FY2013

Reports on
Research Activities
Settlement of Accounts

From April 1, 2013
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Central Research Institute of Electric Power Industry

Contents

On the Publication of the Research Activities Reports for Fiscal 2013

With no indication yet as to when nuclear power plants will resume operations, the electric power industry's business environment remains extremely difficult. In fiscal 2013 (April 1, 2013 to March 31, 2014), power companies temporarily reduced the benefit expenditure that accounts for the majority of CRIEPI's business income as a result of their deteriorating finances. Accordingly, CRIEPI changed its Research Plans and Statement of Budget.

In pursuing our research, we identified and specified research that CRIEPI should address through close communication with the electric power industry, in order to resolve the issues facing the industry. By focusing management resources on research with a particularly high priority, we have begun to produce effective results. As a result, we have provided the output needed to resolve urgent issues in a timely manner, such as the screening to determine nuclear power plants' compliance with new regulatory standards and measures to counter natural disasters at nuclear power facilities. Moreover, we are steadily yielding results in addressing important medium- and long-term issues that contribute to the development of a solid and flexible energy supply-demand structure, including addressing the large-scale adoption of renewable energy.

At the same time, as in fiscal 2012, we thoroughly cut operating expenses overall, starting with personnel costs. In addition, in fiscal 2013 we cancelled and postponed some research on future issues for the electric power industry, and in some cases had to put off plans for the introduction and renovations of large-scale research facilities, which are the source of our research strength and ability to resolve issues.

Under these constraints, CRIEPI conducted its research using various innovative ways to prevent its research capacity from declining. We expect our business environment to remain difficult, and will therefore strive to rebuild our business strategy for the future and generate research results that are very effective in resolving the power industry's issues.

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Key Initiatives in Fiscal 2013

■ Pursue research with clear priorities

In addition to clarifying the issues that should be resolved for the sake of the steady development of the electric power industry, we identified specific actions that CRIEPI would take to resolve these issues in the "Portfolio of Research Subjects". In addition, we determined the priorities of the actions to be taken in terms of urgency, importance and CRIEPI's role, and pursued research with a focus on actions with the greatest priority.
(Refer to "I. Research Activities—3. Research Promotion" for details.)

■ Strengthen initiatives in research contributing to the resolution of urgent issues in the electric power industry

In fiscal 2013, we exercised our collective strengths and gave the highest priority to the particularly urgent issues of improving the safety of light water reactors and developing natural disaster countermeasures. These efforts are aimed at ensuring a stable supply of the power that supports the foundations of Japan's society and economy.

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 carried out research and development on safety assessments for external natural events such as earthquakes and tsunami as well as severe accident countermeasures. We also pursued research on analysis of risk factors in the institutional environment surrounding the electric power industry.

- Standard seismic movement and tornado impact assessments for safety evaluations of nuclear power plants
- Development of seismic-resistant designs for foundations and surrounding slopes of nuclear power plants
- Establishment of methodologies to evaluate fires in nuclear power facilities
- Identification of risks in institutional design for electric power industry associated with power system reform

(2) Further improvement of facility operations and maintenance technologies

We developed the maintenance and management technology needed for the stable operation of nuclear power plants, and the technology supporting the construction, operation and maintenance of thermal and hydro power plants, as well as electric power transmission and distribution facilities.

- Incorporation of testing methods related to evaluations of the structural integrity of light water reactors in codes and standards

- Development of a method to predict remaining life until cracks initiate in high chromium steel pipes
- Development of method to evaluate remaining insulation performance of aged CV cables

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

We worked on the development of next-generation technology and storage battery system technology to facilitate the introduction of renewable energy into the power system. In addition, we developed technology for thermal power generation for the effective use of unutilized resources.

- Development of collaborative control technology for existing power sources and storage batteries when solar power is introduced on a large scale
- Development of an evaluation technique of the performance degradation of lithium-ion batteries for use in power grid stabilization.
- Development of an effective coal blending method for use with resources (coal that is difficult to grind) not yet used as fuel at coal-fired thermal power plants

(Refer to “I. Research Activities” for details.)

■ **Reduction of R&D budget by canceling and postponing some research plans**

As a result of temporary reductions in benefit income in fiscal 2013, CRIEPI reconfirmed the priority level of all of its research plans and facility introduction plans, and decided to cancel or postpone some of these plans, while monitoring the impact (risk) that this could have on future research projects.

Specifically, we canceled or postponed parts of research on power uprates of nuclear power plants, research on geological environment assessments at high-level radioactive waste disposal sites, research on refining systems for dry gas in IGCC in the future, the development of functional materials such as SiC power semiconductors, and research on next-generation hard technology in anticipation of future facility updates and innovations at power distribution facilities.

We also postponed plans to introduce and update large-scale research facilities such as the enhancement of a large-scale vibrating table and a detailed design for a Material Analysis Research Building (tentative name).

(Refer to “I. Research Activities—3. Research Promotion” for details.)

■ Thorough streamlining of operations across all research activities

CRIEPI appointed an operations rationalization director, and endeavored to cut operating costs across all research activities by reviewing operations, adjusting environmental improvements and ensuring competitive bidding.

In conjunction with this, we took measures to rein in personnel costs with a 30% reduction in executive compensation, the elimination of one executive director position and a

10% reduction in senior officers' and general employees' salaries. In addition, we reexamined the need for research and operations and also took steps such as suspending the employment of temporary contract employees in order to reduce the workforce to about 800 by the end of fiscal 2015.

We finalized the plans to focus research at the research bases in the Yokosuka area and the Abiko area with the aim of strengthening research capacity for the future and cutting fixed management costs. We also made steady progress in setting up related facilities. Accordingly, we are raising funds to set up these research bases by selling some of the land in the Komae area.

(Refer to "I. Research Activities," "II. Administration" 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 2013, CRIEPI pursued research with the aim of building a robust and flexible energy supply/demand infrastructure that will ensure a stable supply of power to support the foundation of Japan's socio-economic activities. In particular, we focused our collective strengths 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 2013.

1. Priority subjects and priority subjects with limited terms

CRIEPI identified 32 priority subjects for its research, selected as those the technologies that will be most dispensable to the electric power industry at present and in the future, on which to focus its efforts and maintain, continue or expand.

We identified 10 priority subjects with limited terms from among these priority subjects as particularly urgent issues that must be resolved quickly through the Institute's collective strengths, and produced timely 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

With the aim of reducing and managing risks in stability of electricity supply, CRIEPI evaluates the impacts of socioeconomic changes and natural external events on the electric power industry, and addresses subjects that offer solutions, including social systems and frameworks.

Specifically, we addressed subjects related to enhancing the safety of light water reactors and identifying radiation risks, which are urgent issues for the electric power industry. We also conducted research contributing to natural disaster countermeasures at electric power facilities and research on ways of supporting radioactive waste disposal operations. We also carried out research on evaluation and proposal of energy and environmental policies that can achieve social consensus from a scientific and objective perspective.

Nuclear power plant safety

- Evaluation of LWR System Safety: We modified the analytical model for the hydrogen leak from the nuclear reactor containment vessel into the boiling water reactor (BWR) building in the event of an accident. The modified model accounts for the practical structure of side wall apertures such as blowout panels.

- Assessment of natural hazards to nuclear facilities: With the aim of developing a method to evaluate asperities (an area on an earthquake source fault at which strong seismic movements occur when the fault slips) from active fault information obtained on the ground surface, we examined the extent of the asperities in past earthquakes with long dislocations, as well as slippage and ground surface displacement, and identified a high correlation. Moreover, in order to identify characteristics of the shape of the edges of the earthquake source fault, we analyzed the deformations in the sedimentary rock layer at the 1964 Niigata Earthquake's source area (in marine waters) and estimated the shape of the fault's deep areas.
- Fragility assessment of nuclear facilities against external natural phenomena: Concerning the evaluation of ground failure in the event of an earthquake, we contributed to rational anti-seismic design of slopes by developing a non-linear analysis method that can be used not only to evaluate rupture occurrence, but also the rupture location by applying this method to nuclear power plant sites. In addition, we developed and introduced a large-scale tsunami physical simulator for tsunami safety evaluation tests on nuclear power plant facilities.
- Development of environmental diffusion evaluation methods and long-term behavior of radioactive materials: We added a function enabling the external radiation exposure resulting from surface deposition to be evaluated to the atmospheric diffusion model, which evaluates the diffusion behavior of radioactive substances that have been released, and developed a method for predicting external radiation exposure caused by the release of radioactive substances.
- Establishment of methodologies to evaluate fires in nuclear facilities: In order to develop measures to mitigate the impact of fire at nuclear power plants, we established a method for implementing automatic fire extinguishing systems for fires within cable trays and confirmed its effectiveness in fire verification tests. We also carried out internal arc fire experiments on high-voltage power panels, and evaluated condition values (arc energy thresholds) to prevent fires from developing after arcs occur.

Radiation risk

- Quantitative evaluation of low-dose radiation risk and reflection to radiation protection systems: In order to identify the impact of radiation exposure on cancer risks, we developed an experimental method in which we can trace whether the damaged tissue stem cells are removed from the organism or not. We confirmed the method's effectiveness by a series of preliminary experiments measuring the survival rate of tissue stem cells after 0-4Gy exposure.

