

1. Outline of Research Activities

CRIEPI's R&D Portfolio in FY2013

(Pillars of research and eight research laboratories)

1. Outline of Research Activities

In FY2013, CRIEPI promoted research aimed at developing a robust and flexible energy supply/demand infrastructure in order to provide a stable supply of electric power, which is the foundation of Japan's economic activity. This research was promoted under the "Three Pillars of Research", which govern our mid-term directives; namely "Establishment of Optimal Risk Management", "Further Improvement of Facility Operations and Maintenance Technologies" and "Development of a Supply/Demand Infrastructure for Next-generation Electric Power". CRIEPI also leveraged collective strength and took priority action to address the pressing issues of nuclear power plant safety and natural disaster reduction on transmission and distribution facilities.

Of the technologies believed to be essential now or in the near future to the electric power industry, CRIEPI has selected 32 priority subjects to maintain, inherit, and develop the technologies which are considered to be essential to current and near future to the electric power industry. Of these priority subjects, CRIEPI's collective strength particularly focused on resolving 10 priority subjects with limited terms which were considered to be urgent and, consequently, produced solid results. Priority subjects and priority subjects with limited terms for which collaboration was deemed necessary were grouped into 11 categories and research in these areas was promoted effectively. Furthermore, 36 basic technology subjects were established and through leveraging the characteristics and expertise of 8 specialized research laboratories* we strengthened our research capability by basic technological strength and areas of specialty, which is the source of solving problems faced by the electric power industry. In concrete terms, we engaged in the following activities;

- 1) The accumulation of data and know-how through field investigations, experiments and measurements.
- 2) The development, maintenance and improvement of analytical techniques.
- 3) Basic research to conceive new ideas.

The major research results produced in FY2013 are described in Chapter 2 (Major Research Results). The chapter lists the respective goals and results of both the priority subjects addressed by each subject and the basic technology subjects addressed by each specialized research laboratory.

To support technology infrastructure of the electric power industry as well as maintain and strengthen CRIEPI's basic research capability, large-scale research facilities including the following were installed; large-scale tsunami physical simulators able to reproduce tsunami-inundation flow, full-scale test facilities for snow-storm damage to overhead transmission lines capable of monitoring and verifying countermeasures for strong winds, wet snow accretion and galloping phenomena on electrical wires and conductors, an advanced combustion test facility for diversification of available fuel types enabling mock combustion utilizing various fuels, a test facility for the carbonization of biomass able to evaluate the optimal condition settings in carbonization technology and a test facility for development and evaluation of heat pumps in industrial and commercial use which is utilized in the evaluation of various heat pump product performance.

*Socio-economic Research Center, System Engineering Research Laboratory, Nuclear Technology Research Laboratory, Civil Engineering Research Laboratory, Environmental Science Research Laboratory, Electric Power Engineering Research Laboratory, Energy Engineering Research Laboratory, and Materials Science Research Laboratory.



CRIEPI's R&D Portfolio in FY2013 (31st March, 2014)

Priority Subjects / Priority Subjects with Limited Terms

Priority Subjects: ● Priority Subjects with Limited Terms: ○ Basic Technology Subjects: ◆ Subject group: Frame enclosure
 □: Atomic power □: Power generation (except for atomic power) □: Electric power circulation
 □: Demand side □: Society and economy

Establishment of Optimal Risk Management

Nuclear Power Plant Safety

- Safety Assessment of LWR Systems
- Assessment of the Effects of Natural Hazards on Nuclear Facilities
- Improvement of the Safety Assessment on External Natural Hazards for Nuclear Facilities
- Assessment of Radioactive Material Diffusion in the Environment and its Remediation Effectiveness
- Establishment of Methodologies to Evaluate Fires in Nuclear Facilities

Radiation Risks

- Quantitative Evaluation of Low-Dose Radiation Risk and its Reflection on Radiation Protection

Nuclear Fuel Cycle and Backend Technologies

- Development and Systematization of Long-term Safety Assessment Technologies for Radioactive Waste Disposal
- Development of Long-Term Storage Management Technologies for Spent Fuel

