FY 2012

Reports on Research Activities Settlement of Accounts

From April 1, 2012
To March 31, 2013

June 2013

Central Research Institute of Electric Power Industry

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On the Publication of the Research Activities Reports for Fiscal 2012

In April 2012, CRIEPI became a general incorporated foundation and endeavored to augment its research foundation and carry out business activities independently in its role as a joint research institute for the electric power industry and an independent academic research institution, while responding to changes in the business environment.

In our research activities, we aimed to build a robust and flexible new energy supply/demand infrastructure in response to the Great East Japan Earthquake and Fukushima Daiichi nuclear reactor accident. Accordingly, we pursued our research under the three pillars of “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,” and steadily achieved results in these areas.

In conjunction with this, we reexamined the necessity and the order of priority for all of our research plans and brushed up our research strategies, based on changes in the environment for the electric power industry after the earthquake. Through close communication with all levels and sectors of the electric power industry, we came up with an overall future picture of technology development in this industry going forward and clarified CRIEPI’s own role in this picture. From that point, we endeavored to identify those research subjects that we would focus on even more and those that we would address at a slower pace. Although we had already formed our fiscal 2012 plans, we changed our research projects in line with changes in the environment and accurately reflected this in research plans from fiscal 2013.

At the same time, we expect that the electric power industry’s difficult financial situation will mean that CRIEPI will continue to face budget constraints for some time. To adapt to this, we made further cuts in operating costs across our business activities and expanded the reductions in personnel expenses. At the same time, we reinforced our research structure through mechanisms that would facilitate our research in order to continue to fulfill our mission to produce and provide high-quality research results even in a difficult environment.

We have summarized the main research results achieved through these business activities and our initiatives in research and administration in this research activity report and financial statements.

Key Initiatives in Fiscal 2012

■ Research with the aim of building a robust and flexible new electric power supply/demand structure

In light of changes in situation of society and the electric power industry, in fiscal 2012 we exercised our comprehensive strengths and prioritized the particularly urgent issues of improving the safety of light water reactors and natural disaster countermeasures for electric power facilities.

Below, we have laid out representative results for each of the research pillars, which express the medium-term direction of our research.

(1) Establishment of optimal risk management

We enhanced the safety of light water reactors with safety assessments for external natural events such as earthquakes and tsunami as well as severe accident countermeasures, and developed technology to alleviate the risk that natural disasters pose to electric power facilities and aid the recovery process. In addition, in light of the progress with regulatory reforms in the electric power industry, we carried out research on the institutional framework to be adopted for the reform.

- Seismic activity assessment of faults on site of nuclear power plants
- Development of assessment methods for effect of tsunami wave power on nuclear power facilities
- Severe accident assessment for spent fuel pools at nuclear power plants
- Development of technology for predicting snow-related damage on electric power transmission facilities and examination and evaluation of countermeasure techniques
- Identification of issues in institutional design for electric power industry associated with the power system reform

(2) Further improvement of facility operations and maintenance technologies

We researched the preservation and management of nuclear power plants, which is essential to their safe and stable operation, and developed technology supporting the rational construction, operation and maintenance of thermal and hydro power generating facilities and electric power transmission and distribution facilities.

- Improvement of prediction model for irradiation embrittlement in light water reactor pressure vessels based on the most recent surveillance test data
- Development of remaining life assessment techniques for high chromium steel pipes at coal-fired thermal power plants

- Verification tests of onsite cleaning technology for large-scale power transformers contaminated with trace PCB
- Development of technology for assessing soundness of aged transmission steel towers

(3) Development of a supply/demand infrastructure for next-generation electric power

We developed thermal power generation technology to expand the types of coal used and effectively use low-grade resources, and also developed next-generation grid technology enabling the large-scale introduction of solar power and other sources of renewable energy into the power system.

- Combustion characteristic assessment toward use of coal with a low Hardgrove Grindability Index (HGI)
- Improved distribution system control technology to control the voltage variations when renewable energy is introduced

(See “I. Research Activities” for details.)

■ Reformulating research strategies by brushing up research plans

Changes in the electric power industry’s operating environment after the earthquake has forced major revisions to research development in the electric power industry overall. As a result, CRIEPI, a joint research institution for the electric power industry, surveyed the industry’s prospective research development issues and clarified our own role in resolving these issues in order to contribute to the resolution of urgent problems and remain accountable. In addition, we reexamined the need and order of priority for all research plans in terms of the electric power industry’s needs, and reformulated research strategies from the starting point of electric power technology.

When reexamining our plans, we summarized the needs and requests through close communication with all levels and sectors of the electric power industry and grouped research issues into the three categories below. We reflected the results of our review in fiscal 2012 activities as much as possible and endeavored to generate research output in a timely manner.

○ Research subjects for which initiatives will be ramped up
Issues contributing to risk response and improved efficiency of electric power supply

- Improvements to safety of light water reactors, natural disaster countermeasures on transmission and distribution facilities, analysis and evaluation of electric power system reforms
- Advanced thermal power technologies, evaluation of network security for introduction of renewable energy, etc.

○ Research subjects we will continue to address
Issues contributing to stable supply of electric power

- Support for stable operations of light water nuclear reactors, development of operation and maintenance technologies for power generating facilities and power transmission and distribution facilities, etc.

○ Research subjects whose initiatives will be revised (slowed or postponed)
Issues contributing to improved convenience of electricity use and resolution of future problems

- Promotion of electrification, next-generation equipment development and materials development, etc.

  *We strive to maintain our fundamental research strengths by adjusting roles and methods in our research, depending on the issue.

We will continue to carry out these activities and further augment these research plans so that our efforts will lead to the rapid and accurate delivery of solutions addressing the electric power industry's requests.
(Refer to "I. Research Activities—3. Pursuit of Research" for details.)

■ **Extensive streamlining across all activities to facilitate a strength research structure**

- As in fiscal 2011, we have changed our research plans and statement of budget to accommodate the reduction in donations in this fiscal year. In order to avoid changes in research plans due to revised research expenditures, which were already reduced at the start of the fiscal year, we revised specifications for projects underway, put off plans to upgrade facilities, and ensured competitive bidding in outsourcing and procurement. This resulted in an approximately 10 % reduction in expenditures across operations. Moreover, we will continue producing high-value research results despite budget constraints by verifying the priority of research subjects and their cost effectiveness, thus making our research system more resilient.

- We decided to cut executive salaries 20 % and make across-the-board cuts to managerial employees' annual salaries as well as reduce the annual salaries of managerial employees based on performance. We also lowered the bonuses of general employees. We considered measures to bring the number of employees down to an equilibrium point of about 800 in order to reduce personnel expenses, which are a fixed cost.

- Rebuilding our research bases will not only strengthen our future research capacity but also

lead to reductions in operating costs. Accordingly, we reduced the budget in line with revenue and put off implementation times, while steadily moving ahead with the introduction of the large-scale research equipment needed to solve the problems of the electric power industry. We also made preparations to sell part of the land CRIEPI owns in Komae to raise money for upgrades to research bases and future research and development.

(Refer to “I. Research Activities—3. Pursuit of Research” and “II. Operations and Management” and “III. Workforce” for details.)

Through these activities, we steadily pursued the public interest expenditures plan following our transfer to the status of general incorporated foundation.

I. Research Activities

In fiscal 2012, CRIEPI pursued research with the aim of building a robust and flexible new energy supply/demand structure that will ensure a stable supply of power to support the foundation of Japan's socio-economic activities. In particular, we focused our collective strength and prioritized efforts to improve the safety of light water reactors and enhance natural disaster countermeasures for electric power facilities, which are urgent issues for the electric power industry.

Table 1 shows the number of reports issued and Table 2 shows the number of papers presented, which illustrates our research results in fiscal 2012.

1. Priority subjects and priority subjects with limited terms

CRIEPI set 33 project subjects, selected as those most needed by the electric power industry, to focus its efforts and maintain, continue or develop.

We identified nine priority subjects with limited terms from among these 33 project subjects as particularly urgent issues that must be resolved quickly through the institute's collective strengths, and produced steady results. Priority subjects and priority subjects with limited terms that are highly inter-related will be grouped together in 11 subject groups as we endeavor to produce and disseminate effective results. The main research results for each pillar are outlined below by subject group.

(1) Establishment of Optimal Risk Management

CRIEPI assessed the impact of natural phenomena and socio-economic changes on the electric power industry and proposed countermeasures that encompass social systems and mechanisms.

In particular, we worked on improving the safety of light water reactors and resolving issues related to identifying the risks of radiation, which are particularly pressing issues for the electric power industry since the Fukushima Daiichi nuclear power plant accident. We also pursued research related to prediction methods for natural phenomena and countermeasure techniques, as well as research on technology supporting recovery, to counter disasters for electric power transmission and distribution facilities. Moreover, we evaluated new systems and policies in our research on institutional framework for the electric power industry.

Nuclear power plant safety

- We used our active fault evaluation technology, such as dating technique, to assess the activity of faults on the site of nuclear power plants. We also developed a device that can obtain an undisturbed fault sample without disturbing the fault area included in the boring core.
- We developed a simple and highly accurate new method for assessing tsunami wave

power without using computational fluid dynamics (CFD) codes, which require advanced and complex operations, in order to evaluate the soundness of nuclear power facilities in the face of massive tsunami exceeding design standards. We also confirmed their effectiveness.

- We developed methods for predicting the volume of collapsed rock masses and their traveling area in order to evaluate the impact of a slope failure on crucial buildings, structures and equipment and examined the validity of the method by comparing it to a slope failure experiment results obtained using a shaking table test.
- We used the modular accident analysis program (MAAP, version 5) for analysis to qualitatively assess the event transition in the case of both a loss-of-coolant accident for spent fuel pools and a loss-of-coolant due to station black out at a nuclear power plant. This not only enabled us to accurately estimate the amount of cooling times until the fuels are uncovered in the event of a loss-of-coolant function, but also demonstrated that in the event of a loss-of-coolant, the spent fuels could be cooled through natural circulation of air when the decay heat power of assemblies is small.
- We developed a hydrogen/vapor ventilation assessment model for nuclear reactor buildings that can analyze the behavior of hydrogen leaking within the buildings in the event of an accident at a boiling water reactor and easily calculate the hydrogen concentration in the building.
- In light of the successive fire due to HEAF(high energy arcing fault) event in the high-voltage metal-clad switch gear at the Onagawa Nuclear Power Plant when the 2011 off the Pacific coast of Tohoku Earthquake struck, we conducted fire simulation tests on full scale high-voltage metal-enclosed switch gear components (non-seismic and non-arc proof type), and also evaluated arcing energy and the possibility of the successive fire occurrence.
- We carried out a ocean diffusion simulation of radioactive substances in the wide area off the coast of Fukushima, taking into account the fall-out conditions from the atmosphere, and confirmed that the results were consistent with the ocean monitoring results. We also developed a method for reproducing the concentration of radioactive substances in marine organisms such as Japanese sand lance and olive flounder using the concentration of radioactive substances in ocean water obtained in the simulations.