Nuclear fuel cycle and backend technologies

- Systematization of long-term safety evaluation for radioactive waste disposal: We developed a method to highly accurately measure the hydraulic conductivity of Ca-type

bentonite composite soil, which is expected to be used as an engineered barrier material, in order to quantitatively assess the important parameters in safety evaluations for near surface concrete pit disposal facilities.

- Development of long-term storage/management technologies for spent fuel: With the aim of establishing a method to measure the salt concentration on the canister surface, which causes stress corrosion cracking (SCC), we planned and created a prototype of a device that is inserted in the narrow space between the canister and the concrete container and uses lasers to obtain remote measurements. We confirmed that salt concentration measurements are possible in actual application environments.

Natural disaster reduction on transmission and distribution facilities

- Development of prediction methods of weather/climate affection to electric power facilities: Using meteorological analytical data from the past 50 years, we developed a method that clarifies the characteristics of regions in which major tornadoes occur as a result of massive cumulonimbus and can evaluate the tornado hazards in regions in which nuclear power plants are sited. As a result, we were able to evaluate the tornado-borne missile speeds required in the screenings determining compliance with new regulations for nuclear power plants.
- Demonstration of preventive and mitigating measures against snowstorm damage to transmission and distribution facilities: By considering insolation, the generation of heat on electric lines, and the moisture content of accreted snow, we refined the dynamic simulation code for snow accretion that we developed so that it can evaluate the melting and dropout of snow accretion, and made it possible to exhaustively evaluate snow accretion phenomenon. We also set up full-scale test facilities for snow-storm damage to overhead transmission lines in Kushiro, Hokkaido and began operations with the aim of observing strong winds, the accretion of damp snow and galloping.
- Risk management against lightning: We accomplished the significant improvement of ~~the~~ computational speed of the VSTL REV (Virtual Surge Test Laboratory, Restructured and Extended Version), a program that estimates and analyzes the electromagnetic field phenomenon through lightning strikes on buildings with a high degree of precision. As a result, we made it possible to estimate electromagnetic field phenomena resulting from lightning strikes on multiple structures, which had previously been difficult to analyze electromagnetic field phenomena on those structures, and to establish effective lightning protection measures for electric equipment inside buildings.

Energy and environment institutions

- Well-functioning electricity market and neutralization of network: We examined the capacity market, which is being introduced in Europe and the US to ensure adequate supply following the transmission unbundling and liberalization of the electricity market. Specifically, we analyzed the characteristics of UK's centralized capacity market and France's decentralized capacity market, and identified the issues to be considered when introducing a capacity market in Japan.
- Analyses of energy saving and environment institutions from the point of view of economics and energy security: We surveyed measures to control levies on a sharp rise in photovoltaic (PV) power generation in the five countries that are part of Europe's feed-in tariff (FIT) program (Germany, Italy, Spain, France, England). As a result, we confirmed that in all of these countries, purchase prices have fallen significantly, purchase prices are revised more frequently and quantitative regulations are implemented. This provided suggestions for revisions to FIT, which is to be introduced in Japan in fiscal 2015.
- Scientifically and economically rational scenarios to reduce CO_2 emissions: Using an integrated assessment model developed by CRIEPI, we evaluated multiple CO_2 emission reduction scenarios with different amounts of biomass resources under the condition that the temperature rises is limited below 2℃. The evaluation showed that the targets of emissions reductions that should be achieved by 2050 considerably depends on the availability of bio-energy power generation with carbon capture and storage (BECCS) in the second half of the 21st century.

(2) Further improvement of facility operations and maintenance technologies

In order to provide technical support for the stable supply of electricity, we carried out research and development to improve the efficiency and economics of operation and maintenance of power generating facilities and electric transmission and distribution facilities.

Specifically, we will steadily develop multi-purpose supporting technology for the maintenance 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 plants and electric power transmission and distribution facilities.

Nuclear power plant maintenance

- Structural integrity evaluation of reactor pressure vessels and core internals: In cooperation with research institutions worldwide, we verified that miniature specimens, which can be taken from broken surveillance test specimens, can be used to evaluate the fracture toughness of reactor pressure vessel steels. We have revised the prediction code for irradiation embrittlement of reactor pressure vessel steels based on the analysis of the most recent surveillance test data irradiated to high fluences, and contributed to the revision of the Japan Electric Association Code.

- Integrity evaluation of LWR components and piping: We used the data of pipe wall thickness measurements for feed water piping of pressurized water reactor (PWR) plants to validate the prediction software for pipe wall thinning (FALSET), which CRIEPI developed. We were able to predict residual pipe wall thickness with a degree of accuracy within ±10% and thus confirmed that it has reached a practicable level.
- Integrity evaluation of cable insulation used in nuclear power plants: We statistically analyzed the evaluation results of the degradation characteristics of aged cables removed from nuclear power plants, and compared this to previously conducted degradation prediction based on accelerated aging tests. The results showed that degradation of cables in the actual environment was more gradual than indicated by degradation predictions based on accelerated aging tests thus far.
- Development of nondestructive inspection techniques for LWR components and piping: We applied our own unique phased array ultrasonic testing to SCC occurring on dissimilar metal welds, which are hard to damage using ultrasonic waves, and established a highly accurate method for measuring SCC depth.

Construction, operation and maintenance of power generation facilities

- Development of life assessment technology for high temperature structural components of high chromium steels: With the aim of improving the reliability of creep life assessment methods for high-chromium steel, we applied our life prediction model, which evaluates creep deformation and crack initiation time, to an internal pressure creep test on full-scale piping of high-chromium steel, and verified that the model is capable of evaluating those with sound accuracy.
- Development of comprehensive atmospheric assessment method for thermal power plants: We developed an atmospheric environmental assessment support tool applicable in a wide range of tasks, from preliminary environment impact assessments to the preparation of assessment reports for the construction, extension and replacement of thermal power plants. When source conditions (e.g., position and height of stacks, specifications of emission gas) are entered into the tool, the dispersion of emission gas in the atmosphere is calculated to draw a distribution of the dispersed gas concentration on a map.
- Development of techniques for conservation of biodiversity in construction and operation of electric power facilities: We developed a method for estimating the important species capable of living in the area targeted for the project, using lists of organisms living in the surrounding region, map information on vegetation, and information obtained in previous research on important species, in order to support the smooth implementation of biodiversity assessments and environmental conservation measures in environmental assessment reports written at the planning stage of the construction of electric power facilities.

- Synthesis system of numerical analysis for current and sediments in rivers and reservoirs: We applied the method for assessing slope stability we had developed to slopes that collapsed in the events of torrential rain in typhoons with unprecedented rainfall, and then confirmed its validity. We also developed a device for measuring turbidity and water quality in rivers and reservoirs in real time, and began tests to assess applicability in an actual river.

Operation and maintenance of transmission and distribution facilities

- Maintenance and management technologies of aged transmission and distribution facilities: We accumulated data on degradation characteristics for 20-60 kV CV cables that had been removed and clarified changes in remaining insulation performance by the cables age. By conducting tests in a wide range of conditions, maintenance and renewal standards based on remaining life estimates will be examined for specific conditions such as the cable laying environment.
- Development of soundness assessment technologies for aged transmission towers: We carried out exposure tests on members of a transmission tower in an oceanfront area to measure corrosion rate and identify spots that needs preferential inspection, and to clarify the internal corrosion speed depending on the placement (horizontal brace, diagonal brace) and the part of a steel pipe.

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

To minimize and overcome future risks, we addressed in advance issues in building a next-generation technical foundation that will enable greater efficiency and energy security in terms of both energy supply and energy use.

Specifically, we developed technology for the effective use of unused resources and low-grade resources in thermal power generation. In addition, we worked on developing technology such as 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, such as heat pumps.

Next-generation thermal power technologies

- Improvement of operation and control technologies to diversify fuel types for pulverized coal fired power plant: We proved the effectiveness of the in-furnace blended method in raising the percentage of low grindability coal mixed in with other coal. In this method, low grindability coal and other types of coal are pulverized separately, the former roughly and the latter finely, in order to inhibit the rise in grinding power, and are then combusted.
- Advancement of utilization technologies for low rank energy resources: With the aim of expanding the utilization of low-grade resources such as biomass, we evaluated the characteristics of mixed grinding for carbonized woody biomass with coal, which is

produced by the test facility for the carbonization of biomass. By carbonizing biomass, the grinding power for a 10% mixing rate was kept down to about 1.2 times a situation with no mixing (the grinding power is about three times with uncarbonized biomass), and confirmed that use at high rates of mixed combustion is possible.

Next-generation power grid technologies

- Power system security assessment with high penetration of photovoltaics: We carried out numerical simulation using CPAT (CRIEPI's Power System Analysis Tools) for various full-scale power system models in order to evaluate the impact on the system stability in the case of high PV penetration and wind power generation. The results show that the effects on the power system stability vary depending on the capacity and the position at which renewable energy power generation is introduced, and also on load flow and system fault conditions.
- Development of coordination system of power demand and supply in next generation: We developed a reactive power control method for PV power conditioners, which augment distribution line voltage regulators, as a countermeasure to voltage variations when PV is introduced on a large scale. Numerical simulation demonstrated that reducing the capacity of Static Var Compensators (SVCs), which are needed for regulation, can lower costs.
- Next-generation communications network systems: We built a prototype system to support more effective substation maintenance work using a wireless sensor network. This system makes it possible to easily and rapidly install sensors by working with the plug-and-play function. We have confirmed the actions of the system after sensor installation.
- Evaluation of the feasibility of demand response suitable for Japan: We surveyed the cost-benefit analyses regarding the smart meters carried out in major European countries which are also being adopted in Japan, and identified points of concern, such as the scope of applicable benefits (scope extending to benefits for consumers and social benefits), the impact of uncertainties (particularly the effect on energy conservation) and non-monetary benefits (creation of new services, etc.).

