combustion carbon dioxide capture
- Photovoltaic panels' end-of-life material recycling/reuse/remanufacturing
- Nanoporous aerogel fabrication and applications
- All-solid-state battery with materials and cell structure engineering
- Supercapacitor materials and devices
- High-performance electrode and electrolyte in flow battery
- Metal-air batteries with materials and cell structure engineering
- Liquid metal battery with materials and cell structure engineering

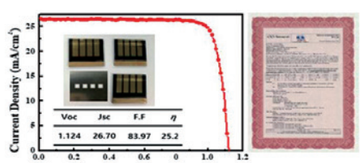


Monocrystalline Ingot/Wafer Utilizing Recycled Silicon

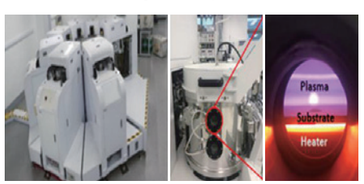
SiOx Nanoparticles

Advanced Energy Technology Research (batteries, PVs, H_2-utilization)

The Ulsan Advanced Energy Technology R&D Center is developing core technologies for next-generation energy technologies, ranging from next-generation secondary batteries and solar cells to hydrogen utilization fields, by building a one-stop research infrastructure for materials syntheses/depositions and cell fabrications to characterizations. Based on these activities, the Center aims to meet the technological needs of SMEs located in the Busan-Ulsan-Gyeongsangdo areas.



Certified World-class High-efficiency Perovskite Solar Cells



Silicon Thin Film Depositions by Use of PECVD for Kerfless Epitaxial Wafers

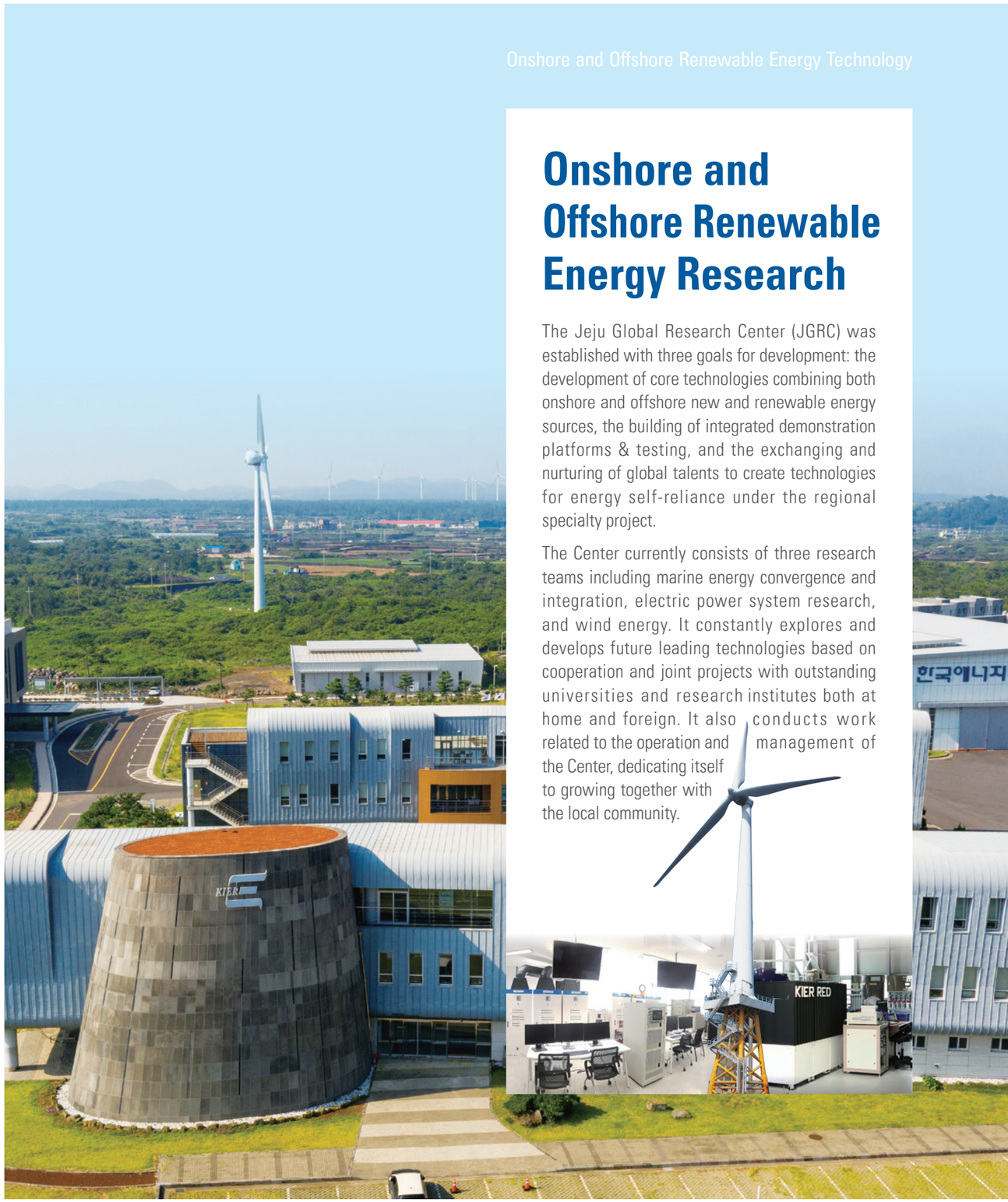
Major Research Fields

- All-solid-state battery system and manufacturing process technologies
- Fabrication and characterization of materials and components for state-of-the-art lithium-ion secondary batteries
- Evaluation of electric vehicle battery system/development of top-notch performance realization technologies
- The world's highest-efficiency perovskite solar cells
- Silicon/perovskite tandem solar cells
- Next-generation silicon heterojunction (SHJ) solar cells with high-quality contacts
- Kerfless silicon epitaxial wafers
- Utilization of hydrogen from by-product hydrogen
- Supporting Ulsan regional SMEs by facilitating their development of hydrogen mobility-related materials/components (linked to Ulsan Hydrogen Mobility Cluster Project)
- Hydrogen production technology using alcohol (methanol, ethanol, etc.) / water electrolysis
- Demonstration and reliability test of hydrogen mobility system using by-product hydrogen piping network
- Stack technology for hydrogen mobility system by use of metal separation plates

