Appendix I

Terms of Reference (draft) for Consultancy Services

Example of Terms of Reference (ToR) - Draft

Terms of Reference for Design and Supervision Consultant for the Design and Build under Engineering Activities of the Barauni Extension Project, Unit No. 10

Chapter 1. Background

1. General

The fundamental purpose of national electric power development is to secure the supply capacity for satisfying the rapid increment of power demand in concurrence with the rapid economic growth of the Republic of India. Electricity shortage in the State of Bihar is currently reaching 4.7 of the supply and 21.8 % of the peak demand hence the government of Bihar state plans huge increment of the power generation capacity in order to meet the growing demand.

With the decommissioning of Units No.4/5 (2 x 50 MW) at Bihar Thermal Power Station (BTPS), Bihar State Power Generation Company Limited (BSPGCL) launched an examination of new power generation equipment. Instead of the originally planned subcritical pressure 250 MW unit, the possibility of construction of a 660 MW supercritical pressure coal-fired thermal power station was requested from the government of India to the Japan International Cooperation Agency (JICA). In fiscal year 2015, JICA implemented a feasibility study of constructing Unit No. 10, a 660 MW-class coal-fired thermal power station, concluding that the introduction of supercritical pressure or higher was feasible. Thermal efficiency of about 42 % can be expected if supercritical or ultra-supercritical pressure is adopted for a 660 MW-class unit.

The Government of India intends to use part of the proceeds of the loan for eligible payments for consulting services for which this ToR is issued.

2. Description of the Project

(1) Configuration of the Project

The Project comprises of the following components:

Civil, Electrical and Mechanical EPC Contract of Power Plant Construction

(2) Duration of the Project

The Project of the Power Plant is expected to be completed in 52 months after NTP.

(3) Location of the Project

BTPS is located in the Begusarai District about 110 km east of Patna, the capital of the State of Bihar, on the north bank of the Ganga River and nearby the National Highway Route 31 (NH-31).

(4) Executing Agency:

Bihar State Power Generation Company Limited (BSPGCL) and Bihar State Power Transmission Company Limited (BSPTCL)

(5) Technical information:

Regarding steam conditions of the 660 MW supercritical unit, steam pressure was set at 245 bar and steam temperature was set at 593°C/593°C (main steam/reheated steam). Power stations with these steam conditions are increasing in India and there are many power stations of this type in Japan. Therefore, reliability and high performance of this type of power station have been fully proved.

1) Plant performance

Expected plant performance was calculated, using the following steam conditions.

- Main steam pressure: 245 bar
- Main steam temperature: 593ºC
- Main steam flow rate: 1,860 t/h
- Reheat steam pressure: 48.9 bar
- Reheat steam temperature: 593ºC
- Reheat steam flow rate: 1,854 t/h

2) Plant power output

100 %TMCR output – 660 MW (generating end) Conditions

- Make-up water: 0 %
- Condenser vacuum: 65 mmHg

3) Governing valve at Valve Wide Open (VWO) - 693 MW (generating end)

4) Station service power

The station service power is expected to be 36,200 kW during the rated load (100 %TMCR) continuous operation.

5) Plant heat rate

The plant heat rate is expected to be 1,791 kcal/kWh at TMCR.

6) Boiler efficiency

The boiler efficiency is expected to be 87.66 % at TMCR at the ambient temperature of 25 degree C and RH of 67 %.

(6) Related projects

BSPGCL is currently implementing Rehabilitation & Modernization / Life Extension work on Units No.6/7 (2 x 110 MW) and the construction of Units No.8/9 (2 x 250 MW) at BTPS.

(7) Characteristic of the Project Implementation

1) Availability of the Project Area

To make available an area of approximately 120 m x 50 m for the turbine building, 100 m x 80 m for the Boiler facility and to make use of the limited area for implementing construction adjacent to Units No. 8/9.

2) Quality Control

To keep and/or store equipment, parts and materials free from the flying ash to satisfy Quality Assurance requirements in construction phase.

3) Technology Transfer

Technology Transfer of Supercritical Pressure Power Station to Executing Agency staff shall be prioritized because the Technology is first introduced to Executing Agency.

(8) Scope of Works under the Project

The scope of works for The Project is as follows:

Table 1-1 The scope of works for the Project

Lots	Contents
Lot 1: Power Plant	➢ Civil and Foundation work of Power Plant ➢ Construction of Buildings of Boiler, Turbine, Generator and other facilities ➢ Boiler ➢ Air Quality Control System ➢ Turbine ➢ Generator ➢ Generator Transformer ➢ Switchyard ➢ Cooling System ➢ Chimney ➢ Fuel Oil Handling System ➢ Coal Handling System ➢ Plant Water System ➢ Ash Handling System ➢ HVAC system
Consulting services	➢ Basic design ➢ Detail design ➢ Tender assistance ➢ Construction supervision ➢ Facilitation of implementation of Environmental Plan, Environmental Monitoring Plan and Resettlement Action Plan ➢ Technology transfer

The procurement of Power Plant shall apply JICA STANDARD BIDDING DOCUMENTS “Design Build”.

Chapter 2. Objectives of Consulting Services

The objective of the consulting services will be to assist Executing Agency in its implementation of the Project. An international consulting firm (hereinafter referred to as the "Consultant") shall endeavor to carry out all the services as described herein under in a satisfactory manner in order to ensure the successful completion of the Project with the quality, cost and schedule originally planned.

The Consultant shall comply with Guidelines for the Employment of Consultants under Japanese ODA Loans, April 2012. The Consultant is to achieve the efficient and proper preparation and implementation of the Project through the following works:

- Basic design
- Detailed design
- Tender Assistance
- Construction Supervision
- Facilitation of implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)
- Technology transfer

Chapter 3. Scope of Consulting Services

(1) Basic design

The Consultant shall:

- List and classify systematically the Technical Standards, Guidelines and Regulations for planning and developing of thermal power stations and related infrastructures in India.
- Collect and trace the past background for the originally planned Unit 10 (1 x 250 MW) and comment about the differences between the original and the current designs.
- Summarize a basic study for the conceptual design of Unit 10 – design condition, engineering data, calculation formula, information criteria and specifications for plant systems and transmission line.
- Check and review the development document – feasibility report and detailed project report- for Unit 10 and provide BSPGCL with comments as required.
- Include Conceptual Designs to determine the capacity of equipment, layouts and arrangement of components, selection of equipment and materials including those related to environmental issues.