Energy utilization technologies

- Development and evaluation of advanced heat pumps: We introduced a test facility for the development and evaluation of heat pumps in industrial and commercial use, a facility to assess the performance of various heat pump models and prototypes, and began performance evaluation tests to identify the energy consumption efficiency of steam-generating heat pumps for industrial use.
- Establishment of evaluation technologies for high performance secondary batteries: We devised a simple technique for measuring the cathode and the anode potentials versus

lithium metal, individually. We applied it to analyze degradation factors of commercial-based lithium-ion cells. The results reveal several internal reactions occurring in the batteries, which is indispensable for the prediction of the remaining lifetime of the lithium-ion batteries.

2. Basic technology subjects

Basic technology subjects are those that we address with the aim of identifying and resolving issues faced by the electric power industry and strengthening our basic research skills, which are the source of our problem-solving, using our "pool of knowledge" consists of knowledge useful on the frontlines, personnel with advanced expertise, sophisticated research facilities and our overseas and domestic human network. Specifically, we built up data and knowhow through studies, experiments and measurements on site, developed, established and refined analytical methods and approaches, and conduced basic research to flesh out new concepts.

We continued to work closely with the government and electric power industry to address the accident in the Fukushima Daiichi nuclear power plants and aimed at resolving technical issues for reactor decommissioning utilizing our basic technology.

We designated 36 basic technology subjects in fiscal 2013 to capitalize on the strengths and specialized skills of eight laboratories with specific research fields. Our main results are outlined below.

Socio-economic Research Center:

The Socio-economic Research Center, in the face of significant structural changes in the socio-economic and energy environment, identified institutional issues with viable countermeasures for them which are relevant for creating and maintaining a robust and flexible electricity supply structure.

- We identified and analyzed institutional issues, such as the inadequacies in the process of reflecting scientific knowledge on regulations, as raised in the Case Study of the Investigation Framework by Nuclear Regulation Authorities on the Shatter Zones at the Tsuruga Power Station. As measures to resolve these issues, we proposed that organizations providing expert decisions, such as advisory groups, should be legalized and that the functions of risk assessment and risk management by nuclear regulatory authorities should be separated.
- We analyzed the impact of North American energy demand and supply on its LNG exports. Contrary to the widely prevalent expectation that exports will lower Japan's average import price of LNG by at least 10%, the results showed that the impact on prices is less than half of that expected, in the event that energy conservation in the US does not advance significantly or that their natural gas production stagnates.

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 distributed power sources. The laboratory also pursued research on the development, testing and assessment of customer service technologies that promote the efficient use of electricity.

- With the aim of ensuring system stabilization with the large-scale adoption of renewable energy, we compared the load frequency control developed by CRIEPI that collaboratively controls the existing power source and storage batteries to a method that only controls the storage battery. In tests using an actual system, we found that the storage battery capacity needed for frequency change control can be reduced significantly.
- To consider countermeasures for insufficient reserve capacity band the occurrence of surplus power resulting from the large-scale integration of renewable energy sources, we developed a prototype for a demand and supply operation simulator capable of generating supply/demand operation plans for power sources and storage facilities, and confirmed that a plan taking into account the output of renewable energy sources can be efficiently generated for one month.

Nuclear Technology Research Laboratory:

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

- In order to quantify the performance of containment filter vent system, which can depressurize a containment vessel during severe accidents, we evaluated decontamination factor of aerosol, iodine (I_2) and organic iodine (CH_3I) under atmospheric pressure for various accidental conditions. In addition, we designed and constructed a test facility which can be operating up to the rated pressure.
- With the aim of use in probabilistic risk assessments of nuclear power plants, we developed a database of common cause failures (CCF), which are one of the dominant risk factors, at Japanese nuclear power plants, and had this incorporated in the Nuclear Information Archives (NUCIA) of the Japan Nuclear Safety Institute so that all electric power companies could use it.
- We carried out dry-out tests using actual waste liquid to analyze the release behavior of radioactive nuclides when highly active liquid waste dries out, which is one of serious accidents at reprocessing plants. We determined the release rate of Ru, the primary radioactive nuclide released, and confirmed that this release rate can be reduced

significantly by adding sugar to the highly active liquid waste as reductant agent.

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.

- We estimated the ground earthquake vibration based on a boring survey and indoor core test for the 2004 Rumoi Earthquake, in which high-acceleration was recorded near the epicenter. The result was utilized as a reference for the “seismic motion formulated without a hypocenter” in the Review Meeting on Conformity to the New Regulatory Requirements. The result was also found to be at the same level as the seismic motion formulated by the former seismic design standards.
- We developed a framework for earthquake performance evaluation using finite element analysis together with characteristics of the evaluation method and the analytical modeling method, for concrete gravity dams and dam gates. Then we established a practical technical manual “Seismic Resistance Analysis and Verification Manual” to evaluate the safety performance in large-scale earthquakes.

Environmental Science Research Laboratory:

The laboratory pursued basic research on the atmosphere, coastal and marine environments, biology, chemistry and biotechnology for the siting and 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.

- With the aim of promoting the effective use of coal ash, we developed a method to simultaneously quantify in a short time the concentration of trace substances in the ash (selenium, arsenic, chromium) using X-ray Fluorescent analysis. This would be an effective technology in managing quality, and also makes it possible to quantify trace substances much faster and at a lower cost than previous methods.
- The heat-circulative wash (for used equipment) and energizing wash (for equipment in use) developed by CRIEPI for transformers contaminated with PCB acquired the technical evaluation from the Ministry of the Environment legally required for wash treatments.

Electric Power Engineering Research Laboratory:

The Electric Power Engineering Research Laboratory maintained and developed basic technologies related to electric power transmission and distribution equipment, including electrical insulation, high voltage technology, lightning protection, the electromagnetic environment and high current technology. The Laboratory also worked on basic and

fundamental research related to new electric power technologies, such as electromagnetic transition analysis methods, numerical analysis of arc failure, power electronics applications and laser applications.

- To develop a method to evaluate the deterioration of O-rings, which affects the reliability and life of substation facility such as gas-insulated switchgear, we developed a method to estimate the compression set rate (an indicator for the degradation in seal performance) from the use environment conditions, such as temperature, and physical values of O-ring rubber.
- In order to prevent public disasters and arc failures in electric power equipment from spreading to surroundings, we developed a numerical analysis model for pressure relief openings, wire meshes and metallic perforated plates, installed to control pressure rises in switchgears. We were able to carry out evaluations of pressure rises and propagation characteristics in switchgears using computational fluid dynamics method and the development numerical analysis model.

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.

- Miniature sample creep tests and metal temperature analysis of actual boiler tubes have been performed to accumulate reference data to form a reasonable judgment of the chemical cleaning interval. It was discovered that the chemical cleaning interval could be extended by forecasting the damaged condition of the boiler tube based on the actual operation data of the thermal power plant boiler.
- We evaluated the thermal efficiency improvement in the existing gas turbine combined cycle (GTCC) system when setting up a solid oxide fuel cell (SOFC), and found that thermal efficiency rose from 53% LHV to 69% at 1250 degrees Celsius class GTCC and from 59% to 71% at 1500 degrees Celsius class GTCC.

Materials Science Research Laboratory:

The laboratory conducted basic technology development related to materials used by the electric power industry, including understanding the mechanisms by which structural materials used in nuclear and thermal power generation are damaged and deteriorate, improving life prediction methods, developing new materials for energy conservation, and developing high-performance power semiconductors.

- Based on analyses of solar irradiation data, we proposed a new categorization of weather into four modes in terms of solar irradiance variability, and used it to discuss solar irradiance prediction needed to estimate PV power yields from sunshine duration

obtained from the AMeDAS data. These results are consistent with the previous empirical rules; this means that we expect to establish a method of easily estimating solar irradiances from the AMeDAS data.

- We developed an interatomic potential for atomistic-level computer simulations of chromium carbides in ferritic steels used in thermal plants. We also developed a computational tool to simulate the coarsening of chromium carbides at long-term operation of thermal plants.

3. Research Promotion

(1) Augment research plans by continuing to brush up plans

- We examined research and development in the electric power industry overall and established the "Issues Facing the Electric Power Industry," which clarifies the issues that need to be resolved, and the "Portfolio of Research Subjects," which lays out the actions that CRIEPI should take to resolve the issues. This clarified our role in research and development for the electric power industry and further augmented research plans.
- We strengthened communication with electric power companies through various research committees held by CRIEPI, gatherings for exchange of opinions and research societies. We thoroughly ascertained information and opinions at various levels, which enabled us to accurately reflect front-line needs in research plans and their implementation in a timely manner.

