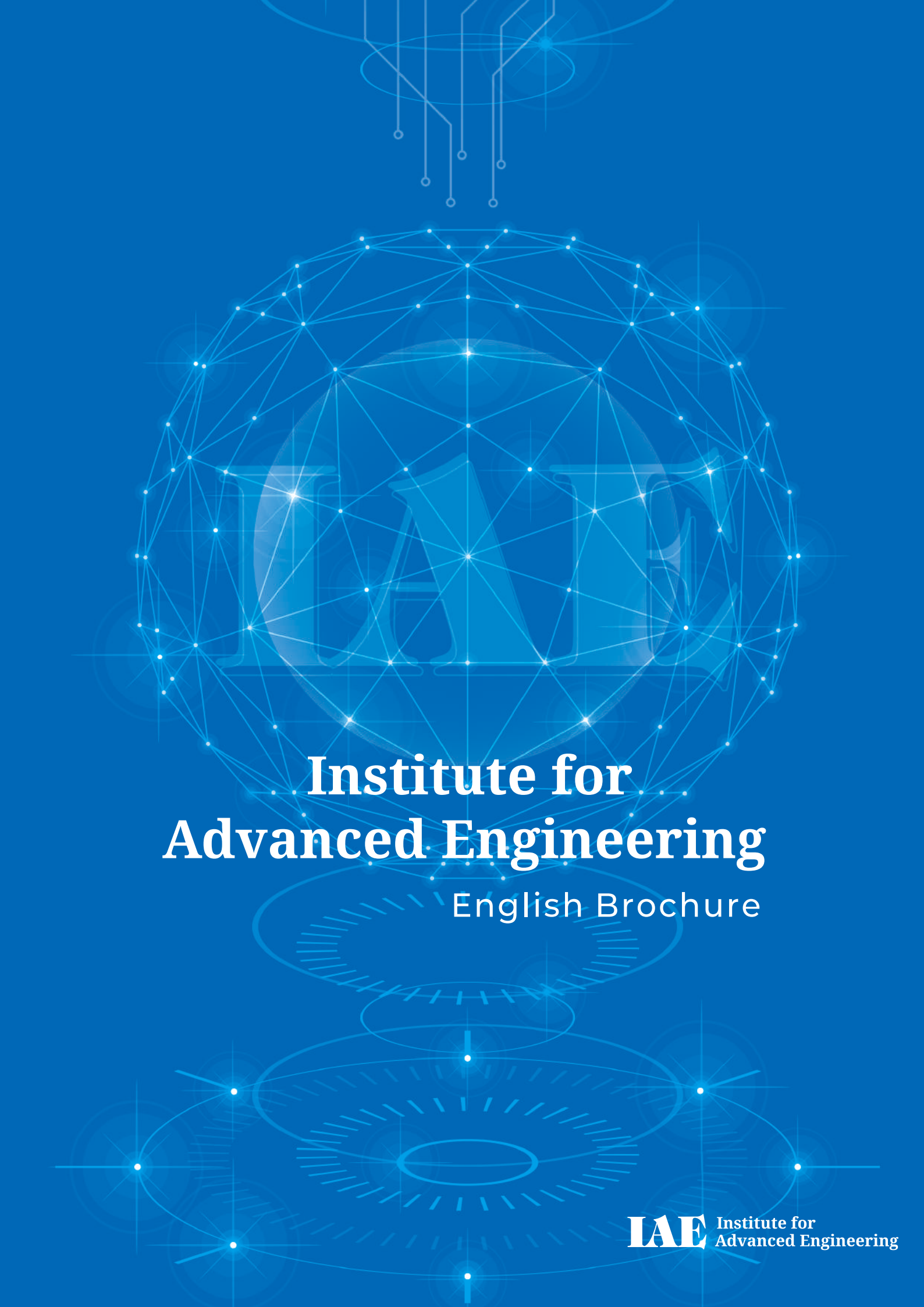

Institute for Advanced Engineering

English Brochure

IAE Institute for Advanced Engineering

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President's Message

The Institute for Advanced Engineering (IAE) was founded in 1992. As Korea's leading non-profit and self-sustaining research institute, IAE has consistently driven technological innovation and industrial growth.

As an industrial technology research association, IAE collaborates annually with over 200 partners,including Small and Medium-sized Enterprises(SMEs), universities, and government-funded research institutes,through a Project-Based System (PBS). We are at the forefront of technology transfer and fostering high-potential small firms, contributing to national industrial development and enhancing Korea's global competitiveness. These efforts have enabled us to grow into a top-tier research institute with the highest level of technological capabilities in Korea.