Onshore and Offshore Renewable Energy Research

The Jeju Global Research Center (JGRC) was established with three goals for development: the development of core technologies combining both onshore and offshore new and renewable energy sources, the building of integrated demonstration platforms & testing, and the exchanging and nurturing of global talents to create technologies for energy self-reliance under the regional specialty project.

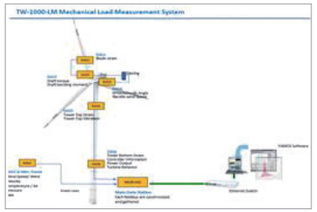
The Center currently consists of three research teams including marine energy convergence and integration, electric power system research, and wind energy. It constantly explores and develops future leading technologies based on cooperation and joint projects with outstanding universities and research institutes both at home and foreign. It also conducts work related to the operation and management of the Center, dedicating itself to growing together with the local community.



Wind Energy Research

The Wind Energy Research Team carries out research and development activities on integrated system design for the spread of wind power systems, wind power plant operation and control systems, and offshore wind farm design technologies. The Team also conducts performance testing as a state certified testing and inspection body for small-/mid-/large-sized wind turbines and continuously explores advanced and future-leading technologies based on joint R&D efforts with outstanding universities and research institutes in Korea and overseas.

Large-scale Marine Wind Power Generation



Measurement System

Major Research Fields

- Control technology for wind turbine and wind farm
- Performance and reliability verification of wind power system
- Floating offshore wind power
- Integrated operation management system of offshore wind farm
- Small and medium-sized wind turbine performance test
- O&M platform for offshore wind power
- Design and economical evaluation of onshore and offshore wind farm
- Prognostics and health management for wind turbines
- Digital twin technology for wind turbines
- Wind turbines - Acoustic noise measurement and evaluation techniques
- Minute-scale forecasting technology for wind farm power
- Wind power HAWT/VAWT blade design and performance improvement technology
- Future super-sized floating wind turbine system development technology

Marine Wind Power Generation System

Marine Energy Convergence and Integration Research

The Marine Energy Convergence and Integration Research Team carries out various R&D activities on salinity gradient power and its application, low-energy water treatment and desalination, new materials (membrane, electrode, and catalysts), technologies using brine water and heat sources, marine energy storage, marine green hydrogen, and marine bio energy (bioelectrochemical technology), water-energy-food nexus to achieve its vision of being a 'global lab competing in the international arena' and its goal of 'securing core technologies in marine energy and environment and their commercialization'. The Team strives to improve its quality of research performance and identify promising marine energy technologies by conducting joint research projects with universities and research institutes at home and foreign and promotes the distribution and dissemination of its research outcomes based on cooperative relations with companies and local governments.

Major Research Fields

- Marine energy convergence platform technology
- Marine energy production technology : salinity gradient power generation (reverse electrodialysis, pressure delay osmosis, capmixing)
- Seawater desalination and water treatment technology
- Useful resource recovery technology
- Low energy consumption pre-treatment technology and process
- Core materials and parts technology for marine energy and environment : ion exchange membrane, osmosis membrane, electrode and catalyst
- Marine bioenergy technology
- Marine energy storage technology
- Marine heat energy network such as marine heat sources
- Regional specialized energy technology

Marine Salinity Gradient Power Generation System

Marine Salinity Gradient Power Generation Laboratory

MVR Seawater Desalination System

Electric Power System Research

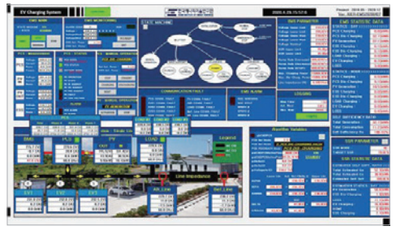
The Electric Power System Research Team strives for increased energy efficiency through distributed energy networks and the development of technologies to achieve energy self-reliance and energy safety. To this end, the Team carries out RD&D activities on convergence design using the PHILS system, operating control system and safety management system, operating technologies of electric vehicle charging infrastructure, data process optimization, and electricity grid stability for prosumer and constantly engages in joint R&D projects with outstanding universities and research institutes in Korea and overseas to develop advanced technologies for commercialization.

Major Research Fields

- System convergence design tool and operation control system
- Pre-verification simulator for performance and reliability of parts and system
- ESS charging status and durability life prediction model
- Distribution network stabilization technology and power quality pre-validation simulator
- Integrated operation monitoring system (total operating center)
- Failure mode and effect analysis technology
- Safety management technology of distribution type energy including ESS
- Test demonstration standardization process
- Waste battery operation evaluation and reuse technology

Electric Vehicle Charging System

30kW Test Evaluation System with PHILS Function



Electric Vehicle Charging System Operation Technology

Hydrogen Energy Research

The Hydrogen Energy Research Division conducts research on hydrogen production, storage, transportation, and utilization to realize a future energy society. It focuses on the development of fuel cell technologies represented by the production, storage, and use of hydrogen, an eco-friendly source of energy with economic benefits obtained by fossil fuel and water. The Division has built the infrastructure to support the entire hydrogen technology life cycle, including materials, system, and performance testing, and strives to strengthen the industry ecosystem of Korea.