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

- Given ongoing cuts in research funding, we used ingenuity to resolve issues by, for example, finding the most effective and rational measure without being chained to previous initiatives and methods. We endeavored to strengthen our research structure by generating research results with high value through these initiatives. Moreover, given temporary reductions to benefit income, we cut costs thoroughly across all research activities by examining plans and reviewing specifications for all research facilities.
- In order to enhance the quality of our research results and remain accountable externally regarding our research activities, we had outside experts evaluate our research. We also conducted research value assessments on all of our research subjects based on the expected outcome, which ensured that our research plans were devised with a focus on cost effectiveness.

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

- In order to build the research foundation that is the source of our researching capacity and ensure that we help to solve the electric power industry's issues on an ongoing basis, we adjusted implementation schedules for the introduction of large-scale research facilities,

despite budget constraints. The main large-scale research facilities introduced in fiscal 2013 are as follows.

- Large-scale tsunami physical simulator: Used to evaluate safety of electricity facilities in the event of a tsunami
- Full-scale test facilities for snow-storm damage to overhead transmission lines: Used to closely study snow-storm damage to overhead transmission lines
- Advanced combustion test facility for diversification of available fuel types: Contributed to the diversification of fuel types and the reduction of fuel costs in coal-fired power stations
- Test facility for the carbonization of biomass: Used to develop carbonizing technology of biomass for mixed combustion use, in coal-fired thermal power
- Test facility for development and evaluation of heat pumps in industrial and commercial use: Used to evaluate performance of heat pumps for a range of applications

When introducing research facilities, we endeavored to cut costs by screening plans and utilizing competitive bids. We also put off plans to introduce some large-scale research facilities as a result of temporary cuts to revenue from benefit income.

- We strengthened collaboration with the electric power industry and improved the applicability of our results to the frontlines by carrying out research jointly with electric power companies and encouraging personal interaction with long-term dispatches, internships and training.
- We proactively pursued joint research and personal interaction with Japanese and overseas research institutes (such as the US-based Electric Power Research Institute, Électricité de France, Japan Atomic Energy Agency and the Marine Ecology Research Institute) in order to produce effective and advanced research results through mutually complementary scientific knowledge.

(4) Management and Utilization of Intellectual Property

- We endeavored to secure, maintain and utilize our intellectual property in order to make a significant contribution to the electric power industry as well as all electricity customers. In fiscal year 2013, we carefully reviewed all our overseas patents in terms of their cost effectiveness, then we abandoned some patents. Table 3 shows the number of patents we officially submitted and registered as well as the number of software applications registered in our institute.
- We have managed the security trade control under Japanese low and carried out extensive risk management, including the prevention of misconduct.
- We published the Annual Research Report for Fiscal Year 2012, and continued to offer a free download service for our research reports in order to encourage the broad use of our research output. We also published The Intellectual Property Report for Fiscal Year 2012,

which summarizes our actions for generating and utilizing our original intellectual property.

- We have proactively utilized our patents and software by providing them to external customers. We also strived to spread our knowledge to engineers in the front lines through technology-exchange courses and technology-lecture courses. Table 4 shows the number of patent rights and software licenses.
- As a non-profit academic research organization, we provided scientific data and contributed to the establishment of specifications, codes, standards and technical guidelines on energy and the environment by participating in many committees of government and academic societies. Table 5 shows our contributions to major codes, standards, and technical guidelines.

(5) Promotion of Funded Research

- We will give priority to funded research that meets the needs of the electric power industry, utilizing our technology, knowledge, staff, facilities and networks, and will generate and provide results in a timely and accurate manner. Given the harsh budget constraints, we endeavored to cut costs by adjusting the content and schedules of some research projects in consultation with the organization funding the research.
- In order to provide prompt and accurate solutions to the electric power industry, we organized examples of how our basic technology is used on the frontlines in the electric power industry in a “Catalog of Technology.” To encourage CRIEPI’s use, we highlighted our role as a contact point for resolving issues and introduced ourselves to electric power companies in a succinct manner.
- We facilitated the activities of the PD Center, which gives certification exams for experts of ultrasonic inspection working with nuclear power plant components, and also facilitated activities of the High Power Testing Laboratory, which performs short-circuit tests on electric power equipment.
- We undertook and implemented research funded by the government that meets our research strategies and that will contribute to the electric power industry through the establishment of specifications and strategies. Table 6 shows the main research projects for which CRIEPI received government funding.

Table 1: Number of Reports

	Research reports, etc.	Funded research	Total
Socioeconomics	28	1	29
Environment	28	21	49
Customer energy services	15	9	24
Power delivery	48	41	89
Nuclear power generation	54	40	94
Fossil fuel power generation	29	24	53
New energy	16	14	30
Information & communication	24	3	27
Construction and maintenance of electric power facilities	18	9	27
Advanced basic technologies	10	4	14
Total	270	166	436

(Number in fiscal year 2012)	271	158	429

Table 2: Number of Papers Reported

	Papers (Peer reviewed papers included above)
Socioeconomics	118 (25)
Environment	169 (62)
Customer services	135 (31)
Power delivery	87 (14)
Nuclear power generation	218 (40)
Fossil fuel power generation	304 (78)
Renewable energy power generation	136 (41)
Information & communication	66 (12)
Construction and maintenance of electric power facilities	48 (7)
Advanced basic technologies	120 (47)
Others	8 (3)
Total	1,409 (360)

(Number in fiscal year 2012)	1,559 (383)

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

	Patent right		Software Registration
	Application	**Registration**	
Socioeconomics	0	0	5
Environment	8	27	13
Customer services	8	2	12
Power delivery	9	20	21
Nuclear power generation	14	13	5
Fossil fuel power generation	9	24	7
Renewable energy power generation	3	8	1
Information & communication	4	7	4
Construction and maintenance of electric power facilities	8	14	5
Advanced basic technologies	18	24	0
Others	0	1	1
Total	81	140	74
(Number in fiscal year 2012)	130	144	67

Note: Number of patents held as of end-FY 2013: 795

Table 4: Number of licensed patents and licensed software applications

	Total	**(Number in** fiscal year 2012**)**
Number of licensed patents	19	20
Number of licensed software applications	312	357

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

Code, Standard, Technical Guideline, etc.	Organizations and Groups Concerned
Guidelines on the Disposal of Trace PCB Contaminated Waste Electrical Equipment: Washing Procedure Version	Ministry of the Environment
JEAC4201-2007Method of Surveillance Tests for Structural Materials of Nuclear Reactors (2013 Addition)	Japan Electric Association
JEAG4625-2014 Guidelines for Methodologies for Volcano Evaluations at Nuclear Power Plants	Japan Electric Association
JEAC4629-2014 Regulations for Technologies for Tsunami-resistant Design at Nuclear Power Plants	Japan Electric Association
JEAG/C4601 Regulations for Technologies for Aseismic Design at Nuclear Power Plants	Japan Electric Association
JEAC3704-2013 Regulations for Gas Turbines for Power Generation	Japan Electric Association
JEAC3712-2013 Ammonia Facility Regulations	Japan Electric Association
JEAG9702-2013 Guidelines on Harmonic Control Countermeasure Technologies	Japan Electric Association
A Standard for Ensuring the Quality of Probabilistic Risk Assessment at Nuclear Power Plants	Atomic Energy Society of Japan
A Standard for Procedures of Probabilistic Risk Assessment of Nuclear Power Plants during Power Operation (Level 1 PRA)	Atomic Energy Society of Japan
Japan Health Physics Society Guidelines “Dose Control Method for Internal Exposure”	Japan Health Physics Society
Outline of Sluice Gate Management	Electric Power Civil Engineering Association
IEC 61786-1 Ed.1.0 Measurement of DC magnetic, AC magnetic and AC electric fields from 1 Hz to 100 kHz with regard to exposure of human beings; Part 1: Requirements for measuring instruments	IEC/TC106 Japan National Committee

Table 6: Main funded research commissioned by government

Name	Source of commission
Survey of Geological Disposal of Technology (Development of Technology for Evaluation and Verification of Migration of Groundwater in Bedrock)	Ministry of Economy, Trade and Industry
Initiative for Safety Measure Improvement and Technical Basis Development for Nuclear Power Plants (Improving Analytical Methods for Thermal Hydraulics Phenomenon in Fuel Exposure Process)	Ministry of Economy, Trade and Industry
Initiative for Safety Measure Improvement and Technical Basis Development for Nuclear Power Plants (Establishment of Technical Foundation for Performance Evaluation of Filter Vents)	Ministry of Economy, Trade and Industry
Survey on Countermeasures for Global Warming (Survey on International Trends in Global Warming [United Nations Framework Convention on Climate Change, UNFCCC])	Ministry of Economy, Trade and Industry
Consideration of Recent Trends and Spread of Biomass Energy in Asia	New Energy and Industrial Technology Development Organization
Technology development for SOFC commercialization promotion / Basic study on rapid evaluation method of SOFC durability	New Energy and Industrial Technology Development Organization
Project on revolutionary coal gasification power generating plant with zero emissions; Basic research project on revolutionary gasification technology; Research on basic technology to develop high efficiency oxy-fuel IGCC	New Energy and Industrial Technology Development Organization
Electrolytic Reduction Tests for Fuel Debris	Japan Atomic Energy Agency
Development of heating method for methane hydrate recovery using CO_2 /water emulsion	National Institute of Advanced Industrial Science and Technology