This growth can be attributed to the ongoing dedication and resilience of our institute. Integrated Gasification Combined Cycle (IGCC) technology has been a long-term focus since IAE's inception. We are pleased to announce that, commencing with the basic research phase, we have successfully attained the highest level of technical expertise in Korea. Building on this foundation, we have expanded our core research into waste and biomass gasification and energy conversion technologies, as well as into related fields such as waste recycling, rare metal recovery, hydrogen energy, and wind power.

However, we do not rest on our past achievements. IAE is preparing for a significant strategic initiative. We have established a new long-term vision—"IAE Vision 2032: A Self-Sustaining Research Institute Leading Future Industries through Innovative Technologies and Practical Value"—and formulated a strategic roadmap for the next decade of transformative growth.

Specifically, we have identified ten key future technologies, including carbon neutrality (hydrogen, CCUS), renewable energy, and AI/DX, and are committed to attracting and retaining top talent and promoting both qualitative and quantitative growth.

Moving forward, we will continue to strengthen institutional and individual capabilities, enhance expertise, and prioritise customer satisfaction, guided by our three core values: practicality, flexibility, and professionalism. At IAE, we are committed to continuous innovation in order to become a trusted partner and a leading force in future industries.

Something Different!! Find Niche!!

President of IAE
Jin-Kyun Kim

VISION

MISSION
Core Values

01 **Challenge**
Practicality
System Engineering approach

02 **Creation**
Flexibility
Convergence, Autonomy, Diversity, Creativity

03 **Passion**
Professionality
Professional, Learning and Growth, Capacity Building

IAE VISION 2032

Self-reliant Research Institute that Drive Future Industries with Innovative Technologies and Practical Values.

IAE History

2020~

2025.03.
Groundbreaking Ceremony for the IAE Chungcheong Campus (ICC)

2024.09.
Presidential Citation for Environmental Conservation
(Ministry of Environment, 5th Blue Sky Day Commemoration)

2023.11.
Inauguration of the IAE Chungcheong Campus (ICC)

2023.06.
Establishment of the IAE Gangwon Campus (IGC)

2023.01.
Establishment of the IAE Chungcheong Campus (ICC)

2022.12.
Establishment of IAE Vision 2032

2022.07.
30th Anniversary of Institution Establishment
(Commemoration Ceremony for the Founder of DAEWOO, Chairman Woo-choong Kim)

2022.03.
Designation/Operation of Chemical Industry Forum Secretariat
(Ministry of Industry)

Chungju BioGreen Hydrogen Charging Station Completed / Commercial Operation Starts
(Ministry of Industry Energy Technology Development Project)

2010~2019

2021.11.
Acquisition of New Environmental Technology for Solid Fuel Production of Sewage Sludge based on Hydrothermal Carbonization
(Certification No.575, Verification No.263)

2020.11.
Establishment of a Branch Office to carry out Regional R&D Projects
(Gyeongnam-Wind Power, Ulsan-CCUS, Chungnam-Hydrogen FC Power Generation)

2019.05.
New Hydrogen Energy-Based Technology Promotion
(Technologies for Hydrogen Production, Storage, Plant Design, Construction, and Operation)

2018.07.
Development of Liquefied Air Storage/Application and CO_2 Capture/Application Technology (ESS & CCUS)

2017.08.
Initiation of Technology Development Related to Wind Power Generation System

2016.07.
Launching the Design of Supercritical CO_2 Generation for Coal-Fired Power Generation Eng.

2015.05.
Start Developing Industrial Strategic Materials
(TiO2, TiCl4)

2014.03.
Establishment of IAE VISION 2022

2013.04.
Establishment of the Rare Metal Industry Technology Research Center (Incheon Songdo TP)

2012.11.
Construction of the Pilot Plant of the Waste Gasification Melting System

2012.03.
Establishment of Advanced Materials Processing Center
(Resource Recycling)

2011.10.
Establishment of BSU for Natural Gas (LNG) Manufacturing Process

2010.09.
Initiation of Technology for Recycling Waste Resources and Recovery of Rare Metals

2010.06.
Establishment of BSU for Synthetic Natural Gas (SNG) Manufacturing Process

2000~2009

2009.07.
MOU signed for Clean Coal Technology Development
(Ministry of Knowledge Economy, POSCO, SK Energy, etc.)

2006.02.
Membership of the Small and Medium Business Support Parts and Materials Integration Research Group
(Ministry of Commerce, Industry and Energy)

2004.04.
ISO9001:2000 Quality Management System Certification
(Engineering and Technology Development)

2003.03.
Designation of a Research Institute for Government R&D Project Labor Cost Estimation (Ministry of Trade, Industry and Energy)