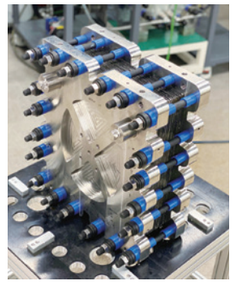
Hydrogen Research

The Hydrogen Research Department conducts research on the production and storage of hydrogen, a promising clean energy, and develops core technologies for hydrocarbon reform and green hydrogen production (hydrolysate for hydrogen generation) and integrated system. Technologies to produce hydrogen from the decomposition of water include the electrolysis of water, photochemical hydrogen production, and thermochemical water splitting process. Those related to hydrocarbon reform include natural gas reforming and chemical looping technologies.

Major Research Fields

- Design of pressurized high purity hydrogen production system for hydrogen station
- Design and control of high efficiency compact fuel reformer for fuel cell
- Fuel reform (methane/ammonia) structure catalyst design
- Core materials, parts and stack design of alkaline/AEM/PEM electrolysis
- Photochemical hydrogen production catalyst design
- Solid hydrogen storage alloy property evaluation and system design (components)

Ammonia Decomposition Reactor



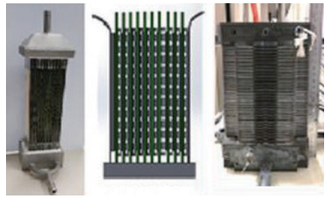
Alkaline Water Electrolysis Stack for Responding to Load Variation

Fuel Cell Research

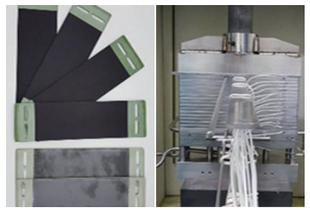
The Fuel Cell Laboratory, which started research on fuel cells for the first time in Korea in October 1980, has been designated and operated as the first and only National Laboratory for fuel cells (N-LAB, Ministry of Science and ICT, July 2020). The Laboratory has been conducting research on basic science in materials and parts and industrialization-based technologies that encompass stacks and systems under its vision to advance the hydrogen economy. It is developing core technologies in the sectors of mobile (automobiles, heavy-duty vehicles, trains, ships, and drones), stationary (home and building CHP, distributed power generation), and special applications (portable, extreme environment). The R&D activities of the Fuel Cell Laboratory cover areas such as polymer electrolyte fuel cells (PEFC), alkaline membrane fuel cells (AMFC), solid oxide fuel cells (SOFC), and direct methanol fuel cells (DMFC).

Major Research Fields

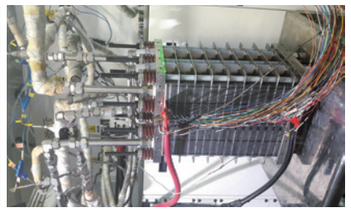
- Core materials and systems for polymer electrolyte fuel cells (PEFC), solid oxide fuel cells (SOFC), alkali membrane fuel cells (AMFC), and direct methanol fuel cells (DMFC)
- Platinum reducing electrode catalyst
- Low cost and high durability electrolyte membrane
- Design and analysis of membrane electrode assembly (MEA)
- Design and analysis of cell and stack
- Fuel cell system control and diagnosis
- Design and manufacturing of cylindrical and flat SOFC cell/stack/system



SOFC Stack Design/Production/Operation Technology



Solid Oxides-based Reversible Electrolysis Cell and Stack



Polymer Fuel Cell System

Energy Materials Research

The Energy Materials Laboratory mainly conducts research on cross-cutting material development and convergence research for new and renewable energy use, clean and high efficiency energy materials, etc. The Laboratory's main research areas are the development of fiber reinforced composite materials for extreme high-temperature conditions, core materials and component technology for high temperature water electrolysis system, and catalyst and membrane materials based on organic and inorganic hybrid materials. Its ultimate goal is to be the world's leader in high efficiency and performance energy original materials and modularization technology through the convergence of energy/environmental technology (ET) and nano technology (NT).

Major Research Fields

- Solid oxide-based two-way water electrolysis material and stack technology
- Solid oxide fuel cell material and process technology
- SiC/SiC ceramic fiber reinforcement composite material technology for high temperature structure
- C/SiC ceramic fiber reinforcement composite material technology for high temperature structure
- Composite functional fiber reinforcement polymer composite material technology
- High temperature corrosion-resistant porous silicon carbide (SiC) ceramic structure technology
- High energy density energy storage material technology based on conductive MOF
- Carbon dioxide separation membrane and adsorption material technology
- Modular metal composite hydrogen separation membrane technology

Modular Hydrogen Separation Membrane

SiC/SiC Composite Blade for Gas Turbine

Fuel Cell Demonstration Research

The Fuel Cell Research & Demonstration Center is equipped with the world's best fuel cell R&D facilities and carries out activities related to the development of fuel cell components, stacks, performance testing, and demonstration. The Center strives to maximize its research productivity through the use of computer programs and AI technology and conducts research that provides solutions to problems such as the cost, durability, and performance of full cells. It aims to be one of the top laboratories in the world, leading the R&D effort to facilitate the hydrogen industry and expand the fuel cell market in cooperation with universities, companies, and research institutes.

