

**FY 2007**

**Project Reports**  
**Settlement of Accounts**

From April 1, 2007

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**Central Research Institute of Electric Power Industry**



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### Basic Project Management Policy

- Contributing to the power industry and saving the community
- Solving problems before they occur and demonstrating creativity
- Enhancing project vitality and creating an upbeat, energetic workplace

Tatsu-No.2 August 12, 1980

# **Project Reports**



## **Project Outline**

In FY 2007, we promoted researches to resolve urgent issues in the power industry including ensuring energy security and approach to the global environmental problems as well as strengthened management and application of intellectual knowledge, and promoted social responsibility management as a public corporation. Aiming at realization of "research institute with presence" to develop business activities.

Our FY 2007 income was 33.6 billion yen, including the balance brought from the previous period, and the expenditure was 32.71 billion yen. As a result, the balance of the net property at the term end was 33.29 billion yen - up 550 million yen compared with the previous year.

1. We positioned active approaches to "ensuring energy security" and "approach to the global environmental problems" as our most significant mission relied by the power industry and community to promote intensively.
2. For our fundamental technology as resources for resolving problems, we reviewed our present fundamental technology to reconstruct database aiming at further reinforcement, enhancement, and external publication to quickly and accurately respond to changes in the power industry and community.
3. We promoted integrally research activities through establishment of general project, research promoter function to enhance field crossing management, and applying three basic principles (field, actual thing, and fact).
4. We responded requirement quickly to recover seismic reliability to nuclear power plants at the momentum of Niigata Chuetsu-Oki earthquake.
5. To fully apply intellectual properties created in CRIEPI, we actively deliver our intellectual property to the power industry and community and enhanced wide application though technical transfer.
6. To execute social responsibility as a public service corporation, we made an effort for proper information easy to understand and studied analysis and response to new public service corporation system.

## I. Research Activities

CRIEPI aims at realization of "research institute with presence" relied by the power industry and community under eight research institutes classified by special fields. We mainly engaged in researches on "basic research subjects" for field backup and future core technology and promoted them specifying "promotive project subjects" to focus on accomplishing urgent research with the highest demands, centering on "five research pillars" crossing special fields, and "project subjects" to supply easy-to-use solution to respond the field requirements.

In FY2007, we promoted research activities focusing on fulfillment of our total research power for prescribed missions. In particular, we positioned researches relating to light water reactor aging deterioration and global warming issues as urgent research subjects directly linked to missions to form integral project through enhancement of cross-cutting research.

From the viewpoints of widely applying research results to the power industry and community, we promoted research considering outcome (propagation effect of research accomplishment) from the research planning stage.

In addition, we introduced "assessment facility of electric power apparatus insulation maintenance standard", "gas turbine blade integrity assessment facility", and "highly aged concrete structural performance test system" to construct large-scale research facilities to support research activities.

The following is an overview of major research for the period.

### 1. Promoted project subjects and project subjects (Table 1)

In FY 2007, along with the "five research pillars", we conducted promoted project subjects, 12 subjects, and project subjects, 31 subjects as shown in Table 1.

#### (1) Nuclear technology - Supporting foundations for a stable supply -

For nuclear technology to support stable supply in the future, we promoted researches relating to light water aging issues, back-end project support, radiation safety, and next generation nuclear technology.

For ageing research of light water reactors, we contributed to the industry road mapping on various technical problems for ageing and integrally promoted development of survey, assessment, and countermeasure technology for irradiation embrittlement, deterioration due to thermal hydraulics, SCC (stress corrosion cracking). Among them for irradiation embrittlement, an embrittlement prediction method, developed by CRIEPI, of the reactor pressure vessel steel was employed in the electric technical code in Japan Electric Association JEAC4201-2007.

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Note: Socio-economic Research Center, System Engineering Research Laboratory, Nuclear Technology Research Laboratory, Civil Engineering Research Laboratory, Environmental Science Research Laboratory, Electric Power Engineering Research Laboratory, Energy Engineering Research Laboratory, Material Science Research Laboratory

For backend project support researches, we developed high-, low-level radioactive wastes disposal technology and recycled fuel transport and storage technology to support projects by the national government and the power industry smoothly. For low-level radioactive wastes disposal, we reflected our research accomplishments and knowledge into "technical report on the excess depth disposal (draft)" in the Japan Society of Civil Engineers for establishment of private standards.

(2) Advanced maintenance technology - Rational operation of electric facilities -

To contribute to total cost reduction and ensuring reliability on electric facility arrangement to maintenance technology from power generation to transmission and distribution, we developed facility diagnostic technology and operation maintenance supporting technology applying at the power business site immediately.

For power generating facilities, we applied internal pressure bending creep tests for full-scale piping weld specimen to establish life assessment method of aged power generating components and steel structures through crack detection closely related to the life and clarified changes in failed conditions at the weld heat affected zones after 3,000 hours long period operation.

For transmission and distribution facilities, aiming at construction of maintenance standard for aged facilities we developed the component deterioration diagnostic technology to verify that abnormal phenomena such as partial discharge and conductor contact failure expected at aged gas-insulated switchgear (GIS) can be detected by using accumulation of SF<sub>6</sub> decomposite gas.

(3) Environmental innovative technology - Sustainable use of fossil fuels and new energy -

To contribute to solution of global environmental problems, we promoted scientific assessment of global warming and high efficient utilization technology of biomass energy.

Among them, for scientific assessment of global warming, we carried out numerical simulations of paleoclimate using a global earth system model and clarified that the feedback of vegetation changes to climate was significant.

For high efficiency utilization of biomass energy, we assessed performances of biomass co-firing with coal and characteristics of spontaneous ignition for various biomass kinds, and we verified high practical use of our technologies for a carbonizing-gasification gas engine power generation and a dry gas purification by means of demonstration test using food processing residue.

In the technical development relating to environmental problems in the electric power industry, we developed soil purification material for arsenic and lead contamination using hydroxyapatite produced in reaction of phosphorus extracted from sewage sludge and desulfurized gypsum.

(4) Optimum energy utilization technology - Contributing to more comfortable and enriched life -

We developed energy utilizing technology supporting rich life and industry, and satisfying comfort and environmental requirement. We also conducted performance evaluation for changes in ambient temperature, room temperature, and water temperature using the environmental test facility for Heat Pump Water Heater introduced in FY2006 for spreading of new Eco-cute system for cold area application.

We also conducted research for rationalized system operation and control when a large number

of distributed power generations such as photovoltaic power generation are penetrated into the utility distribution lines in the future. We improved the detection system for islanding of distributed power generation to verify its effectiveness from both viewpoints of simulation analysis and experiments and finally clarified rationalized voltage control method effectively responding to individual conditions at penetrated area of distributed power generation and its penetrated volume.

(5) Social and business risk management - Contributing to more comfortable and safer communities

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To ensure safety and security in the power facility, we integrally promoted researches on countermeasures for natural disaster risks due to earthquake, harsh weather, and thunderstorm, as well as human risks caused by human errors. Among them, for wind disaster resistant assessment for the power facilities, we added accumulated rainfall prediction function to the typhoon disaster prediction system of the power distribution installation developed by CRIEPI for improving prediction accuracy to raise practicality as a disaster recovery tool. In addition, we proposed a design method considering thunderstorm, strong wind, and wind disturbance for the purpose of establishing guidelines for wind power generation facilities in Japan.

In addition, relating to global warming prevention policy, we concluded future direction including Japan's energy scenario, global warming measures and framework in the 21st century and delivered to the society based on case example analyses such as environment tax, emissions trading, and technical development policies.

## 2. Base research subjects (Table 2)

In FY 2007, we were steadily engaged in 39 base research subjects. Applying the characteristics of individual institutes classified in special fields, we created new core technology by further strengthening our basic research power to challenge advanced fundamental research, aiming at a response to future subjects and seeds research.

Table 3 shows major funded research conducted in FY 2007. Table 4 indicates the number of reports and Table 5 shows the number of paper presentations. The number of reports in FY 2007 was 544 items and paper presentation domestically and overseas was 1,656 items.

**Table 1 Major Research Accomplishments in ● Promoted Project Subjects/○ Project Subjects**

(\* Shows subjects finished in FY2007)

**(1) Nuclear technology**

**Light water reactor aged deterioration research (Integral project)**

- High accuracy prediction of irradiation embrittlement in the light water reactor and its code formation
  - Embrittlement prediction method developed by CRIEP based on observation of microstructure monitoring specimen of domestic nuclear reactor pressure vessel steel was employed in JEAC4201-2007, Japan Electric Association technical standards.
  - For determination of lower limit reliability curve of master curve fracture toughness test for domestic nuclear reactor pressure vessel steel, we developed a margin determining method corresponding to the number of specimen.
- Comprehensive measures of thermal flow caused deterioration
  - We developed tools quantifying locations possibly generating liquid drop erosion.
- Advanced SCC assessment method
  - We clarified the effect of material surface hardness distribution and crystal grain boundary to SCC generation in low carbon stainless steel.
- Aged deterioration measures
  - We contributed to establishment of industry load mapping on various technical problems to aged deterioration of light water reactors.