1999.09.
Designated a Nationally Designated Laboratory
(Ministry of Science and Technology)

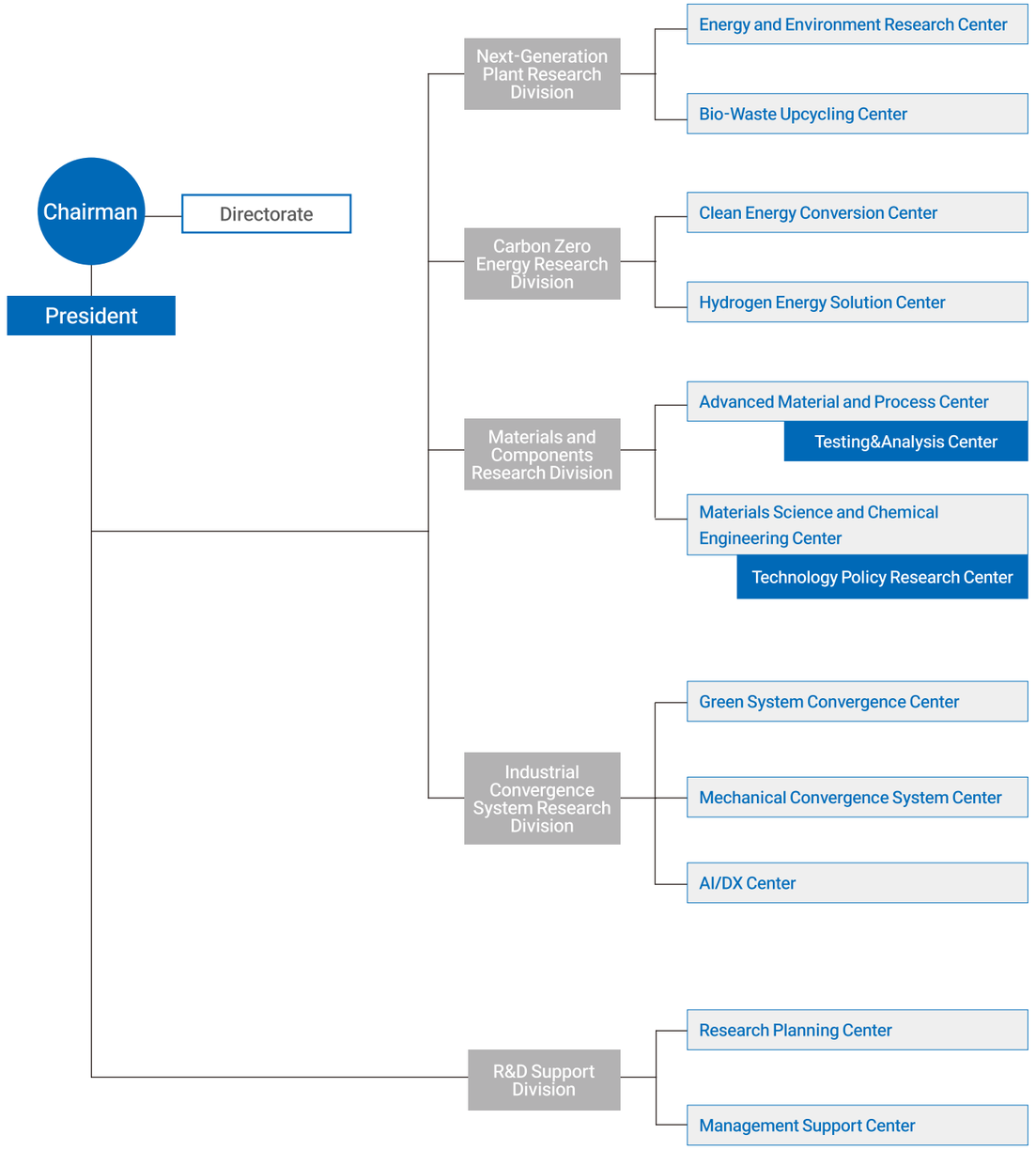
1995.11.
Yongin Research Center is completed
(referred to the institute)

1992~1999

1994.08.
Establishment of a branch in Ajou University
(IGCC Research)

1992.07.
Establishment (Seoul)

IAE Organization



The Next-Generation Plant Research Division

Vision

Commercialization of energy and environmental innovation technologies that can contribute to carbon neutrality

Mission

Leading next-generation energy and environmental technologies for a sustainable future

The Next-Generation Plant Research Division conducts research leading the realization of carbon neutrality and sustainable technology innovation in the energy and environment sectors.

We provide plant sector solutions that aim for intelligence, low carbonization, and high efficiency through research on DT(digital transformation) and GT(green transformation) in the traditional plant sector.