II. Administration

1. Extensive review of expenditures to cut costs

- In addition to firmly establishing the cost-cutting initiatives we have taken thus far, we appointed an operations rationalization director and identified areas with room for further cost-cutting. Specifically, we revised specifications for outsourced operations, reduced the rental area of buildings housing head office organizations and others, and curbed travel expenses for business trips by using video conferencing instead. As such we steadily reduced operating costs across all operations.
- We used competitive bidding in principle for outsourcing and procurement, and laid out specific guidelines in “Production and Outsourcing Requiring Data Continuity and Consistency” and “Maintenance and Management by Producers and Developers for Facilities, Equipment and Information Systems” as criteria for unavoidable negotiated contracts.
- We reexamined the priority of facility and environmental improvements in terms of their need and urgency, including plans whose implementation was postponed in fiscal 2012, and decided whether or not to go ahead with implementation. Specifically, we postponed some plans to repair deteriorating facilities, such as repairs to outer walls of buildings, and environmental maintenance measures until fiscal 2014.
- In light of higher fixed asset tax obligations resulting from the transition to the status of a general incorporated foundation, we proactively retired and disposed of idle facilities and unused assets, and sold the site of training facilities. We carefully examined the maintenance of facilities and assets that continue to be used, and endeavored to reduce maintenance costs.
- We streamlined the management system by reducing executive salaries by 30% and eliminating the position of one executive director. We also reduced the salaries of managerial employees and general employees by about 10%. We took measures to suspend the hiring of temporary contract employees. We also took measures to curb overall expenditures on welfare costs, such as closing directly-run resort facilities and shrinking the cafeteria plan program.

2. Establishing research bases in line with income and expenditures

- We established the research environment indispensable in maintaining and strengthening our research capacity for the future, and steadily established research bases to the Yokosuka and Abiko, which is aimed at reducing fixed management costs. We also sold some land in the Komae area (about 14,000 m^2 out of a total area of 58,000 m^2) to raise money to establish these bases.
  - In the Yokosuka area, which we aim to turn into a “technology research base for energy industry,” we completed the construction of the 7th Research Building for

common use and the Power Plant Thermal-Hydraulics Test Building, which the facilities will be relocated from the Komae area. In addition, we prepared temporary office for some employees of the Komae area who will use these facilities. We have begun advance consideration of the administrative procedures for the Materials Analysis Building (tentative name). We finalized the construction plans for the New Research Building (tentative name), where the Research Division employees transferred from the Komae area will work, and selected a designer using the proposal method.

- In the Abiko area, which is intended to be a "research base for nature and the environment," we carried out updates on air conditioning at the main building and annex and maintained and repaired other facilities as well in order to effectively utilize existing facilities and equipment.

- Beginning in fiscal 2015, the Administrative Support Center and Intellectual Property Center functions, currently located in the Komae area, will be consolidated with related groups in the head office, after which we will move integrated processing functions for standard, repetitive operations such as labor welfare, contracts, accounting and information systems to the Abiko area. We decided to disperse the intellectual property and research contract functions to the Yokosuka and Abiko areas with the aim of strengthening research support, and have begun considering the specific organizations and systems.

3. Encouraging personnel's job performance and hiring diverse staff in line with research development

- As part of our efforts to strengthen our personal support for personnel, we offered ongoing opportunities for all employees to talk one-on-one with the Human Resources Division. We also developed an electronic system to consolidate personal information to contribute to ongoing HR training and utilization. We utilized the deputy associate vice president position established in fiscal 2012 to hire research personnel quickly. In administrative work, we endeavored to utilize personnel by giving more titles identifying responsibilities (research management manger, intellectual property manager, etc.).
- In order to hire diverse researchers with the kind of sophisticated expertise that enables them to begin contributing immediately, we decided to introduce the "special limited-term research position" beginning in fiscal 2014. This program will have the same benefits and responsibilities as an employee, and personnel in these positions can become employees if they meet certain conditions.

4. Strengthen dissemination of research results to enhance CRIEPI's value

- We transmitted research results in a timely manner in accordance with developments in energy policy, such as electricity system reforms, and also shared scientifically objective information on natural disasters and Low-Dose Radiation.
- In May 2013, we held the "Research Results Presentation 2013" to introduce CRIEPI research activities related to ensuring the reliability of thermal power generation and distribution facilities supporting the stable supply of electric power. Moreover, we published research results produced with our advanced expertise and collective strengths in an easy-to-understand way in CRIEPI TOPICS and other publications (in Japanese).
- In addition to focusing on compiling information from power companies and outside experts so that our publicity activities are in line with the electric power industry's needs and external conditions, we continued to provide information of our own to strengthen this coalition.

5. Sound and rigorous pursuit of business operations

- We continued efforts to strengthen governance and risk management and establish and improve compliance awareness among executives and regular employees, and ensured sound and rigorous administration with autonomy.
- We strengthened our IT-BCP (Business Continuity Plan) to prepare for large-scale natural disasters. For example, we developed a remote back-up system for all shared operating systems and a cloud back-up environment for research and administrative data.
- We steadily pursued our Plan on Expenditures for Public Benefit through the activities described in this report. This plan is expected to be completed in fiscal 2014.
- Please refer to the next page regarding our system for ensuring that directors comply with laws and articles of incorporation and our system for 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 maintained the current number of research staff, while slightly reducing the staff in administrative appointments in order to streamline operations and better utilize human resources. This was 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.

We carefully examined the number of employees needed to expand projects in the future and their composition, as well as the number of employees needed for each research project and operations, and then suspended the employment of temporary contract employees as part of our efforts to reduce the workforce.

The workforce as of March 31, 2014, was as follows.

Item	Numbers	Percentage distribution (%)
1. Research	722 *Including 30 visiting researchers	88.0
(Breakdown according to field)		(100.0)
(1) Electrical Engineering	106	14.7
(2) Civil Engineering and Architecture	98	13.6
(3) Mechanical Engineering	98	13.6
(4) Chemistry	67	9.3
(5) Biology	56	7.7
(6) Nuclear Engineering	54	7.4
(7) Environmental Science	38	5.3
(8) Information and Communication	37	5.1
(9) Socio-economics	49	6.8
(10) Research Support and Management	119	16.5
2. Office work	98	12.0
Total	820	100

IV. Meetings held

1. Board of Councilors

Date held	Agenda
June 14, 2013 (No. 5)	1. Approval of report on research activities in FY2012 2. Approval of report on settlement of accounts in FY2012 3. Presentation of Report on Implementation of Public Interest Expenditures Plan 4. Election of councilors, vice presidents and general auditors
August 21, 2013 (No. 6)	1. Election of councilors, vice presidents and general auditors
September 30, 2013 (No. 7)	1. Decision on decrease in ongoing donations in FY2013 2. Approval of Changes to Research Plan in FY2013 3. Approval of Changes to Statement of Budget in FY2013
March 14, 2014 (No. 8)	1. Decision on decrease in ongoing donations in FY2014 2. Approval of Research Plan in FY2014 3. Approval of Statement of Budget in FY2014

2. Board of Directors

Date held	Agenda
May 30, 2013 (No. 5)	1. Reports on research activities in FY2012 (Draft) 2. Statement of Budget in FY2012 (Draft) 3. Report on Implementation of Public Interest Expenditures Plan (Draft) 4. Report on performance of job functions by President, Executive Vice President, and Managing Directors 5. Election of councilors, vice presidents and general auditors 6. Decision to convene regular Board of Councilors
June 14, 2013 (No. 6)	1. Election and division of responsibilities for executive president, executive directors, standing directors and vice presidents 2. Election of important employees 3. Payment of allowance for retirement benefits for directors
August 5, 2013 (No. 7)	1. Election of councilors, vice presidents and general auditors
September 10, 2013 (No. 8)	1. Decrease in ongoing donations in FY2013 2. Changes to FY2013 research plans 3. Changes to FY2013 statement of budget 4. Changes in division of responsibilities for managing directors 5. Abridgment of decisions by Board of Councilors

Date held	Agenda
March 6, 2014 (No. 9)	1. Decrease in ongoing donations in FY2014 2. Research Plan in FY2014 3. Statement of Budget in FY2014 4. Report on performance of job functions by President, Executive Vice President, Standing Director and Managing Directors 5. Decision on convening Board of Councilors

Settlement of Accounts

Outline of Settlement of Accounts

Net property at the end of fiscal 2013 was 41.11 billion yen, 4.26 billion higher than the end of the previous fiscal year.

1. Financial statements

(1) Assets condition

Total assets amounted to 56.82 billion yen, up 6.29 billion yen over the end of the previous fiscal year. The growth in assets can be attributed to a 360 million yen increase in cash and deposits, 5.99 billion yen in reserves of special assets to establish bases in the Abiko and Yokosuka areas funded by proceeds from the partial sale of the Komae area, and a 2.06 billion yen increase in other fixed assets, such as research assets. At the same time, the decrease in assets was due to a 3.4 billion yen difference between the amount in special assets for research facility acquisition allowance and the amount used.

(2) Liabilities condition

Liabilities totaled 15.71 billion yen, up 2.02 billion yen over the end of the previous fiscal year. This was due to a 1.74 billion increase in accrued liabilities due to the increase in the acquisition of research facilities at the end of the fiscal year compared to the previous fiscal year.

(3) Net assets condition

Net assets amounted to 41.11 billion yen at the end of the fiscal year, consisting of 40.36 billion yen in general net assets and 740 million yen in designated net assets.