Radiation risks

- A framework concept of application of intermediate ‘reference levels’ (dose target values), recommended by the International Commission on Radiological Protection (ICRP), according to the progress of the environmental remediation and the reduction in the existing ambient dose was proposed for a safe and practical management of radioactive wastes including contaminated soil under an existing exposure situation with a certain ambient dose due to contamination after the accident at the Fukushima Daiichi nuclear

- In order to determine whether the replacement of damaged stem cells by normal tissue stem cells (turnover) were related to the mechanism of the dose rate effect (in which health risks do not increase as a result of long-term exposure to low-dose-rates of radiation), we developed a method for quantitative evaluation of the turnover of stem cells. We confirmed the method's effectiveness under exposure to high-dose-rates.

Backend Management in Nuclear Fuel Cycle

- We carried out laboratory experiments to ascertain initial stress and gas influx conditions in order to accurately evaluate the effect that hydrogen gas occurring due to metal corrosion in low-level radioactive waste interfere with the barrier function of bentonite, which prevents the leak of radioactive substances. We also refined the numerical code for gas-liquid two-phase flow (developed by CRIEPI), which can assess gas migration, and presented an impact assessment method for initial stress and gas influx conditions.
- Given concerns over shortages of the wood used as a shock-absorbing material in radioactive substance shipping cask, we conducted material tests and drop tests using shipping cask scaling specimens to confirm that rigid polyurethane foam can be used as a substitute.

Natural Disaster Countermeasures at Power Transmission and Distribution Facilities

- As part of our efforts to mitigate climate and marine disasters for electric power facilities and support recovery after disasters, we incorporated analytical results from the climate radar into the Numerical Weather Forecasting and Analysis System (NuWFAS) that we developed and found that this enabled us to accurately predict weather about three hours out and assess squalls resulting from low atmospheric pressure and typhoons at a high degree of resolution (about 50 m mesh).
- In order to examine snow-related damage and the effectiveness of countermeasures to counter this damage, we continued to operate a snow-related damage database made up of data from measurement systems set up nationwide, data on damage and related weather information. Using those data, we identified the weather conditions for snow accretion and refined our snow accretion forecasting methods.
- Aiming at establishing the rational lightning protection scheme for distribution lines, we developed a lightning risk assessment program that evaluates distribution line outage rates for different lightning countermeasures taking into account regional distribution line density and lightning frequency.

Recommendations for energy and environmental measures

- In order to contribute to the future institutional design as part of the reforms to the electric power system currently underway, we surveyed the status of electric power deregulation in Europe and the US, and pointed out problems with the current situation,

such as the establishment of a capacity market to secure supply capacity, issues with the separation between the sale and distribution of electric power, measures to encourage the introduction of renewable energy, and consistency with competition policies.

- Given the international agreement over the long-term goal to keep the temperature increase since preindustrial below 2 °C, we proposed a more realistic scenario based on the new concept of climate stabilization focusing on long-lasting CO_2 uptake by the ocean. In this scenario, even if the excessive emission of greenhouse gases is not reduced in the 21st century, the temperature would be stabilized by bringing emissions to zero from the middle of the 22nd century.

(2) Further Improvement of Facility Operations and Maintenance Technologies

To ensure stable electricity supply, we pursued research development on technology related to the preservation and management of light water reactors, essential to their ongoing operation, as well as technology supporting the construction, operation and maintenance of thermal and hydro power generating facilities and power transmission and distribution facilities.

Development of Plant Life Management Technology for Light Water Reactors

- Microstructural characterization of highly-irradiated surveillance materials were performed for a better understanding of the mechanism of the neutron irradiation embrittlement of reactor pressure vessel steels. We confirmed that the microstructural changes of the materials were well within expected, which allowed us to calibrate the current embrittlement correlation method to the most recent surveillance data in order to improve the accuracy of the method.
- We evaluated the thinning area and relative thinning amount caused by flow accelerated corrosion (FAC) for T-tubes with reinforcing plates and T-joints and identified the thinning trend based on flow analysis. Their configurative restrictions make it difficult to measure the wall thinning accurately.

Construction, Operation and Maintenance of Power Generating Facilities

- We analyzed a large amount of creep test data in order to improve the reliability of creep life assessments for high chromium steels used in coal-fired thermal power plants, and refined the creep life evaluation formula for welded joints of the steels. As a result, we are now able to more accurately evaluate the creep life of welded joints over a long period of about 100,000 hours.
- In order to improve the efficiency of bird survey in the risk assessment of bird collisions to wind turbines, which has been mandated in the Environmental Impact Assessment Law amended in 2011, we developed software to easily assess the frequency of bird flights within anticipated wind turbines area, by automatically detecting the flight passes of birds

from video images.

- In order to support air environmental assessments for thermal power plants, we developed software to quickly and easily project the concentration distribution of gas emissions on the surface of the ground, based on the location of sources, the height of stacks and the condition of exhaust gas.
- With the aim of rationally operating hydropower dams, we developed a method for evaluating changes in the stability of the slope around the dam caused by rainfall infiltration to the ground. In addition, we developed a system to identify information on dynamic state of sediments in a river in real time, such as turbidity and water quality in actual rivers, in order to predict sediment depositions in the river and turbidity after discharge begins.

Operation and Maintenance Support for Electric Power Transmission and Distribution Facilities

- With the aim of reducing the disposal cost of PCB contaminated transformers, we conducted tests of the heat circulation cleaning and the energizing circulation cleaning developed by CRIEPI on large-scale power transformers contaminated with trace PCBs. This verified that cleaning results meeting the standards set by the Ministry of the Environment are being achieved.
- In order to support rational updates for electric power distribution facilities, we developed a lifetime estimation method taking into account intensity degradation of oil-immersed transformers' insulating paper and the amount of short-circuit current caused by lightning. In particular, we made stochastic life evaluations possible for the incidence of short-circuit current caused by lightning.
- We clarified corrosion characteristics inside steel pipes through exposure tests to establish maintenance and management techniques for power transmission steel towers to support the formulation of rational renewal plans. We also confirmed that corroded areas can be identified and remaining wall thickness can be assessed by adopting an ultrasonic flaw detection method that we developed for corrosion tests from the outer wall of steel pipes.

(3) Development of a Supply/Demand Infrastructure for Next-generation Electric Power

We developed technology for thermal power plants that makes it possible to expand the type of coal used and efficiently use low-grade resources, with the aim of achieving energy security. Moreover, we developed technology for next-generation grids enabling the smooth introduction of solar power and other sources of renewable energy into the power system, as well as technology that promotes the efficient use of energy and energy conservation, such as next-generation heat pumps and high-performance power semiconductors.

Developing more advanced thermal power technology

- In order to diversify the types of fuel used in pulverized coal-fired power generation, we carried out grinding and combustion experiments on coal (low-HGI coal), which is not used because of its low grindability. We determined that even if the particle of low-HGI coal is coarser than that of the pulverized coal usually used, high combustion efficiency can be achieved because of high volatile matter content.
- In order to support the operations of the Integrated coal Gasification Combined Cycle (IGCC) demonstration plant, we developed a simplified tool for predicting gasification characteristics in the demonstration plant from the fundamental experiments on gasification reactivity under high temperature and elevated pressure. We also developed the technique, which was based on the numerical analysis technique including the molten slag behavior evaluation to evaluate coal adaptability to IGCC commercial plants.

Next-generation Grid Technologies

- We carried out an analysis incorporating the static voltage regulator (SVR) model into the unbalanced load-flow calculation program that we developed and proposed an SVR control method that is effective in controlling imbalances in order to address voltage imbalances that occur in electric power systems as a result of skewed connections in each phase in single-phase large-capacity equipment, such as photovoltaics (PVs) and heat pump-type hot water supply devices.
- In order to establish communication technology that can be applied to collect a data from smart meters, we clarified the communication characteristics of multi-hop wireless communication systems using 920 MHz band which is one of a candidate to be used for the smart meter communications systems. Furthermore we proposed an optimizing method for the communication parameters such as transmission timing, transmission waiting time, and the number of retransmissions in order to improve the communication successes rate.
- In order to consider the effectiveness of new methods for applying demand response (DR) to counter voltage limits on distribution lines through reverse power flow from PVs, we identified the relationship between the PV connection rate and number of days and time DR is set in motion, and also clarified the applicable scope in which these methods would be economically effective compared to previous equipment countermeasures.

Electrification and Energy Conservation Technologies

- We had previously developed a new residential heat pump for hot-water room heating in cold areas using CO_2 refrigerant jointly with an electric power company and a manufacturer, and this fiscal year we confirmed that target performance in terms of heating capacity, coefficient of performance (COP), hot-water temperature and so on is satisfactory, enabling it to be commercialized.

- Lithium-ion batteries (LIBs) are expected to be used for level-operation on electric power fluctuation connected with renewable power generation such as photovoltaic cells. By quantitative evaluations of the degradation mechanism on the electrode's active material with disassemble inspection of the degraded cell, we elucidated the capacity fading of the LIB could be explained by degradation of the cathode active material and changes in the cathode potential behavior.
- In order to examine the energy-saving effect of electric kitchens, we conducted experiments to confirm that there was no significant increase in temperature in the kitchen, reducing thermal comfort, or increase in condensation or smell even if the amount of ventilation was reduced to 50 % of the current standard.

2. Basic Technology Subjects

We designated 37 basic technology subjects in fiscal 2012 to capitalize on the strengths and specialized skills of eight laboratories in order to refine the basic technology skills that are the source of solutions to issues faced by the electric power industry and strengthening our research skills in each specialty. These include field studies, the accumulation of data and knowhow generated in experiments and observations, the development, formulation and refinement of analytical methods and algorithms, and basic research to bring new ideas to life.