(2) Detailed design

The Consultant shall:

- Review and verify all available primary and secondary data collected during the JICA's preparatory survey for the Project;
- Collect all existing engineering design data and data other than the above;
- Carry out all the required engineering surveys and investigations such as topographical survey, hydrological survey, geotechnical survey, material availability survey and etc., as applicable to the concerned project components;
- Prepare detailed work plan, progress reports and implementation schedule for the Project to ensure effective monitoring and timely project outputs, and regularly update the same; and
- Prepare the detailed design of the Project in sufficient detail to ensure clarity and understanding by Executing Agency, contractors and other relevant stakeholders. All the design should be in conformity with the Indian Standards (if available), or with the appropriate international standards. The detailed design will, as a minimum, include construction drawings, detailed cost estimates, necessary calculations to determine and justify the engineering details for the Project, associated contract documentation to include detailed specifications, bill of quantities (BOQ), and implementation schedule for the Project. Such detailed specifications will contain those in relation to i) quality control of plant materials and workmanship, ii) safety, and iii) protection of the environment. The detailed design shall be prepared in close consultation with, and to meet the requirements of Executing Agency and will be incorporated into the detailed design report to be submitted for approval of Executing

Agency.

- Investigate, test, and define sources and estimated quantities of construction materials and prepare the material sources map with indicative properties, its applicability (i.e. for sub-grade, for sub-base and etc.) and estimated quantities.
- Assess the air pollution and noise impact to be caused by the Project based on the measured baseline data (background noise) and define appropriate mitigation measures.

(3) Tender assistance

1) Assistance in Pre-Qualification (PQ)

The Consultant shall:

- Define technical and financial requirements, capacity and/or experience for PQ criteria taking into consideration technical feature of the Project;
- Prepare PQ documents in accordance with the latest version of Standard Prequalification Documents under Japanese ODA Loans;
- Assist Executing Agency in PQ announcement, addendum/corrigendum, and clarifications to the applicants' queries;
- Evaluate PQ applications in accordance with the criteria set forth in PQ documents; and
- Prepare a PQ evaluation report for approval of the PQ evaluation committee.

2) Assistance in the Bidding Procedures

The Consultant shall:

- Prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement of Works together with all relevant specifications, drawings and other documents;
- Prepare bidding documents which includes i) clauses stating that the Contractor is to comply with the requirement of the Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) JICA Guidelines for environmental and social considerations (April 2010) (JICA Environmental Guidelines), ii) the specification clearly stipulating the safety requirements in accordance with the laws and regulations in the country of the Borrower, relevant international standards (including guidelines of international organization), if any, iii) the requirement to furnish a safety plan to meet the safety requirements and iv) the requirement for the personnel for key positions to include an accident prevention officer.
- Assist Executing Agency in issuing bid invitation, conducting pre-bid conferences, issuing addendum/corrigendum, and clarifications to bidders' queries.
- Evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical

proposal including, but not limited to; site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP, have been prepared in consistent with each other and meet requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;

- Prepare a bid evaluation report for approval of the bid evaluation committee;
- Assist Executing Agency in contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
- Prepare a draft and final contract agreement.

(4) Construction supervision of the Power Plant

The Consultant shall perform his duties during the contract implementation period of the contracts to be executed by Executing Agency and the Contractor. Standard Bidding Documents under Japanese ODA Loans for Procurement of Electrical and Mechanical Plant, and for Building and Engineering Works, Designed by the Contractor will be applied to this Project. In this context, the Consultant shall:

- Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by Executing Agency;
- Provide assistance to Executing Agency concerning variations and claims which are to be ordered/issued at the initiative of Executing Agency. Advise Executing Agency on resolution of any dispute with the Contractor;
- Issue instructions, approvals and notices as appropriate;
- Provide recommendation to Executing Agency for acceptance of the Contractor's performance security, advance payment security and required insurances;
- Provide commencement order to the Contractor;
- Assess adequacy of all inputs such as materials, labor and equipment provided by the Contractor;
- Check and approve the Contractor's method of work, including site organization, program of performance, quality assurance system, safety plan, and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;
- Regularly monitor physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;
- Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions;
- Review and approve the Contractor's design for the works to be constructed, working

drawings, shop drawings and drawings for temporary works;

- Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;
- Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the Contract;
- Organize, as necessary, management meetings with the Contractor to review the arrangements for future work. Prepare and deliver minutes of such meetings to Executing Agency and the Contractor;
- Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site. Require the Contractor to take appropriate remedies if any questions are recognized regarding the safety measures;
- Supervise field tests, sampling and laboratory test to be carried out by the Contractor;
- Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with Executing Agency's Requirements;
- Verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;
- Coordinate the works among different contractors employed for the Project;
- Modify Executing Agency's Requirements as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);
- Carry out timely reporting to Executing Agency for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
- Inspect, verify and fairly determine claims issued by the parties to the contract (i.e. Executing Agency and Contractor) in accordance with the Contract;
- Supervise the Test on Completion carried out by the Contractor and assist Executing Agency in carrying out the Test after Completion, if applicable;
- Perform the inspection of the works and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the Contract;
- Provide periodic and/or continuous inspection services during defects notification period and if any defects are noted, instruct the Contractor to rectify;
- Check and certify as-built drawings prepared by the Contractor; and
- Check and certify the operation and maintenance manual prepared by the Contractor.

Prepare and submit reports to the BSPGCL, which are detailed in Chapter 6 in relation to the implementation of the Project.

