

# 1. Outline of Research Activities

The research activities of the CRIEPI focus on the three key technology fields of “Nuclear Technology”, “Stable Power Supply Technology” and “Environment and Energy Utilisation Technology” to achieve the overall objective of “ensuring energy security and responding to global environmental problems”. The actual technologies under development include not only supply side technologies to maintain and improve a reliable power supply capacity but also technologies designed for highly efficient energy use by users and those for the utilisation of biomass and renewable energies to achieve a low carbon society.

Among the numerous research subjects, those for which there are urgent needs by society in general and by the electric power industry in particular and for which timely achievements and utilisation are required are referred to as “project subjects”. Research activities on these project subjects are being conducted through interdisciplinary and coordinated efforts of the eight research laboratories\* of the CRIEPI. The other group of research subjects is called “base technology subjects”, where efforts are being made to develop and improve technology basis. Those under development making the best use of the special expertise of the eight laboratories include technologies for succession technologies to be further developed, and technologies for innovation, such as highly efficient energy utilisation on the user side.

In FY 2010, intensive research activities were conducted for 37 project subjects and 36 elemental technology subjects as shown by the “Configuration of Research Subjects” on the opposite page. There was one “general project” on the plant life management of light water reactors. This research project was given priority status in view of the aging of existing light water reactors and was promoted across various research fields.

The principal research results in FY 2010 are described in Chapter 2 by each subject in the case of project subjects and by each laboratory in the case of base technology subjects along with the objectives of each research subject.

FY 2010 saw the installation of new research facilities/equipment to support research activities. These include “a system to evaluate the characteristics of progressive SCC under the condition of high restriction”, an “updated large capacity short-circuit test device” and “an updated and enhanced CRIEPI power system simulator”. These facilities/equipment are briefly described in Chapter 3. The overall business activities of the CRIEPI are compiled in Chapter 4.

\*These are the 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 Material Science Research Laboratory.

## Ensuring energy security & responding to global environmental problems

### Project Subjects

#### Nuclear Technology

##### Plant Life Management Research of Light Water Reactors (General Project)

- Irradiation Embrittlement and Structural Integrity of Reactor Pressure Vessel
- Stress Corrosion Cracking in Light Water Reactors
- Pipe Wall Thinning Evaluation & Seismic Evaluation of Thinned Pipeline
- Deterioration Diagnosis of Instrumentation and Electrical Equipment

##### Nuclear Fuel Cycle Backend Research Project

- Transport and Storage for Spent Nuclear Fuel
- High-Level Radioactive Waste Management
- Low Level Radio Active Waste Disposal

##### Improvement of Seismic Reliability

- Seismic Margin Evaluation of Civil-engineered Structures at Nuclear Power Plants

##### Advanced Fuel Cycle Technology

- Development of Metal Fuel Cycle Technology for Practical Application

##### Radiation Safety

- Elucidation of the Mechanisms of Low Dose Radiation Effects
- Rational Radiation Safety Technology

#### Stable Power Supply Technology

##### Maintenance and Operation Management of Electricity Supply Facilities

- Diagnosis and Operation of Aged Transmission and Distribution Facilities
- Evaluation of Damages to Overhead Transmission Facilities Caused by Wind, Snow and Salt
- Development of a Simple PCB Removal Method for Contaminated Transformers and a Rapid PCB Measurement Method
- Strategic Disaster Restoration Support Technology for Electric Power Distribution and Substation Equipment
- Lightning Protection for an ICT Oriented Society

##### Maintenance and Operation of Power Generating Facilities

- Disaster Prevention and Maintenance for Hydropower Facilities
- Integrated Maintenance Technology of Inspection, Prediction and Monitoring

##### Next Generation Thermal Power Technology

- Expansion of fuel types and improvement of efficiency in IGCC
- Utilization of Low Grade Fuels
- Advanced Utilization Technology of Biomass and Waste
- Thermal Power Generation Systems with CO<sub>2</sub> Capture
- CO<sub>2</sub> Storage Technology

#### Environment and Energy Utilization Technology

##### Global Warming Projection and Impact Assessment

- Long-term Global Warming Projection and Support for Adaptation
- Severe Storm Prediction and Impact Assessment of Electric Facilities Under Global Warming

##### Electrification and Energy Conservation Technologies

- Design Support for Electric Kitchens
- Highly-Efficiency Heat Pump
- Low-loss Power Semiconductors
- Low loss Compact Inverter Applied Equipment
- Secondary Battery Utilization Technology
- R&D for Safe and Reliable Solvent-free Lithium-Ion Polymer Batteries

##### Next Generation Grid Technology (TIPS)

- Integrated Operation and Control Techniques of Supply and Demand Sides in Autonomous Demand Area Power System
- Next-Generation Communication Network System
- Evaluation of Demand Response Programs
- Trunk Power System Planning and Operation Under Large Penetration of Intermittent Generations
- Next Generation Electric Power Equipments for Distribution and Transmission Systems

- Energy Technology Strategy

### Base Technology Subjects

#### Socio-economic Research Center

- ◆ Energy Management and Policy
- ◆ Regional Policy
- ◆ Energy Technology Policy
- ◆ Human Factors Research

#### System Engineering Research Laboratory

- ◆ Electric Power Systems
- ◆ Customer Systems
- ◆ Communication Systems
- ◆ Mathematical Informatics

#### Nuclear Technology Research Laboratory

- ◆ Nuclear Power Generation Technology
- ◆ Advanced Nuclear Fuel Cycle
- ◆ Reactor Systems Safety
- ◆ Nuclear Power Technology Applications / Innovative System Assessments

#### Civil Engineering Research Laboratory

- ◆ Geosphere Science
- ◆ Earthquake Engineering
- ◆ Structural Engineering
- ◆ Fluid Dynamics

#### Environmental Science Research Laboratory

- ◆ Atmospheric and Marine Environment
- ◆ Hydropheric Environment
- ◆ Biological Environment
- ◆ Environmental Risk Assessment
- ◆ Biotechnology

#### Electric Power Engineering Research Laboratory

- ◆ High-voltage and Insulation
- ◆ Lighting 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
- ◆ Numerical Analysis of Turbulent Heat Transfer and Reacting Flows

#### Materials Science Research Laboratory

- ◆ Materials for Nuclear Power Plants
- ◆ Materials for Fossil Power Plants
- ◆ Batteries and Electrochemical Materials
- ◆ Advanced Functional Materials
- ◆ PD Center