Our main achievements are outlined below.

Socio-economic Research Center:

In light of the major changes in the electric power industry, the Socio-economic Research Center accurately identified social changes and policy trends related to the electric power system, and also conducted multi-faceted analysis and evaluation, such as technical assessments and economic analysis, on a broad range of activities in the electric power industry and its relationship with society.

- We estimated the economic impact that a zero nuclear power policy would have for two scenarios: a scenario through 2018 in which no new thermal and other power plants would be built and a scenario through 2030 in which new power plants would be built. We found that GDP would fall by a cumulative 28 trillion yen in the first scenario and 86 trillion yen in the second scenario.
- Focusing on the French cases where the Commission Locale d'Information (CLI) plays a critical role, we examined how to improve stakeholder involvement and thereby derived concrete lessons for the ongoing comprehensive review of nuclear emergency preparedness in Japan.

System Engineering Research Laboratory:

The System Engineering Research Laboratory conducted research on planning, operation, control and analysis methods for electric power transmission systems, distribution systems and information and communication systems to ensure a stable supply of electricity through large-scale power sources and diversified power sources. The laboratory also pursued research on the development, testing and assessment of customer service technologies that promote the efficient use of electricity.

- In order to improve the lightning protection performance of the microwave radio equipment which make up important communication circuits of the electric power companies, we proposed a technology that would reduce the effect of lightning surges by replacing the waveguide part of the microwave radio equipment with optical fiber, optical to electrical converters and electrical to optical converters.
- In order to facilitate energy conservation in households, we identified the problem with the previous approach to selecting air conditioners, in which criteria were limited to the size of the room and the anticipated annual electricity fees. We designed a tool supporting the selection of household air conditioners in which the insulation grade of the house and the lifestyle of the residents are also used as criteria.

Nuclear Technology Research Laboratory:

The laboratory pursued fundamental researches related to improving the safety and maintenance of light water reactors, technologies for fuel cycles, and measures to prevent human error. The laboratory also carried out property evaluations and development of treatment technology for fuel debris, an issue in the decommissioning of the Fukushima Daiichi Nuclear Power Plant.

- Common cause failure (CCF) has a major effect on the safety of nuclear power plants. Accordingly, in order to reflect Japan's operational experiences in a probabilistic risk assessment, we continued to carry out analyses of the failures of electrical instrumentation on Japan's nuclear power plants, and calculated the CCF occurrence ratio used in risk assessments for the first time in Japan.
- In order to clarify the soundness of fuel claddings when sea water is injected to spent fuel pools as a coolant, we carried out corrosion tests on fuel cladding specimen in synthetic seawater. This demonstrated that, as a result of the corrosion inhibition effect due to the deposits formed on the surface of the fuel claddings, there was no major corrosion of the fuel claddings in sea water with high concentrations and at high temperature.

Civil Engineering Research Laboratory:

The laboratory conducted fundamental research on geosphere science, earthquake engineering, structural engineering and fluid dynamics needed for civil engineering

technology and natural disaster measures for power facilities, as well as for backend management in nuclear fuel cycle and underground energy utilization technologies.

- With the aim of contributing to rational earthquake-resistance design for transformer substations, we analyzed the transformer bushing damage resulting from the 2011 off the pacific coast of Tohoku Earthquake, and concluded that it was caused by the strong ground motion exceeding the current design level.
- In order to improve the structural soundness of underground reinforced concrete structures at thermal and nuclear power plants that experience earthquakes, we developed a method for evaluating the residual load performance taking into account the corrosion of the reinforcing steel caused by cracks due to the earthquake, based on loading experiments with full-scale specimens.

Environmental Science Research Laboratory:

The laboratory pursued basic research on the atmosphere, river, coastal and marine environments, biology, biotechnology and environmental chemistry for the siting and stable operation of electric power facilities, the establishment of a low-carbon society, and the reduction of various environmental risks associated with the electric power industry.

- In order to adapt to the amendment of the Environmental Impact Assessment Law and the shortening procedure of assessments for thermal power plants, as well as to support preliminary studies in the initial stages of planning and assessment, we developed a method to easily predict the diffusion area of thermal discharge under various discharge conditions, such as submerged outlet and surface outlet. We also devised methods to evaluate the habitability of the business area for important plants and animals using information from existing literature on the surrounding area.
- Of the body weight, histopathology of organs and chemistry blood of experimental animals (rats) exposed to an electromagnetic field stronger than the international guideline value over a six-month period showed that intermediate frequency magnetic fields emitted by household electric appliances do not have a negative effect on health.

Electric Power Engineering Research Laboratory:

The Electric Power Engineering Research Laboratory developed basic and fundamental technologies related to electric power transmission and distribution facilities, including electrical insulation, lightning protection and high currents, and also conducted research on next-generation electric power equipment and power electronics technology.

- Aiming to support electric power companies' departments such as system operation, transmission and distribution, we added analysis models of electric power equipment and system components to the eXpandable Transient Analysis Program (XTAP) in order to easily and accurately carry out electrical transient analysis of transmission and distribution lines.

- Aiming to streamline the maintenance works in transmission and distribution systems, we developed a new method to measure the electromagnetic noise generated from the electrical discharge observed at degraded area. As the results, we concluded that the developed method can accurately identify the point of origin even if there are interfering structures in the vicinity.

Energy Engineering Research Laboratory:

The laboratory worked to develop fundamental technology on improved efficiency of thermal power plants, environmental impact mitigation, facility diagnosis, operations and repairs, biomass use, energy conversion and utilization, and systems using heat on the demand side.

- We refined the thermal efficiency analysis program EnergyWin that we developed and developed a new operation data analysis system that can quantitatively analyze the impact that performance changes in the plant equipment have on the plant's overall thermal efficiency. This is intended to be used to evaluate plant performance during facility remodeling and regular inspections at a geothermal power plant.
- In order expand the use of coal ash, we created a prototype of pebbles using a manufacturing method that we proposed in which shell waste is used as the calcium source needed to solidify the coal ash, and confirmed that it has the necessary strength for use in applications such as artificial beach nourishment.

Materials Science Research Laboratory:

The laboratory conducted research on various materials issues which the electric power industry is now facing at. Our research covers the understanding the aging mechanism of structural materials, the improvements in life prediction and nondestructive evaluation methods for nuclear and thermal power plants, as well as the development of new materials used for energy saving device.

- We revised the "Handbook on Feed-water Treatment for Steam Power Plant" (published by CRIEPI in 1985), which is used for feed-water treatment and cycle chemistry management in thermal plants. The revised edition based on the latest operation experiences and researches concerning cycle chemistry of ultra super critical power plants and combined cycle plants as well as conventional power plants.
- Assuming the leak of sea water into condensers of nuclear power plants, we examined the crevice corrosion occurrence and propagation in several types of stainless steels. We have succeeded in determining the critical chloride ion concentration to cause crevice corrosion.

3. Research Promotion

(1) Reformulating Research Strategies by brushing up Research Plans

- Given changes in the electric power industry's operating environment after the earthquake, we clarified the research and development that the electric power industry should carry out and our own role in this process, and then reexamined our research plans in terms of the electric power industry's needs, and reformulated research strategies from the starting point of electric power technology. The specific process is as follows.
  - ➢ We organized the key points for the issues that we should address for each supply chain based on our outlook for the electric power industry overall.
  - ➢ We clarified the division of responsibilities between CRIEPI and other organizations in resolving issues, and ranked the issues we should address in order of priority. When summarizing this, we held research councils in each sector to ensure that we communicate closely with the electric power industry. This enabled us to consolidate and reflect the requests and plan feedback of management, line divisions, research and development divisions and frontline of operations such as electric power plants.
  - ➢ We reexamined all of our research plans, taking into account the need and order of preference given the electric power industry's needs, as well as constraints on research costs. We brushed up our research plan so that it would be more appealing to the electric power industry and reformulated our research strategy.
- As a result of the above, we identified those research subjects that we would focus on even more, those that we would continue to steadily pursue and those projects that we would revise and address at a slower pace while still maintaining our fundamental research strength. This enabled us to identify research topics in which we would concentrate our resources. We will continue these activities from fiscal 2013 so that we can further augment our research plans and provide rapid and suitable solutions meeting the electric power industry's needs.

(2) Strengthening Research Structure to Produce High-value Results Despite Budget Constraints

- We confirmed the priority and cost effectiveness of all individual research projects currently underway so that we can continue to produce high-value research output for the electric power industry and society overall, despite the ongoing budget constraints we face as a result of the electric power industry's difficult finances. Specifically, we utilized researchers' knowledge and experience to the fullest extent by narrowing down the number of cases for experiments, substituted for experiments with more advanced simulation technology and expanded application ranges, and also encouraged research done in-house. In this way, we created a research structure that is more resilient even in the face of declining research funding.

- In order to improve the quality of research results and remain accountable regarding our research activities, we had outside experts evaluate our research and conducted research value assessments to quantitatively evaluate the cost effectiveness of our research in order to fulfill our accountability. In particular, we conducted research value assessments on all of our research subjects planned for fiscal 2013, which ensured that our research plans were devised with a focus on cost effectiveness.

(3) Steady Pursuit of Research Addressing Earthquake

- The entire institute worked together to steadily pursue research related to the disaster recovery, while responding to the shift from short-term issues to medium- and long-term issues as the country recovers from the earthquake. Specifically, we clarified geophysical phenomena related to active faults, conducted research on tsunami behavior, and explained the behavior of transmission and distribution facilities such as steel towers when earthquakes occur. We also formed special research teams to focus on research related to improving the safety of light water reactors and preservation support.
- In terms of technology development to help resolve the Fukushima Daiichi Nuclear Power Plant accident, we carried out research to solve medium- and long-term issues, such as stabilizing the power plant and retrieving fuel in close collaboration with the government and the electric power industry. For example, we participated in relevant meetings between the government and Tokyo Electric Power Co. on medium- and long-term countermeasures.

