Introduction of Korea Institute of Energy Research for G-COE Program Kyushu University-Novel Carbon Resources Science

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1. Introduction

Energy and the environmental protection are becoming more important for both the industrial development and human wellbeing as we enter the 21st century.

The rapid growth of developing countries, especially BRICs, is making a huge change in the supply and the demand system of global energy. As a result, energy is an essential factor in the national security that may determine the very survival of each nation.

Finite reserves of fossil energy and global warming are forcing all countries to develop both energy-efficient technologies and new energy sources that can secure the sustainable development. For 30 years Korea Institute of Energy Research (KIER) has been committed to the research and the development of energy-efficient technologies, environmental technologies, and new & renewable energy technologies to meet the need of our nation to gain the international competitiveness. KIER, the sole institution dedicated to energy research in Korea, will make our utmost effort to fulfill the mission of resolving nation's energy-related problems by developing a variety of energy technologies and by supporting the formulation of national energy policies.

At present, KIER has more than 360 peoples of staff and about 300 peoples of master and doctoral students work as research assistance with the research budget of 120million US dollar per year.

KIER's development strategy

2. Associated study of KIER

1) New and Renewable Energy Technology

There are 5 main research topics in New and Renewable Research Department.

The research in photovoltaic research in KIER are on silicon solar cells, silicon thin film and CIGS thin film solar cells, dye-sensitized solar cells, PV modules, BIPV modules, PV PCS, PVsystems, certification test and performance evaluation of PV components, and PV manpower training program. Development of fuel cell core technologies for improving performance and durability and reducing cost through optimization of materials, components and systems for residential, transportation, distributed, and mobile applications are doing in fuel cell research group. R & D on the system and key technologies of solar thermal energy, geothermal energy are working in solar thermal and geothermal research group. R&D on wind turbine system and elements development, wind resource assessment, wind turbine system performance test, wind farm design and maintenance and especially offshore wind power generation demonstration. Hydrogen energy research group focusing on key technologies for hydrogen production via fossil fuel reforming and water splitting are developing in KIER.

Hydrogen station in KIER

KIER wind farm in Jeju island.

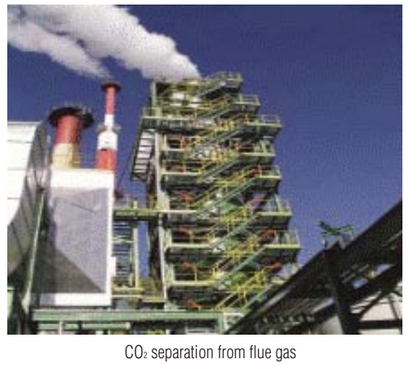
2) Climate Change Technology

Climate change technology is one of main technology for green earth. KIER has three research groups, greenhouse gas research group, clean fossil energy research group and waste energy research group. Greenhouse gas research group is carrying out research on capturing carbon dioxide from industries and energy-related sources for mitigating climate change. Core technologies include various types of post combustion CO_2 capture technologies, pre combustion CO_2 capture technologies, oxygen production technology for oxy-fuel combustion and the chemical looping combustion technology. Clean fossil fuel research group are developing our own technologies to convert fossil fuels such as coal, natural gas and unconventional oils (oil sand and oil shale) to a cleaner form of fuel to ensure energy security of Korea. The main topics for Climate Change Technology are i)coal upgrading (dashing and drying) and coal gasification, ii)coal gas cleaning and coal liquefaction (CTL: coal-to-liquids), iii)compact Fischer-Tropsch reaction system for gas-to-liquids (GTL) application, iv)upgrading unconventional oil sources likes an oil sand and oil shale, v) process development of gas separation, storage and transportation using gas hydrate.

Wastes energy research group are doing on the development of core technologies to produce

Alternative fuels through the conversion of various kinds of combustible and organic wastes into energy by environmentally friendly treatment methods.

Coal liquefaction



CO_2 separation from flue gas

3) Energy Efficiency and Material Convergence Technology

For increasing energy efficiency and developing new material, KIER have building energy research group, industrial energy efficiency research group, reaction and separation materials research group and energy conversion and storage research group. The main works in building energy research group are R&D on energy saving technologies for buildings including a building envelope, HVAC (heating, ventilating, and air conditioning), control systems, and convergence technologies, R&D on highly efficiency innovative lighting application using new light sources, distributed generation power and advanced power electronics R&D on cogeneration system, energy network (DHC and CES), boiler, burner system and heat exchanger aiming at high energy efficiency and low pollutant emission. Industrial energy efficiency research group are doing on the R&D on energy-saving heating and electricity production technology and advanced combustion technology to meet environmental challenges. R&D on green engine for car and power plant, high efficiency heat exchanger and heat conversion to utilize the waste heat from industrial processes and high efficiency combined drying system.

The main work in reaction and separation materials research group are i) R&D on ionic conducting ceramics materials and gas and liquid separating materials, ii) R&D on advanced chemical reaction and separation materials and technologies for realizing a new energy and environmental system. Energy conversion and storage research group are doing on electrochemical energy storage systems, photo electrochemical conversion of solar energy, electrical and electronic materials, and ribbon silicon wafer for future energy.

3. Conclusion

From basic chemistry to utilization of carbon resources and development of resources environmental system including economic analysis & evaluation are main research topic in G-COE "Novel Carbon Resources Sciences". The strategy of G-COE program doing on Kyushu University is very similar with the main research work of Korea Institute of Energy Research. It is very useful to increase research power by exchanging technology information, international collaboration research with research staff, and also visiting research of student in each institute.

Reference

1.NCR Newsletter, vol.3.2010
2.Korea Institute of Energy Research Pamphlet , 2010