Energy Environment Research Center

A research center that collaborates with clients based on Korea domestic best technology development capabilities in the energy and environment fields.

Management philosophy	Management purpose	Clients and Members	Social responsibility
Korea's best research center in the energy and environment fields based on excellence, efficiency, and flexibility	A research center with the best research capabilities in Korea for sustainable research institute development	A research center that promotes the growth of researchers and clients satisfaction	Research center developing core technologies th realize a carbon-neutral society

Bio-Waste to Valorization Center

The Bioresource Circulation Center is developing technology to circulate unused waste resources into resources.

Main achievements include ① production of organic waste biomass energy and high value-added products, ② wastewater reuse and useful resource recovery, and ③ production of high-surface-area carbon-based adsorption materials and resource recovery ④ Marine calcium limestone substitute material.

◆ Waste/Biomass based Gasification hydrogen production and Torrefaction/ Bio-Char technology

- Produces syngas through gasification of waste and biomass (5TPD)
- Technology for purifying contaminants from syngas and extracting high-purity hydrogen
- Produced Biomass fuel and Bio-char through torrefaction technology

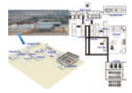
◆ Development of a methodology for LCA of H2 and a FEMS energy solution

- Development of LCA calculation modules for H2 and linking the platform
- Predicting energy demand/supply and optimizing energy use based on machine learning
- Energy saving derived through EIS/EOS modules and development of integrated package FEMS

CO_2 Cryogenic capture

Mobile CO_2 capture

e-methane production



Water electrolysis Performance evaluation center

◆ CO_2 Capture(Cryogenic , absorption) technology, E-fuel Production technology

- Carbon Dioxide cryogenic capture for ship
- CO_2 capture and storage technology for heavy duty vehicles

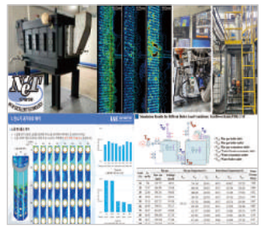
◆ Techno-economic Analysis for hydrogen & e-fuel technology

◆ Water electrolysis system test & operation technology

- Stack and system performance evaluation
- 0.1~1 MW Alkaline and PEM electrolysis system
- Performance test under various load fluctuation

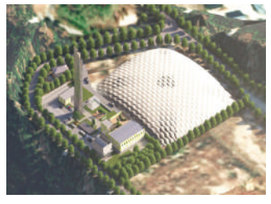
◆ Gasification-based Syngas and Hydrogen Production Plant Technology

- Syngas and Hydrogen production from various low-grade feedstocks
- Provision of turn-key solutions for the design, construction, and operation of syngas and hydrogen production plants
- Syngas Purification and Utilization Technologies
- Risk assessment and safety management technology for hydrogen



◆ Hydrogen Ultra-Flexible Combustion Technology and DCSG(Direct Contact Steam Generator) Technology

- Flexible hydrogen co-firing capability ranging from 20% to 100% (Certified with NET(New Excellent Technology) by relevant authority(2024))
- Flame visualization using spectrally invisible intermediate species (e.g., OH^- radicals)
- Combustor Geometry Design and Computational Analysis
- CAE Process Simulation and Algebraic Control
- Combustor technology that supplies steam and combustion gas generated by directly injecting water into a high-temperature combustion environment



◆ Energy/resource recycling production process technology of organic waste resources

- Integrated plant for simultaneous production of solid fuel and biogas based on hydrothermal carbonization
- 200 tons/day underground space utilization urban complex plant
- Livestock manure membrane filtration liquid fertilizer and high-quality compost production plant

◆ Treatment and reuse of non-biodegradable wastewater and recovery of useful resources technology

- High-efficiency electrode-based non-biodegradable wastewater treatment
- Recovery of high concentration ammonia (NH3) in wastewater and production of nitrogen products

◆ Mass production technology for high-quality carbon-based adsorbent materials

- Mass production plant for adsorption materials of 2,500 m2/g, more and 30 kg/batch
- Energy conversion process technology for air pollutants (VOCs, odors, etc.)
- Development of waste activated carbon regeneration and advanced activation process

◆ Calcium production resource technology utilizing abandoned shells

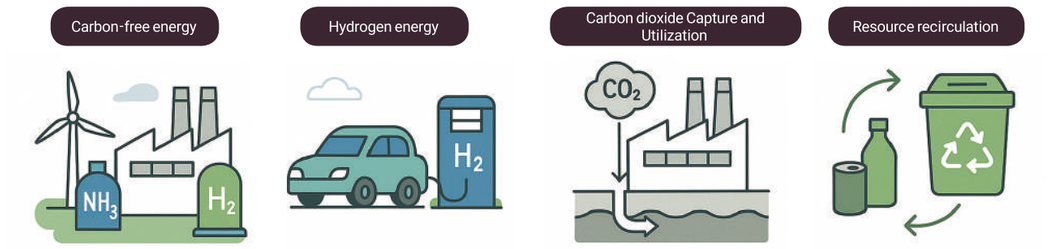
- 2 ton/day abandoned shell sintering-based resource recovery plant
- High-grade calcium material based on abandoned shells as a substitute for limestone