(5) Facilitation of implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)

The Consultant shall:

- Update EMP as appropriate; incorporating necessary technical specifications with design and contract documentation;
- Assist Executing Agency in complying with laws and regulations relevant with EIA procedures and environmental protection, and complying with the conditions stated in Environmental Clearance (EC) and other permits obtained for the Project;
- Assist Executing Agency in dissemination and explanation of additionally confirmed and identified environmental and issues to public in a way such as by holding public consultation meetings;
- Assist Executing Agency to review the Construction Contractor's Environmental Program to be prepared by the Contractor in accordance with EMP, EMoP and other relevant plans and JICA Environmental Guidelines and to make recommendations to MoEF regarding any necessary amendments for its approval;
- Assist Executing Agency to implement the measures identified in the EMP;
- Assist Executing Agency to review Waste Management Plan, and other necessary plans to be prepared by the Construction Contractor in accordance with the EMP and ESIA Report, and make recommendations to Executing Agency regarding any necessary amendments for its approval.
- Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that Executing Agency can improve situation when necessary;
- Assist Executing Agency in monitoring the compliance with conditions stated in the EC and the requirements under EMP and JICA Environmental Guidelines;
- Assist Executing Agency in preparation of the answer to the request from JICA's advisory committee for environmental and social considerations if necessary;
- Assist Executing Agency in the capacity building of Executing Agency staff on environmental management through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring, and reporting;
- Update and/or revise RAP as necessary based on detailed design in accordance with the agreed resettlement framework, including entitlement matrix and compensation plan; coordinate with various agencies in preparing the procedures for timely land acquisition and

disbursement of compensation to Project Affected Persons (PAPs);

- Assist Executing Agency in identifying the eligible PAPs, and in preparation/updating of the list of eligible PAPs and 'Payment Statement' for individual eligible PAPs. The places where each eligible PAPs will relocate to are necessary to be recorded so that Executing Agency could implement monitoring on income and living conditions of resettled persons;
- Assist Executing Agency in conducting social assessment during early stage of the detailed design stage and review the existing income restoration plan and special assistance plan for vulnerable PAPs and revise/update the contents of the plans if necessary based on priorities identified with support of relevant government agencies and Non-Governmental Organizations (NGOs). The following contents should be included in the plans;
  - ✓ Skills Training
  - ✓ Project related Job Opportunities
  - ✓ Provision of social welfare grant
  - ✓ Provision of Agricultural Extension Services
  - ✓ Provision of the special allowance to vulnerable PAPs
- Assist Executing Agency to implement the measures identified in the revised RAP.
- Monitor land acquisition and compensation activities being undertaken by Executing Agency and and/or competent authorities, and report the results in monthly progress reports;
- Assist Executing Agency in procurement of RAP Implementation organization (e.g. NGO, consultants), and experts, external monitoring agency;
- Assist Executing Agency in facilitating stakeholder's participation (including focus group discussions for vulnerable PAPs) and providing feedback their comments on RAP;
- Assist Executing Agency in establishment of grievance redress mechanism including formation of Grievance Redressal Committee (GRC);
- Assist Executing Agency to ensure that the PAPs are fully aware of the grievance redress procedure and the process of bringing their complaints, investigate the veracity of the complaints, and recommends actions/measures to settle them amicably, fairly and transparently before they go to the redress committee or the courts of law;
- Provide technical services with GRC for keeping and updating records when necessary.

(6) Technology transfer

The Consultant shall carry out the technology transfer as an important aspect in design and supervision works. The Consultant shall provide the opportunity to Executing Agency officers and staffs to be involved in the working team of the Consultant during the design, contract administration and supervision works for their capacity building wherever possible. If requested by BSPGCL, the Consultant shall brief and demonstrate the survey and design procedure, the construction supervision

and contract management process and procedures. The Consultant shall assist Executing Agency and its staff to build their capacity as a part of on the job training under the Project.

Chapter 4. Expected Time Schedule

The total duration of consulting services will be 66 months followed by 12 months of defects liability period. The implementation schedule expected is as shown in Table 4-1.

Table 4-1 Implementation Schedule Expected

Key Activities	Date	Duration in Months
Commencement of Consulting Services	14 months before NTP	6
Completion of detail design, preparation of drawings and tender documents	6 months after the Contract between Executing Agency and Consultant	
Tender process including prequalification	5 months after the contract between Executing Agency and Consultant	5
Commencement of EPC works of Power Plant	14 months after Commencement of Consulting Services	52
End of EPC works of Power Plant	52 months after NTP	
Defect Liability Period of Power Plant	12 months after Delivery and start commercial running	12
Termination of Consulting Services of Power Plant	12 months after Delivery and start commercial running	12

Chapter 5. Staffing (Expertise required)

13 of Professional A consultants and 20 of Professional B consultants will be engaged, over 13 months' duration of consulting services, for a total of 340 man-months for Professional A and 551 man-months for Professional B consultants. Total consulting input is 891 man-months.

(1) Qualification of key Team Members

The qualification of key Team Members is shown in Table 5-1.

Table 5-1 Qualification of key Team Members

Professional A	
Designation	Qualification
Project Manger	Education: ➢ Bachelor degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as power plant engineer ➢ Experience in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600MW) with AQCS (ESP, SCR and FGD) ➢ Experience of overseas projects implemented by ODA ➢ Experience of leading a consultants' team as Project Manager or Deputy Project Manager in projects (at least one as Team Leader)
Civil Engineer (Power Plant)	Education: ➢ Bachelor Degree of Civil Engineering or other relevant Experience: ➢ Experience as civil engineer ➢ Experience in thermal power generation projects which capacity not less than 600 MW with AQCS ➢ Experience in power plant construction projects
Mechanical Engineer (Boiler) Mechanical Engineer (Turbine)	Education: ➢ Bachelor Degree of Mechanical Engineering Experience: ➢ Experience as power plant engineer in construction to power plant

	➢ Experience in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600 MW, and at least one shall be his/her own specialized field) with AQCS ➢ Experience of test run, operation, maintenance and/ or management of USC power plant.
Electrical Engineer (Generator/Sub-station)	Education: ➢ Bachelor Degree of Electrical Engineering Experience: ➢ Experience as electrical engineer for power plant, substation, and/or switch yard in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600 MW, and at least one shall be his/her own specialized field) ➢ Experience of design and/or supervision of installation works for power plant, substation and/or switch yard
Professional B	
Designation	Qualification
Project Manger	Education: ➢ Bachelor degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as power plant engineer in construction of power plant ➢ Experience in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600 MW) with AQCS ➢ Experience of overseas projects implemented by ODA ➢ Experience of leading a consultants' team as Project Manager or Deputy Project Manager in projects (at least one as Team Leader)
Assistant Project Manager	Education: ➢ Bachelor Degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as power plant engineer

	➢ Experience in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600 MW) with AQCS ➢ Experience of construction supervision for power sector projects in ICB contract ➢ Experience of leading a consultants' team as Project Manager or Deputy Project Manager in projects (at least one as Team Leader)
Mechanical Engineer (Boiler) Mechanical Engineer (Turbine)	Education: ➢ Bachelor Degree of Mechanical Engineering Experience: ➢ Experience in professional power plant engineer ➢ Experience in thermal power generation projects (at least one shall be USC coal-fired power plant of which capacity not less than 600 MW) with AQCS
Environmental Expert	Experience: ➢ Experience in safeguard related fields ➢ Experience as safeguard Specialist
Social Expert	Experience: ➢ Experience in safeguard related fields ➢ Experience as safeguard Specialist

Consultant may propose other experts and supporting staffs required to accomplish the tasks outlined in the ToR.