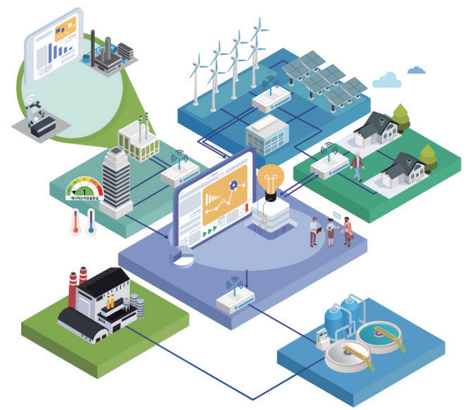
Major Research Fields

- Fuel cell price efficiency
- Fuel cell durability
- Improvement of fuel cell performance
- Collaboration with universities, enterprises, local governments and research institutes

Energy Efficiency Research

The main mission of the Energy Efficiency Research Division is to improve energy efficiency throughout the entire cycle, from energy generation to consumption, for the realization of a smart energy society.

The Division's main research areas are energy AI and ICT, energy saving and demand management, energy efficient conversion and power generation, energy storage system and operation, low pollution and high efficiency combustion, and distributed energy generation and network technology.



Energy ICT Convergence Research

The Energy ICT Convergence Research Department aims to increase energy efficiency and realize GHG reduction technologies based on the convergence of energy, IT, and AI. The Department's main areas of research include the integrated design and operation of distributed power generation, microgrids, management and operation of energy storage systems, energy/environment performance diagnosis of buildings, real-time estimation and analysis of energy use for buildings, intelligent energy optimization based on combined energy monitoring, and heat-electricity network optimization.

Major Research Fields

- Optimization management and saving technology of ICT convergence complex energy
- Integrated operation open communication/control platform
- Energy demand management technology
- Smart platform for integrated operation of renewable energy
- Energy demand prediction and optimal management system through IoT-based machine learning
- Core technologies for microgrid and smartgrid
- High reliability microgrid
- Direct current (DC) microgrid system
- Mobile microgrid and multi-agent system
- High efficiency technologies for power consuming devices
- High-efficiency power supply system for Internet of Things (IoT)
- New technology of intelligent lighting control and LED application
- Energy harvesting commercialization technology
- Fault diagnosis and prediction technology such as arc
- High efficiency technology for buildings
- Smart green building, smart window/cover technology
- Diagnosis platform for existing housing site
- On-site diagnostic measuring device for thermal and environment performance
- Evaluation of building energy efficiency
- Weather forecast data-linked middleware platform
- Intelligent energy monitoring and analysis technology for apartment houses
- 5 types of secured wireless smart metering technology
- Intelligent energy big data analysis platform/Intelligent analysis platform through energy big data

300kVA-class Microgrid Real-time Digital Simulation System

HILS System for Smart Meters

Energy Management System Research

The EMS Laboratory conducts research on the data analysis and management and optimum use of energy to efficiently manage energy use in the areas of industry, transport, and buildings, and its scope can be expanded from a single workplace (building) to an industrial complex (community). The data-based EMS value chain includes upstream/downstream, management, cluster/convergence, and distribution industries, and it is also available to create a new energy industry by combining various related industries together.

Major Research Fields

- High-efficiency complex drying system and exhaust heat recovery system
- Original technology for producing ultra-high temperature steam using superheat exchange device
- Fuel production and process technology for sewage sludge using green carbon
- Vehicle/engine fuel efficiency/environment improvement technology
- High-efficiency eco-friendly car and technology of future alternative fuel usage
- High efficiency heat management technology for electric vehicles

Ammonia Gasoline Mixed-fuel Car

High-efficiency Drying Device using Turning Air Current

Ammonia Car Interior

Thermal Energy Conversion Systems Research

The Thermal Energy Conversion Systems Laboratory conducts R&D projects on thermal energy systems, including efficient conversion technologies between heat to heat/electricity and electricity to heat, and large-scale power storage to increase the efficiency of low/high thermal energy. The Laboratory's main areas of research include supercritical generation, heat pumps based on new and renewable energy and unused energy sources, thermal energy networks with the application of such technologies, cooling towers, and Carnot batteries to compensate the volatility of renewable energy. It seeks to converge technologies between new and renewable energy sources, including solar, thermal, and geothermal heat, and energy saving technologies, cooling towers, and common core devices such as turbines, compressors, future applications of heat exchangers, and heat pipes.

Major Research Fields

- Futuristic power generation and energy storage technology
- Heat pump and air conditioning system application technology
- Thermal energy system convergence and common fields

300kWth Supercritical Oxygen Combustion

Industrial Steam Production Heat Pump

Advanced Combustion Power Research

The Advanced Combustion Power Laboratory studies high efficiency/low emission combustion technologies to respond to global warming and air pollution. The Laboratory's main areas of research include the supercritical oxyfuel combustion to preempt the next-gen clean power generation market, excess enthalpy combustion applied to non-biodegradable greenhouse gas abatement and rapid heating, and smart design platform to tackle energy challenges in the era of the 4th Industrial Revolution. Areas of application include burners for power plants and scrubbers, low NOx burners, non-catalytic reformers, high value-added reactors for gas conversion, heat treatment furnaces, and glass melting furnaces using plasma.

Major Research Fields

- (Combustion for power generation) Future power generation technology
- (Eco-friendly combustion) High-efficiency eco-friendly excess enthalpy combustion technology
- (Industrial combustion) High-efficiency combustor design technology to respond to demand in the root industry
- Thermal reaction system fusion field

High-performance Decomposable Greenhouse Gas Decomposition Treatment Technology

Non-oxidizing Uniform Heating Technology by Continuous Steel Sheet Heat Treatment

Energy Network Research

The Energy Network Laboratory conducts research on energy use and measures for GHG reduction based on the efficient production and use of thermal energy. To this end, the Laboratory strives to develop various technologies such as smart energy network, combined heat and power (CHP), boiler facility and thermal energy storage, and ORC and thermoelectric generation (TEG) using heat for the effective production and use of thermal energy. It also focuses on the development of new cooling technologies in preparation for a potential rise in energy consumption.