The Carbon Zero Energy Research Division

Vision & Mission

Establish a technology-driven R&D model for the private sector by developing core technologies for carbon neutrality and energy conversion, and lead the government, industry and global cooperation system
Realize climate crisis response and future energy transition through sustainable energy technology development for zero carbon emissions.

The Carbon Zero Energy Research Division is a leading research organization in the development and realization of carbon-neutral energy technology for a sustainable future. Our division promotes R&D, demonstration, policy support and industrial cooperation in various fields such as renewable energy, hydrogen energy, carbon dioxide capture and utilization (CCU), resource recycling and energy efficiency technology. Through this, we present innovative solutions for building an ecosystem of sustainable future energy.



The Clean Energy Conversion Center

The Clean Energy Conversion Center provides a wide range of research services from catalyst and process development to core device development, plant design/operation, and resource plant consulting, with the goal of pursuing growth together with customers based on leading technology creation and R&D capabilities in the field of carbon neutrality response for the realization of a sustainable technology society.

The main research areas include carbon neutral fuel and raw material manufacturing, CCUS technology for CO2 capture and utilization, fine dust reduction technology, eco-friendly waste resource recycling technology, and clean hydrogen production technology. We are conducting a wide range of research from R&D to technology verification to secure technologies for core technologies related to carbon neutrality.

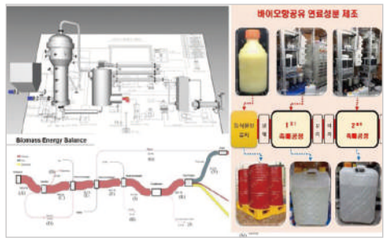
The Hydrogen Energy Solutions Center

The Hydrogen Energy Solutions Center is dedicated to advancing future-oriented energy technologies, including hydrogen, biomethane, and renewable synthetic fuels. We focus on technological innovation and expert development, positioning ourselves as leaders in resource-recycling hydrogen energy by building upon our proven success in developing and operating advanced clean hydrogen production systems.

Our mission is to cultivate a hub of hydrogen energy experts, achieve carbon neutrality, and secure core engineering technologies essential for green hydrogen-based integrated energy systems.

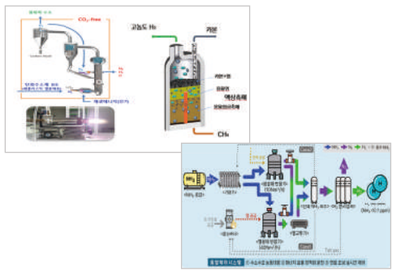
◆ CCUS(Carbon Capture, Utilization & Storage) Technology

· Carbon capture and chemical conversion technology as an element of CCUS to utilize greenhouse gases generated by carbon neutral response technology.



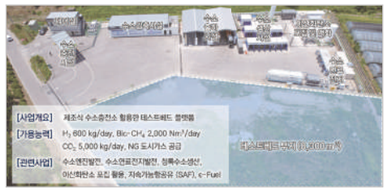
◆ Biofuel and raw material production and utilization technology

· We are conducting research on the production of carbon-neutral raw materials and the development of various technologies to produce energy and products using these materials, in order to achieve a sustainable carbon-neutral society.



◆ Carbon-neutral clean hydrogen production and Green hydrogen production technology based on carbon-free fuel

· We are conducting research on clean hydrogen production technology centered on net-zero through renewable energy-based turquoise hydrogen production technology, not the conventional gray hydrogen.
· We are developing hybrid process technology to secure the original technology in the field of ammonia-based green hydrogen production.