(4) Maintaining and Improving Research Activities and Problem-solving Ability

- In order to develop a research foundation that can serve as the origins of superb research skills into the future and contribute to resolutions of the electric power industry's issues on a sustainable basis, we moved ahead with the establishment of research basis in the Yokosuka region and Abiko region, while monitoring cashflow.
- Large-scale research facilities were introduced to support the electric power industry's technical foundation and to maintain and reinforce our fundamental research capacity. These include several Power Conditioning System (PCS) test facilities to contribute to resolutions when large volumes of PV are introduced; a testing facility for long CV cable insulating properties to examine the insulating properties of aged CV cables; laser electrode topographic atom probe for nanoscale chemical analysis at metal grainboundaries. Electron Probe Micro Analyzer (EPMA) for surface analysis of irradiated materials; and an outdoors disconnect switch for use with large-capacity short-circuit testing facilities that enable a maximum of 100 kA in continuous current. Moreover, we introduced facilities for experiments on light water reactor fuel cooling limits to contribute to research improving the safety of light water reactors and a tsunami physical simulator to be used to evaluate the safety of electric power facilities in the face

- We allocated research resources with priority on issues directly facing the electric power industry and issues that would maintain or strengthen our basic research skills. In addition, we fostered our research capacity by allocating resources with consideration for the diversity of research sectors in order to prepare for future research expansion.
- We held cross-cutting workshops within the institute to evaluate changes in the energy situation after the earthquake and the public's awareness and values, and as well as to expand our research in directions that would respond to the resulting risks. We also searched for the research subjects that the institute should address in advance, in line with the electric power industry's supply chain. The results are utilized in formulating research plans for fiscal 2013.
- We systematically facilitated personal interaction tailored to the characteristics of the parties involved and the technology sectors, including joint research at electric power plants and sending employees to other companies, accepting other companies' employees and offering training. We endeavored to strengthen our ability to adapt to actual conditions in order to reinforce our affiliations with the electric power industry.
- As part of our efforts to maintain and improve our functions as a "knowledge pool" made up of a network of knowledge, human resources, research facilities and domestic and overseas institutions, we proactively pursued joint research and personal interaction with domestic and overseas university and research institutions with impressive knowledge (Electric Power Research Institute, Électricité de France, Japan Atomic Energy Agency and Marine Ecology Research Institute). Such collaboration will enable scientific knowledge to mutually complement each other and to efficiently improve fundamental research strengths.

(5) Management and Application of Intellectual Property

- We reinforced our prior art surveys using patent information and academic literature, generated intellectual assets, and promoted acquisition intellectual property rights and their utilization. We also enhanced our risk management for intellectual property and security export control.

  Table 3 summarizes the numbers of patents we officially submitted and registered as well as the number of software applications registered in our institute.
- We digitized research reports that have already been published with the aim of encouraging broad use of intellectual property and augmented our download services for publicly released materials. We also minimized the duration from the completion of the manuscript of research reports until their issuance by improving the affair efficiency. We continued to make intellectual property more visible by publishing the fiscal 2011 version of The Intellectual Property Report.

- We not only utilized the intellectual property we have built up to promptly resolve issues in the electric power industry, but also worked to spread technology to businessmen working on the frontlines of industry through technology exchange courses and technology lectures. Moreover, we provided patents and software to the public and encouraged its use.

  Table 4 shows the number of patent licenses and software licenses that CRIEPI authorized.
- We capitalized on our strengths as an academic research organization to participate in national and academic committees, thus contributing to the establishment of specifications, standards and technical guides for the energy and environment.

  Table 5 highlights major contributions to the formation of codes, standards and technical guides.

(6) Promotion of Funded Research

- Applying CRIEPI's fundamental research skills, we proactively engaged in funded research that met the needs of the electric power industry and contributed to the resolution of problems faced by the electric power industry. In particular, we prioritized the allocation of research resources to urgent issues occurring during this fiscal period that have tended to increase in recent years, such as the assessment of natural disasters and accidents for power distribution facilities and power generation facilities, and rapidly and accurately provided solutions.
- We received government funding for research that helped to clarify issues in the electric power industry and would lead to appropriate technical policies.

  Table 6 shows the main research projects for which CRIEPI received government funding.
- We also ran the PD Center, which gives certification exams for experts in ultrasonic inspection working with nuclear power plant components, as well as the High Power Testing Laboratory, which performs short-circuit tests on electric power equipment.

Table 1: Number of Reports

	Research reports, etc.	Funded research	Total
Socioeconomics	32	3	35
Environment	17	19	36
Customer energy services	24	7	31
Power delivery	52	37	89
Nuclear power generation	61	39	100
Fossil fuel power generation	25	17	42
New energy	9	10	19
Information & communication	21	6	27
Construction and maintenance of electric power facilities	24	14	38
Advanced basic technologies	6	6	12
Total	271	158	429

(Number in previous fiscal year)	464	131	595

Table 2: Number of Papers Reported

	Papers (Peer reviewed papers included above)
Socioeconomics	143 (31)
Environment	150 (34)
Customer energy services	108 (20)
Power delivery	220 (43)
Nuclear power generation	336 (85)
Fossil fuel power generation	139 (42)
New energy	61 (9)
Information & communication	45 (18)
Construction and maintenance of electric power facilities	163 (46)
Advanced basic technologies	181 (50)
Others	13 (5)
Total	1,559 (383)

(Number in previous fiscal year)	1,407 (383)

Table 3: Number of applications and registrations of patent, and software

	Patent		Software Registration
	Application	Registration	
Socioeconomics	0	0	2
Environment	11	23	3
Customer energy services	7	11	9
Power delivery	13	13	24
Nuclear power generation	18	11	5
Fossil fuel power generation	23	18	5
New energy	12	6	4
Information & communication	3	7	1
Construction and maintenance of electric power facilities	7	7	8
Advanced basic technologies	15	25	0
Others	10	8	6
Total	119	129	67
(Number in previous fiscal year)	97	170	92

Note: Number of patents held as of end-FY 2012: 707

Table 4: Number of licensed patents and licensed software applications

	Total	(Number in previous fiscal year)
Number of licensed patents	20	11
Number of licensed software applications	357	299

Table 5: Contribution to Formulation of Major Codes, Standards, and Technical Guidelines

Code, Standard, Technical Guideline, etc.	Organizations and Groups Concerned
Guidelines on environmental impact assessment methods related to thermal power plants' replacement	Ministry of the Environment
JEAC9701-2012 Grid connection regulations	Japan Electric Association
JEAC7001-2012 Electric power distribution regulations	Japan Electric Association
AESJ-SC-P005: 2012 Implementation standards for aged nuclear power plants: 2012 (Supplement 3)	Atomic Energy Society of Japan
Concrete standards specification report formulated for 2012 (basic principles version and design version)	Japan Society of Civil Engineers
Energy Conservation Law's Standards of Judgment for Residential Construction Clients	Institute for Building Environment and Energy Conservation
JSME S NA1-2012 Codes for Nuclear Power Generation Facilities: Rules on Maintenance (2012 version)	The Japan Society of Mechanical Engineers
JIS C8715-1 Secondary lithium cells and batteries for use in industrial applications—Part 1: Tests and requirements of performance	Battery Association of Japan Japanese Standards Association

Table 6 Main research commissioned by national government

Name	Source of commission	Research subject name used at CRIEPI
Fiscal 2012: Study on recycled fuel resource storage technology (tests on long-term soundness of intermediate storage facility)	Ministry of Economy, Trade and Industry	Development of long-term storage management technology for spent fuel
Fiscal 2012 project to establish technical foundation for more advanced safety measures for nuclear reactor systems used for power generation (establishment of technical foundation for functional assessment of vent filters)	Ministry of Economy, Trade and Industry	Nuclear reactor system safety
Development of computer simulation of structural transformation analysis techniques for nuclear fuel	Ministry of Education, Culture, Sports, Science and Technology	Fuel, reactor core
Evaluation of validity and predictability of air quality modeling for urban $PM_{2.5}$ in Japan's cities	Ministry of the Environment	Development of techniques for comprehensive impact assessment of thermal power on atmospheric environment
Development of elemental technology for solid oxidizer fuel battery systems; Research and development for fundamental and shared issues; establishment of durable evaluation methods	New Energy and Industrial Technology Development Organization	Energy conversion
Project on revolutionary coal gasification power generating plant with zero emissions; Basic research project on revolutionary gasification technology; Development of CO_2 capture next-generation IGCC technology	New Energy and Industrial Technology Development Organization	More advanced IGCC and establishment of low-carbon technology
Development of pressure heat method for carbonic acid gas slurry	National Institute of Advanced Industrial Science and Technology	Geosphere sciences

II. Administration

1. Thorough cost cutting to adapt to increasingly harsh operating environment

- We endeavored to cut operating costs further by closely reviewing our administrative activities and, based on our findings, deciding to suspend projects, revise specifications for projects or partially carry out projects in-house, taking into account the need to ensure the safety of operations and maintain high-quality research. In particular, we postponed environmental management that was not a high priority or very urgent, such as repairs to outer walls of buildings, road repairs, upgrades to laboratories' air conditioning and heating systems, and improvements to electric facilities. As a result, we were able to reduce costs across all business activities by approximately 10 %.
- We cut costs and optimized subcontracting operations by ensuring that bidding was competitive in outsourcing or making purchases. As a result, the competition ratio based on contract amounts in commissions and purchases rose about 13 points over the previous fiscal year to about 39 %.
- While we utilize assets effectively, we streamlined fixed assets by proactively retiring and disposing of assets we did not plan to use. This not only reduced maintenance costs and fixed asset taxes, but also secured the space needed for future research. Moreover, we continued preparations to sell sites of welfare program facilities while monitoring real estate market conditions.
- In addition to a 20 % cut in executive salaries from the start of the fiscal year, we decided to make across-the-board cuts to managerial employees' annual salaries and also reduce the annual salaries of 30 % of managerial employees based on performance. We also lowered the bonuses of general employees. We also decided to take steps to reduce welfare costs, such as closing directly-run resort facilities and revising the cafeteria plan program.

2. Establishing research bases to strengthen research foundation

- We continued to develop infrastructure such as roads, power sources and communications needed for the new large-scale research facilities in the Yokosuka region, where we are building a new laboratory that will become the hub for research on energy and industrial technology. We limited the specifications for the power source infrastructure work to the bare minimum to reduce the budget, and postponed the work until fiscal 2013 in light of the laboratory completion date and the start of operations in the research facilities.
- We devised a basic concept for the specific facility development plan for the Abiko region, which is to be the hub of natural and environmental science research. This concept projects future needs and reorganizes research facilities in a rational and efficient way, while taking into account changes in the management environment.