Major Research Fields

- Smart energy network technology
- Development of cogeneration power plant and performance evaluation
- Development of high-efficiency low-pollution boiler and performance evaluation
- Next generation cooling technology
- Unused thermal energy utilization technology

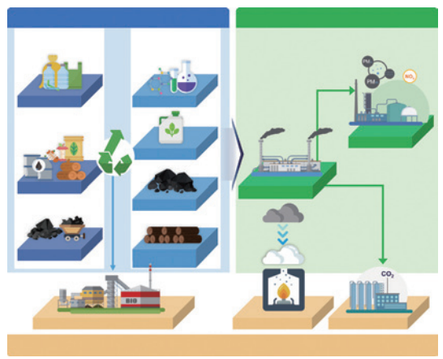
Two-way Energy Network System

Organic Rankine Cycle (ORC) Power Generation System

Climate Change Research

The Climate Change Research Division develops carbon capture, utilization, and storage (CCUS) technologies to tackle the challenges of climate change; fine dust technologies to secure clean air; and high value-added technologies that turn coal fuel, biomass, and waste into clean energy in order to prepare for future high oil prices.

The Division's main areas of research include fine dust reduction technology, CCUS, clean coal technology, gasification technology, gas/oil to add high value, biomass production to add high value, and generation and recycling of alternative energy from waste. Other areas of research include technologies related to the elimination of environmental hazards emitted during energy generation to near zero. In addition, it continually carries out joint R&D projects with domestic industries and academia and cooperates with related organizations overseas with advanced technologies.



Fine Dust Research

The Fine Dust Research Department is striving to develop innovative technologies to provide the effective solutions for air pollution problems. The Department has been developing zero emission technologies for PM, SOx, NOx and VOCs in industries and transport; low-rank fuel upgrading technology for reducing of original PM sources; air pollution monitoring technology; indoor and outdoor air quality control technology to provide a healthier and safer air environment for the public.

Major Research Fields

- Low cost and high efficiency filtration dust collection technology
- Coal-fired power plant electrostatic precipitator performance improvement technology
- Pure oxygen fluidized bed boiler flue gas ultra fine dust control technology
- Air purification vehicle technology for reducing fine dust in the air
- Low-temperature denitrification catalyst technology for reducing nitrogen oxides
- Water recovery and white smoke reduction technology using energy-saving moisture separation membrane
- Fine dust source reduction type low grade fuel high quality technology

Low Ash Biomass Manufacturing Facility (1ton/day)

Filter Dust Collector with 1/10 Dust Discharge

Greenhouse Gas Research

The Greenhouse Gas Research Laboratory is developing carbon capture and utilization (CCU) technologies in order to prevent global warming and developing clean energy technologies in order to reduce dependency on fossil fuels. The Laboratory's research areas of interest include CCU, low-carbon energy and environmental processes, fluidized-bed combustion/conversion, flue gas treatment and removal of pollutants, etc.

Major Research Fields

- Low-carbon energy and environmental process technology
- CO_2 capture and utilization technology using absorption, adsorption and membrane separation
- Fluidized-bed combustion or conversion of SRF (Solid Refuse Fuel)
- Flue gas treatment and pollutant removal technology
- Low water/no water/phase-separated CO_2 absorbent with low regeneration energy
- CO_2 capture technology using wet solution (KIERSOL)
- Synthesis gas production technology using CO_2

10 TPD Coal Drying System

Mobile CO_2 Capture KIERSOL Process

Clean Fuel Research

The Clean Fuel Research Laboratory aims to contribute to the development of national strategies for low carbon power generation and energy security by producing low carbon/carbon-free fuels with low-grade fuels. The Laboratory also develops eco-friendly, high efficiency energy harvesting technologies based on the convergence of high-performance nano-catalytic synthesis and innovative reaction systems. Its other areas of R&D activities include diversification of the process, production, and use of low carbon gas. Specifically, it develops technologies on low-grade fuels; gasification of biomass; nano-catalytic materials; low carbon fuels such as CH_4, CH_3OH, and C_2H_5OH based on biogas reforming and conversion; production and refinement techniques for carbon neutral gasoline and diesel; and carbon-free fuels (H_2, NH_3).

Major Research Fields

- Low-grade fuel gasification technology
- Distribution type biomass, gasification power generation system using waste plastics
- Coal liquefaction (CTL) and biomass liquefaction (BTL) technologies
- High-performance catalyst technology for Fischer-Tropsch synthesis reaction
- Refinery and petrochemical process technology
- Gas and liquid separation process : adsorption, distillation, absorption, crystallization
- Marine and ground natural gas/crude treatment and conversion process (FLNG, FPSO, etc.)
- High performance nano catalyst automation synthesis and domestic reference catalyst manufacturing technology
- Electric field imposing catalytic reaction technology
- Hydrogen and transportation fuel production technology using biogas
- Carbon-free ammonia fuel and hydrogen carrier synthesis technology

5000Nm³/h Class Hydrogen PSA

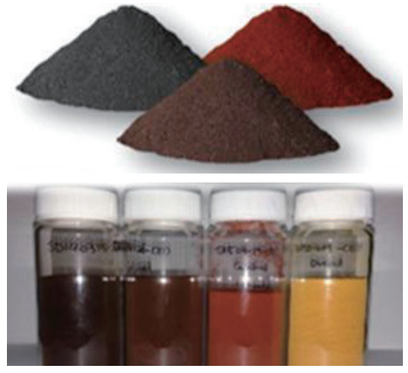
10 TPD Fisher-Tropsch Reactor

Carbon Conversion Research

The Carbon Conversion Research Laboratory conducts research on the conversion of CO_2 and other low-grade carbon resources into high value-added chemicals and eco-friendly fuels to achieve a carbon-neutral society. The Laboratory is committed to applying carbon conversion technologies based on CO_2 conversion and ultra-high-value chemical production from syngas as core technologies as well as the development of separation/purification technologies and process design packages to practical industrial sites.