(2) Scope of works for the respective personnel

Detailed information on the major tasks and duties each member of the detailed engineering design team and the construction supervision team shall perform is provided as follows:

No	Position	I or L	Major Tasks and Duties
A-1	Project Manager	I (Pro-A)	➢ Check and review the development document – Feasibility Study Report (FSR) and Detailed Project Report (DPR) for Unit No. 10 and provide comments as required. ➢ Prepare the Design Concept or the Project Design Report, and to discuss and agree with BSPGCL on it before establishing the full scope. ➢ Prepare an updated Project Implementation Schedule, Project Cost Estimation, Cash Flow and Economic/Financial and Performance Analysis. ➢ Prepare the technical specification. ➢ Prepare Pre-qualification (P/Q) documents in accordance with JICA Guidelines for Procurement and the Indian Regulations for review and approval by BSPGCL for the Project, assist BSPGCL in P/Q Announcement, evaluate P/Q proposals in accordance with BSPGCL and JICA approved criteria and prepare draft and final P/Q Evaluation Reports to BSPGCL. ➢ Assist BSPGCL in the evaluation and tabulation of the contents of all bids for compliance with the tender specifications, reasonableness of prices and proposed time for completion of the work and any supply with any other guidance as required by BSPGCL and JICA. ➢ Assist BSPGCL in preparing Bidding Documents and relevant Drawings in accordance with JICA Guidelines and BSPGCL Guidelines and Practice. ➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Assist BSPGCL in the contract negotiation by preparing agenda for negotiations. During the contract negotiations, appropriate assistance shall be rendered to BSPGCL to facilitate the successful completion of the negotiations, including preparation of draft minutes of negotiation meeting. ➢ Establish a basic overall project construction schedule, preparation of project Program Evaluation and Review Technique (PERT) / Critical Path Method (CPM) network, budget and cash disbursement schedule for both foreign and local cost. ➢ Establish a project management system and procedures to monitor and control the cost and time schedules to enable timely corrective measures. ➢ Assist construction supervision to ensure the compliance with the technical specifications and construction drawings. ➢ Assist coordination, supervision and inspection of all construction and erection activities. ➢ Review the Contractor's commissioning test report and obtain BSPGCL's approval.
A-2	Engineer (Civil, Mechanical, Electrical and I & C)	I (Pro-A)	➢ List and classify systematically the Technical Standards, Guidelines and Regulations for planning and developing of thermal power stations and related infrastructures in India. ➢ Check and review the development document – Feasibility Study Report (FSR) and Detailed Project Report (DPR) - for Unit No. 10 and provide comments as required. ➢ Prepare Design Calculations, Basic Designs, Drawings,

No	Position	I or L	Major Tasks and Duties
			Specifications and Bill of Quantities for Bidding and Contract Documents, considering the interface between the packages (e.g. Intake water, Water treatment system, Power Plant, Coal Handling System, Ash Handling System, Power Evacuation System, etc.) and Conceptual Designs to determine the capacity of equipment, layouts and arrangement of components, selection of equipment and materials including those related to environmental issues. ➢ Prepare the technical specification. ➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Attend the bid receiving and opening meetings as well as to prepare the Minutes of Meeting. ➢ Review design and engineering activities of the EPC Contractors, all engineering drawing, documents and quality assurance documents to check technical acceptability, conformity with technical specifications and contractual scope, adherence to applicable codes and standards, operational and safety aspects, reliability and ease of maintenance and sound engineering practice. ➢ Provide technical, financial and administrative management supports to BSPGCL, including coordination and decision making actions, engineering and design activities related to construction works in order to ensure that quality control and engineering standards are consistently maintained within cost and time constraints throughout project implementation. ➢ Set up an effective system of project progress and status to BSPGCL. ➢ Advise the Social Development Expert and Environmental Expert to undertake environmental monitoring and take necessary actions. Also ensure the incorporation of the findings and supporting data into the project completion reports. ➢ Review proposal on quality assurance, quality control plan and delivery schedule prepared by the Contractor and obtain BSPGCL's approval. ➢ Regularly review production and delivery schedule by the Contractor ➢ Review factory testing procedures and factory test results submitted by the Contractor and obtain BSPGCL's approval. ➢ Formulate test and commissioning procedures as part of the integrated project management plan. ➢ Review the Contractor's start-up and testing procedures including performance test to meet guarantee and obtain BSPGCL's approval.