- We brushed up our plan to move our research facilities in the Komae area to the Yokosuka area based on the refinements made to our research plans. We also continued preparations to sell some land (approximately 10,000 ㎡) in order to raise the funds needed to build this research base, such as the examination of the relevant regulations.
- We began to consider specific organization and systems for the transfer and reorganization of administrative and management divisions. This is intended to streamline administration, cut operating costs and strengthen the research support system in line with our policy to shift to two rebuilt research bases.

3. Enhancing public recognition and reputation through strategic information transmission and public relations activities

- We gave interviews and contributed material to mass media outlets and issued some publications such as "CRIEPI Topics" in order to introduce our wide-ranging and expert information and research results. In particular, we sent out information on nuclear power safety, stable electric power supply and deregulation of the electric power industry. Moreover, in May 2012 we held a forum on restoration and recovery efforts after the earthquake to follow up on the first forum held the previous fiscal year. This was an opportunity to systematically introduce some of our institute's research activities addressing earthquake and tsunami damage.
- We exchanged information even more closely with the electric power industry and external experts in order to accurately understand external conditions, such as trends in the electric power industry and society, and ascertain opinions of and requests for CRIEPI. Moreover, we shared the information and knowledge acquired through these means within CRIEPI, to develop public relations strategies and carry out other operations, deepen employees' knowledge, and raise consciousness of issues.

4. Hiring, training and utilizing the employees as the key to maintaining and expanding the organization

- As part of our efforts to strengthen our personal support function, we offered ongoing opportunities for all employees to talk one-on-one with the Human Resources Division and identify each employee's interest and future objectives and desires for their research and work. We endeavored to ensure that this led to the assignment of the right person for the right job.
- We set up a new deputy associate vice president position that quickly rewards employees who are expected to aid managerial decision-making about research operations. This measure to raise motivation focuses on selecting talented employees for higher positions, for example to train the next generation of leaders.
- As a means of hiring research staff according to our research operations we considered a new framework for special contract researchers in which the employment contract period

5. Ensuring sound and rigorous operations

- Through the various activities described in this report, we steadily implemented a public interest expenditures plan upon receiving authorization for the transfer to the status of general incorporated foundation.
- With the transition to a general incorporated foundation, we adopted procedures for settling public interest purpose assets and accounting standards for new public interest corporations (20 year benchmark), submitted notices on changes in corporation categories related to corporate taxes, and submitted notices regarding corporate inhabitant taxes.
- After becoming a general incorporated foundation, we established regulations on compensation for vice-presidents, auditors and councilors and Board of Councilors management rules. We also audited the status of the operation of our internal governance system in terms of the appropriateness, effectiveness and efficiency of operations, educated officers on compliance and carried out risk management activities for the organization.
- We considered measures to further reduce risks, such as encryption and network monitoring, to enhance the information security that is so crucial for research institutes. These measures were tested and are expected to be completely introduced in fiscal 2013.
- Please refer to the next page regarding our system for ensuring that directors comply with laws and articles of incorporation and our system ensuring appropriate operations.

Basic Principles on Internal Controls

CRIEPI has established the following basic principles for its internal control system in order to ensure that its operations are managed appropriately and efficiently.

(1) Management system for administration

- The Board of Directors will hold meetings regularly and will also hold special meetings as necessary, and will discuss and make decisions on important issues related to the performance of operations in accordance with laws and articles of incorporation as well as decisions by the Board of Councilors. In addition, Vice Presidents' job performance will be supervised.
- A committee concerned with management and research strategies and consisting of Vice Presidents and other the executives carrying out operations (below, "Management Committee") will be held regularly and important issues involved in conducting operations will be discussed with a flexible and multidisciplinary approach.
- The operations that executives are in charge of performing will be clarified and business will be conducted in an appropriate and prompt manner.
- Responsibilities and authority in exercising professional duties for Vice Presidents will be clarified in internal regulations, and efforts made to ensure that Vice President and employees perform their jobs appropriately and efficiently.
- Minutes for important committees such as the Board of Councilors, Board of Directors and Management Committee and other information related to Vice Presidents' execution of professional duties will be appropriately prepared, saved and managed in accordance with the articles of incorporation and internal regulations.
- An Internal Audit Division will be set up under the jurisdiction of the President and the job performance of each division will be regularly monitored in order to ensure that operations are conducted appropriately and efficiently.

(2) System for risk management

- A risk management system and internal regulations will be established.
- Risks related to business activities in carrying out professional duties will essentially be managed with a self-governing approach, based on laws and internal regulations.
- General risk management will be carried out by the Internal Audit Division in a centralized manner, with audits to ensure that important risks are appropriately managed without omission; the results will be reported to the President and Management Committee.
- Important risks that could potentially have a substantial effect on management will be discussed in the Management Committee and the necessary countermeasures will be discussed as required.
- In order to prepare for emergency disasters, internal regulations on the support organization and information system will be stipulated in internal regulations, and disaster prevention training will be carried out.

(3) Management system for compliance

- Action guidelines for compliance will be established and put into practice with the Vice Presidents taking the lead. In addition, employees will receive ongoing training on the prevention of improprieties via CRIEPI's website for internal users.
- A whistleblowing hotline will be permanently established with both internal and external access so that employees can discuss issues anonymously.
- The Internal Audit Division will audit employees' performance of professional duties in terms of compliance and report the results to the Management Committee. Executives will make the necessary improvements in light of the audit results.

(4) Audit system

- The General Auditor will audit Vice Presidents' and other the executives' performance of professional duties to ensure that they conform to the law and are appropriate by attending important meetings such as the Board of Directors meetings and perusing important documents. A full-time auditor will be appointed.
- The Internal Audit Division will provide staff to assist in the auditor's work. During the periods when the General Auditor's support staff are working exclusively with the General Auditor, they will not receive instructions or guidance from executives, and the General Auditor's wishes will be respected as regards transfers and evaluations.
- When Vice Presidents and/or employees discover anything that could significantly harm CRIEPI or detect acts that violate laws, articles of incorporation and other internal regulation, they should report directly to the President General Auditor and/or the Internal Audit Division.
- The Vice Presidents and employees will report to the auditor regarding the status of the execution of professional duties when requested to do so.

III. Workforce

We enhanced the capacity of current staff, assigned staff to appropriate positions and carefully selected special contract employees in line with our basic policy to reduce the current staff of about 840 as of the start of fiscal 2012 to about 800 by the end of fiscal 2015. In addition, we considered specific measures such as halting the employment of term-limited contract employees in order to achieve this goal as soon as possible.

The workforce as of March 31, 2013, was as follows.

Item	Numbers	Percentage distribution (%)
1. Research	726*[1]	88.1
[Breakdown]		〔100.0〕
(1) Electricity	116	16.0
(2) Civil engineering and construction	95	13.0
(3) Mechanical	97	13.4
(4) Chemistry	68	9.4
(5) Biology	59	8.1
(6) Nuclear engineering	45	6.2
(7) Environmental science	42	5.8
(8) Information & communication	40	5.5
(9) Socioeconomics	47	6.5
(10) Research support & management	117	16.1
2. Office work	99	12.0
Total	825*[2]	100

IV. Meetings held

1. Board of Councilors

Date held	Agenda
June 15, 2012 (No. 1)	1. Approval of report on research activities in FY2011 2. Approval of report on settlement of accounts in FY2011 3. Decision on total compensation for vice presidents and general auditors 4. Decision on regulations on compensation for councilors and general auditors 5. Decision on indemnity liability limit for external vice presidents and general auditors 6. Election of councilors and vice presidents
August 23, 2012 (No. 2)	1. Election of councilors, vice presidents and general auditors
January 4, 2013 (No. 3)	1. Decrease in ongoing donations in FY2012 from Tohoku Electric Power Company and Tokyo Electric Power Company 2. Decrease in ongoing donations in FY2012 from nine electric utility companies 3. Changes to FY2012 research plans 4. Changes to FY2012 statement of budget
March 15, 2013 (No. 4)	1. Decision on Board of Councilors management rules 2. Approval of Research Plan in FY2013 3. Approval of Statement of Budget in FY2013

2. Board of Directors

Date held	Agenda
May 24, 2012 (No. 1)	1. Reports on research activities in FY2011 2. Reports on settlement of accounts in FY2011 3. Report on performance of job functions by President, Executive Vice President, and Managing Directors 4. Necessary documentation related to settlement of charitable purpose assets 5. Total compensation for compensation for councilors and

	general auditors (proposal) 6. Regulations on compensation for councilors and general auditors (proposal) 7. Regulations on compensation for councilors 8. Indemnity liability limit for external vice presidents and general auditors (proposal) 9. Election of councilors and vice presidents (proposal) 10. Division of responsibilities for Executive Vice President, and Managing Directors 11. Election of important employees 12. Decision to convene regular Board of Councilors
August 7, 2012 (No. 2)	1. Election of councilors, vice presidents and general auditors
December 5, 2012 (No. 3)	1. Decrease in ongoing donations in FY2012 from Tohoku Electric Power Company and Tokyo Electric Power Company 2. Decrease in ongoing donations in FY2012 from nine electric utility companies 3. Changes to FY2012 research plans 4. Changes to FY2012 statement of budget
March 7, 2013 (No. 4)	1. Research plan in FY2013 (proposal) 2013 2. Statement of budget in FY2013 (proposal) 3. Report on performance of job functions by President, Executive Vice President, Standing Director and Managing Directors 4. Setting large loan amounts 5. Board of Councilors management rules (proposal) 6. Decision to convene Board of Councilors

Settlement of Accounts

Outline of Settlement of Accounts

Net property at the end of fiscal 2011 was 36.84 billion yen, 710 million yen lower than the end of the previous fiscal year.

1. Financial statements

(1) Assets condition

- Total assets amounted to 50.53 billion yen. This consisted of 4.44 billion yen in current assets, 12.77 billion yen in special assets and 33.31 billion yen in other fixed assets.
- Special assets consisted of 900 million yen in fixed assets funded by designated net assets, 3.43 billion yen in special assets for retirement lump sum grants benefits package allowance, and 7.7 billion yen in special assets for research facility acquisition allowance.
- Other fixed assets consist of 8.69 billion yen in land, 9.35 billion yen in buildings, 2.49 billion yen in ancillary buildings and 6.42 billion yen in machine and equipment.