**Radiation safety**

- Low dose radiation effect assessment
  - We clarified that low dose X rays bystander effect is a different phenomenon from heavier particles than X rays.
- Rationalized radiation safety ensuring
  - On the basis of the field demonstration tests, we demonstrated practical performance as an alternative contamination inspection method for improved CRIEPI's clearance level measuring equipment (CLALIS).

**Backend project supporting research**

- High-level radioactive waste disposal
  - We developed stress-measuring method relating to survey and assessment technology for geological environmental property and elemental technology including control boring.
- Low-level radioactive waste disposal
  - To reflect to private standards, we finalized our research accomplishment and knowledge into "Technical report on margin depth disposal (draft)".

- Transpiration and storage of recycled fuel
  - We ensured cask-sealing integrity by high speed flying object horizontal impact test and analysis using scaled cask models.

#### **Next generation nuclear technology**

- Metallic fuel cycle
  - We established metal fuel production technology satisfying requirements for compositions and densities.

## **(2) Advanced maintenance technology**

### **Advanced maintenance technology of power generating facilities**

- Gas turbine hot gas path parts maintenance
  - Practical operation of the X ray CT scanning system has been started, and the system was applied to the measurement of used parts.
  - Improvement in reliability of operating temperature distribution estimates has been made for film-cooled and TBC-coated blades. \*TBC; thermal barrier coating.
- Power generating plant performance diagnostics
  - We promoted to distribute diagnostics method to power plants by establishing support system of the thermal efficiency analysis program for power generation systems and by enhancing function to increase convenience to program users.
- Status diagnostics on power generation components
  - We developed high-speed simulation program for ultrasonic flaw detection to shorten the current prediction time for ultrasonic propagation behavior nearly to 1/10.
  - We conducted internal pressure bending creep test for full-sized piping weld specimen to determine changes in failed condition of weld heat affected zone due to long time operation (after 3,000 hours).

### **Advanced maintenance technology of power distribution facilities**

- Establishment of maintenance standards for aged electric facilities
  - We verified that abnormal phenomenon of aged gas-insulated switchgear (GIS) was be able to detect applying accumulated decomposite gas of SF<sub>6</sub>.
    - We verified diagnostics method possible for detection of water tree degradation and location causing aged deterioration of XLPE power cables.
- Management measures for power distribution facilities
  - We developed fundamental model assessing the effect of power transmitting congestion mitigation and avoidance of supplying troubles.

- Asset management of power network
  - We were developing a support tool to level transmission equipment replacements over long planning horizon. Essential parts including reliability assessment and procedures to develop replacement plan were implemented.
- Asset management support technology
  - Maintenance management plan support tools developed by CRIEPI were remodeled to a general-purpose model to apply to various power components with different performance in aged deterioration.

### (3) Environmental innovation technology

#### **Global warming measures research (Integral project)**

- Warming projection and adaptive measures
  - We confirmed that changes in vegetation greatly influenced on CO<sub>2</sub> absorption through calculation of paeloclimate using an earth system model.
  - For research on adaptation to unavoidable climate change, we clarified relationship between air temperature rise and typhoon intensity change at the end of 20th century using re-analysis data from collaboration work with Japan Meteorological Agency.
- CO<sub>2</sub> underground storage
  - We determined CO<sub>2</sub> underground behavior performance at the field tests and indoor tests to increase accuracy of CO<sub>2</sub> underground behavior simulation model.
- High efficiency utilization of biomass energy
  - We assessed performances of biomass co-firing with coal and characteristics of spontaneous ignition.
  - We demonstrated carbonizing-gasification gas engine power generation technology and dry gas purification technology using food-processing residue.

#### **Innovative environment technology**

- Innovative environment measurement
  - We developed an economical method to remove PCBs from PCBs contaminated transformer by changing transformer oil, followed by power operation.
  - We confirmed that simplified measurement method of selenium in wastewater developed by CRIEPI could be adapted for wastewater from power plants.
- Coal ash environment measures
  - We developed soil purification material for arsenic and lead contamination using hydroxyapatite produced in reaction of phosphorus extracted from sewage sludge and desulfurized gypsum.

### **Next generation thermal plant technology**

- Integrated operation and evaluation system for pulverized coal combustion power generation
  - We developed the numerical simulation basis code to estimate pulverized coal combustion characteristics.
- Coal gasified furnace
  - To support IGCC demonstration plant operation, we predicted gasification performance by numerical simulation and clarified gasification characteristics by CRIEP's "coal gasifier for basic research" to actual tested coal.
- Trace element control
  - We developed prediction method for boron behavior in coal fired power plants.
  - From coal properties and operating condition of exhaust gas processing facilities, we assessed quantitatively boron concentration in clinker, fly ash and desulfurization wastewater.
- Low cost MCFC power generating system
  - We developed low cost separator technology and electrolyte pre-impregnation technology at a single cell to develop a low cost stack.

### **(4) Optimum energy utilization technology**

#### **End use technology**

- Customer energy utilization support
  - For practical realization of residential indoor thermal environment design tool, we improved the tool to evaluate detailed heating conditions using various types of floor heating and air conditioning as well as energy consumption.
- Evaluation of system operational performance of new Eco-cute model
  - We evaluated operating performance of various new Eco-cute systems to difference in ambient temperature, room temperature, and water temperature using the environmental test facility for evaluate of Heat Pump Water Heater introduced in FY2006.
- Inverter with SiC device
  - Targeting an inverter for distributed power source interconnection, we developed a prototype device (3.3 kW) applying SiC diode to achieve maximum efficiency of 96.4%, and obtained possibility to reduce the device volume by 15% compared to conventional device.
- SiC power semiconductor
  - To realize a large capacity and low-loss SiC semiconductor devices, we developed crystal growth technology of high purity and thick SiC film having purity and thickness that correspond to 20-30 kV class withstanding voltages.
- Compact secondary battery utilization
  - We measured energy consumption at complete electrical housing combining Eco-cute, IH cooking heater, and others for actual condition survey considering family structure.

### **Next generation grid technology**

- Technology for autonomous demand area power system\*
  - We improved the detection system for islanding of distributed power generation to verify its effectiveness from both sides of simulation analysis and experiment.
  - We clarified, by simulation, combination of proper voltage control systems corresponding to penetration area and penetration rate of distributed power generation.

### **(5) Social and business risk management**

#### **Risk management of electric power infrastructure (natural disaster risk)**

- Earthquake scale assessment by active fault survey
  - Targeting seismic source region during the 1984 Nagano-ken Seibu earthquake difficult to determine seismic source, we constructed analysis flow to estimate seismic fault property from long-term accumulation displacement due to earthquake fault.
- Wind and snow disaster prevention assessment of electric power facilities
  - We applied accumulated rainfall prediction function to the typhoon disaster prediction system of the power distribution facilities to increase prediction accuracy.
  - We established a guideline of Japan type wind power generation systems in which lightning, strong wind and wind disturbance are considered.
- Ground collapse effect assessment at earthquake occurrence
  - We studied earthquake collapse behavior by centrifugal loading test at the slope modifying cracks in the ground to verify adaptability of slope collapse effect analysis code.
- Lightning risk management
  - We have developed a nationwide lightning hazard map for power transmission lines and substations that covers all over the country based on the lightning flash density and lightning peak current values.
- Disaster recovering support of electric distribution facilities
  - We added the short term planning support function to the disaster restoration simulator already developed to expand simulating system for emergency response process at the individual zone level.

#### **Risk management of electric power infrastructure (human risk)**

- Cyber security risk management framework
  - We developed an analysis framework for the cost-effective security measures along with the progress of security technology, and also developed the fundamental part of a highly accurate abnormal event detection method as a basis of intrusion detecting technology.

- Human error measures and safety culture cultivation
  - We prepared a pocket-sized Caution Report effective for reminder at the working field to prevent human error at the nuclear power plant business.

### **Energy policy**

- Analysis and recommendation of global warming prevention policy\*
  - Throughout the case-based analysis of environmental tax, emissions trading, technical development policy, technical development treaty, we concluded Japan's energy scenario, global warming measures, and future framework in the 21st century to deliver to the society.
- Japan type deregulation system measures
  - For proper understanding trading trend at Japan Electric Power Exchange, JEPX, we developed an estimation method of trade bidding price reflecting time-shift at the electric power spot market and demand price elasticity of demand.
- Scenario analysis for energy technical policy
  - We finalized scenarios for large-scale reduction of greenhouse effect gas viewing to 2050, China scenario for energy saving, and introduction of biomass scenario in Japan.
  - We concluded the case-based analysis on technical development policy, energy saving regulation, low pollution vehicle diffusion, and solar water heater diffusion.
- Biological effect assessment of intermediate frequency magnetic fields
  - We confirmed that intermediate frequency magnetic fields did not affect rat organogenesis *in vivo* and gene mutation *in vitro*.