2. New assets increase/decrease calculation sheet

(1) Changes in general net assets

- Ordinary revenue was down 2.35 billion yen over the previous fiscal year to 26.47 billion yen. Current donations decreased 2.71 billion over the previous fiscal year to 23.56 billion yen due to temporary reductions made as a result of the rapid deterioration in electric power companies' financial conditions. In addition, revenue from research projects funded by the government rose 420 million yen to 2.02 billion yen.
- Ordinary expenditure fell 440 million yen compared to the previous fiscal year to 28.42 billion yen. This decrease can be attributed to revisions to project plans to compensate for the decline in revenue, and a drop in personnel expenses.
- As a result, the current change in ordinary revenue was a drop of 1.91 billion yen to a net decrease of 1.95 billion yen after a net decrease of 30 million yen in the previous fiscal year.
- Nonrecurring revenue was up 6.76 billion yen over the previous fiscal year to 6.36 billion yen due to the partial sale of the Komae area.

As a result, the current change in net assets was a net increase of 4.41 billion yen.

(2) Change in designated net assets

The change in designated net assets was a net decrease of 150 million yen, up 120 million yen over the previous fiscal year, due to a reduction in depreciation expenses for the special assets funding designated net assets.

I. Financial Statements

Balance Sheet

As of March 31, 2014

(Unit: yen)

Account	Current fiscal year	Previous fiscal year	Increase/ decrease
I. Assets section			
1. Current assets			
Cash and deposit	3,559,402,456	3,198,576,076	360,826,380
Securities	4,130,545	4,128,621	1,924
Account receivable	1,380,919,284	1,107,786,069	273,133,215
Suspense payable	32,556,830	125,794,742	△ 93,237,912
Advance payment	382,652,938	11,929,723	370,723,215
Total current assets	5,359,662,053	4,448,215,231	911,446,822
2. Fixed assets			
(1) Special assets			
Buildings	237,679,539	258,033,100	△ 20,353,561
Ancillary buildings	1,310,928	2,621,757	△ 1,310,829
Structures	2,059,385	2,672,890	△ 613,505
Machine and equipment	604,502,982	848,362,479	△ 243,859,497
Tools and furniture	48,138,006	22,315,542	25,822,464
Lump-sum depreciable assets	1,170,833	1,103,211	67,622
Intangible fixed asset	9,854,811	2,370,580	7,484,231
Special assets for retirement lump sum grants benefits package allowance	3,435,900,000	3,435,900,000	0
Specific assets for reserves for acquisition of research facilities	4,300,000,000	7,700,000,000	△ 3,400,000,000
Special assets for special project reserves	1,450,000,000	500,000,000	950,000,000
Specific assets for purpose of setting up bases	5,997,134,033	0	5,997,134,033
Total special assets	16,087,750,517	12,773,379,559	3,314,370,958
(2) Other fixed assets			
Land	8,553,518,118	8,698,562,302	△ 145,044,184
Building	10,935,609,058	9,350,481,451	1,585,127,607
Ancillary buildings	3,337,535,463	2,493,596,502	843,938,961
Structure	1,270,091,960	1,236,471,797	33,620,163
Machine and equipment	8,228,664,436	6,420,885,983	1,807,778,453
Tools and furniture	1,893,042,321	2,095,109,876	△ 202,067,555
Rolling stock and vehicles	50,266,593	12,313,186	37,953,407
Lump-sum depreciable assets	43,887,715	40,826,810	3,060,905
Intangible fixed asset	632,801,125	538,429,909	94,371,216
Construction in process account	435,894,090	2,387,225,600	△ 1,951,331,510
Long-term prepaid expenses	0	41,074,011	△ 41,074,011
Total other fixed assets	35,381,310,879	33,314,977,427	2,066,333,452
Total fixed assets	51,469,061,396	46,088,356,986	5,380,704,410
Total assets	56,828,723,449	50,536,572,217	6,292,151,232
II. Liability section			
1. Current liability			
Accrued liability	5,002,766,734	3,261,954,053	1,740,812,681
Money entrusted	86,984,059	96,862,107	△ 9,878,048
Advance receipt	176,181,067	193,116,472	△ 16,935,405
Accrued bonus	253,000,000	355,000,000	△ 102,000,000
Total current liability	5,518,931,860	3,906,932,632	1,611,999,228
2. Fixed liabilities			
Allowance for retirement benefits for directors	440,000,000	399,000,000	41,000,000
Accrued retirement benefits for employees	9,757,000,000	9,383,000,000	374,000,000
Total fixed liabilities	10,197,000,000	9,782,000,000	415,000,000
Total liabilities	15,715,931,860	13,688,932,632	2,026,999,228

Account	Current fiscal year	Previous fiscal year	Increase/ decrease
III. Net assets section			
1. Designated net assets			
Special benefits	391,968,484	439,096,146	△ 47,127,662
Cash subsidy	233,626,138	359,144,296	△ 125,518,158
Cash contribution	123,630,812	105,551,220	18,079,592
Total designated net assets	749,225,434	903,791,662	△ 154,566,228
(Including appropriation to special assets)	(749,225,434)	(903,791,662)	(△ 154,566,228)
2. General net assets	40,363,566,155	35,943,847,923	4,419,718,232
(Including appropriation to special assets)	(11,902,625,083)	(8,433,687,897)	(3,468,937,186)
Total net assets	41,112,791,589	36,847,639,585	4,265,152,004
Total of liability and net assets	56,828,723,449	50,536,572,217	6,292,151,232

Net Assets Increase/Decrease Calculation Sheet

From Aril 1, 2013 to March 31, 2014

(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	23,565,000,000	26,279,193,000	△ 2,714,193,000
[2] Operating revenue	(2,474,101,545)	(1,993,405,373)	(480,696,172)
Funded research operating revenue	2,024,089,394	1,604,054,329	420,035,065
Other operating revenue	450,012,151	389,351,044	60,661,107
[3] Other revenue	(126,043,356)	(132,464,361)	(△ 6,421,005)
Interest received	7,604,783	7,924,914	△ 320,131
Facility usage fee received	80,880,097	86,093,236	△ 5,213,139
Miscellaneous revenue	37,558,476	38,446,211	△ 887,735
[4] Transfer from designated net assets	311,725,606	427,910,683	△ 116,185,077
Total current revenue	26,476,870,507	28,832,973,417	△ 2,356,102,910
(2) Current expenditure			
[1] Project cost			
Personnel expenditure	(9,302,895,324)	(10,554,932,001)	(△ 1,252,036,677)
Salary and benefit	6,811,565,964	7,385,550,520	△ 573,984,556
Retirement benefit expenditure	1,534,742,318	2,185,853,040	△ 651,110,722
Welfare expenditure	956,587,042	983,528,441	△ 26,941,399
Expenditure	(17,254,719,198)	(16,331,472,915)	(923,246,283)
Supplies expenses	1,771,746,908	1,551,266,522	220,480,386
Printed material expenses	320,817,102	389,732,830	△ 68,915,728
Fuel, light, and water expenses	881,012,127	764,222,810	116,789,317
Expenses for commission	5,353,779,137	5,255,239,229	98,539,908
Collaboration research contribution	677,418,837	494,983,544	182,435,293
Repair expenses	1,432,415,664	1,240,933,863	191,481,801
Rental rate	250,595,187	283,497,208	△ 32,902,021
Tax and public charge	335,690,817	91,210,730	244,480,087
Travel and transport expenses	636,858,970	656,743,357	△ 19,884,387
Communication and transportation expenses	91,915,907	92,366,634	△ 450,727
Other expenditure	781,067,328	540,555,971	240,511,357
Depreciation allowance	4,721,401,214	4,970,720,217	△ 249,319,003
Subtotal of project cost	26,557,614,522	26,886,404,916	△ 328,790,394
[2] Administrative expenses			
Personnel expenditure	(1,076,034,436)	(1,160,323,775)	(△ 84,289,339)
Board members' salary	142,705,000	153,450,000	△ 10,745,000
Salary and benefit	581,649,898	602,898,980	△ 21,249,082
Retirement benefit expenditure	120,858,888	159,482,836	△ 38,623,948
Welfare expenditure	138,100,650	147,491,959	△ 9,391,309
Allowance for retirement benefits for directors transfer	92,720,000	97,000,000	△ 4,280,000
Expenditure	(793,224,716)	(820,784,224)	(△ 27,559,508)
Supplies expenses	14,580,195	9,853,753	4,726,442
Printed material expenses	39,274,949	47,104,504	△ 7,829,555
Fuel, light, and water expenses	32,893,152	34,654,296	△ 1,761,144
Expenses for commission	123,918,659	148,730,694	△ 24,812,035
Repair expenses	15,633,696	12,300,538	3,333,158
Rental rate	361,610,564	369,436,177	△ 7,825,613
Tax and public charge	32,689,103	11,476,455	21,212,648
Travel and transport expenses	24,883,175	25,753,331	△ 870,156