(2) Liabilities condition

- Liabilities totaled 13.68 billion yen. This consisted of 3.9 billion in current liabilities and 9.78 billion yen in fixed liabilities.
- Fixed liabilities consisted of 9.38 billion yen in accrued retirement benefits for employees.

(3) Net assets condition

- Net assets amounted to 36.84 billion yen at the end of the fiscal year, consisting of 35.94 billion yen in general net assets and 900 million yen in designated net assets.

2. New assets increase/decrease calculation sheet

(1) Changes in general net assets

- Ordinary revenue was 28.83 billion yen. Of this, current donations decreased to 26.27 billion yen as a result of a reduction in current donations from Tohoku Electric Power Company and Tokyo Electric Power Company. Revenue from research projects funded by the government fell to 1.6 billion yen.
- Ordinary expenditure totaled 28.86 billion yen. This can be attributed to 26.88 billion in business activity expenditures related to research projects and 1.98 billion yen in administrative expenditures related to head office operations.
- Project costs consisted of 10.55 billion yen in personnel expenditures and 16.33 billion yen in expenditures. Administrative expenses consisted of 1.16 billion yen in personnel expenditures and 820 million yen in expenditures.
- As a result, ordinary revenue fell 300 million yen.

- The nonrecurring change was a net decrease of 390 million yen, primarily due to losses on sales related to the upgrade of large computers.

As a result, the current change in general net assets was a net decrease of 420 million yen in the current fiscal year.

(2) Change in designated net assets

The change in designated net assets was a net decrease of 280 million yen, due to depreciation of special assets funded by designated net assets.

3. Other

CRIEPI became a general incorporated foundation in fiscal 2012. Accordingly, the Public-Service Corporation Accounting Standard (October 14, 2004, understood thing at the concerned government ministries meeting related to teaching and direction of public-service corporations) was employed.

I. Financial Statements

Balance Sheet

As of March 31, 2013

(Unit: yen)

Account	Current fiscal year	Previous fiscal year	Increase/ decrease
I. Assets section			
1. Current assets			
Cash and deposit	3,198,576,076	—	—
Securities	4,128,621	—	—
Account receivable	1,107,786,069	—	—
Suspense payable	125,794,742	—	—
Advance payment	11,929,723	—	—
Total current assets	4,448,215,231	—	—
2. Fixed assets			
(1) Special assets			
Buildings	258,033,100	—	—
Ancillary buildings	2,621,757	—	—
Structures	2,672,890	—	—
Machine and equipment	848,362,479	—	—
Tools and furniture	22,315,542	—	—
Lump-sum depreciable assets	1,103,211	—	—
Intangible fixed asset	2,370,580	—	—
Special assets for retirement lump sum grants benefits package allowance	3,435,900,000	—	—
Special assets for research facility acquiring allowance	7,700,000,000	—	—
Special assets for special project reserves	500,000,000	—	—
Total special assets	12,773,379,559	—	—
(2) Other fixed assets			
Land	8,698,562,302	—	—
Building	9,350,481,451	—	—
Ancillary buildings	2,493,596,502	—	—
Structure	1,236,471,797	—	—
Machine and equipment	6,420,885,983	—	—
Tools and furniture	2,095,109,876	—	—
Rolling stock and vehicles	12,313,186	—	—
Lump-sum depreciable assets	40,826,810	—	—
Intangible fixed asset	538,429,909	—	—
Construction in process account	2,387,225,600	—	—
Long-term prepaid expenses	41,074,011	—	—
Total other fixed assets	33,314,977,427	—	—
Total fixed assets	46,088,356,986	—	—
Total assets	50,536,572,217	—	—
II. Liability section			
1. Current liability			
Accrued liability	3,261,954,053	—	—
Money entrusted	96,862,107	—	—
Advance receipt	193,116,472	—	—
Accrued bonus	355,000,000	—	—
Total current liability	3,906,932,632	—	—
2. Fixed liabilities			
Allowance for retirement benefits for directors	399,000,000	—	—
Accrued retirement benefits for employees	9,383,000,000	—	—
Total fixed liabilities	9,782,000,000	—	—
Total liabilities	13,688,932,632	—	—

Account	Current fiscal year	Previous fiscal year	Increase/ decrease
III. Net assets section			
1. Designated net assets			
Special benefits	439,096,146	—	—
Cash subsidy	359,144,296	—	—
Cash contribution	105,551,220	—	—
Total designated net assets	903,791,662	—	—
(Including appropriation to special assets)	(903,791,662)	(—)	(—)
2. General net assets	35,943,847,923	—	—
(Including appropriation to special assets)	(8,433,687,897)	(—)	(—)
Total net assets	36,847,639,585	—	—
Total of liability and net assets	50,536,572,217	—	—

Note: The Public Service Corporation Accounting Standard (April 11, 2008; revised on October 16, 2009 by the Cabinet Office's Public Interest Corporation Commission) was adopted in the current fiscal year, so the figures for the previous fiscal years lack continuity with this fiscal year's data. Accordingly, we have not provided data for the previous fiscal year, in line with the Operational Guidelines for Public Service Corporation Accounting Standards (April 11, 2008; revised on October 16, 2009 by the Cabinet Office's Public Interest Corporation Commission).

Net Assets Increase/Decrease Calculation Sheet

From Aril 1, 2012 to March 31, 2013

(Unit: yen)

Account	Current fiscal year	Previous fiscal year	Increase/decrease
I. General net assets increase/decrease section			
1. Current increase/decrease section			
(1) Current revenue			
[1] Benefit received			
Current benefit received	26,279,193,000	—	—
[2] Operating revenue	(1,993,405,373)	(—)	(—)
Funded research operating revenue	1,604,054,329	—	—
Other operating revenue	389,351,044	—	—
[3] Other revenue	(132,464,361)	(—)	(—)
Interest received	7,924,914	—	—
Facility usage fee received	86,093,236	—	—
Miscellaneous revenue	38,446,211	—	—
[4] Transfer from designated net assets	427,910,683	—	—
Total current revenue	28,832,973,417	—	—
(2) Current expenditure		—	—
[1] Project cost		—	—
Personnel expenditure	(10,554,932,001)	(—)	(—)
Salary and benefit	7,385,550,520	—	—
Retirement benefit expenditure	2,185,853,040	—	—
Welfare expenditure	983,528,441	—	—
Expenditure	(16,331,472,915)	(—)	(—)
Supplies expenses	1,551,266,522	—	—
Printed material expenses	389,732,830	—	—
Fuel, light, and water expenses	764,222,810	—	—
Expenses for commission	5,255,239,229	—	—
Collaboration research contribution	494,983,544	—	—
Repair expenses	1,240,933,863	—	—
Rental rate	283,497,208	—	—
Tax and public charge	91,210,730	—	—
Travel and transport expenses	656,743,357	—	—
Communication and transportation expenses	92,366,634	—	—
Other expenditure	540,555,971	—	—
Depreciation allowance	4,970,720,217	—	—
Subtotal of project cost	26,886,404,916	—	—
[2] Administrative expenses		—	—
Personnel expenditure	(1,160,323,775)	(—)	(—)
Board members' salary	153,450,000	—	—
Salary and benefit	602,898,980	—	—
Retirement benefit expenditure	159,482,836	—	—
Welfare expenditure	147,491,959	—	—
Allowance for retirement benefits for directors transfer	97,000,000	—	—
Expenditure	(820,784,224)	(—)	(—)
Supplies expenses	9,853,753	—	—
Printed material expenses	47,104,504	—	—
Fuel, light, and water expenses	34,654,296	—	—
Expenses for commission	148,730,694	—	—
Repair expenses	12,300,538	—	—
Rental rate	369,436,177	—	—
Tax and public charge	11,476,455	—	—
Travel and transport expenses	25,753,331	—	—
Communication and transportation expenses	10,119,664	—	—
Other expenditure	111,739,142	—	—
Depreciation allowance	39,615,670	—	—

Account	Current fiscal year	Previous fiscal year	Increase/decrease	
Subtotal of administrative expenses	1,981,107,999	—	—	
Total current expenditure	28,867,512,915	—	—	
Current ordinary increase/decrease	△34,539,498	—	—	
2. Nonrecurring increase/decrease section				
(1) Nonrecurring profit				
[1] Fixed asset donated profit				
Facility donated profit	21,140,000	—	—	
[2] Gain from sale of fixed assets				
Gain on sale of facility	205,938	—	—	
[3] Transfer from designated net assets	6,137,246	—	—	
Total nonrecurring profit	27,483,184	—	—	
(2) Nonrecurring expenses				
[1] Loss on sale of fixed assets				
Loss on sale of tools and furniture	419,245,269	—	—	
Total nonrecurring expenses	419,245,269	—	—	
Current nonrecurring increase/decrease	△391,762,085	—	—	
Current ordinary net asset increase/decrease	△426,301,583	—	—	
Ordinary net asset beginning balance	36,370,149,506	—	—	*1
Ordinary net asset final balance	35,943,847,923	—	—	
II. Designated net asset increase/decrease section				
[1] Cash subsidy received				
Subsidy received	128,148,715	—	—	
[2] Fixed asset donated profit				
Facility donated profit	22,104,699	—	—	
[3] Transfer to ordinary net assets	434,047,929	—	—	
Current designated net assets increase/decrease	△283,794,515	—	—	
Designated net assets beginning balance	1,187,586,177	—	—	*2
Designated net assets final balance	903,791,662	—	—	
III. Net assets final balance	36,847,639,585	—	—	

Note 1: The Public Service Corporation Accounting Standard (April 11, 2008; revised on October 16, 2009 by the Cabinet Office's Public Interest Corporation Commission) was adopted in the current fiscal year, so the figures for the previous fiscal years lack continuity with this fiscal year's data. Accordingly, we have not provided data for the previous fiscal year, in line with the Operational Guidelines for Public Service Corporation Accounting Standards (April 11, 2008; revised on October 16, 2009 by the Cabinet Office's Public Interest Corporation Commission).

Note 2: CRIEPI became a general incorporated foundation on April 1, 2012. Since fundamental assets were not stipulated in the articles of corporation, fundamental assets ceased to exist when CRIEPI made this transition and fundamental assets (designated net assets) were recorded as other fixed assets (general net assets). As a result, the designated net assets beginning balance decreased by 7,000,000 yen and the ordinary net asset beginning balance increased by the same amount compared to the end of the previous fiscal year.