No	Position	I or L	Major Tasks and Duties
B-1	Assistant Project Manager	L (Pro-B)	➢ Collect and trace the past background for the originally planned Unit No. 10 (1 x 250 MW) and comment about the differences between the original and the current designs. ➢ Summarize a basic study for the conceptual design of Unit No. 10 – design condition, engineering data, calculation formula, information criteria and specifications for plant systems and transmission line. ➢ Assist BSPGCL in P/Q Announcement. ➢ Evaluate P/Q proposals in accordance with BSPGCL and JICA approved criteria. ➢ Prepare draft and final P/Q Evaluation Reports to BSPGCL. ➢ Coordinate the works among the different Contractors. ➢ Examine, review drawings, procedures and designs submitted by or requested from the Contractor and obtain BSPGCL's approval. These include drawings and designs requiring approval from regulatory bodies. ➢ Check the construction methods and site works carried out by the Contractor and obtain BSPGCL's approval. ➢ Check approve the Contractor's quality assurance and control program and obtain BSPGCL's approval. ➢ Coordinate and supervise all tests according to the Contract. ➢ Review and recommend tentative taking over and acceptance certificates for the equipment, subject to prior approval of BSPGCL. ➢ Conduct adequate on-the-job training programs for a period of 12 months at the Site for BSPGCL operation and maintenance staffs assigned to the operation and maintenance of Unit No. 10 in BTPS. ➢ Train 6 BSPGCL staffs (3 operation staffs and 3 maintenance staffs) for a period of one month in the home country of the Consultant with respect to all aspects related to operation and maintenance technology of Supercritical Pressure Thermal Plant (e.g. periodic inspection and measures, preventing measures and etc.) Prepare the detailed contents and schedule of "training BSPGCL staffs for a period of one month in the home country of the Consultant.
B - 2	Engineer (Civil, Mechanical and Electrical)	L (Pro-B)	➢ Collect and trace the past background for the originally planned Unit No. 10 (1 x 250 MW) and comment about the differences between the original and the current designs. ➢ Summarize a basic study for the conceptual design of Unit No. 10 – design condition, engineering data, calculation formula, information criteria and specifications for plant systems and transmission line. ➢ Check and review of power plant surveys and investigations conducted by the Bidders. ➢ Check, review and clarify regarding the design and calculations submitted by the Bidders. ➢ Check, review and clarify regarding manufacture, fabrication, shop tests and installation drawings submitted by the Bidders. ➢ Check the test procedure for materials and equipment to be tested on site by the Contractor to obtain BSPGCL's approval and witness such tests, review and give recommendation regarding the test result of field test of materials and equipment performed by the Contractor.

No	Position	I or L	Major Tasks and Duties
			➢ Provide necessary interpretation to BSPGCL project manager on technical and commercial issues. ➢ Prepare and update detailed and overall project disbursement schedule and issuance of payment certificates. ➢ Monitor and control work progress and initiate corrective measures. ➢ Prepare and update detailed and overall project physical target accomplishment. ➢ Check, examine and certify the work quantities performed by the Contractor. ➢ Check, examine and solve claims submitted by the Contractor. ➢ Check contractual matters (guarantee, performance bonds, insurance, claims, etc.). ➢ Inspect and direct preventive safety and environmental control measures. ➢ Check as-built drawings and obtain BSPGCL's approval. ➢ Check issuance of "Certificate of Ready" for commissioning certificates by the Contractor. ➢ Monitor manufacturing progress, testing and regular inspection and ensure compliance with contract documents. ➢ Witness factory test of major equipment and prepare corresponding certificates (equipment items and tests to be witnessed needs agreement between BSPGCL and the Contractor). ➢ Review inspection report on each factory inspection submitted by the Contractor. ➢ Coordinate and supervise all tests according to the Contract. ➢ Review and recommend tentative taking over and acceptance certificates for the equipment, subject to prior approval of BSPGCL. ➢ Conduct adequate on-the-job training programs for a period of 12 months at the Site for BSPGCL operation and maintenance staffs assigned to the operation and maintenance of Unit No. 10 in BTPS. ➢ Train 6 BSPGCL staffs (3 operation staffs and 3 maintenance staffs) for a period of one month in the home country of the Consultant with respect to all aspects related to operation and maintenance technology of Supercritical Pressure Thermal Plant (e.g. periodic inspection and measures, preventing measures and etc.) Prepare the detailed contents and schedule of "training BSPGCL staffs for a period of one month in the home country of the Consultant.
B-3	Environment Expert	L (Pro-B)	➢ Supervise and monitor the project from Environmental viewpoint disposed soil, noise, vibration, waste, air and water pollution and etc.
B-4	Social Expert	L (Pro-B)	➢ Supervise and monitor the project from Social viewpoint such as recruitment of non-skilled local workers, CSR and etc.

Chapter 6. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to Executing Agency as shown in Table 6-1. The Consultant shall provide electronic copy of each of these reports.

Table 6-1 Reports and Documents Schedule Expected

Category	Type of Report	Timing	No. of Copies
Consultancy Services	Inception Report	Within1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Quarterly Progress Report	Every quarter	10
	Project Completion Report	At the end of Services	10
Construction Supervision	Quality Control Report	Every month	10
	Completion Report (and As-built Drawings, if any)	At the end of the Project	5
Training	Training Plan	At appropriate timing in accordance with the Inception Report	10
	Training Execution and Evaluation Report	Within 1 month after training	10
Environment and Social Safeguard	Environmental Monitoring Report	Every quarter	10
	Land Acquisition and Resettlement Monitoring Report	Every month	10
	Environmental and Social Safeguard Evaluation Report	At the end of the Project	20
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

- Monthly Progress Report: Describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.
- Inception Report: To be submitted within 1 month after the commencement of the services, presenting the methodologies, schedule, organization, etc.

(1) Detail Design

- Project Definition Report (20 copies), to be submitted in the 3rd month after the commencement of services, presenting the design criteria and standards.

- Draft Detailed Design Report (20 copies), to be submitted in the 6th month after the commencement of services, presenting detailed engineering design.
- Cost Estimate Report (20 copies), to be submitted in the 7th month after the commencement of services, presenting detailed cost estimate.
- Final Detailed Design Report (20 copies), to be submitted in the 8th month after the commencement of services, compiling all the items carried out during services.
- Final Design Report (20 copies), to be submitted in the 10th month after the commencement of services, finalizing detailed design, cost estimate, bid plan, bid evaluation criteria, technical evaluation criteria and bidding documents through the incorporation of comments on the Draft Design Report, provided by the Consultant.

(2) Tender Assistance

- Pre-qualification Document Report (20 copies), to be submitted in the 5th month after the commencement of the services, presenting the pre-qualification documents and its evaluation criteria.
- Bidding Document Report (20 copies), to be submitted in the 7th month after the commencement of the services, presenting the bidding documents and bid evaluation criteria.
- Pre-qualification Evaluation Report (15 copies) to present the results of the evaluation and to select the qualified applicants.
- Technical Evaluation Report (15 copies) to present the results of technical evaluation and to recommend the qualified applicants.
- Tender Evaluation Report (15 copies) to present the results of the tenders to select the most responsible contractors.