Account	Current fiscal year	Previous fiscal year	Increase/decrease
Communication and transportation expenses	8,069,111	10,119,664	△ 2,050,553
Other expenditure	100,225,129	111,739,142	△ 11,514,013
Depreciation allowance	39,446,983	39,615,670	△ 168,687
Subtotal of administrative expenses	1,869,259,152	1,981,107,999	△ 111,848,847
Total current expenditure	28,426,873,674	28,867,512,915	△ 440,639,241
Current ordinary increase/decrease	△ 1,950,003,167	△34,539,498	△ 1,915,463,669
2. Nonrecurring increase/decrease section			
(1) Nonrecurring profit			
[1] Fixed asset donated profit			
Facility donated profit	6,436,400	21,140,000	△ 14,703,600
[2] Gain from sale of fixed assets			
Gains on sale of land and other	6,553,046,014	205,938	6,552,840,076
[3] Transfer from designated net assets	0	6,137,246	△ 6,137,246
Total nonrecurring profit	6,559,482,414	27,483,184	6,531,999,230
(2) Nonrecurring expenses			
[1] Loss on sale of fixed assets			
Loss on sale of tools and furniture	189,746,896	419,245,269	△ 229,498,373
[2] Losses on sale of fixed assets			
Losses on sale of facilities and other	14,119	0	14,119
Total nonrecurring expenses	189,761,015	419,245,269	△ 229,484,254
Current nonrecurring increase/decrease	6,369,721,399	△391,762,085	6,761,483,484
Current ordinary net asset increase/decrease	4,419,718,232	△426,301,583	4,846,019,815
Ordinary net asset beginning balance	35,943,847,923	36,370,149,506	△ 426,301,583
Ordinary net asset final balance	40,363,566,155	35,943,847,923	4,419,718,232
II. Designated net asset increase/decrease section			
[1] Cash subsidy received			
Subsidy received	95,658,920	128,148,715	△ 32,489,795
[2] Fixed asset donated profit			
Facility donated profit	61,500,458	22,104,699	39,395,759
[3] Transfer to ordinary net assets	311,725,606	434,047,929	△ 122,322,323
Current designated net assets increase/decrease	△ 154,566,228	△283,794,515	129,228,287
Designated net assets beginning balance	903,791,662	1,187,586,177	△ 283,794,515
Designated net assets final balance	749,225,434	903,791,662	△ 154,566,228
III. Net assets final balance	41,112,791,589	36,847,639,585	4,265,152,004

Breakdown of Net Assets Increase/Decrease Calculation Sheet

From Aril 1, 2013 to March 31, 2014

(Unit: yen)

Account	Project total Ongoing projects (*)	Corporate total	Total
I. General net assets increase/decrease section			
1. Current increase/decrease section			
(1) Current revenue			
[1] Benefit received			
Current benefit received	0	23,565,000,000	23,565,000,000
[2] Operating revenue	(2,474,101,545)	(0)	(2,474,101,545)
Funded research operating revenue	2,024,089,394	0	2,024,089,394
Other operating revenue	450,012,151	0	450,012,151
[3] Other revenue	(110,608,358)	(15,434,998)	(126,043,356)
Interest received	0	7,604,783	7,604,783
Facility usage fee received	76,130,461	4,749,636	80,880,097
Miscellaneous revenue	34,477,897	3,080,579	37,558,476
[4] Transfer from designated net assets	311,725,606	0	311,725,606
Total current revenue	2,896,435,509	23,580,434,998	26,476,870,507
(2) Current expenditure			
[1] Project cost			
Personnel expenditure	(9,302,895,324)	(0)	(9,302,895,324)
Salary and benefit	6,811,565,964	0	6,811,565,964
Retirement benefit expenditure	1,534,742,318	0	1,534,742,318
Welfare expenditure	956,587,042	0	956,587,042
Expenditure	(17,254,719,198)	(0)	(17,254,719,198)
Supplies expenses	1,771,746,908	0	1,771,746,908
Printed material expenses	320,817,102	0	320,817,102
Fuel, light, and water expenses	881,012,127	0	881,012,127
Expenses for commission	5,353,779,137	0	5,353,779,137
Collaboration research contribution	677,418,837	0	677,418,837
Repair expenses	1,432,415,664	0	1,432,415,664
Rental rate	250,595,187	0	250,595,187
Tax and public charge	335,690,817	0	335,690,817
Travel and transport expenses	636,858,970	0	636,858,970
Communication and transportation expenses	91,915,907	0	91,915,907
Other expenditure	781,067,328	0	781,067,328
Depreciation allowance	4,721,401,214	0	4,721,401,214
Subtotal of project cost	26,557,614,522	0	26,557,614,522
[2] Administrative expenses			
Personnel expenditure	(0)	(1,076,034,436)	(1,076,034,436)
Board members' salary	0	142,705,000	142,705,000
Salary and benefit	0	581,649,898	581,649,898
Retirement benefit expenditure	0	120,858,888	120,858,888
Welfare expenditure	0	138,100,650	138,100,650
Allowance for retirement benefits for directors transfer	0	92,720,000	92,720,000
Expenditure	(0)	(793,224,716)	(793,224,716)
Supplies expenses	0	14,580,195	14,580,195
Printed material expenses	0	39,274,949	39,274,949
Fuel, light, and water expenses	0	32,893,152	32,893,152
Expenses for commission	0	123,918,659	123,918,659
Repair expenses	0	15,633,696	15,633,696
Rental rate	0	361,610,564	361,610,564

Account	Project total	Corporate total	Total
	Ongoing projects (*)		
Tax and public charge	0	32,689,103	32,689,103
Travel and transport expenses	0	24,883,175	24,883,175
Communication and transportation expenses	0	8,069,111	8,069,111
Other expenditure	0	100,225,129	100,225,129
Depreciation allowance	0	39,446,983	39,446,983
Subtotal of administrative expenses	0	1,869,259,152	1,869,259,152
Total current expenditure	26,557,614,522	1,869,259,152	28,426,873,674
Current ordinary increase/decrease	△ 23,661,179,013	21,711,175,846	△ 1,950,003,167
2. Nonrecurring increase/decrease section			
(1) Nonrecurring profit			
[1] Fixed asset donated profit			
Facility donated profit	6,436,400	0	6,436,400
[2] Gain from sale of fixed assets			
Gains on sale of land and other	6,512,884,939	40,161,075	6,553,046,014
Total nonrecurring profit	6,519,321,339	40,161,075	6,559,482,414
(2) Nonrecurring expenses			
[1] Loss on sale of fixed assets			
Loss on sale of tools and furniture	184,367,878	5,379,018	189,746,896
[2] Losses on sale of fixed assets			
Losses on sale of facilities and other	14,119	0	14,119
Total nonrecurring expenses	184,381,997	5,379,018	189,761,015
Current nonrecurring increase/decrease	6,334,939,342	34,782,057	6,369,721,399
Current ordinary net asset increase/decrease	△ 17,326,239,671	21,745,957,903	4,419,718,232
Ordinary net asset beginning balance			35,943,847,923
Ordinary net asset final balance			40,363,566,155
II. Designated net asset increase/decrease section			
[1] Cash subsidy received			
Subsidy received	95,658,920	0	95,658,920
[2] Fixed asset donated profit			
Facility donated profit	61,500,458	0	61,500,458
[3] Transfer to ordinary net assets	311,725,606	0	311,725,606
Current designated net assets increase/decrease	△ 154,566,228	0	△ 154,566,228
Designated net assets beginning balance			903,791,662
Designated net assets final balance			749,225,434
III. Net assets final balance			41,112,791,589

(*) 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. 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.

(4) Account processing of consumption tax, etc.

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

2. Change in important account policy

There were no changes in important account policy.

3. 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	258,033,100	0	20,353,561	237,679,539
Ancillary buildings	2,621,757	0	1,310,829	1,310,928
Structures	2,672,890	0	613,505	2,059,385
Machine and equipment	848,362,479	3,500,000	247,359,497	604,502,982
Tools and furniture	22,315,542	48,634,672	22,812,208	48,138,006
Lump-sum depreciable assets	1,103,211	1,193,786	1,126,164	1,170,833
Intangible fixed assets	2,370,580	8,938,760	1,454,529	9,854,811
Special assets for reserves for lump-sum retirement benefits	3,435,900,000	0	0	3,435,900,000
Specific assets for reserves for acquisition of research facilities	7,700,000,000	900,000,000	4,300,000,000	4,300,000,000
Special assets for reserves for projects	500,000,000	950,000,000	0	1,450,000,000
Specific assets for purpose of setting up bases	0	5,997,134,033	0	5,997,134,033
Total	12,773,379,559	7,909,401,251	4,595,030,293	16,087,750,517

4. 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 previous period	(Including appropriation from designated net asset)	(Including appropriation from general net asset)	(Including liability relating item)
Building	237,679,539	(237,679,539)	-	-
Ancillary buildings	1,310,928	(1,310,928)	-	-
Structures	2,059,385	(1,197,680)	(861,705)	-
Machine and equipment	604,502,982	(449,873,637)	(154,629,345)	-
Tools and furniture	48,138,006	(48,138,006)	-	-
Lump-sum depreciable assets	1,170,833	(1,170,833)	-	-
Intangible fixed assets	9,854,811	(9,854,811)	-	-
Special assets for reserves for lump-sum retirement benefits	3,435,900,000	-	-	(3,435,900,000)
Specific assets for reserves for acquisition of research facilities	4,300,000,000	-	(4,300,000,000)	-
Special assets for reserves for projects	1,450,000,000	-	(1,450,000,000)	-
Specific assets for purpose of setting up bases	5,997,134,033	-	(5,997,134,033)	-
Total	16,087,750,517	(749,225,434)	(11,902,625,083)	(3,435,900,000)

5. Assets offered as collateral

No asset offered as collateral is recorded.