**Table 2 Major Research Accomplishments in Base Research Subjects**

Research Field (Number of Subjects)	Major Research Accomplishments
Socio-economic Research Center (4)	<ul style="list-style-type: none"> <li>• We quantitatively analyzed changes in efficiency index and stock price targeting large-scale M&amp;A items in energy businesses.</li> <li>• From simulation analysis results on tax system reform using multi-region general equilibrium model, we assessed the effect of tax system reform on family finances.</li> <li>• Through attitude survey and analysis for residents at nuclear siting area, we clarified difference in structure of consciousness to nuclear energy and communication problems.</li> <li>• On the basis of the end use energy model analysis in the commercial sector, we estimated CO<sub>2</sub> emission reduction possibility at the commercial sector to FY 2030 resulting from diffusion of energy saving and fuel conversion technology.</li> </ul>
System Engineering Research Laboratory (5)	<ul style="list-style-type: none"> <li>• For power system operation, we developed a method that forecasts short-term (15 minutes ahead) electricity load accurately based on online data.</li> <li>• For influence assessment to the wind power generation system, we developed a simulation model on dynamic performance of constant and variable speed machines including their prime movers.</li> <li>• We clarified methods for applying adaptation function middleware and security function in the distributed real-time computer network architecture (DRNA) proposed by CRIEPI to tackle problems for practical application.</li> <li>• To efficiently construct a sensor network at maintenance site at a minimum resource, we developed methods to assist sensor node arrangement automatically collecting fundamental transmitting performance of the radio signal.</li> <li>• To effectively apply the site-monitoring camera, we confirmed practical accuracy of the moving body detection method using monitoring camera image from different operation mode.</li> </ul>
Nuclear Technology Research Laboratory (5)	<ul style="list-style-type: none"> <li>• We collected basic data from the test reactor to investigate failure mechanism of high burnup light water reactor fuel cladding tube at abnormal output operation.</li> <li>• Through comparison to the test data from U.S. fast experimental reactor EBR-II and U.S. analytical codes, we ensured adaptability of the fast reactor system dynamic performance analysis code (CERES) developed by CRIEPI.</li> <li>• We constructed Bayes estimation module for the light water reactor deterioration mechanism and optimization of inspection and replacing intervals.</li> <li>• Applying fresh-green technology developed by CRIEPI, we improved corrosion resistance of nuclear materials, antiwear property, and hydrogen absorption limiting property.</li> </ul>
Civil Engineering Research Laboratory (5)	<ul style="list-style-type: none"> <li>• We developed a tsunami fluid force analysis code and improved a meteorological prediction model and a water circulation model to examine their capabilities.</li> <li>• To assess water surface turbulence and overflow phenomenon due to sloshing in a nuclear power plant spent fuel pool during an earthquake, we upgraded analysis codes to verify its capability for assessment of practical examples.</li> <li>• We developed a non-steady system identification procedure to sophisticate damage detection technology of large structures and confirmed its adaptability using actual earthquake records of seismic isolation structure.</li> <li>• We applied the performance assessment method of volcanic activity developed by CRIEPI to actual volcanoes to study volcanic activity in detail from older age than the past research to the present.</li> <li>• We developed a scenario for earthquake, heavy rain, and facility accident to hydro- and civil engineering facilities from disaster generation to the social impact to construct assessment methods of social loss including disaster occurrence probability and electric power company's losses.</li> </ul>

<p>Environmental Science Research Laboratory (5)</p>	<ul style="list-style-type: none"> <li>• We developed secondary particle producing and transporting models, cooling tower white fume prediction models, and nuclear exhausted gas diffusion model contributing to urban area environment monitoring and atmospheric environment assessment.</li> <li>• On the basis of aquarium experiments for <i>Laminaria japonica</i>, one of the major marine forests forming kelp in Japan, we finalized an experimental formula to predict lethal probability when waste sand exhausted from dam was accumulated at the <i>Laminaria</i> forest.</li> <li>• To remove selenium in wastewater in the power plants economically and effectively, we developed a new processing technology by combining plural microorganisms.</li> <li>• We applied scientific and rational ecosystem assessment method developed by CRIEPI to the ongoing Ecological Impact Assessment for an electric power plant to demonstrate its effectiveness.</li> <li>• Using a multimedia model, developed by CRIEPI, for atmosphere, soil, and water transition, we assessed an oral risk of trace elements such as mercury to demonstrate minor health risk.</li> </ul>
<p>Electric Power Engineering Research Laboratory (5)</p>	<ul style="list-style-type: none"> <li>• We experimentally clarified pressure rising property due to fault arc inside power equipment by using in a sealed vessel.</li> <li>• For creating XTAP (eXpandable Transient Analysis Program) which can apply to the future power system analysis, we developed a high accurate transmission line model and a steady-state analysis method considering the harmonic component and load flow conditions.</li> <li>• We proposed a structure of central conductor connecting part at gas/solid hybrid insulation power equipment to assess its breakdown electric field.</li> <li>• Radiated electromagnetic waves with the maximum frequency of 2.8 GHz generate when spark discharges occur at metal contact parts of the insulator strings in distribution lines. Measuring the amplitude of the radiated electromagnetic waves, we confirmed that the amplitude with more than 2.3GHz frequency reduce to the background noise level at the place approximately 5 meters away from the distribution lines.</li> <li>• In experiment using a microparticulated pressed samples of saline containing concrete specimen, we revealed that Cl concentration (<math>0.6 \text{ kg/m}^3</math>) possibly starting reinforcing bar corrosion by applying laser induced breakdown spectral technology (LIBS).</li> </ul>
<p>Energy Engineering Research Laboratory (3)</p>	<ul style="list-style-type: none"> <li>• Adaptability and problems of new type liquid fuel used for a gas turbine are clarified, including non-conventional fossil fuel such as oil sand and bio fuel such as Jatropa.</li> <li>• We developed a ceria catalyst module to decompose volatile organic compound (VOC) and verified its performance for benzene, toluene, and xylene.</li> <li>• We conducted basic survey to expand heat pump application in agricultural fields and evaluated basic heat transfer performance of <math>\text{CO}_2</math> to upgrade the <math>\text{CO}_2</math> heat pump heat exchanger.</li> </ul>
<p>Materials Science Research Laboratory (7)</p>	<ul style="list-style-type: none"> <li>• Pressurizing nearly to 0.3 MPa, we improved power-generating performance of 500 to 650 °C class compact SOFC module by nearly 30%.</li> <li>• We clarified fatigue crack propagation property in crystal growing direction under loading in transverse direction of gas turbine rotor blade material.</li> <li>• We investigated that stress corrosion cracking at Inconel primary cooling system was greatly affected by surface film.</li> <li>• We conducted thermal cycling tests of gas turbine thermal barrier coating (TBC) and revealed that failure mode of TBC under temperature gradient was different from under isothermal condition.</li> <li>• We clarified temporal change mechanism for various properties on endurance of dye-sensitized solar cell.</li> <li>• By applying an epitaxial growth technique, we developed a method to control copper oxide superconductor thin films from superconductor to insulator with keeping their carrier density constant.</li> <li>• We clarified generation mechanism of valuable function using layer cobalt oxide and layer manganese oxide.</li> </ul>

**Table 3 Major Funded Researches from the National Government and Others**

Research Title	Consigner
Recycle fuel resources storage technical survey, etc.	METI
Geological disposal technical survey, etc.	METI
Thermal plants related environmental review survey (power plant cooling tower white fume survey)	METI
Thermal and nuclear plants related environmental review survey (trace element environmental impact assessment method)	METI
Power generation facility seismic property survey (by mock-up test)	METI
Coal introduction acceleration survey (survey on shared use of coal and biomass at thermal power plants)	METI
Development of practical element technology of metal electrolytic method dry reprocessing process components	MEXT
Development of defect prevention technology for welding structures in next generation high temperature nuclear plants	MEXT
Technical development on dry reprocessing of oxide fuel applying electrolytic reduction method	MEXT
Research development for cathode/anode treatment of molten salt electrolytic refining of metallic fuel	MEXT
Development of environment assessment technology using multi-element, multi-component simultaneous instrument technology of atmospheric nano particles	MOE
Demonstration research of new power network system	NEDO
Technical development of solid oxide fuel cell (SOFC) system	NEDO
Strategic technical development for practical application of polymer electrolyte fuel cell (PEFC)	NEDO
Strategic technical development for practical application of next generation storage system	NEDO
Technical development of system linkage smoothing storage system	NEDO
Wind power stabilization technology development - wind power forecasting system -	NEDO
New energy technical development/ solar energy generation system future technical development	NEDO
Environment balanced production basic technical development applying microorganism function/ High efficiency environment biomass processing technical development by designing of microorganism	NEDO

**Table 4 Number of Reports in FY 2007**

	Socioeconomics	Environment	Customer energy services	Power delivery	Nuclear power generation	Fossil fuel power generation	New energy	Information & communication	Construction and maintenance of electric power facilities	Advanced basic technologies	Total
Research reports, etc.	51	40	24	53	76	39	16	26	32	6	363
Funded research	11	19	11	34	31	23	15	9	26	2	181
Total	62	59	35	87	107	62	31	35	58	8	544

**Table 5 Number of Documents Reported in FY 2007**

	Socioeconomics	Environment	Customer energy services	Power delivery	Nuclear power generation	Fossil fuel power generation	New energy	Information & communication	Construction and maintenance of electric power facilities	Advanced basic technologies	others	Total
Documents	182	274	75	270	320	126	59	52	163	109	26	1656

## **II. Management and Application of Intellectual Property**

To fully apply intellectual property held by CRIEPI as property useful for the society, we promoted to deliver intellectual property to the society through technical transfer and other processes.