(3) Assistance in Environment and Resettlement Monitoring

- Environmental Monitoring Report (10 copies), to be submitted at every three (3) months after the commencement of the services, presenting the environmental impacts and implementation of environmental mitigation measures during and after the construction stage. Environmental monitoring forms attached as Figures 10.16-1 to 10.16-9 in the main body will be filled and attached to the Report.
- Land Acquisition and Resettlement Monitoring Report (10 copies), to be submitted at every

month during land acquisition and resettlement implementation period. RAP monitoring form will be filled and attached to the Report.

- Environmental and Social Safeguard Evaluation Report (20 copies), to be submitted by the end of the consulting services, presenting the EMP, EMoP and RAP prepared.

(4) Construction Supervision

- Quarterly Progress Report (15 copies), to be submitted at every three (3) months during construction, presenting the progress status of the Project.

- Operation and Maintenance Manual (20 copies) containing technical procedures for the appropriate operation and maintenance of all project facilities.

- Construction Completion Report (20 copies), to be submitted within three (3) month after completion of construction, which comprises a full size of as-built drawings for all the structures and facilities completed, and the final details of the construction completed together with all data, records, material tests results, field books.

Chapter 7. Obligations of the Executing Agency

A certain range of arrangements and services will be provided by the Executing Agency to the Consultant for smooth implementation of the Consulting Services. In this context, the Executing Agency will:

(1) Report and data

Make available to the Consultant existing reports and data related to the Project;

(2) Office space

Provide an office space in the Headquarters of the Executing Agency with necessary equipment, furniture and utility. However, the Consultant's requirement for office space, including necessary equipment, furniture and utilities, should be clearly stated in the proposal with its rental cost for the case where Executing Agency would be unable to provide such facilities;

(3) Cooperation and counterpart staff

Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services;

(4) Assistance and exemption

Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to:

- work permit and such other documents;
- entry and exit visas, residence permits, exchange permits and such other documents;
- clearance through customs;
- instructions and information to officials, agent and representatives of the Borrower's Government;
- exemption from any requirement for registration to practice their profession; and
- privilege pursuant to the applicable law in the Borrower's Country.

Example of Terms of Reference (ToR) - Draft

Terms of Reference for Design and Supervision Consultant for the Works under Engineering Activities of Power Evacuation System for the Barauni Extension Project, Unit No. 10

Chapter 1. Background

1. General

The fundamental purpose of national electric power development is to secure the supply capacity for satisfying the rapid increment of power demand in concurrence with the rapid economic growth of the Republic of India. Electricity shortage in the State of Bihar is currently reaching 4.7 % of the supply and 21.8 % of the peak demand hence the government of Bihar state plans huge increment of the power generation capacity in order to meet the growing demand.

With the decommissioning of Units No.4/5 (2 x 50 MW) at Bihar Thermal Power Station (BTPS), Bihar State Power Generation Company Limited (BSPGCL) launched an examination of new power generation equipment. Instead of the originally planned subcritical pressure 250 MW unit, the possibility of construction of a 660 MW supercritical pressure coal-fired thermal power station was requested from the government of India to the Japan International Cooperation Agency (JICA). In fiscal year 2015, JICA implemented a feasibility study of constructing Unit No. 10, a 660 MW-class coal-fired thermal power station, concluding that the introduction of supercritical pressure or higher was feasible. Thermal efficiency of about 42 % can be expected if supercritical or ultra-supercritical pressure is adopted for a 660 MW-class unit. In this feasibility study clarify that new Power Evacuation system will need to be constructed.

The Government of India intends to use part of the proceeds of the loan for eligible payments for consulting services for which this ToR is issued.

2. Description of the Project

(1) Configuration of the Project

EPC Contract of Power Evacuation System

(2) Duration of the Project

The Project of the Power Evacuation System is expected to be completed in 36 months after NTP.

(3) Location of the Project

Power Evacuation System will be conducted between Gaighat (new) s/s will be located at Bakhtiyarpur about 50 km east of Patna, the capital of the State of Bihar on the south bank of the

Ganga River and BTPS is located in the Begusarai District about 110 km east of Patna on the north bank of the Ganga River.

(4) Executing Agency:

Bihar State Power Transmission Company Limited (BSPTCL)

(5) Technical information:

Equipment/material to be supplied against this specification shall be suitable for satisfactory continuous operation under conditions as specified below:

- Maximum ambient temperature (Degree Celsius) : 50
- Minimum ambient temperature (Degree Celsius) : 4
- Relative humidity (% range) : 10-100
- Maximum annual rainfall & snowfall (cm) : as per published Meteorological/ climatological data
- Wind zone (as per IS: 875) : 4
- Maximum wind velocity (m/sec.) : 47 m/ sec (as per IS: 875)
- Maximum altitude above mean sea level (Meters) : Up to 1000 m
- Isokeraunic level (days/years) : 50

Climate varies from moderately hot and humid tropical climate to cold climate

- General Description of the Tower

  The transmission towers are of self-supporting hot dip galvanized lattice steel type designed to carry the line conductors with necessary insulators, earth wires and all fittings under all loading conditions. The tower shall be fully galvanized using mild steel or/and high tensile steel sections. Bolts and nuts with spring washer are to be used for connections. The tower parts, stubs and pack washers shall be hot dip galvanized. The galvanization shall be done as per requirements of IS 4759 after all fabrication work is completed.

- The towers are of the following types:

  400 kV Double Circuit (DA, DB, DC & DD)

- Conductor/ground wire types

  Usually, ASCR Moose (Twin) conductor is used for the 400 kV transmission lines in India. Also, low loss type ACSR (LL-ACSR/AS 590mm^2) conductor is a new type of conductor that uses a trapezoid shaped aluminum conductor.

- Normal span length

  Normal span length between towers are 400 meters.

- Ground clearance

  Ground clearance for the transmission line will be set in order to meet the requirements in IS 5613.

- River crossing foundations

  Inverted T-shape foundations or pile foundations will be used for the steel tower foundations.

(6) Related projects

BSPGCL is currently implementing Rehabilitation & Modernization / Life Extension work on Units No.6/7 (2 x 110 MW) and the construction of Units No.8/9 (2 x 250 MW) at BTPS.

(7) Characteristic of the Project Implementation

400 kV transmission line installation work shall be securely implemented because the system will be the first-ever introduced to Executing Agency.

