1. Outline of Research Activities

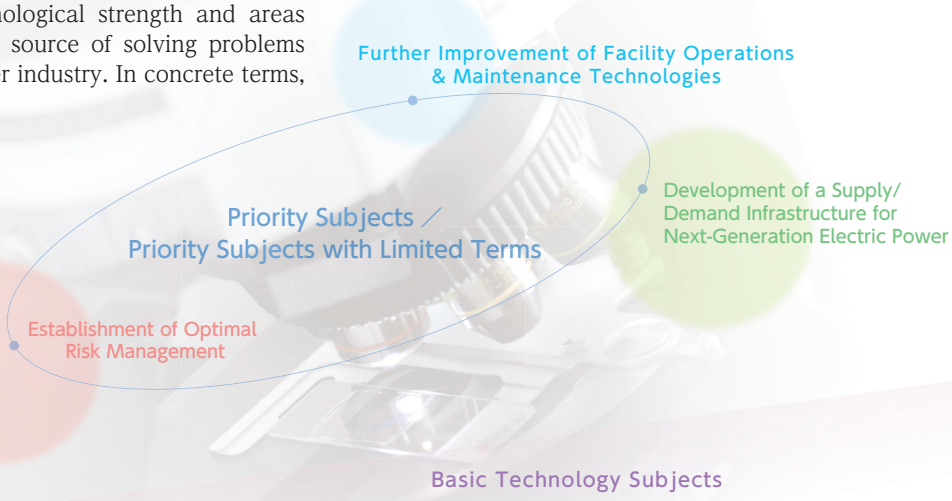
CRIEPI conducted research aimed at the development of technologies essential to a stable power supply in the future as well as to prepare for the increase in risks in order to provide a stable supply of power, which is the foundation of Japan's economic activity. This research was conducted under the "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". In concrete terms, CRIEPI leveraged its collective strength and took priority action to address the pressing issues of the electric power industry, namely, safety assessments of nuclear power plants against the natural external factors of earthquakes, tsunamis, tornados and so on as well as responding to investigations verifying conformity with new regulatory standards.
Moreover, we proceeded steadily with the development of equipment diagnosis and life assessment technology for the efficient maintenance and renewal of power generating and power distribution equipment as well as technological developments to respond to changes in the power networks, such as increased introduction of renewable energy and more activity on the demand side.

Of the technologies believed to be essential now or in the future to the electric power industry, CRIEPI has selected 35 priority subjects to maintain and develop. Of these priority subjects, CRIEPI focused its collective strength particularly on resolving 10 priority subjects with limited terms which were believed 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 conducted effectively. Furthermore, 35 basic technology subjects were established and through action leveraging the characteristics and expertise of eight 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, by accumulating data and know-how through field investigations and experiments and the development, maintenance and improvement of analytical techniques, basic research was conducted to conceive new ideas.

The major research results produced in FY2014 are described in Chapter 2 (Major Research Results). This chapter lists the different priority subjects addressed by each project subject, the basic technology subjects addressed by each specialized research laboratory, and the respective aims of each subject.

Regarding large-scale research facilities essential to solving issues faced by the electric power industry and in order to maintain and advance CRIEPI's research capability and problem-solving capacity, the following actions were implemented; renewal of CRIEPI' generator simulator, the power system simulator, which can analyze power system phenomenon in a near-real environment with high accuracy, introduction of an experimental facility for simulated rod bundle cooling of light-water nuclear reactors which can visualize the cooling state inside fuel bundles, installation of a strong shake generator which enables performance assessment of nuclear power plant devices against large accelerations in the vertical direction, addition of a unidirectional shaking table on a dynamic geotechnical centrifuge to evaluate stability of the subsurface structure of nuclear power plants and the surrounding slopes during an earthquake, redevelopment of DC test lines and related facilities to measure the electrical environment of real-scale DC transmission lines, battery performance evaluation and materials production facilities for the evaluation of rechargeable lithium-ion battery materials production and evaluation facilities and production/evaluation of battery materials.

*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 FY2014 (31st March, 2015)

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 Radioactive Material Diffusion and its Environmental Impact Evaluation
- ○Establishment of Methodologies to Evaluate Fires in Nuclear Facilities
- ○Assessment of Fragility of Nuclear Facilities due to External Natural Events
- ○Assessment for the Effects of Natural Hazards on 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 Weather/Climate Impact on Electric Power Facilities
- ・Establishment of Protective Measure Technologies against Damages to Overhead Transmission and Distribution Facilities Caused by Wind and Snow
- ・Development of Lightning Risk Management Schemes

Energy and Environment Institutions
- ○Well-functioning Electricity Market and Network Neutralization
- ・Social and Institutional Analysis of Nuclear Business Environment in Japan
- ・Climate Change Policy
- ・Scientifically and Economically Rational Scenarios for Reducing CO_2 Emissions

Further Improvement of Facility Operations and Maintenance Technologies

Nuclear Power Plant Maintenance
- ・Structural Integrity Evaluation of Reactor Pressure Vessels and Core Internals
- ・Evaluation of Components and Piping Integrity in LWRs
- ・Evaluation of Insulation Properties of Cables Used in Nuclear Power Plants
- ・Development of Nondestructive Inspection Technologies for Components and Piping in Nuclear Power Plants

Construction, Operation and Maintenance of Power Generation Facilities
- ○Development of Life Assessment Technology for High Temperature Structural Components of High Chromium Steels
- ・Development of Assessment Techniques for Comprehensive Impact of Thermal Power on Atmospheric Environment
- ・Development of Technologies for Increasing Use of Coal Ash
- ・Development of Efficient Impact Assessment Methods for Ecosystems
- ・Synthesis System of Numerical Analysis for Current and Sediments in River and Reservoirs

Operation and Maintenance of Transmission and Distribution Facilities
- ○Development of a Maintenance Scheme 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
- ・Improvement of Utilization Technology for Low-Grade Energy Resources

Next-generation Power Grid Technologies
- ・Assessment of System Security with High Penetration of Photovoltaics
- ・Development of Precise Power Output Estimation and Prediction Techniques of Photovoltaic Power Generation
- ・Development of ICT Infrastructure Building Techniques Based on General-purpose Communication Technology
- ・Development of Technologies for Next-generation Power Distribution Networks
- ・Assessment of the Value of Next-generation Demand Management

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
- ◆Communication Systems
- ◆Mathematical Informatics

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

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
- ◆Advanced Functional Materials
- ◆High Performance SiC Semiconductor for Power Electronics
- ◆Materials Science Research Fundamentals