### **1. Foundation enhancement of intellectual property activity**

- We inventoried our patent rights to ensure the intellectual property right and its qualitative improvement. We also issued "intellectual property report" summarizing economical, social, and academic propagation effect of intellectual property held by CRIEPI for "visualization of the patent".
- We engaged in prior art, market research activity, and presentation of management measures on security export and trial, manpower education by continued intellectual property training including dispatch to MOT (technical management) graduate college.

Table 6 shows the number of applications and registration of patents and software.

### **2. Enhancement of intellectual property application**

- To enhance intellectual property application, we widely appealed our intellectual property to the society through exposition from viewpoint of social contribution and promoted continuous technical transfer and promoted technical transfer such as "SiC single crystal film manufacturing technology" and "Flesh green" with extremely-high quality developed as symbolic products.
- Responding to social requirements, we began consultant activity applying totally know-how and accomplishment accumulated in CRIEPI and actively handled technical cooperation requirement from overseas.

### **3. Contribution to forming codes and standards**

Through joining to various advisory councils, we contributed to formulation codes, standards, and technical guides including metal cask structural codes for spent fuel intermediate storage.

Table 7 shows contribution to formulation of major codes, standards, and technical guides.

### **4. Promotion of technical succession**

To support actively technical succession at the power industry, we promoted continuously "tutorial courses and seminars".

Table 8 shows the tutorial courses and seminars carried out in FY2007.

**5. Promotion of test services**

Based on neutrality as a public-service corporation, we conducted licensed test services for test services based on the licensed system of private independent standard PD (Performance Demonstration) and reliability increase of nondestructive inspection at nuclear power plants and short-circuit testing services at the high power test facilities.

Table 9 indicates the practical accomplishments of licensed test services.

**Table 6 FY 2007, Number of applications and registrations of patent, software**

Type \ Field		Socioeconomics	Environment	Customer energy services	Power delivery	Nuclear power generation	Fossil fuel power generation	New energy	Information & communication	Construction and maintenance of electric power facilities	Advanced basic technologies	Total
Patent	Application	0	32	11	17	8	27	12	1	13	21	142
	Registration	0	3	5	5	5	9	3	3	8	8	49
Software registration		4	6	13	26	6	8	3	2	12	3	83

**Table 7 Contribution to Formulation of Major Codes, Standards, and Technical Guides**

Rule, Standard, Technical Guideline etc.	Organizations and Groups Concerned
Discussion of ministry ordinance to enact electricity enterprises law, electricity enterprises law enforcement regulations, technical standards on electric facilities	Nuclear and Industrial Safety Agency
Establishment of a guideline of Japan type wind power generation systems	New Energy Development Organization (NEDO)
Discussion of ministry ordinance (ministry ordinance No.62) description draft revisions to enact technical standard on power generating nuclear facilities	Japan Nuclear Energy Safety Organization
Discussion and establishment of various IEC international standards	IEC, Institute of Electrical Engineers (IEE)
Discussion and establishment of various ISO/IEC international standards	Information Processing Societies
Discussion, revision, and establishment of various JEC standards	Institute of Electrical Engineers (IEE)
Discussion and establishment of test voltage standards	Institute of Electrical Engineers (IEE)
Discussion and establishment of various JEA codes (JEACs) and JEA guidelines (JEAGs)	Japan Electric Association (JEA)
Establishment and revision of explanation of technical standards of electric facilities	Japan Electric Association (JEA)
Discussion, revision, and establishment of various JIS standards draft	Japanese Standards Association
Revision and establishment of safety design and inspection standard of metal cask for spent fuel intermediate storage facilities	Atomic Energy Society of Japan (AESJ)
Establishment of fundamental concept on confirmation of returned wastes	Atomic Energy Society of Japan (AESJ)
Aged deterioration measures practical standard draft of nuclear power plants	Atomic Energy Society of Japan (AESJ)
Establishment and revision of ASME Boiler and Pressure Vessel Code (Section III, XI)	American Society of Mechanical Engineers
Survey of revised codes on piping thinning control	Japan Mechanical Engineering Society
Discussion and establishment of power generation nuclear facility codes and maintenance codes	Japan Mechanical Engineering Society
Discussion and establishment of spent fuel storage facilities codes and metal cask structure codes	Japan Mechanical Engineering Society
Discussion and establishment of wind power generation facility support structure design guide and its description	Japan Society of Civil Engineers
Discussion and establishment of nuclide migration parameter setting concept used for underground water scenario at safety assessment of margin depth disposal	Japan Society of Civil Engineers
Establishment of water gate steel pipe technical standard draft	Water gate steel pipe association

**Table 8 Tutorial Courses and Seminars**

Course Title
Technical basic training for electric power system analysis
Application technical training of power system analysis
Insulation, electric environmental technology training
Power distribution technology training
Insulation deterioration diagnostic technology training
Base and application training of EMTP
Wind load response assessment technology at power transmission facility
Commutation network technology (IP network construction and security technology application)
Civil engineering technology on siting and construction of nuclear facility (civil works related)
Civil engineering technology on construction and maintenance of hydropower plants (civil works related)
Environment technology, 1. atmosphere and land environment, 2. water area environment
Thermal efficiency analysis technical training
Water chemistry, SCC countermeasure technology training on nuclear technology and light water reactor
Nuclear technology, structure integrity assessment technology training of nuclear component
Social and economical seminar. Energy and environment course, Social and economical course, Electric power management course
HF instructor - training base, training application
Technical course "seminar on biological effect by electromagnetic field"
Technical course "seminar on lightning damage measures for distribution lines and grounding"
Socio-economical research institute seminar "CSR practice by stakeholder approach"

**Table 9 Accomplishments of licensed test services in FY 2007**

Short-circuit test service	Number of testing:	49 items
	Number of days in testing:	about 113 days
PD qualification test service	Number of license tests:	6 times
	Total number of examinees:	13 persons, number of successful applicants, 4 persons

### **III. Business Management**

#### **1. Promotion of social responsibility management**

- (1) Increase in transparency and accountability and thoroughness of information control

We extracted problems to construct internal control system to start structural formation. For further enhanced compliance organization, we opened information contact to external organizations in addition to the present internal message contact. We protected research development information and clarified rules for systematic information control to improve information management provision.

- (2) Correct response to innovation of public-service corporation systems

On the basis of formation trend on cabinet order, ministerial order, guideline and tax system related to innovation of public-service corporation, we studied business design, functional design, and financial design at the new system basically for continuing and developing our activity aiming at "contribution to electric power industry and service to the society."

- (3) Enhanced public information and welcoming information aiming at acquiring understanding and reliance

To further fix CRIEPI's brand reliable from the society, we conducted several measures as follows.

- Under the theme of "satisfying both of global environment and energy security", we held "energy future technical forum" at Tokyo, Takamatsu, and Sendai with more participants than every year.
- We delivered major research accomplishments in the press release and CRIEPI news. As one of the social contribution activities related to energy and environment, we held seminar and conference (23 times) for ordinary people and teachers at each city throughout the country.

#### **2. Activation of human resources and effective application of business resources**

- (1) Human resources cultivation to enhance research integral power

Aiming research power enhancement and effective research promotion, we dispatched younger researchers to Lawrence Berkeley National Laboratory and Ohio State University in the United States and send other researchers to domestic organizations to collect and upgrade specialized knowledge and skills necessary for business promotion. In addition, we conducted "opinion exchange meeting with management" for young leader researchers and as well as leveled education and self-enlightenment measures.

- (2) Effective application of business resources

Through removal of unnecessary experimental structure, life enlargement of aged building, and promotion of energy saving, we improved facility conditions to reduce operation costs.

From the viewpoint of research power enhancement, know-how accumulation, we shifted researches from outsourcing to inside work limiting to essential external consignment only.

## IV. Workforce

Workforce configuration as of March 31, 2008 is as follows.