(8) Scope of Works under the Project

The scope of works for the Project is as follows:

Table 1-1 The scope of works for the Project

Lots	Contents
Lot 2: Transmission line	➢ Survey & Soil investigation ➢ Tower & Foundation design work ➢ Tower testing ➢ Foundation construction including sheet pile wall work ➢ Conductor, Earth-wire and Optical-fiber string work ➢ Comprehensive exam
Consulting services	Refer to Chapter 3 Scope of Consulting Services

Lot 2: Transmission line shall apply JICA STANDARD BIDDING DOCUMENTS “Works”.
Japan’s Grant Aid Project Tender Documents (Prototype of Instruction to Tenderers) - for the Projects of Construction -

Chapter 2. Objectives of Consulting Services

The objective of the consulting services is to assist Executing Agency in its implementation of the Project. An international consulting firm (hereinafter referred to as the "Consultant") shall endeavor to carry out all the services as described herein under in a satisfactory manner in order to ensure the successful completion of the Project with the quality, cost and schedule originally planned.

The Consultant shall comply with Guidelines for the Employment of Consultants under Japanese ODA Loans, April 2012. The Consultant is to achieve the efficient and proper preparation and implementation of the Project through the following works:

- Detailed design
- Tender Assistance
- Construction Supervision
- Facilitation of implementation of Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP)
- Technology transfer

Chapter 3. Scope of Consulting Services

(1) Detailed design

The Consultant shall:

- Review and verify all available primary and secondary data collected during the JICA's preparatory survey for the Project;
- Collect all existing engineering design data and data other than the above
- Carry out all the required engineering surveys and investigations such as topographical survey, hydrological survey, geotechnical survey, material availability survey and etc., as applicable to the concerned project components.
- Prepare detailed work plan, progress reports and implementation schedule for the Project to ensure effective monitoring and timely project outputs, and regularly update the same;
- Prepare the detailed design of the Project in sufficient detail to ensure clarity and understanding by Executing Agency, contractors and other relevant stakeholders. All the design should be in conformity with the Indian Standards (if available), or with the appropriate international standards. The detailed design will, as a minimum, include construction drawings, detailed cost estimates, necessary calculations to determine and justify the engineering details for the Project, associated contract documentation to include detailed specifications, bill of quantities (BOQ), and implementation schedule for the Project.

Such detailed specifications will contain those in relation to i) quality control of construction materials and workmanship, ii) safety, and iii) protection of the environment. The detailed design shall be prepared in close consultation with, and to meet the requirements of Executing Agency and will be incorporated into the detailed design report to be submitted for approval of Executing Agency;

- Investigate, test, and define sources and estimated quantities of construction materials and prepare the material sources map with indicative properties, its applicability (i.e. for sub-grade, for sub-base and etc.) and estimated quantities; and
- Assess noise impact to be caused by the Project based on the measured baseline data (background noise) and define appropriate mitigation measures.

(2) Tender assistance

1) Assistance in Pre-Qualification (PQ)

The Consultant shall:

- Define technical and financial requirements, capacity and/or experience for PQ criteria taking into consideration technical feature of the Project;
- Prepare PQ documents in accordance with the latest version of Standard Prequalification Documents under Japanese ODA Loans;
- Assist Executing Agency in PQ announcement, addendum/corrigendum, and clarifications to the applicants' queries;
- Evaluate PQ applications in accordance with the criteria set forth in PQ documents; and
- Prepare a PQ evaluation report for approval of the PQ evaluation committee.

2) Assistance in the Bidding Procedures

The Consultant shall:

- Prepare bidding documents in accordance with the latest version of Standard Bidding Documents under Japanese ODA Loans for Procurement of Works together with all relevant specifications, drawings and other documents;
- Prepare bidding documents which includes i) clauses stating that the winner of bidding who will provide facilities (hereinafter referred to as the "Contractor") is to comply with the requirement of the Environmental Management Plan (EMP) and Environmental Monitoring Plan (EMoP) JICA Guidelines for environmental and social considerations (April 2010) (JICA Environmental Guidelines), ii) the specification clearly stipulating the safety requirements in accordance with the laws and regulations in the country of the Borrower, relevant international standards (including guidelines of international organization), if any, iii) the requirement to furnish a safety plan to meet the safety requirements and iv) the

requirement for the personnel for key positions to include an accident prevention officer.

- Assist Executing Agency in issuing bid invitation, conducting pre-bid conferences, issuing addendum/corrigendum, and clarifications to bidders' queries.
- Evaluate bids in accordance with the criteria set forth in the bidding documents. In such evaluation, the Consultant shall carefully confirm that bidders' submissions in their technical proposal including, but not limited to; site organization, mobilization schedule, method statement, construction schedule, safety plan, and EMP, have been prepared in consistent with each other and meet requirements set forth in applicable laws and regulations, specifications and other parts of the bidding documents;
- Prepare a bid evaluation report for approval of the bid evaluation committee;
- Assist Executing Agency in contract negotiation by preparing agenda and facilitating negotiations including preparation of minutes of negotiation meeting; and
- Prepare a draft and final contract agreement.

(3) Construction supervision of the Power Evacuation System

The Consultant shall perform his duties during the contract implementation period of the contracts to be executed by Executing Agency and the Contractor. FIDIC MDB Harmonized Edition (2010) complemented with the Specific Provisions as included in the Standard Bidding Documents under Japanese ODA Loans for Procurement. Works will be applied to the civil works of the Project. In this context, the Consultant shall:

- Act as the Engineer to execute construction supervision and contract administration services in accordance with the power and authority to be delegated by Executing Agency;
- Provide assistance to Executing Agency concerning variations and claims which are to be ordered/issued at the initiative of Executing Agency. Advise Executing Agency on resolution of any dispute with the Contractor;
- Issue instructions, approvals and notices as appropriate;
- Provide recommendation to Executing Agency for acceptance of the Contractor's performance security, advance payment security and required insurances;
- Provide commencement order to the Contractor;
- Assess adequacy of all inputs such as materials, labor and equipment provided by the Contractor;
- Check and approve the Contractor's method of work, including site organization, program of performance, quality assurance system, safety plan and environmental monitoring plan so that the requirements set forth in the applicable laws and regulations, the specifications or other parts of the contract are to be duly respected;