Major Research Fields

- Electrochemical conversion technology for the production of high value-added chemicals and eco-friendly fuels from CO_2
- High-performance catalyst technology for Fischer-Tropsch synthesis reaction
- Ultra-high-valued chemical production technology from syngas
- Waste resource recovery and high value-added technology
- Separation/purification technology for high purity
- Carbon conversion system and optimization technology



Catalysts for Syngas Conversion

Simultaneous CO_2 Capture-Mineralization System (100kg-CO_2/day)

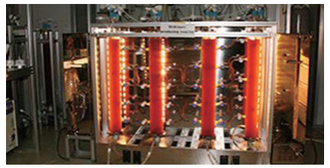
Energy Resources Upcycling Research

The Energy Resources Upcycling Research Laboratory conducts research on converting biomass and waste resources to energy in order to establish a sustainable society without greenhouse gas emissions and provide future energy/chemical resources after the oil age. The Laboratory's main research fields are bio-fuel production technology, chemicals production technology, hydro-processing technology of heavy oil, and environmental catalyst and process technology.

Major Research Fields

- Bio-fuel production technology for power generation/transportation from lignocellulosic biomass
- Bio heavy oil/diesel production technology from low-grade fats
- Chemicals production technology from bio resources
- Pyrolysis liquefaction technology of waste plastics
- Catalyst and process for NOx/N_2O abatement
- Upgrading technology of unconventional oil

Rapid Pyrolysis Process for Lignocellulosic Biomass (Capacity : 2tons/day)



Photosynthesis Fermenter for Bio-hydrogen Production (Capacity : 80L)

Bio/Energy Research

The Gwangju Bio/Energy R&D Center conducts research on bio-refinery as a renewable energy source and eco-friendly energy storage technologies in order to not only support the paradigm shift to a sustainable energy society but also provide solutions for environmental problems. Specifically, the Center focuses on fundamental biotechnology such as bio-catalyst and bio-process for developing bio-refinery systems and battery regeneration/restoration through analysis on the deterioration of spent batteries and their reuse by identifying new sources of demand.

Major Research Fields

- Bio energy
- Biorefinery technology using industrial waste gas (CO_2, by-product gas)
- Wood-based biomass pretreatment and biofuel conversion technology
- Anaerobic digestion of organic waste
- Eco-friendly energy storage
- Secondary battery reuse/recycling technology
- Battery regeneration and restoration technology
- Identification analysis on the cause of battery deterioration
- Secondary battery condition diagnosis technology
- Next-generation secondary battery core material technology

Carbon Monoxide Conversion High Pressure Bioreactor

Bioelectrochemical Reactor

Energy Technology Policy Research

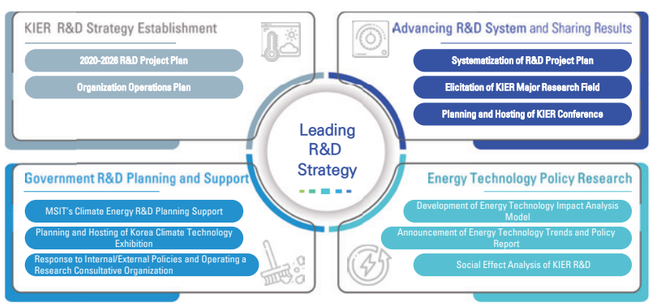
The R&D Strategy Division develops the mid- and long-term R&D strategies of KIER and its joint R&D projects with global partners and supports the government by researching energy and climate change policies. The Division also implements technology transfer and IPR management activities to disseminate R&D outcomes and promote cooperation with companies for the mutual growth of KIER and SMEs. It has been playing a significant role as an integrated platform of R&D processes, from strategy planning to commercialization, supporting KIER as a leading global research institute.

Energy Policy Research

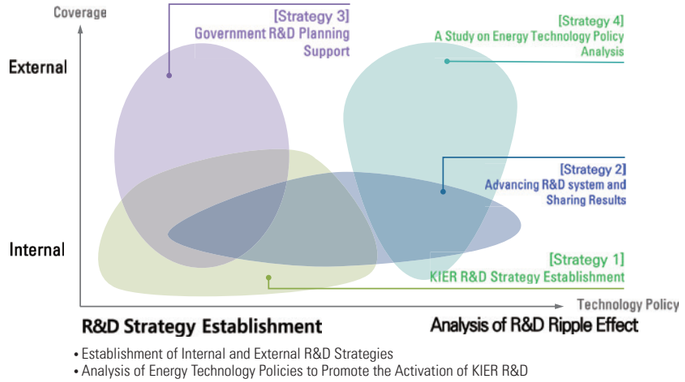
The Energy Policy Research Team develops the R&D policies and strategies of KIER, including research project plan, mid- and long-term development strategies, and implementation plans of KIER directed R&D projects, and conducts policy research projects to lead the energy technology policies of Korea in relation to energy, climate change, and environmental issues based on the multiple-criteria decision-making (MCDM) approach and energy system modeling.

Major Research Fields

- Analysis of domestic and global energy technology trends and policy monitoring
- Establishment and performance analysis of energy technology strategy
- Analysis of energy technology R&D performance and effect
- Development of energy technology effect model
- Support for establishment of national energy technology policy



Think Tank on Energy Technology R&D Strategy to Overcome Climate Crisis and Open a Carbon Neutral Society



- Establishment of Internal and External R&D Strategies
- Analysis of Energy Technology Policies to Promote the Activation of KIER R&D

Climate Technology Strategy

The Climate Technology Strategy Team analyzes technology policy trends to tackle challenges related to climate change and conducts basic studies to develop R&D strategies for innovative climate technology and related policies, providing solutions for climate change and contributing to the growth of the national economy.