Item	Numbers	Percent Distribution (%)
1. Research	688	87.9%
	* Including 34 research member with employment contract limited	
[Breakdown]		[100.0]
(1) Electricity	109	15.8%
(2) Civil engineering and construction	95	13.8%
(3) Engineering	78	11.3%
(4) Chemistry	71	10.3%
(5) Biology	53	7.7%
(6) Nuclear engineering	48	7.0%
(7) Environment science	43	6.3%
(8) Information & communication	39	5.7%
(9) Socioeconomics	43	6.3%
(10) Research support control	109	15.8%
-----	-----	-----
2. Office work	95	12.1%
Total	783	100.0%

## V. General Affairs

### 1. Executive board

<b>Held Date</b>	<b>Agenda</b>
June 7, 2007 (No. 208)	1. Approval of project reports in FY 2006 2. Approval of settlement of accounts in FY 2006
June 7, 2007 (No. 209)	1. Mutual voting of executive president, executive directors and others 2. Presentation of retirement benefit at retirement of executive president 3. Delegating to consultants 4. Approval of acting for administrative director's duty at on an emergency basis
August 24, 2007 (No. 210)	1. Selection of councilor 2. Appointment of executive secretary
March 6, 2008 (No. 211)	1. Approval of project plans in FY 2008 2. Approval of revenue and expenditure budget in FY 2008 3. Selection of councilor

### 2. Board of trustees

<b>Held Date</b>	<b>Agenda</b>
May 18, 2007 (No. 22)	1. Project reports in FY 2006 2. Settlement of accounts in FY 2006 3. Appointment of directors and auditors at termination
August 24, 2007 (No. 23)	1. Appointment of directors and auditors
February 22, 2008 (No. 24)	1. Project plans in FY 2008 2. Revenue and expenditure budget in FY 2008



# **Settlement of Accounts**



## Outline of Accounts of Settlement

Business scale was 32.71 billion yen down to 1.11 billion yen to the revenue and expenditure budget and net property as of FY2007 end was 33.29 billion yen up 550 million yen to the previous year. Major points are as follows.

### 1. Financial statements

#### (1) Assets condition

- Total amount of assets was 47.33 billion yen comprising current assets of 6.42 billion yen and fixed assets including basic assets of 7 million yen, special assets of 5.66 billion yen and other fixed assets of 35.23 billion yen.
- Special assets consists of fixed assets of 840 million yen from designated net property, and special assets for retirement lump sum grants benefits package allowance of 3.43 billion yen, and special assets for research facility acquiring allowance of 1.38 billion yen.

#### (2) Liability condition

- Total amount of liability was 14.03 billion yen, comprising current liability of 5.93 billion yen and fixed liability of 8.1 billion yen.

#### (3) Net property condition

- Net property was 33.29 billion yen, comprising designated net property of 850 million yen and general net property of 32.44 billion yen.
- 7 million yen in the designated net property was shifted to the basic property and other 840 million yen was to special assets.
- Increase/decrease of general net property was up 670 million yen, including up 1.05 billion yen in current account and down 380 million yen in nonrecurring account.
- Increase/decrease of designated net property was down 110 million yen mainly by depreciation.

### 2. Statement of revenues and expenses

Current income was 32.85 billion yen, and carried forward from the previous period was 740 million yen. Total income was 33.6 billion yen down 220 million yen to the budget. Current expenditure was 32.71 billion yen down 1.11 billion yen to the budget, resulting in the difference in balance of payments transferred to the next term balance of payment was 890 million yen.

#### (1) Balance of business activity

- Business activity income was 32.01 billion yen down 60 million yen to the budget, and business activity expenditure was 25.97 billion down 1.41 billion yen to the budget. As a result, balance of business activity was 6.04 billion yen up 1.35 billion yen to the budget.

(2) Investment activity balance

- Investment activity income was 840 million yen down 450 million yen to the budget. This was mainly caused by income decrease shifted from the special asset along with the delay of introduction of large research facilities.
- Investment activity expenditure was 6.74 billion yen up 300 million yen to the budget. This was mainly caused by increase in the fixed asset acquiring expenditure.

(3) Financial activity balance

- No income and expenditure related to financial activity.

# I. Financial Statements

## Balance Sheet

As of March 31, 2008

(Unit: yen)

Account	Current fiscal year	Previous fiscal year	Increase/decrease
<b>I. Assets section</b>			
1. Current assets			
Cash and deposit	4,418,317,423	4,149,332,991	268,984,432
Securities	13,059,800	0	13,059,800
Account receivable	1,852,110,020	3,173,636,091	Δ 1,321,526,071
Suspense payable	133,444,324	121,516,422	11,927,902
Advance payment	8,610,405	13,958,100	Δ 5,347,695
Total current assets	6,425,541,972	7,458,443,604	Δ 1,032,901,632
2. Fixed assets			
(1) Fundamental property			
Cash and deposit	7,000,000	7,000,000	0
Total fundamental property	7,000,000	7,000,000	0
(2) Special assets			
Buildings	357,531,777	373,989,852	Δ 16,458,075
Structures	1,642,002	1,913,730	Δ 271,728
Machine and equipment	461,460,283	540,511,747	Δ 79,051,464
Tools and furniture	25,963,399	48,420,521	Δ 22,457,122
Intangible fixed asset	2,361,469	661,939	1,699,530
Special assets for retirement lump sum grants benefits package allowance	3,435,900,000	3,435,900,000	0
Special assets for research facility acquiring allowance	1,380,000,000	1,190,000,000	190,000,000
Total special assets	5,664,858,930	5,591,397,789	73,461,141
(3) Other fixed assets			
Land	4,907,396,676	4,907,396,676	0
Building	13,048,210,180	12,253,895,612	794,314,568
Structure	1,175,415,412	1,054,367,129	121,048,283
Machine and equipment	10,384,634,010	11,601,519,535	Δ 1,216,885,525
Tools and furniture	1,992,256,599	1,786,725,336	205,531,263
Intangible fixed asset	1,113,529,466	1,223,212,958	Δ 109,683,492
Construction in process account	1,776,114,920	1,421,028,772	355,086,148
Long-term prepaid expenses	841,960,000	934,929,000	Δ 92,969,000
Total other fixed assets	35,239,517,263	35,183,075,018	56,442,245
Total fixed assets	40,911,376,193	40,781,472,807	129,903,386
Total assets	47,336,918,165	48,239,916,411	Δ 902,998,246
<b>II. Liability section</b>			
1. Current liability			
Accrued liability	5,436,221,535	6,615,759,602	Δ 1,179,538,067
Money entrusted	95,435,795	94,382,120	1,053,675
Accrued bonus	399,000,000	417,300,000	Δ 18,300,000
Total current liability	5,930,657,330	7,127,441,722	Δ 1,196,784,392
2. Fixed liabilities			
Allowance for retirement benefits for directors	393,000,000	413,833,000	Δ 20,833,000
Accrued retirement benefits for employees	7,716,000,000	7,954,954,000	Δ 238,954,000
Total fixed liabilities	8,109,000,000	8,368,787,000	Δ 259,787,000
Total liabilities	14,039,657,330	15,496,228,722	Δ 1,456,571,392
<b>III. Net assets section</b>			
1. Designated net assets			
Special benefits	762,574,579	849,620,182	Δ 87,045,603
Cash subsidy	40,318,747	65,740,607	Δ 25,421,860
Cash contribution	53,065,604	57,137,000	Δ 4,071,396
Total designated net assets	855,958,930	972,497,789	Δ 116,538,859
(Including appropriation to fundamental property)	( 7,000,000 )	( 7,000,000 )	( 0 )
(Including appropriation to special assets)	( 848,958,930 )	( 965,497,789 )	( Δ 116,538,859 )
2. General net assets			
(Including appropriation to fundamental property)	( 0 )	( 0 )	( 0 )
(Including appropriation to special assets)	( 1,380,000,000 )	( 1,190,000,000 )	( 190,000,000 )
Total net assets	33,297,260,835	32,743,687,689	553,573,146
Total of liability and net assets	47,336,918,165	48,239,916,411	Δ 902,998,246