Breakdown of Net Assets Increase/Decrease Calculation Sheet

From Aril 1, 2012 to March 31, 2013

(Unit: yen)

Account	Project total	Corporate total	Total

Account	Project total	Corporate total	Total

(*) Content of ongoing projects: Research, surveys, and tests on electric power technology and the economy and general coordination of the aforementioned.

Notes for Financial Statements

1. Transition to general incorporated foundation

CRIEPI became a general incorporated foundation on April 1, 2012.

2. Important accounting policy

CRIEPI adopted the Public-Service Corporation Accounting Standard (April 11, 2008, revised on October 16, 2009; Cabinet Office's Public Interest Corporation Commission).

(1) Assessment standard and assessment method of valuable stock certificates

For other valuable stock certificates without market price, the cost method by the moving-average method has been applied.

(2) Depreciation method of fixed assets

- For tangible fixed assets, building (excluding building attached structures) has been managed by the equal installment method, small fixtures have been by the three-year uniform extinguishment, and other tangible fixed assets including machine and equipment have been by the constant percentage method.
- Intangible fixed asset has been managed by the equal installment method.
- Lease assets from finance lease trade other than ownership transfer was calculated for the lease period of expiration year and based on the equal installment method with zero residue prices.

(3) Allowance allocating standard

Allowance for doubtful debts: To prepare for doubtful debts including account receivable and loan receivable, uncollectible amount is individually estimated to account for allowance.

Bonus payment reserve: To prepare for doubtful debts including account receivable and loan receivable, uncollectible amount is individually estimated to account for allowance.

Allowance for retirement benefits for vice presidents: To prepare payment of vice presidents special service bonus, estimation at the end of period is account for allowance based on the private regulation to pay allowance for retirement benefits for vice presidents.

Accrued retirement benefits for employees: To prepare for payment of retirement allowance and annual pension, amount deducting the pension asset amount assessed from the present value method based on future estimated retirement benefit is account for allowance. And retirement benefits for counselors are accounted for the estimation at the end of period based on the related private regulation and expressed in the combined form.

Additional information:

As a result of revisions to retirement pension regulations, CRIEPI shifted from its previous retirement pension program to a defined benefit corporate pension system based on the Defined-Benefit Corporate Pension Act (Act. No. 50 of 2001) on April 1, 2012. As

a result of this transition, past service costs decreased 2,625,311,902 yen. Past service costs are amortized using the straight-line depreciation method for a five-year period from the fiscal year in which they were incurred. In the current fiscal year, 525,062,381 yen in past service costs were amortized.

(4) Account processing of consumption tax, etc.

Account processing of consumption tax, etc. is controlled by the before tax method.

3. Change in important account policy

There were no changes in important account policy.

4. Change in designated assets and balance

The change in designated assets and balance are as follows.

(Unit: yen)

Subject	Balance at the end of previous period	Current increased amount	Current decreased amount	Balance at the end of current period
Building	278,386,661	0	20,353,561	258,033,100
Ancillary buildings	3,941,228	0	1,319,471	2,621,757
Structures	3,359,079	0	686,189	2,672,890
Machine and equipment	1,217,615,256	5,606,000	374,858,777	848,362,479
Tools and furniture	36,921,060	12,880,499	27,486,017	22,315,542
Lump-sum depreciable assets	665,284	1,378,700	940,773	1,103,211
Intangible fixed assets	772,436	2,068,000	469,856	2,370,580
Special assets for reserves for lump-sum retirement benefits	3,435,900,000	0	0	3,435,900,000
Special assets for acquisition of research facilities	7,900,000,000	2,200,000,000	2,400,000,000	7,700,000,000
Special assets for reserves for projects	0	500,000,000	0	500,000,000
Total	12,877,561,004	2,721,933,199	2,826,114,644	12,773,379,559

5. Breakdown of funding for fixed assets

The funding for fixed assets can be broken down as follows.

(Unit: yen)

Subject	Balance at the end of current period	(Including appropriation from designated net asset)	(Including appropriation from general net asset)	Including liability relating item)
Building	258,033,100	(258,033,100)	-	-
Ancillary buildings	2,621,757	(2,621,757)	-	-
Structures	2,672,890	(1,638,431)	(1,034,459)	-
Machine and equipment	848,362,479	(615,709,041)	(232,653,438)	-
Tools and furniture	22,315,542	(22,315,542)	-	-
Lump-sum depreciable assets	1,103,211	(1,103,211)	-	-
Intangible fixed assets	2,370,580	(2,370,580)	-	-
Special assets for reserves for lump-sum retirement benefits	3,435,900,000	-	-	(3,435,900,000)
Special assets for acquisition of research facilities	7,700,000,000	-	(7,700,000,000)	-
Special assets for reserves for projects	500,000,000	-	(500,000,000)	-
Total	12,773,379,559	(903,791,662)	(8,433,687,897)	(3,435,900,000)

6. Assets offered as collateral

No asset offered as collateral is recorded.

7. Acquisition value, accumulated depreciation and balance at the end of current period for fixed assets

Acquisition value, accumulated depreciation and balance at the end of current period for fixed assets are as follows.

(Unit: yen)

Subject	Acquisition value	Accumulated depreciation	Balance at the end of current period
Special asset	(5,703,412,272)	(4,565,932,713)	(1,137,479,559)
Building	621,962,762	363,929,662	258,033,100
Ancillary buildings	131,084,924	128,463,167	2,621,757
Structures	28,268,470	25,595,580	2,672,890
Machine and equipment	4,836,718,324	3,988,355,845	848,362,479
Tools and furniture	80,501,272	58,185,730	22,315,542
Lump-sum depreciable assets	1,930,920	827,709	1,103,211
Intangible fixed asset	2,945,600	575,020	2,370,580
Other fixed asset	(100,237,656,554)	(78,049,541,040)	(22,188,115,514)
Building	18,852,619,929	9,502,138,478	9,350,481,451
Ancillary buildings	12,295,936,707	9,802,340,205	2,493,596,502
Structures	5,847,335,878	4,610,864,081	1,236,471,797
Machine and equipment	47,833,443,063	41,412,557,080	6,420,885,983
Tools and furniture	11,007,128,015	8,912,018,139	2,095,109,876
Rolling stock and vehicle	78,608,321	66,295,135	12,313,186
Lump-sum depreciable assets	112,107,487	71,280,677	40,826,810
Intangible fixed asset	4,210,477,154	3,672,047,245	538,429,909
Total	(105,941,068,826)	(82,615,473,753)	(23,325,595,073)

8. Claimable assets, balance of allowance for doubtful debts at the end of period, and balance of claimable assets at the end of period

Claimable assets, balance of allowance for doubtful debts at the end of period, and balance of claimable assets at the end of period are as follows.

(Unit: yen)

Subject	Claimable assets	Balance of allowance for doubtful debts at the end of period	Balance of claimable assets at the end of period
Account receivable	1,107,786,069	0	1,107,786,069
Housing loans and welfare loans among special assets of accrued retirement benefits	20,153,000	0	20,153,000
Total	1,127,939,069	0	1,127,939,069

9. Contingent liabilities such as guarantee liabilities

A guarantee liability to employees housing loans is 1,993,480,973 yen.

10. Breakdown of held-to maturity bond certificates and book values, actual values, and appraisal profit or loss

No held-to-maturity bond certificates are recorded.

11. Breakdown of subsidies, etc. and delivers, current increase/decrease, and balance.

Breakdown of subsidies, etc. and delivers, current increase/decrease, and balance are as follows.

(Unit: yen)

Name of subsidies	Deliverer	Balance at the end of period	Current increase	Current decrease	Balance at the end of period	Describing division in balance sheet
Subsidies						
• Subsidy for projects assessing impact on power systems of mass adoption of destributed generation	Ministry of Economy, Trade and Industry	327,397,314	0	116,880,818	210,516,496	Designated net assets
• Project to promote the introduction of solar power generation system at CRIEPI's laboratories in the Yokosuka area in fiscal 2008	New Energy and Industrial Technology Development Organization	12,795,979	0	1,625,089	11,170,890	Designated net assets
・Project to promote introduction regional new energy in fiscal 2009	New Energy Promotion Council	2,910,436	0	427,834	2,482,602	Designated net assets
• Applicability survey of manufacturing technology for fly ash concrete not using cement	Ministry of Economy, Trade and Industry	0	13,339,999	13,339,999	0	-
・ Development of technology to ascertain solar power generation output in real time	Ministry of Economy, Trade and Industry	0	2,107,556	2,107,556	0	-
・Next-day solar power generation projections using climate model	Ministry of Economy, Trade and Industry	0	1,958,695	1,958,695	0	-
• Experimental study of next-generation energy transmission and distribution optimal control technology	Ministry of Economy, Trade and Industry	0	6,930,113	6,930,113	0	-
・ Research and development for Advanced Humid Air Turbine (AHAT) System	Ministry of Economy, Trade and Industry	0	2,358,000	2,358,000	0	-
• Experimental studies on next-generation two-way communication output control technology	Ministry of Economy, Trade and Industry	0	995,839	995,839	0	-
Grant						
・R&D for SiC innovative power electronics to create a low-carbon society (super-thick membrane and multi-layer SiC	Japan Society for the Promotion of Science	208,871,399	86,933,400	163,084,940	132,719,859	Designated net assets
・Research on impact of forest's watershed characteristics on hydroelectric power generation volume (fiscal 2010 portion)	National Land Afforestation Promotion Organization	329,219	0	205,761	123,458	Designated net assets
・Research on impact of forest's watershed characteristics on hydroelectric power generation volume (fiscal 2011 portion)	National Land Afforestation Promotion Organization	2,516,553	2,644,617	4,166,691	994,479	Designated net assets
• Research on impact of forest's watershed characteristics on hydroelectric power generation volume (fiscal 2012 portion)	National Land Afforestation Promotion Organization	0	10,880,496	10,880,496	0	-
・Fiscal 2010 grant for project to subsidize costs of development of dual analog/digital equipment to alleviate poor reception	Association for Promotion of Digital Broadcasting	1,364,359	0	227,847	1,136,512	Designated net assets

Total	556,185,259	128,148,715	325,189,678	359,144,296	

12. Breakdown of transfer from designated net assets to general net assets

Breakdown of transfer from designated net assets to general net assets is as follows.