◆ Establishment and operation of a resource-recycling clean hydrogen production facility

· Operation of Korea's first hydrogen mother station
· Establishment of clean hydrogen production and hydrogen refueling station linked to biogas facilities
· Commercialization of small-scale distributed on-site hydrogen refueling station
· Development of hydrogen city master plan and Clean hydrogen infrastructure

◆ Energy efficiency enhancement through waste-to-energy technologies

· Fuel cell cogeneration systems utilizing agricultural by-product carbonization and gasification
· Biomass boiler-based cogeneration system development
· High-quality solid fuel production from biomass and waste
· Advanced environmental technology for hazardous substance management in industrial processes

◆ Customized Hydrogen Infrastructure Design and Commercialization

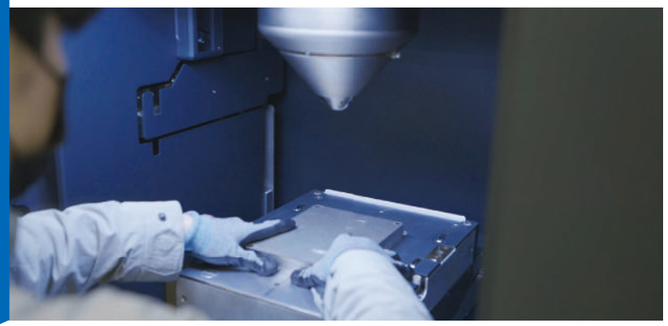
· **[Master Plan and Basic Concept]**
Dangjin, Paju, Boryung, Chungju, Ansan, Yongin

· **[Hydrogen production Infrastructure Development]**
Incheon, Yongin, Cheongju

The Materials and Components Research Division

Vision & Mission

- Technology convergence and collaboration
- Sustainable development
- Strengthening the foundation for growth



The Materials and Components Research Division develops core materials and components technologies essential across all industrial sectors, including mobility, batteries, semiconductors, energy, and defense, to meet the demands of emerging future industries.
The division focuses on the advancement of core materials and components for various industries, emphasizing the following areas:

- High-performance materials such as high conductivity, insulation, thermal dissipation, and low dielectric properties
- Material convergence and application process technologies to maximize performance
- Supply chain stabilization and carbon-neutral research

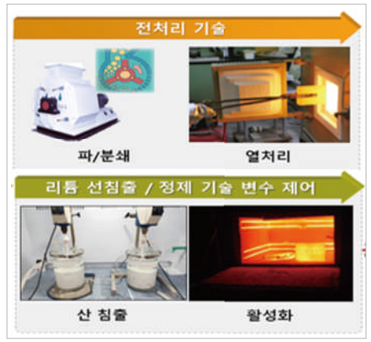
We conduct full-cycle R&D ranging from fundamental source technologies to commercialization, incorporating industry needs.

Advanced Materials Processing Center

Advanced Materials Processing Center conducts research on inorganic and organic materials—including metals, ceramics, and polymers—as well as component materials for energy and environmental applications. We also focus on recycling processes and the materialization of valuable metal resources. To enhance material performance and strengthen both domestic and global competitiveness, we develop original and practical technologies across a broad spectrum, including functional components, high-value-added materialization, valuable metal resource recycling, alloy design, and advanced material manufacturing processes. Leveraging our expertise, we lead joint R&D and commercialization (R&BD) initiatives in collaboration with government agencies, industry partners, universities, and research institutes.

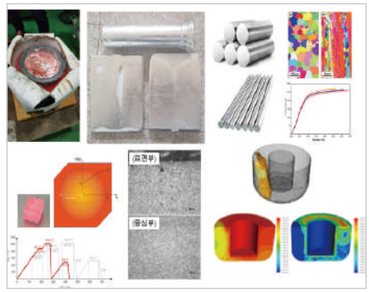
Materials Science and Chemical Engineering Center

The Research Center concentrates on addressing future industrial demands through the development of innovative metals, composite materials, and nanomaterials that overcome existing performance limitations. Its primary research areas include the high-performance enhancement of ferrous and non-ferrous metals, the creation of functional composite materials with high heat resistance and low dielectric properties, and the development of semiconductor and secondary battery materials.
Furthermore, the center is dedicated to advancing eco-friendly technologies such as resource recycling and application process technologies. Through these efforts, it aims to establish technological leadership in materials and components while securing global competitiveness in the rapidly evolving industrial landscape.



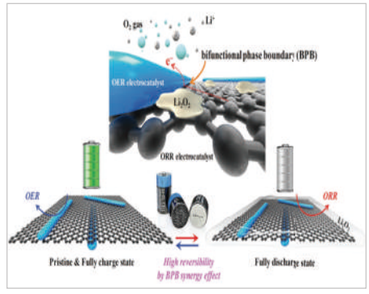
◆ Valuable Metal Resource Recycling and Materialization Technology

- Total recycling technologies including recovery high-purity metals from valuable metal-containing resources such as waste secondary battery and industrial by-products
- High-value materialization technologies for waste resources
- Efficient resource recovery based on dry/wet processes such as leaching, solvent extraction, and electrolytic refining
- Technology for advanced resource recycling and pilot plant operation