## Net Assets Increase/Decrease Calculation Sheet

From April 1 2007 to March 31 2008

(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	28,131,396,000	27,871,924,000	259,472,000
[2] Operating revenue	( 3,714,768,204 )	( 5,162,690,952 )	( Δ 1,447,922,748 )
Funded research operating revenue	3,065,931,330	4,592,852,612	Δ 1,526,921,282
Other operating revenue	648,836,874	569,838,340	78,998,534
[3] Other revenue	( 162,952,240 )	( 219,793,638 )	( Δ 56,841,398 )
Interest received	29,275,062	9,379,409	19,895,653
Facility usage fee received	85,964,289	92,842,258	Δ 6,877,969
Miscellaneous revenue	47,712,889	117,571,971	Δ 69,859,082
[4] Transfer from designated net assets	123,937,820	170,670,363	Δ 46,732,543
Total current revenue	32,133,054,264	33,425,078,953	Δ 1,292,024,689
(2) Current expenditure			
[1] Project cost			
Personnel expenditure	( 9,543,561,336 )	( 9,433,246,392 )	( 110,314,944 )
Salary and benefit	7,698,930,656	7,672,742,248	26,188,408
Retirement benefit expenditure	858,622,010	777,065,189	81,556,821
Welfare expenditure	986,008,670	983,438,955	2,569,715
Expenditure	( 19,422,424,758 )	( 20,010,196,451 )	( Δ 587,771,693 )
Supplies expenses	1,841,242,321	2,037,693,649	Δ 196,451,328
Printed material expenses	523,797,650	502,679,493	21,118,157
Fuel, light, and water expenses	633,462,178	625,573,551	7,888,627
Expenses for commission	6,505,357,390	7,050,943,156	Δ 545,585,766
Collaboration research contribution	682,831,739	736,953,921	Δ 54,122,182
Repair expenses	1,365,174,878	1,123,042,974	242,131,904
Rental rate	189,630,893	422,647,308	Δ 233,016,415
Tax and public charge	95,282,442	94,774,182	508,260
Travel and transport expenses	797,475,767	742,458,031	55,017,736
Communication and transportation expenses	116,441,435	131,173,346	Δ 14,731,911
Other expenditure	1,385,483,838	1,201,129,995	184,353,843
Depreciation allowance	5,286,244,227	5,341,126,845	Δ 54,882,618
Subtotal of project cost	28,965,986,094	29,443,442,843	Δ 477,456,749
(2) Administrative expenses			
Personnel expenditure	( 1,040,424,820 )	( 1,050,404,838 )	( Δ 9,980,018 )
Board members' compensation	168,602,000	120,924,000	47,678,000
Salary and benefit	609,135,716	721,498,252	Δ 112,362,536
Retirement benefit expenditure	95,402,440	50,521,841	44,880,599
Welfare expenditure	64,007,664	71,311,745	Δ 7,304,081
Allowance for retirement benefits for directors transfer	103,277,000	86,149,000	17,128,000
Expenditure	( 1,074,811,697 )	( 1,449,659,311 )	( Δ 374,847,614 )
Supplies expenses	15,216,168	18,456,921	Δ 3,240,753
Printed material expenses	82,284,763	56,571,015	25,713,748
Fuel, light, and water expenses	31,503,477	33,915,164	Δ 2,411,687
Expenses for commission	274,604,162	423,066,688	Δ 148,462,526
Repair expenses	9,373,985	27,696,717	Δ 18,322,732
Rental rate	364,363,739	399,414,889	Δ 35,051,150
Tax and public charge	10,515,850	10,452,275	63,575
Travel and transport expenses	67,926,925	72,045,718	Δ 4,118,793
Communication and transportation expenses	12,642,898	12,420,102	222,796
Other expenditure	103,803,775	119,897,606	Δ 16,093,831
Depreciation allowance	102,575,955	275,722,216	Δ 173,146,261
Subtotal of administrative expenses	2,115,236,517	2,500,064,149	Δ 384,827,632
Total current expenditure	31,081,222,611	31,943,506,992	Δ 862,284,381
Current ordinary increase/decrease	1,051,831,653	1,481,571,961	Δ 429,740,308

2. Nonrecurring increase/decrease section			
(1) Nonrecurring profit			
[1] Gain from sale of fixed assets			
Gain from sale of land and building	0	7,359,328	Δ 7,359,328
[2] Fixed asset donated profit			
Facility donated profit	3,673,392	101,240,193	Δ 97,566,801
[3] Amount transferred from designated net property	4,612,199	0	4,612,199
Total nonrecurring profit	8,285,591	108,599,521	Δ 100,313,930
(2) Nonrecurring expenses			
[1] Loss on sale of fixed assets			
Loss on sale of tools and furniture	220,384	2,436,652	Δ 2,216,268
[2] Loss on retirement of fixed assets			
Loss on retirement of facilities	389,784,855	171,524,040	218,260,815
[3] Past fiscal year adjustment due to applying new accounting standard	0	1,243,281,500	Δ 1,243,281,500
Total nonrecurring expenses	390,005,239	1,417,242,192	Δ 1,027,236,953
Current nonrecurring increase/decrease	Δ 381,719,648	Δ 1,308,642,671	926,923,023
Current ordinary net asset increase/decrease	670,112,005	172,929,290	497,182,715
Ordinary net asset beginning balance	31,771,189,900	31,598,260,610	172,929,290
Ordinary net asset final balance	32,441,301,905	31,771,189,900	670,112,005
II. Designated net asset increase/decrease section			
[1] Cash subsidy received			
Subsidy received	7,807,790	25,109,782	Δ 17,301,992
[2] Fixed asset donated profit			
Facility donated profit	4,203,370	3,791,450	411,920
[3] Transfer to ordinary net assets	128,550,019	170,670,363	Δ 42,120,344
Current designated net assets increase/decrease	Δ 116,538,859	Δ 141,769,131	25,230,272
Designated net assets beginning balance	972,497,789	1,114,266,920	Δ 141,769,131
Designated net assets final balance	855,958,930	972,497,789	Δ 116,538,859
III. Net assets final balance	33,297,260,835	32,743,687,689	553,573,146

## Notes for Financial Statements

### 1. Important accounting policy

#### (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.

#### (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 employee's bonus expense, current obligation fees of expected bonus pay are account for allowance.

Allowance for retirement benefits for directors:

To prepare for payment of directors 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 directors.

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 lease trading

Excepting items authorized to transfer ownership of lease objects to borrowers, finance trading is controlled by account processing equivalent to the ordinary lease provision.

#### (5) 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

No change in important account policy is recorded.

3. Increase, decrease and its balance of fundamental asset and special asset

Increase, decrease and its balance of fundamental asset and special asset 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
Fundamental asset				
Cash and deposit	7,000,000	0	0	7,000,000
Subtotal	7,000,000	0	0	7,000,000
Special asset				
Building	373,989,852	0	16,458,075	357,531,777
Structure	1,913,730	0	271,728	1,642,002
Machine and equipment	540,511,747	0	79,051,464	461,460,283
Tools and furniture	48,420,521	1,948,690	24,405,812	25,963,399
Intangible fixed asset	661,939	2,254,680	555,150	2,361,469
Special asset for accrued retirement benefits for employees	3,435,900,000	0	0	3,435,900,000
Special asset for acquiring research facility	1,190,000,000	900,000,000	710,000,000	1,380,000,000
Subtotal	5,591,397,789	904,203,370	830,742,229	5,664,858,930
Total	5,598,397,789	904,203,370	830,742,229	5,671,858,930

4. Breakdown of financial resources for fundamental assets and special assets

Breakdown of financial resources for fundamental assets and special assets is as follows.

(Unit: yen)

Subject	Balance at the end of current period	(Including appropriation from designated net asset)	(Including appropriation from general net asset)	(Including liability relating item)
Fundamental asset				
Cash and deposit	7,000,000	(7,000,000)	-	-
Subtotal	7,000,000	(7,000,000)	-	-
Special asset				
Building	357,531,777	(357,531,777)	-	-
Structure	1,642,002	(1,642,002)	-	-
Machine and equipment	461,460,283	(461,460,283)	-	-
Tools and furniture	25,963,399	(25,963,399)	-	-
Intangible fixed asset	2,361,469	(2,361,469)	-	-
Special asset for accrued retirement benefits for employees	3,435,900,000	-	-	(3,435,900,000)
Special asset for acquiring research facility	1,380,000,000	-	(1,380,000,000)	-
Subtotal	5,664,858,930	(848,958,930)	(1,380,000,000)	(3,435,900,000)
Total	5,671,858,930	(855,958,930)	(1,380,000,000)	(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	(4,293,697,505)	(3,444,738,575)	(848,958,930)
Building	753,996,762	396,464,985	357,531,777
Structure	25,095,620	23,453,618	1,642,002
Machine and equipment	3,380,036,169	2,918,575,886	461,460,283
Tools and furniture	132,064,274	106,100,875	25,963,399
Intangible fixed asset	2,504,680	143,211	2,361,469
Other fixed assets	(94,221,512,926)	(66,507,467,259)	(27,714,045,667)
Building	29,496,874,625	16,448,664,445	13,048,210,180
Structure	5,259,597,240	4,084,181,828	1,175,415,412
Machine and equipment	48,162,833,294	37,778,199,284	10,384,634,010
Tools and furniture	8,313,609,480	6,321,352,881	1,992,256,599
Intangible fixed asset	2,988,598,287	1,875,068,821	1,113,529,466
Total	(98,515,210,431)	(69,952,205,834)	(28,563,004,597)

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	1,852,110,020	0	1,852,110,020
Special asset for accrued retirement benefits for employees (Including housing loans and welfare loans)	53,682,397	0	53,682,397
Total	1,905,792,417	0	1,905,792,417

8. Contingent liabilities such as guarantee liabilities

A guarantee liability to employees housing loans is 3,036,934,574yen.

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
• Research project on energy utilization system development of forest resources in mountain areas	Institution of land afforestation proceeding organization	0	781,653	781,653	0	-
• Research for the effect of forest watershed characteristics on hydro power output	Institution of land afforestation proceeding organization	0	6,026,137	6,026,137	0	-
• Benchmark study to increase energy efficiency	Antipollution measure corporation foundation	0	1,000,000	1,000,000	0	-
Total		0	7,807,790	7,807,790	0	

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 on designated net asset	114,930,940
Transfer by exception from designated net asset	1,199,090
Transfer by implementation of objective business of received subsidy	7,807,790
Transfer to nonrecurring profit	
Transfer due to return of designated net property	4,612,199
Total	128,550,019

12. Trading content to related parties

No trading to related parties is recorded.

13. Important subsequent event

No important subsequent event is recorded.