Major Research Fields

- Establishment of national policy and strategy for climate change
- Analysis of R&D investment trends for climate technology and expected effects
- Supporting for R&D planning of national climate technology
- Monitoring and raising issues of climate technology policy
- Analysis of climate technology issues including policy, market, and industry

Business Development

The Business Development Team is in charge of technology diffusion to support the transfer and commercialization of competitive energy technologies. To this end, the Team is working to identify and match outstanding KIER technologies and demand-side companies and concluding technology transfer contracts, while supporting activities related to intellectual property rights for the protection of research outcomes.

Major Research Fields

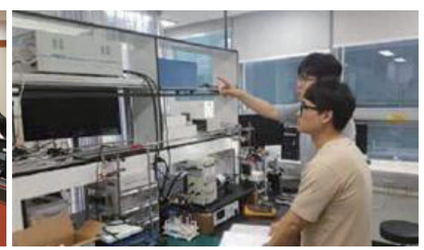
- Strengthening the IPMS (Intellectual Property Management System) base to create excellent research results
- IP management enhancement, market-based technology commercialization networking, strategic technology transfer and follow-up management to establish a customized commercialization system for technology and market

Business Partnering and Outreach

The Business Partnering and Outreach Team collaborates with businesses by providing technical advice and creating opportunities for them to participate in joint R&D projects. The Team also actively spreads KIER's R&D outcomes by fostering KIER tech-based startups.

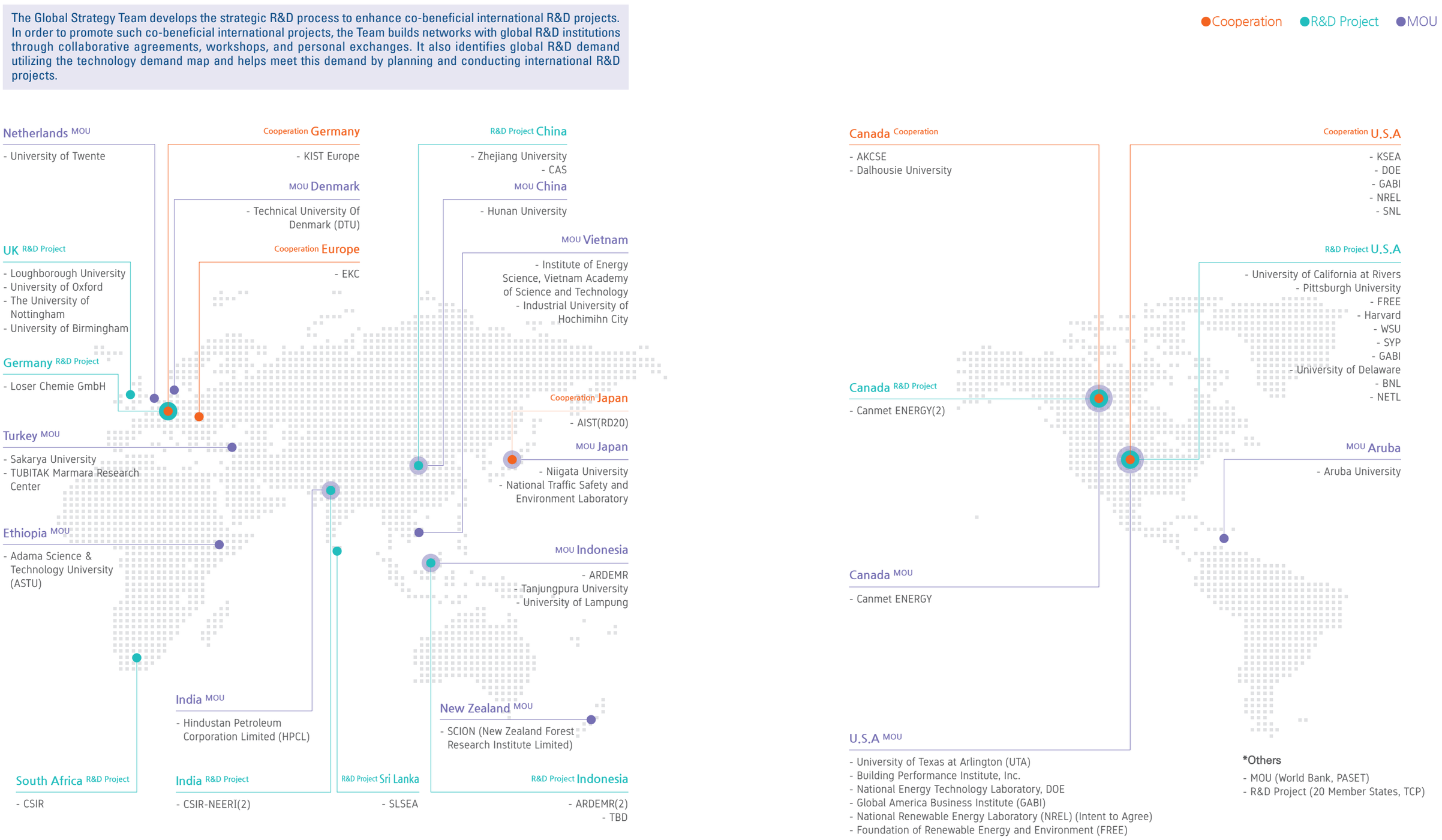
Major Research Fields

- Promoting technical support and information exchange, etc. by designating partner companies as family companies
- Conducting technical exchange meeting, technical community operation and customized enterprise support to strengthen partnerships with companies
- Conducting energy doctor technical mentoring program, business growth support projects and technical counseling for the enterprise, etc.