Natural Disaster Reduction on Transmission and Distribution Facilities

- Development of Prediction Methods for Meteorological and Climatic Impact on Power Facilities
- Establishment of Protective Measure Technologies against Wind and Snow Damage of Overhead Transmission and Distribution Facilities
- Development of Lightning Risk Management Schemes

Energy and Environment Institutions

- Well-functioning Electricity Market and Network Neutralization
- Analyses of Energy Saving and Environment Institutions from an Economics and Energy Security Perspective
- Scientifically and Economically Rational Scenarios for Reducing CO₂ Emissions

Further Improvement of Facility Operations and Maintenance Technologies

Nuclear Power Plant Maintenance

- Structural Integrity Evaluation of Reactor Pressure Vessels and Core Internals
- Integrity of Components and Piping in Nuclear Power Plants
- Assessment of Cable Insulating Performance Used in Nuclear Power Plants
- Research of Advanced Nondestructive Evaluation

Construction, Operation and Maintenance of Power Generation Facilities

- Development of Life Assessment Technology for High Temperature Structural Components of High Chromium Steels
- Development of Comprehensive Assessment Techniques for the Impact of Thermal Power on Atmospheric Environment
- Development of Technologies for Supporting Construction and Maintenance of Power Plants with Consideration to Biodiversity Conservation
- Synthesis System of Numerical Analysis for Current and Sediments in Rivers and Reservoirs

Operation and Maintenance of Transmission and Distribution Facilities

- Development of Maintenance Technologies for Aged Power Transmission and Distribution Facilities
- Development of Soundness Assessment Techniques for Aged Overhead Transmission Steel Towers

Development of a Supply/Demand Infrastructure for Next-Generation Electric Power

Next-generation Thermal Power Technologies

- Improvement of Operation and Control Technologies to Diversify Fuel Types for Pulverized Coal-fired Power Plants
- Sophisticated Technology for Low-Grade Energy Resources

Next-generation Power Grid Technologies

- Assessment of System Security Assuming High Penetration of Photovoltaics
- Development of a Next-Generation Coordination System for Power Demand and Supply
- Next-generation Communications Network Systems
- Feasibility of Demand Response Suitable for Japan

Energy Utilization Technologies

- Development and Evaluation of Advanced Heat Pumps
- Establishment of Evaluation Technologies for High Performance Secondary Batteries

Basic Technology Subjects

Socio-Economic Research Center

- ◆ Utility Management and Policy
- ◆ Economic and Social Systems
- ◆ Energy Technology Assessment

System Engineering Research Laboratory

- ◆ Electric Power Systems
- ◆ Customer Systems
- ◆ Communications System
- ◆ Mathematical Informatics

Nuclear Technology Research Laboratory

- ◆ Nuclear Reactor Systems Safety
- ◆ Nuclear Fuel and Reactor Core
- ◆ Nuclear Fuel Cycle
- ◆ Human Factors

Civil Engineering Research Laboratory

- ◆ Geosphere Science
- ◆ Earthquake Engineering
- ◆ Structural Engineering
- ◆ Fluid Dynamics
- ◆ Underground Energy Utilization Technologies

Environmental Science Research Laboratory

- ◆ Atmospheric and Marine Environment
- ◆ River and Coastal Environment
- ◆ Biological Environment
- ◆ Bioengineering
- ◆ Environmental Chemistry

Electric Power Engineering Research Laboratory

- ◆ High-voltage and Insulation
- ◆ Lightning and Electromagnetic Environment
- ◆ Applied High Energy Physics
- ◆ Electric Power Application
- ◆ High Current Technology

Energy Engineering Research Laboratory

- ◆ High Efficiency Power Generation
- ◆ Advanced Fuel Utilization
- ◆ Heat Pump and Thermal Storage
- ◆ Energy Conversion Engineering
- ◆ Innovative Numerical Simulation Technology

Materials Science Research Laboratory

- ◆ Structural Materials
- ◆ Materials for Energy Conversion and Storage
- ◆ Advanced Functional Materials
- ◆ High Performance SiC Semiconductor for Power Electronics
- ◆ Materials Science Research Fundamentals