(Unit: yen)

Content	Amount of money
Transfer to balance of current account	
Depreciation allowance related to designated net assets	294,375,703
Transfer by exception from specification as designated net asset	5,386,265
Transfer by implementing of project for which subsidy was received	128,148,715
Transfer to nonrecurring profit	
Transfer through retirement of designated net assets	6,137,246
Total	434,047,929

13. Trading content to related parties

No trading to related parties is recorded.

14. Important subsequent event

No important subsequent event is recorded.

15. Notes on assets from projects implemented

The balance of assets from projects implemented is as follows.

(Unit: yen)

Subject	Book value at start of fiscal year	Book value at end of fiscal year
Special asset	(1,532,076,529)	(1,137,479,559)
Building	278,386,661	258,033,100
Ancillary buildings	3,932,586	2,621,757
Structures	3,359,079	2,672,890
Machine and equipment	1,210,654,332	848,362,479
Tools and furniture	34,514,899	22,315,542
Lump-sum depreciable assets	456,536	1,103,211
Intangible fixed asset	772,436	2,370,580
Other fixed asset	(30,366,998,227)	(30,245,662,536)
Land	8,385,231,067	8,385,231,067
Building	9,143,536,146	9,127,939,763
Ancillary buildings	2,481,479,236	2,457,791,893
Structures	764,150,519	1,223,774,702
Machine and equipment	7,477,101,132	6,416,779,605
Tools and furniture	1,447,008,937	2,054,882,819
Lump-sum depreciable assets	11,556,847	9,409,129
Intangible fixed asset	34,598,878	38,318,640
Building	622,335,465	531,534,918
Total	(31,899,074,756)	(31,383,142,095)

16. Retirement benefit related

(1) Summary of employed retirement benefit

CRIEPI has set up a defined benefit corporation pension system and termination allowance plan as defined benefit contribution plans. As a result of revisions to its retirement pension regulations, CRIEPI shifted from its previous retirement pension program to a defined benefit corporate pension system based on the Defined-Benefit Corporate Pension

Act (Act. No. 50 of 2001) on April 1, 2012.

(2) Retirement benefit liability and its contents

(Unit: yen)

[1] Retirement benefit liability	1123,383,568,323
[2] Retirement pension asset	13,141,523,340
[3] Non-accumulated retirement benefit ([1]+[2])	1110,242,044,983
[4] Non-depreciated mathematical calculation difference	2,959,294,504
[5] Unamortized past service liabilities	112,100,249,521
[6] Accrued retirement benefits for employees ([3]+[4]+[5])	119,383,000,000

(3) Items for retirement benefit expense

(Unit: yen)

[1] Working expense	960,477,168
[2] Interest expense	228,658,731
[3] Expectable operation benefit	11129,081,053
[4] Mathematical calculation difference depreciation	1,810,343,411
[5] Unamortized past service liabilities	11525,062,381
[6] Retirement benefit expense ([1]+[2]+[3]+[4]+[5])	2,345,335,876

(4) Items for calculation bases of retirement benefit liability

[1] Period allocation method of retirement benefit expectation: Period fixed amount standard based on the working period

[2] Discount rate: 1.0%

[3] Expectable operation benefit: 1.0%

[4] Processing year of difference on mathematical calculation: Five-year constant percentage method is applied for depreciation after next year of occurrence.⑤
Number of years over which past service costs are amortized: Past service costs are amortized using the straight-line depreciation method for a five-year period from the fiscal year in which they were incurred.

[5] Number of years over which past service costs are amortized: Past service costs are amortized using the straight-line depreciation method for a five-year period from the fiscal year in which they were incurred.

II. Supplementary Statement

1. Details on specific assets

(Unit: yen)

Type of asset	Book value at start of fiscal period	Increase in current fiscal period	Decrease in current fiscal period	Book value at end of fiscal period
Buildings	278,386,661	0	20,353,561	258,033,100
Ancillary buildings	3,941,228	0	1,319,471	2,621,757
Structures	3,359,079	0	686,189	2,672,890
Machines and equipment	1,217,615,256	5,606,000	374,858,777	848,362,479
Tools and furniture	36,921,060	12,880,499	27,486,017	22,315,542
Lump-sum depreciable assets	665,284	1,378,700	940,773	1,103,211
Intangible fixed assets	772,436	2,068,000	469,856	2,370,580
Special assets for allowances for lump-sum retirement benefits	3,435,900,000	0	0	3,435,900,000
Special assets for allowance for acquisition of research facilities	7,900,000,000	2,200,000,000	2,400,000,000	7,700,000,000
Special assets for reserves for projects	0	500,000,000	0	500,000,000
Total special assets	12,877,561,004	2,721,933,199	2,826,114,644	12,773,379,559

(Note 1) The increase in the special assets for research facility acquiring allowance in this fiscal period is attributable to reserves for specific assets with the objective of constructing the Yokosuka Thermal Hydraulics Laboratory, acquiring the tsunami and flood channel, and acquiring the power system simulator. The decrease in in this fiscal period was due to the liquidation of specific assets with the aim of building Yokosuka area infrastructure, upgrading Facility for Experiments on Advanced Gasification of Low-Grade Resources and large-scale computers, and upgrading large-capacity power short-circuit testing facility.

(Note 2) CRIEPI is setting aside specific assets as reserves for its specific projects beginning this fiscal year. The increase in this fiscal year consists of reserves for collaboration research contributions.

2. Breakdown of Allowances

(Unit: yen)

Category	Balance at start of fiscal period	Increase in current fiscal period	Decrease in current fiscal period		Balance at end of fiscal period
			Intended use	Other	
Allowance for employees	359,000,000	355,000,000	359,000,000	0	355,000,000
Allowance for retirement benefits for directors	302,000,000	97,000,000	0	0	399,000,000
Allowance for retirement benefits for employees	8,199,000,000	2,345,335,876	1,161,335,876	0	9,383,000,000

Audit Report by Third-Party Auditor

May 8, 2013

Central Research Institute of Electric Power Industry
President Masahiro Kakumu

Meisho auditors
Senior Partner Certified Public Accountant,
Managing Partner Yoshihiro Wada

Managing Partner

We audited the financial statements of the Foundation of Central Research Institute of Electric Power Industry (hereinafter referred to as "CRIEPI") in the FY2012 business term from April 1, 2012 to March 31, 2013, including balance sheets, profit and loss statement ("net assets increase/decrease calculation sheet" according to the stipulations of the Public Interest Corporation Authorization Guideline II-4), supplementary statements, notes on financial statements and the breakdown of the "net assets increase/decrease calculation sheet" cash flow calculation sheet, notes on financial statements and list of assets (hereinafter, the subjects of our audit will be referred to as "financial statements"), in accordance with Clause 199 of the Act on General Incorporated Associations and General Incorporated Foundations and Paragraph 1, Section 2, Clause 124 of the same Act.

Management's responsibility for financial statements

Management is responsible for the preparation and fair presentation of the consolidated financial statements in accordance with accounting principles generally accepted in Japan, and for such internal control as management determines is necessary to enable the preparation of consolidated financial statements that are free from material misstatements, whether due to fraud or error.

Auditor's responsibility

Our responsibility is to express an opinion on the consolidated financial statements based on our audit as an independent auditor. We conducted our audit in accordance with auditing standards generally accepted in Japan. Those standards require that we plan and perform the audit to obtain reasonable assurance about whether the consolidated financial statements are free from material misstatement.

An audit involves performing procedures to obtain audit evidence about the amounts and disclosures in the consolidated financial statements. The procedures selected depend on our judgment, including the assessment of the risks of material misstatement of the consolidated financial statements, whether due to fraud or error. In making those risk assessments, we

consider internal control relevant to the entity's preparation and fair presentation of the consolidated financial statements in order to design audit procedures that are appropriate in the circumstances, while the objective of the financial statement audit is not for the purpose of expressing an opinion on the effectiveness of the entity's internal control. An audit also includes evaluating the appropriateness of accounting policies used and the reasonableness of accounting estimates made by management, as well as evaluating the overall presentation of the consolidated financial statements.

We believe that the audit evidence we have obtained is sufficient and appropriate to provide a basis for our audit opinion.

Opinion

In our opinion, the financial statements referred to above fairly present, in all material respects, the net change in assets and profit/loss (change in net assets) for the period for which the financial statements were prepared, in accordance with accounting principles generally accepted in Japan.

Interests

Our firm and its employees have no interest in CRIEPI which should be disclosed pursuant to the provisions of the Certified Public Accounts Law of Japan.

Audit Report

Audit Report

May 16, 2013

Central Research Institute of Electric Power Industry
President Masahiro Kakumu

Central Research Institute of Electric Power Industry
General Auditor, Kouichi Nishi
General Auditor, Makio Fujiwara
General Auditor, Koji Kaibe

We audited management's execution of their professional duties and CRIEPI's financial assets and income and expenditures in the fiscal year from April 1, 2012 to March 31, 2013 and report the audit method and results as follows.

1. Outline of the audit method

In accordance with the audit standards and the fiscal 2012 audit plan, we sought to facilitate mutual understanding with directors, the Internal Auditing Department and other employees, gathered information and worked to improve the environment for conducting audits. In addition, we attended meetings of the Board of Directors and other important meetings, received reports from directors and other employees regarding the performance of their duties, and when deemed necessary, sought explanations, and perused important documents in surveying business and financial conditions.

We received reports on the establishment and administration of the system established to ensure appropriate and efficient business operations (internal control system) from directors and other employees, and sought explanations when deemed necessary.

Moreover, we examined whether the independent auditor was correctly performing the audit and also received reports from the independent auditor on the execution of these responsibilities and sought explanations when deemed necessary.

Based on the above methods, we examined the business reports and statements of revenue and expenditures (balance sheets and net assets increase/decrease calculation sheet) and supplementary statements.

2. Results of audit

(1) We recognized that the business reports properly indicated the business contents of CRIEPI in accordance with laws and Articles of Incorporation.

(2) We have determined that there were no serious occurrences of dishonest or false activity or violations of any laws or the Articles of Incorporation by any of the directors in carrying out their duties.

(3) There are no points to note regarding the establishment and administration of the

internal control system.

(4) The method of audit employed by Meisho auditors and the results thereof are proper and the statements of revenue and expenditures and supplementary statements properly presents CRIEPI's financial assets and income and expenditures in all important respects.