Global Strategy

The Global Strategy Team develops the strategic R&D process to enhance co-beneficial international R&D projects. In order to promote such co-beneficial international projects, the Team builds networks with global R&D institutions through collaborative agreements, workshops, and personal exchanges. It also identifies global R&D demand utilizing the technology demand map and helps meet this demand by planning and conducting international R&D projects.

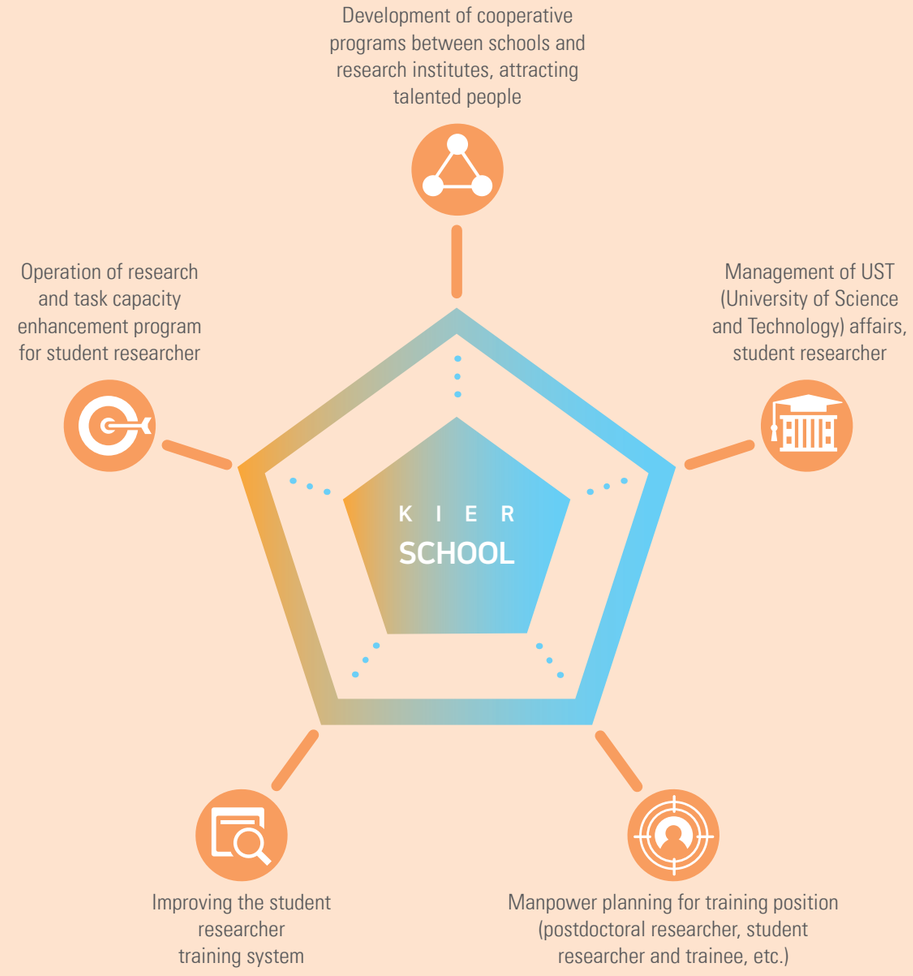


Platform Technology

The Platform Technology Laboratory conducts R&D-based technology support and R&D improvement processes with the aim of enhancing R&D outcomes quality and productivity. In particular, the Laboratory covers the support of specialized analysis, testing/evaluation, computational science and Big Data analysis, engineering, and R&D quality assurance with the main goal of being an Enabler and Pathfinder of R&D performance in the energy environment sector.

KIER SCHOOL

The KIER SCHOOL aims to cultivate creative and convergence talents in the energy/environmental field. To achieve the goal, it promotes active human exchanges with related domestic and foreign universities and systematic research-oriented practical education.



FEP Convergence Research Center
www.kier.re.kr/fep

- Launched as a part of future advanced fusion research project of the National Research Institute for Science and Technology (NST)
  ※Collaborate research institutes : Korea Institute of Industrial Technology, Korea Research Institute of Standards and Science and Korea Institute of Machinery & Materials
- Improvement of power generation efficiency by separation of carbon dioxide sources and supercritical power generation technologies
- Solving global warming through water recovery and technology reuse

R&D Center for Reduction of Non-CO_2 Greenhouse Gases
www.nonco2.re.kr

- Launched as a part of the ministry of environment's next-generation eco-innovation project (EI project)
- Development of the world's best non-CO_2 emission reduction technology
- Early commercialization of developed technologies and export commercialization
- Achieving GHG reduction targets through eco-friendly enterprise emissions

Center for Environmentally Friendly Vehicle
www.cefv.re.kr

- Launched as a part of ministry of environment's next-generation eco-innovation project (EI project)
- Development of low-emission and low carbon technologies focusing on automobile emission allowance standards and automobile greenhouse gas reduction technologies
- Strengthening competitiveness of the domestic automobile industry through integrated development, distribution and management of eco-friendly automobile technologies
- Leading the globalization and top 4 green car powers by advancement into the overseas advanced automobile markets

KIER, creating
a clearer Earth and achieving
stronger economy

- **Renewable energy innovation technology**
  for realizing an energy transition 3020 / 4035 plan
- **Hydrogen supply and utilization technology**
  for leading the hydrogen economy society
- **Smart energy technology**
  for building a high-efficiency low-carbon society
- **Clean utilization technology of carbon-based energy**
  for greenhouse gas reduction and clean air