14. Trading finance lease related

- (1) Equivalent transaction prices, equivalent accumulated depreciation, and equivalent balance at the end of period for lease objects

(Unit: yen)

	Machine and equipment	Tools and furniture	Total
Equivalent transaction prices	148,002,000	34,521,900	182,523,900
Equivalent accumulated depreciation	81,401,100	23,528,680	104,929,780
Equivalent balance at the end of period	66,600,900	10,993,220	77,594,120

- (2) Equivalent balance at the end of period of prepaid lease revenue

(Unit: yen)

	Within one year	Over one year	Total
Equivalent balance at the end of period of prepaid lease revenue	35,390,100	31,040,400	66,430,500

- (3) Current paid lease revenue, equivalent depreciation

(Unit: yen)

Paid lease revenue	37,893,660
Equivalent depreciation	38,015,060

- (4) Equivalent depreciation is calculated on a straight-line basis.

- (5) Equivalent interest is not accounted.

15. Retirement benefit related

- (1) Summary of employed retirement benefit

As a defined-benefit system, retirement pension system and termination allowance plan are employed.

- (2) Retirement benefit liability and its contents

(Unit: yen)

Content	Balance at the end of period	Remarks
[1] Retirement benefit liability	△21,545,404,762	
[2] Retirement pension asset	14,125,662,428	
[3] Non-accumulated retirement benefit	△7,419,742,334	[1] + [2]
[4] Non-depreciated mathematical calculation difference	296,257,666	
[5] Accrued retirement benefits for employees	△7,716,000,000	[3] - [4]

(3) Items for retirement benefit expense

(Unit: yen)

<b>Content</b>	<b>Expense</b>
[1] Working expense	913,558,739
[2] Interest expense	420,018,296
[3] Expectable operation benefit	△150,996,152
[4] Mathematical calculation difference depreciation	△228,556,433
<b>Total</b>	<b>954,024,450</b>

(4) Items for calculation bases of retirement benefit liability

- [1] Period allocation method of retirement benefit expectation: Period fixed amount standard based on the working period
- [2] Discount rate: 2.0%
- [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.

## Lists of Assets

As of March 31 2008

(Unit: yen)

Subject	Amount of money		Memo
<b>I. Assets section</b>			
<b>1. Floating asset</b>			
<b>Cash and deposit</b>			
General deposit	4,311,637,693		Mitsubishi Tokyo UFJ bank, 3,433,427,352 yen and others
Fixed deposit account	100,000,000		Tokyo Tomin Bank, Limited, 100,000,000 yen
Postal savings	6,679,730		Ordinary deposit
		4,418,317,423	
Securities		13,059,800	Open-end bond investment trust
Account receivable		1,852,110,020	Funded research business income and others
Suspense payment		133,444,324	Temporary payment consumption tax on construction suspense account expense and others
Advance payment		8,610,405	Research survey consignment and others
Total floating asset			6,425,541,972
<b>2. Fixed asset</b>			
<b>(1) Fundamental property</b>			
<b>Case and deposit</b>			
Fixed deposit account		7,000,000	Mizuho trust bank
Total fundamental property		7,000,000	
<b>(2) Special asset</b>			
<b>Building</b>			
Steel structure	621,962,762		Yokosuka area, short circuit test house and others
Building attached structure	132,034,000		Komae area, WANO Tokyo center, air conditioner and others
Accumulated depreciation	396,464,985		
Subtotal of building		357,531,777	
<b>Structures</b>			
Structures	25,095,620		Yokosuka area, short circuit test house, outdoor facility and others
Accumulated depreciation	23,453,618		
Subtotal of structures		1,642,002	
<b>Machine and equipment</b>			
Research machine and equipment	50,970,667		Air electromagnetic flaw detector and others
General machine and equipment	3,329,065,502		Large capacity short circuit test facility and others
Accumulated depreciation	2,918,575,886		
Subtotal of machine and equipment		461,460,283	
<b>Tools and furniture</b>			
Research tools and furniture	132,064,274		Nano particle instrument laser system and others
Accumulated depreciation	106,100,875		
Subtotal of tools and furniture		25,963,399	
<b>Intangible fixed asset</b>			
Research software	2,504,680		GIS software and others
Accumulated depreciation	143,211		
Subtotal of intangible fixed asset		2,361,469	
<b>Accrued retirement benefits for employees special asset</b>			
Housing loan	20,989,397		Personnel loan
Welfare loan	32,693,000		Personnel loan
Long-term official credit deposit	397,318,320		Caution money and guarantee deposit and others
Special deposit	2,984,899,283		General deposit: Mitsubishi Tokyo UFJ bank, 34,899,283 yen
Subtotal of accrued retirement benefits for employees special asset		3,435,900,000	Fixed deposit account: Mitsubishi Tokyo UFJ bank, 2,950,000,000 yen
Research facility acquiring benefits special asset		1,380,000,000	Fixed deposit account: Mitsubishi Tokyo UFJ bank, 1,380,000,000 yen
Total special asset		5,664,858,930	
<b>(3) Other fixed asset</b>			
<b>Land</b>			
Komae area	1,858,713,231		Research institute land and others 71,389.31 m <sup>2</sup>
Abiko area	1,584,921,459		ditto 177,816.01 m <sup>2</sup>
Yokosuka area	372,023,039		ditto 206,721.92 m <sup>2</sup>
Akagi area	651,429,826		ditto 1,005,571.44 m <sup>2</sup>
Others	440,309,121		Shiobara experimental land and others 55,418.81 m <sup>2</sup>
Land subtotal		4,907,396,676	

Subject	Amount of money		Memo
Building			
Reinforced concrete structure	12,325,750,572		Yokosuka area, administration building and others
Steel structure	5,496,815,357		Komae area, third building and others
Wooden structure	57,535,993		Okachi experiment field measuring house and others
Building attached structure	11,616,772,703		Yokosuka area, administration south building, air conditioner and others
Accumulated depreciation	16,448,664,445		
Building subtotal		13,048,210,180	
Structure			
Structure	4,468,766,375		Yokosuka area, second switchgear and others
Greening facility	203,900,309		Akagi area, planting and others
Other structures	586,930,556		Abiko south No.2 and 3 experiment houses front door repair and others
Accumulated depreciation	4,084,181,828		
Subtotal of structure		1,175,415,412	
Machine and equipment			
Research machine and equipment	45,796,657,896		Large computer system (first term) and others
General machine and equipment	2,366,175,398		Large capacity short circuit test facility and others
Accumulated depreciation	37,778,199,284		
Subtotal of machine and equipment		10,384,634,010	
Tools and furniture			
Research tools and furniture	6,899,379,840		Wind speed field observation system within atmospheric boundary layer and others
General tools and furniture	993,404,548		Abiko, Yokosuka network component and others
Fixture and household furniture	343,948,430		Manual moving shelf and others
Car and vehicle	76,876,662		Elevated working vehicle and others
Accumulated depreciation	6,321,352,881		
Subtotal of tools and furniture		1,992,256,599	
Intangible fixed asset			
Research software	1,972,263,296		Reliability analysis program and others
Business software	879,225,737		ERP system and others
Facility utilization right	128,134,254		Yokosuka area, sewer work contribution and others
Telephone right	8,975,000		Each area telephone rights
Accumulated depreciation	1,875,068,821		
Subtotal of intangible fixed asset		1,113,529,466	
Building under construction		1,776,114,920	Yokosuka area insulation experiment house (tentative name) new construction and others
Long-term advanced payment		841,960,000	Equivalent facility construction expense in research contribution on research collaboration (coal gasification combined power demonstration plant research)
Other fixed asset total		35,239,517,263	
Fixed asset total			40,911,376,193
Asset total			47,336,918,165
II. Liability section			
1. Floating liability			
Accrued liability		5,436,221,535	Contract construction and purchased goods expense and others
Money entrusted		95,435,795	Consumption tax, inhabitant's tax and others
Accrued bonuses		399,000,000	Allowance for employee, etc. bonus
Floating liability total			5,930,657,330
2. Fixed liability			
Allowance for retirement benefits for directors		393,000,000	Allowance for retirement benefits for directors
Allowance for retirement pension benefits for employees			
Accrued retirement lump sum benefits for employees		7,716,000,000	Allowance for retirement benefits for employees, etc.
Total fixed liability			8,109,000,000
Total liability			14,039,657,330
Net asset			33,297,260,835

## Cash flow calculation sheet

From April 1, 2007 to March 31, 2008

(Unit: yen)