6. 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	(5,742,096,357)	(4,837,379,873)	(904,716,484)
Building	621,962,762	384,283,223	237,679,539
Ancillary buildings	131,084,924	129,773,996	1,310,928
Structures	28,268,470	26,209,085	2,059,385
Machine and equipment	4,840,218,324	4,235,715,342	604,502,982
Tools and furniture	106,381,811	58,243,805	48,138,006
Lump-sum depreciable assets	2,870,906	1,700,073	1,170,833
Intangible fixed asset	11,309,160	1,454,349	9,854,811
Other fixed asset	(105,193,073,559)	(78,801,174,888)	(26,391,898,671)
Building	20,669,781,391	9,734,172,333	10,935,609,058
Ancillary buildings	13,299,250,201	9,961,714,738	3,337,535,463
Structures	5,784,927,321	4,514,835,361	1,270,091,960
Machine and equipment	49,577,549,211	41,348,884,775	8,228,664,436
Tools and furniture	11,113,980,787	9,220,938,466	1,893,042,321
Rolling stock and vehicle	114,601,685	64,335,092	50,266,593
Lump-sum depreciable assets	126,624,365	82,736,650	43,887,715
Intangible fixed asset	4,506,358,598	3,873,557,473	632,801,125
Total	(110,935,169,916)	(83,638,554,761)	(27,296,615,155)

7. 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	1,380,919,284	0	1,380,919,284
Housing loans and welfare loans among special assets of accrued retirement benefits	25,880,000	0	25,880,000
Total	1,406,799,284	0	1,406,799,284

8. Contingent liabilities such as guarantee liabilities

A guarantee liability to employees housing loans is 1,838,958,409 yen.

9. 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.

10. 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	210,516,496	0	75,154,361	135,362,135	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	11,170,890	0	1,418,703	9,752,187	Designated net assets
• Project to promote introduction regional new energy in fiscal 2009	New Energy Promotion Council	2,482,602	0	364,942	2,117,660	Designated net assets
• Experimental study of next-generation energy transmission and distribution optimal control technology	Ministry of Economy, Trade and Industry	0	2,608,502	2,608,502	0	-
• Applicability survey of manufacturing technology for fly ash concrete not using cement	Ministry of Economy, Trade and Industry	0	18,913,999	18,913,999	0	-
• Research and development for Advanced Humid Air Turbine (AHAT) System	Ministry of Economy, Trade and Industry	0	2,778,000	2,778,000	0	-
• Experimental studies on next-generation two-way communication output control technology	Ministry of Economy, Trade and Industry	0	994,804	994,804	0	-
• Fiscal 2013 subsidies for project costs for development and verification of technology for solar power generation output projections	Ministry of Economy, Trade and Industry	0	3,998,495	3,998,495	0	-
Subsidies						
• R&D for SiC innovative power electronics to create a low-carbon society (super-thick membrane and multi-layer SiC epitaxial wafer technology)	Japan Society for the Promotion of Science	132,719,859	51,730,000	99,705,154	84,744,705	Designated net assets
• Research on impact of forest's watershed characteristics on hydroelectric power generation volume	National Land Afforestation Promotion Organization	1,117,937	2,119,504	3,237,441	0	-
• 2013 Review of measures for utilizations of micro hydro power generation in forestry areas	National Land Afforestation Promotion Organization	0	12,515,616	11,812,880	702,736	Designated net assets
• 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	1,136,512	0	189,797	946,715	Designated net assets
Total		359,144,296	95,658,920	221,177,078	233,626,138	

11. 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	209,810,053
Transfer by exception from specification as designated net asset	7,023,393
Transfer by implementing of project for which subsidy was received	94,892,160
Total	311,725,606

12. Trading content to related parties

No trading to related parties is recorded.

13. Important subsequent event

No important subsequent event is recorded.

14. 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	(1,137,479,559)	(904,716,484)
Building	258,033,100	237,679,539
Ancillary buildings	2,621,757	1,310,928
Structures	2,672,890	2,059,385
Machine and equipment	848,362,479	604,502,982
Tools and furniture	22,315,542	48,138,006
Lump-sum depreciable assets	1,103,211	1,170,833
Intangible fixed asset	2,370,580	9,854,811
Other fixed asset	(30,245,662,536)	(34,303,619,241)
Land	8,385,231,067	8,243,518,118
Building	9,127,939,763	10,722,257,606
Ancillary buildings	2,457,791,893	3,310,360,101
Structures	1,223,774,702	1,268,774,869
Machine and equipment	6,416,779,605	8,220,580,234
Tools and furniture	2,054,882,819	1,848,576,275
Lump-sum depreciable assets	9,409,129	19,873,527
Intangible fixed asset	38,318,640	43,043,318
Building	531,534,918	626,635,193
Total	(31,383,142,095)	(35,208,335,725)

15. Retirement benefit related

(1) Summary of employed retirement benefit

CRIEPI has established a defined-benefit pension system for its retirement pension program and retirement lump sum grants.

(2) Retirement benefit liability and its contents

(Unit: yen)

[1] Retirement benefit liability	△ 23,085,693,035
[2] Retirement pension asset	13,385,532,585
[3] Non-accumulated retirement benefit ([1]+[2])	△ 9,700,160,450
[4] Non-depreciated mathematical calculation difference	△ 1,518,347,591
[5] Unamortized past service liabilities	1,575,187,141
[6] Accrued retirement benefits for employees ([3]-[4]-[5])	△ 9,757,000,000

(3) Items for retirement benefit expense

(Unit: yen)

[1] Working expense	992,023,469
[2] Interest expense	228,075,681
[3] Expectable operation benefit	△131,415,234
[4] Mathematical calculation difference depreciation	1,091,979,670
[5] Unamortized past service liabilities	△525,062,380
[6] Retirement benefit expense ([1]+[2]+[3]+[4]+[5])	1,655,601,206

(4) Primary pension assets

The percentage of each main category making up total pension assets is as follows.

Bonds	54%
Stocks	7%
Cash and deposits	5%
Other	34%
Total	100%

Total pension assets includes 26% in retirement benefit trusts established for the corporation pension plan.

(5) 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.

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	258,033,100	0	20,353,561	237,679,539
Ancillary buildings	2,621,757	0	1,310,829	1,310,928
Structures	2,672,890	0	613,505	2,059,385
Machines and equipment	848,362,479	3,500,000	247,359,497	604,502,982
Tools and furniture	22,315,542	48,634,672	22,812,208	48,138,006
Lump-sum depreciable assets	1,103,211	1,193,786	1,126,164	1,170,833
Intangible fixed assets	2,370,580	8,938,760	1,454,529	9,854,811
Special assets for allowances for lump-sum retirement benefits	3,435,900,000	0	0	3,435,900,000
Specific assets for reserves for acquisition of research facilities	7,700,000,000	900,000,000	4,300,000,000	4,300,000,000
Special assets for reserves for projects	500,000,000	950,000,000	0	1,450,000,000
Specific assets for purpose of setting up bases	0	5,997,134,033	0	5,997,134,033
Total special assets	12,773,379,559	7,909,401,251	4,595,030,293	16,087,750,517

(Note 1) The increase in the special assets for the research facility acquisition allowance in this fiscal period is attributable to reserves for specific assets with the objective of acquiring the Materials Analysis Building (provisional name), and the decrease is attributable to the liquidation of specific assets with the aim of acquiring the Power-generating Plant Thermal Hydraulics Laboratory, the No. 7 Laboratory, the test facility for the carbonization of biomass, the test facility for development and evaluation of heat pumps in industrial and commercial use, the advanced combustion test facility for diversification of available fuel types and the large-scale tsunami physical simulator.

(Note 2) The increase in specific assets as reserves for specific projects in this fiscal year was due to reserves for collaborative research contributions and reserves set aside for specific projects with the purpose of moving research facilities to the Yokosuka area laboratories and taking safety measures.

(Note 3) Special assets set aside for the bases are assets for the purpose of establishing research bases in the Abiko and Yokosuka areas. Money from the partial sale of assets in the Komae area are set aside as reserves for this purpose.

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	355,000,000	253,000,000	355,000,000	0	253,000,000
Allowance for retirement benefits for directors	399,000,000	92,720,000	51,720,000	0	440,000,000
Allowance for retirement benefits for employees	9,383,000,000	1,655,601,206	1,281,601,206	0	9,757,000,000

Audit Report by Third-Party Auditor

May 8, 2014

Central Research Institute of Electric Power Industry

President Masahiro Kakumu

Meisho auditors

Senior Partner Certified Public Accountant

Managing Partner YoshihiroWada

Managing Partner Certified Public Accountant

Masayuki Tomikawa

We audited the financial statements of the Foundation of Central Research Institute of Electric Power Industry (hereinafter referred to as “CRIEPI”) in the FY2013 business term from April 1, 2013 to March 31, 2014, 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 21, 2014

Central Research Institute of Electric Power Industry
President Masahiro Kakumu

Central Research Institute of Electric Power Industry
General Auditor, Kouichi Nishi
GeneralAuditor, Yoshihiro Naito
GeneralAuditor, 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, 2013 to March 31, 2014 and report the audit method and results as follows.

1. Outline of the audit method

In accordance with the audit standards and the fiscal 2013 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 endent 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.