◆ Functional Materials Design and Manufacturing Technology

- Non-ferrous/ferrous metal alloy design, heat treatment, phase control, surface treatment, etc. high-functional metal material technology
- Eco-friendly wet and dry metallurgical technologies for non-ferrous metals
- Special casting processes such as continuous casting and vacuum casting, and process technologies such as rolling and extrusion
- Nano-material and energy materialization technology
- Application of core industry technology such as electrical, electronic, mechanical, and automobile



◆ High-performance Energy Storage Materials and Battery Technology

- High-performance secondary battery materials and system development technology for next-generation energy storage technology
- Development of fundamental technologies such as electric catalysts, aqueous batteries, and next-generation batteries
- Development of core electrode materials through advanced electrolyte and separator manufacturing

◆ Support for small and medium-sized company Infrastructure

- Support for test evaluation and certification
- Support for development of materials and components and resolution of technical difficulties
- Support for companies through the establishment of core infrastructure for materials and components (prototype production, testing and analysis)

◆ Metal/Ceramic Composite and Surface Treatment Technology

- Convergence technologies for energy material components
- High-functionality smart powder material component technology
- Integration and design of multi-type and heterogeneous materials for future energy and advanced industries
- High-performance smart powder materials and advanced powder processing technologies
- Metal/ceramic composite materials for high-efficiency energy systems

The Industrial Convergence Systems Research Division

Vision & Mission

A research division that provides technology development services by create practical value through collaboration and linkage in various technical fields

The Industrial Convergence Systems Research Division is dedicated to generating synergy in future technologies by integrating diverse technologies and sharing resources across mechanical systems, green energy/offshore systems, and AI/DX. The Research Division specialize in integrated product solution technology, intelligent production process/structural health monitoring technology, green energy/system convergence technology, and industrial intelligence/digital transformation technology. We drive industrial convergence and innovation to create future practical value across various industries through seamless collaboration between diverse technologies.

Green System Convergence Center

Realizing a carbon-neutral society and advancing energy and safety sys. through core convergence tech. development in green energy-based mechanical and offshore systems

Philosophy of Technology	A proactive research center that builds trust through fair and transparent processes grounded in professional expertise
Customers and Members	Renewable energy, Shipbuilding and Offshore, Defense, Disaster safety, and Predictive maintenance

Development strategies

1. Strengthening design competitiveness for next-gen & large-scale wind power sys.
2. Establishing a testing and validation infrastructure for component and equipment reliability.
3. Advancing UAV-based maintenance and inspection technologies.
4. Enhancing capabilities in safety and disaster-resilient system design

Mechanical Convergence System Center

Creating Future Value through Human-Centered Innovation and Integrated Solutions

Philosophy of Technology	Social Responsibility	Customers and Members
Realizing Future Dreams, Improving Quality of Life, Providing One-stop Solution	Creating Social Value, Advancing Together with Future Technologies	Global and local SMEs to large firms in future mobility, aerospace, shipbuilding, and advanced machinery

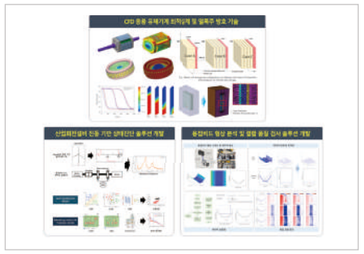
AI/DX Center

A leading research center driving the advancement of AI-based application technologies and digital transformation solutions applicable to various industrial fields

Philosophy of Technology	Social Responsibility	Customers and Members
Prioritizes practical, scalable, and sustainable solutions with on-site applicability	Promotes ethical, sustainable AI for human-centered digital transformation	Manufacturing, mobility, energy, healthcare, defense, and plant sectors needing AI·DX convergence

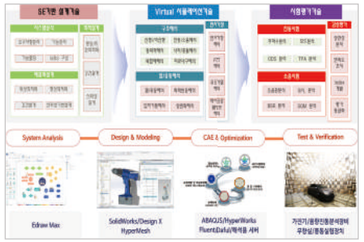
◆ Green energy & ocean systems technology

- Optimization of wind farm control using wake prediction
- Ultra-large and next-generation wind turbine systems design
- Motion evaluation and mooring sys. optimization of floating str.
- Durability performance eval. for large-scale bearings in WT



◆ Mechanical systems and safety technology

- CFD-Based optimization design of fluid machinery
- Thermal runaway prevention for lithium-ion batteries
- Vibration-based cond. monitoring sol. for Industrial rot. equip.
- Weld bead shape anal. and bonding quality inspection sol.