Subject	Current year	Previous year	Increase/ decrease
I Cash flow in business activity			
1. Current period ordinary net property increase/decrease	670,112,005	-	-
2. Adjust amount to cash flow			
(1) Depreciation allowance	5,388,820,182	-	-
(2) Fixed asset loss on retirement	389,784,855	-	-
(3) Transferred long-term advance payment	132,991,000	-	-
(4) Loss on fixed asset sale	220,384	-	-
(5) Facility donating profit	Δ 3,673,392	-	-
(6) Increase/decrease in allowance for retirement benefits for directors	Δ 20,833,000	-	-
(7) Increase/decrease in accrued retirement benefits for employees	Δ 238,954,000	-	-
(8) Increase/decrease in accrued bonus	Δ 18,300,000	-	-
(9) Increase/decrease in account receivable	1,321,526,071	-	-
(10) Increase/decrease in suspense payment	Δ 11,927,902	-	-
(11) Increase/decrease in advance payment	5,347,695	-	-
(12) Increase/decrease in accrued liability	Δ 322,789,150	-	-
(13) Increase/decrease in money entrusted	1,053,675	-	-
(14) Transferred amount from designated net property	Δ 128,550,019	-	-
(15) Others	Δ 460,000	-	-
Subtotal	6,494,256,399	-	-
3. Increase/decrease in designated net property			
(1) Subsidy income	7,807,790	-	-
Cash flow by business activity	7,172,176,194	-	-
II Cash flow by investment activity			
1. Investment activity income			
(1) Long-term deposit repayment income	30,000,000	-	-
(2) Transferred income from research facility acquiring special asset	710,000,000	-	-
(3) Fixed asset sale income	160,000	-	-
Total investment activity income	740,160,000	-	-
2. Investment activity expenditure			
(1) Special asset acquiring expenditure	900,000,000	-	-
(2) Fixed asset acquiring expenditure (note 3)	6,700,291,962	-	-
Total investment activity expenditure	7,600,291,962	-	-
Cash flow by investment activity	Δ 6,860,131,962	-	-
III Cash flow by financial activity			
1. Financial activity income	0	-	-
2. Financial activity expenditure	0	-	-
Cash flow by financial activity	0	-	-
IV Difference in conversion of cash and cash equivalent	0	-	-
V Increase/decrease in cash and cash equivalent	312,044,232	-	-
VI Cash and cash equivalent balance at the beginning of a period (note 4)	4,119,332,991	-	-
VII Cash and cash equivalent balance at the end of a period (note 4)	4,431,377,223	-	-

Note: 1 Asset scope

Asset scope includes cash and cash equivalent.

2 Important non-asset trade

No important non-asset trade is reported.

3 Breakdown of fixed asset acquiring expenditure

Fixed asset acquiring expenditure	5,803,521,045
Increase/decrease in accrued liability	856,748,917
Long-term advance payment expenditure	40,022,000
Total	6,700,291,962

4 Relation between cash and cash equivalent balance at the end of a period and amount of money described in balance sheet

Subject	Beginning of current period	End of current period
Cash deposit	4,149,332,991	4,418,317,423
Including long-term deposit	Δ 30,000,000	0
Securities	0	13,059,800
Cash and cash equivalent	4,119,332,991	4,431,377,223

## II. Statement of Revenues and Expenses

### Statement of revenues and expenses

From April 1 2007 to March 31 2008

(Unit: yen)

Subject	Budget	Account settlement	Difference	Remarks
<b>I. Business activity balance of payments section</b>				
1. Business activity income				
(1) Benefit income				
Current benefit income	28,000,000,000	28,131,396,000	Δ 131,396,000	
(2) Business income	3,950,000,000	3,722,575,994	227,424,006	
Funded research business income	( 3,340,000,000 )	( 3,065,931,330 )	( 274,068,670 )	
Other business income	( 610,000,000 )	( 656,644,664 )	( Δ 46,644,664 )	
(3) Other income	130,000,000	162,398,698	Δ 32,398,698	
Total business activity income	32,080,000,000	32,016,370,692	63,629,308	
2. Business activity expenditure				
(1) Business expense expenditure	24,800,000,000	23,953,812,776	846,187,224	
Personnel expense expenditure	( 9,910,000,000 )	( 9,817,632,245 )	( 92,367,755 )	
Expense expenditure	( 14,890,000,000 )	( 14,136,180,531 )	( 753,819,469 )	
(2) Management cost expenditure	2,590,000,000	2,016,423,111	573,576,889	
Personnel expense expenditure	( 1,240,000,000 )	( 1,044,187,369 )	( 195,812,631 )	
Expense expenditure	( 1,350,000,000 )	( 972,235,742 )	( 377,764,258 )	
Total business activity expense	27,390,000,000	25,970,235,887	1,419,764,113	
Difference in business activity balance of payments	4,690,000,000	6,046,134,805	Δ 1,356,134,805	
<b>II. Investment activity balance of payments section</b>				
1. Investment activity income				
(1) Special asset transferred income				
Research facility acquiring special asset transferred income	1,090,000,000	710,000,000	380,000,000	
(2) Long-term advance payment transferred income	210,000,000	132,991,000	77,009,000	
Total investment activity income	1,300,000,000	842,991,000	457,009,000	
2. Investment activity expenditure				
(1) Special asset acquiring expenditure				
Research facility acquiring special asset expenditure	900,000,000	900,000,000	0	
(2) Fixed asset acquiring expenditure	5,500,000,000	5,803,521,045	Δ 303,521,045	
(3) Long-term advance payment expense expenditure	40,000,000	40,022,000	Δ22,000	
Total investment activity expenditure	6,440,000,000	6,743,543,045	Δ 303,543,045	
Difference in investment activity balance of payments	Δ 5,140,000,000	Δ 5,900,552,045	760,552,045	
<b>III. Financial activity balance of payments</b>				
1. Financial activity income	0	0	0	
2. Financial activity expenditure	0	0	0	
Difference in financial activity balance of payments	0	0	0	
Difference in current balance of payments	Δ 450,000,000	145,582,760	Δ 595,582,760	
Difference in balance of payments transferred from previous period	450,000,000	748,301,882	Δ 298,301,882	
Difference in balance of payments transferring to next period	0	893,884,642	Δ 893,884,642	

### Note for income and expenditure accounts

1. Scope of revenue

Scope of revenue includes cash and deposit, securities, account receivable, suspense payments, advanced payment and accrued liability, money entrusted, and advance receipt. Balances at the ends of previous and current periods are as shown in the following paragraph 2.

2. Breakdown of assets and liabilities included in difference in balance of payments transferred to next period

(Unit: yen)

Subject	Balance at the end of previous period	Balance at the end of current period
Cash and deposit	4,149,332,991	4,418,317,423
Securities	0	13,059,800
Account receivable	3,173,636,091	1,852,110,020
Suspense payments	121,516,422	133,444,324
Advanced payment	13,958,100	8,610,405
Total	7,458,443,604	6,425,541,972
Accrued liability	6,615,759,602	5,436,221,535
Money entrusted	94,382,120	95,435,795
Total	6,710,141,722	5,531,657,330
Difference in balance of payments transferred to the next period	748,301,882	893,884,642

## **Audit Report by Third-Party Auditor**

May 7, 2008

Foundation of Central Research Institute of Electric Power Industry

Administrative Director

Ryoichi Shirato

Certified public accountant, Wada Yoshihiro Office

Certified public accountant, Wada Yoshihiro

Certified public accountant, Kanbayashi Katsuaki Office

Certified public accountant, Kanbayashi Katsuaki

We audited the financial statements of the Foundation of Central Research Institute of Electric Power Industry (herein after referred to as CRIEPI) in the FY 2007 business term from April 1 2007 to March 31 2008, including balance sheets, net property increase/decrease calculation sheets, statement of cash flow, statement of flow property list and income and expenditure account statement (hereinafter referred to as “financial statements”.) The responsibility to prepare these financial statements falls upon the executive board members, and our responsibility is to express an opinion on the financial statements from an independent standpoint.

We carried out the audit based on an auditing standard generally authorized to be public and acceptable in Japan. The auditing standard requires us to give reasonable assurance that no false expression is contained in financial statements. The audit is done based on audit tests to thoroughly check expressions in financial statements, including the account policy employed by the executive board members and its application method, and an assessment of estimations made by the members. We understand that reasonable basement was obtained to express our opinion as the audit result.

As the result of the audit, our opinion is as follows:

- (1) We accepted that all important points in the financial states of CRIEPI at the end of the business term in FY 2007 and net property increase/decrease and cash flow at the business term are expressed correctly in their financial statements, according to the public-service corporation accounting standard to be public and acceptable in Japan.
- (2) We accept that the income and expenditure account statement is prepared correctly based on “internal management items in the public-service corporation account” (March 23, 2005, mutual agreement at related government ministries and agencies liaison conference on guidance in public-service corporations) and expresses all important points for the balance of payments in the FY 2007 business term for CRIEPI.

Between CRIEPI and us, there is no interest to be describe based on certified public accountant law.



# **Audit report**



# Audit Report

May 14, 2008

Foundation of Central Research Institute of Electric Power Industry

Administrative Director

Ryoichi Shirato

Foundation of Central Research Institute of Electric Power Industry

Auditor, Katsutoshi Tsukidate

Auditor, Koji Kaifu

On the basis of the provision in Article 7 on Foundation of Central Research Institute of Electric Power Industry endowment act, we audited business reports and settlement of accounts in the FY 2007 business term (balance sheet, net property increase/decrease calculation sheet, statement of cash flow, property lists, and income and expenditure account statement) to accept their appropriateness.