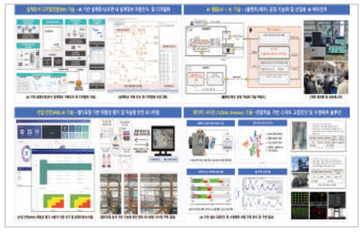


◆ Integrated product solution technology

- Product design technology based on SE applications
- Simulation technology based on virtual environments
- Performance enhancement based on multi-physics
- Multidimensional human-centered evaluation

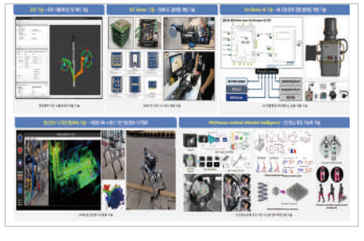
◆ Intelligent manufacturing & monitoring technology

- Core advanced manufacturing technologies
- Smart welding/joining & quality evaluation
- Metal composites & power material development
- Real-time structural health monitoring



◆ AI applications (AI + X) technologies

- LLM-based industrial AI agent technologies
- Federated learning-based fault diagnosis and RUL prediction
- Multimodal AI-based industrial safety monitoring
- AI-based digitalization of design information extraction



◆ Digital Transformation(DX) application technologies

- LiDAR-based 3D spatial information digitization
- 4D-based shape change management and BIM integration consistency verification
- Human behavior recognition/analysis and interaction application
- Visual-Language-Action (VLA)-based HRI technology

The IAE Testing & Analysis Center

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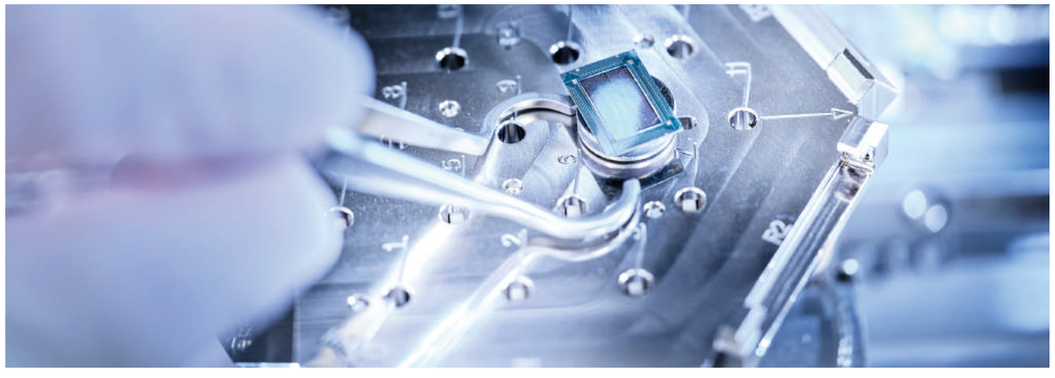
031-330-7458
test.iae.re.kr



precise analytical services to small and medium-sized enterprises and various research institutions, while also fostering opportunities for collaboration. The center offers analytical services and contract testing projects for both internal and external clients, based on the evaluation of physicochemical properties—including qualitative, quantitative, and physical characteristics of solid and liquid materials, as well as microstructural analysis of metallic and ceramic materials. It actively participates in government-funded projects, including the advancement of analytical techniques, development of testing methodologies, and standardization of test specifications, with the goal of contributing to future national standardization initiatives. While striving to enhance the quality and substance of ongoing government and contract research, the center remains responsive and adaptable to the evolving needs of both academia and industry, and pursues mutual growth with its clients.

In addition to its analytical instruments, the center also offers reservation and rental services for testing facilities. For more details, please refer to the equipment list below.

IAE Testing & Analysis Center Director
Research Fellow
Kim Dae-Weon

02 Analytical Testing Services
Provision of comprehensive analytical services using 16 types of testing equipment

01 Rental of Testing/ Experimental Equipment
Rental services of internal infrastructure to support researchers' needs

03 Participation in R&D Projects
Support for improving the reliability of SME's products through participation in R&D projects

Proactive and Responsive to the Needs of Academia and Industry

The Gangwon Mobility Innovation Center

VISION & MISSION

The Gangwon Mobility Innovation Center is a specialized research and development institution that strengthens industrial competitiveness through advanced technology development and leads innovation in future mobility solutions. The center conducts research on core technologies for electric vehicles, autonomous vehicles, and eco-friendly vehicles, and proposes practical solutions for commercialization. Through collaboration with industry, this institution actively contributes to advancing technologies and nurturing a robust industrial ecosystem.

IGC Functional Overview

01.
Fundamental and applied research on future mobility technologies

02.
Professional training and technology transfer programs

03.
Tailored R&D and technology commercialization

04.
Development of autonomous vehicle, electric vehicle, and smart mobility technologies

Institute for Advanced Engineering

Self-reliant Research Institutes that Drive Future Industries with Innovative Technologies and Practical Values.

Location

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