- Regularly monitor physical and financial progress, and take appropriate action to expedite progress if necessary, so that the time for completion set forth in the contract will be duly respected by the Contractor;
- Explain and/or adjust ambiguities and/or discrepancies in the Contract Documents and issue any necessary clarifications or instructions. Issue further drawings and give instructions to the Contractor for any works which may not be sufficiently detailed in the contract documents, if any;
- Review and approve the Contractor's working drawings, shop drawings and drawings for temporary works. Also review and approve, if any, design prepared by the Contractor for any part of the permanent works;
- Liaise with the appropriate authorities to ensure that all the affected utility services are promptly relocated;
- Carry out field inspections on the Contractor's setting out of the works in relation to original points, lines and levels of reference specified in the contract;
- Organize, as necessary, management meetings with the Contractor to review the arrangements for future work. Prepare and deliver minutes of such meetings to BSPTCL and the Contractor;
- Supervise the works so that all the contractual requirements are met by the Contractor, including those in relation to i) quality of the works, ii) safety and iii) protection of the environment. Confirm that an accident prevention officer proposed by the Contractor is duly assigned at the project site. Require the Contractor to take appropriate remedies if any questions are recognized regarding the safety measures;
- Supervise field tests, sampling and laboratory test to be carried out by the Contractor;
- Inspect the construction method, equipment to be used, workmanship at the site, and attend shop inspection and manufacturing tests in accordance with the specifications;
- Survey and measure the work output performed by the Contractor verify statements submitted by the Contractor and issue payment certificates such as interim payment certificates and final payment certificate as specified in the contract;
- Coordinate the works among different contractors employed for the Project;
- Modify the designs, technical specifications and drawings, relevant calculations and cost estimates as may be necessary in accordance with the actual site conditions, and issue variation orders (including necessary actions in relation to the works performed by other contractors working for other projects, if any);
- Carry out timely reporting to Executing Agency for any inconsistency in executing the works and suggesting appropriate corrective measures to be applied;
- Inspect, verify and fairly determine claims issued by the parties to the contract (i.e. Executing

Agency and Contractor) in accordance with the civil works contract;

- Perform the inspection of the works, including Test on Completion, and to issue certificates such as the Taking-Over Certificate, Performance Certificate as specified in the contract;
- Supervise commissioning and carry out tests during the commissioning, if applicable;
- Provide periodic and/or continuous inspection services during defects notification period and if any defects are noted, instruct the Contractor to rectify;
- Prepare as-built drawings for the parts of the works constructed in accordance with the design provided by Executing Agency. Check and certify as-built drawings for the parts of the works designed by the Contractor, if any; and
- Prepare an operation and maintenance manual for the parts of the works constructed in accordance with the design provided by Executing Agency. Check and certify an operation and maintenance manual for the parts of the works designed by the Contractor, if any.

Prepare and submit reports to Executing Agency, which are detailed in Chapter 6 in relation to the implementation of the Project.

(4) Facilitation of implementation of Environmental Management Plan (EMP), Environmental Monitoring Plan (EMoP) and Resettlement Action Plan (RAP)

The Consultant shall:

- Update EMP as appropriate; incorporating necessary technical specifications with design and contract documentation;
- Assist Executing Agency in complying with laws and regulations relevant with EIA procedures and environmental protection, and complying with the conditions stated in Environmental Clearance (EC) and other permits obtained for the Project;
- Assist Executing Agency in dissemination and explanation of additionally confirmed and identified environmental and issues to public in a way such as by holding public consultation meetings;
- Assist Executing Agency to review the Construction Contractor's Environmental Program to be prepared by the contractor in accordance with EMP, EMoP and other relevant plans and JICA Environmental Guidelines and to make recommendations to MoEF regarding any necessary amendments for its approval;
- Assist Executing Agency to implement the measures identified in the EMP;
- Assist Executing Agency to review Waste Management Plan, and other necessary plans to be prepared by the Construction Contractor in accordance with the EMP and ESIA Report, and make recommendations to Executing Agency regarding any necessary amendments for its approval;

- Monitor the effectiveness of EMP and negative impacts on environment caused by the construction works and provide technical advice, including a feasible solution, so that Executing Agency can improve situation when necessary;
- Assist Executing Agency in monitoring the compliance with conditions stated in the EPC and the requirements under EMP and JICA Environmental Guidelines;
- Assist Executing Agency in preparation of the answer to the request from JICA's advisory committee for environmental and social considerations if necessary;
- Assist Executing Agency in the capacity building of Executing Agency staff on environmental management through on-the-job training on environmental assessment techniques, mitigation measure planning, supervision and monitoring, and reporting;
- Update and/or revise RAP as necessary based on detailed design in accordance with the agreed resettlement framework, including entitlement matrix and compensation plan; coordinate with various agencies in preparing the procedures for timely land acquisition and disbursement of compensation to Project Affected Persons (PAPs);
- Assist Executing Agency in identifying the eligible PAPs, and in preparation/updating of the list of eligible PAPs and 'Payment Statement' for individual eligible PAPs. The places where each eligible PAPs will relocate to are necessary to be recorded so that Executing Agency could implement monitoring on income and living conditions of resettled persons;
- Assist Executing Agency in conducting social assessment during early stage of the detailed design stage and review the existing income restoration plan and special assistance plan for vulnerable PAPs and revise/update the contents of the plans if necessary based on priorities identified with support of relevant government agencies and Non-Governmental Organizations (NGOs). The following contents should be included in the plans;
  - ✓ Skills Training
  - ✓ Project related Job Opportunities
  - ✓ Provision of social welfare grant
  - ✓ Provision of Agricultural Extension Services
  - ✓ Provision of the special allowance to vulnerable PAPs
- Assist Executing Agency to implement the measures identified in the revised RAP;
- Monitor land acquisition and compensation activities being undertaken by Executing Agency and/or competent authorities, and report the results in monthly progress reports;
- Assist in procurement of RAP Implementation organization (e.g. NGO, consultants), and experts, external monitoring agency;
- Assist Executing Agency in facilitating stakeholder's participation (including focus group discussions for vulnerable PAPs) and providing feedback their comments on RAP;
- Assist Executing Agency in establishment of grievance redress mechanism including

formation of Grievance Redressal Committee (GRC);

- Assist Executing Agency to ensure that the PAPs are fully aware of the grievance redress procedure and the process of bringing their complaints, investigate the veracity of the complaints, and recommends actions/measures to settle them amicably, fairly and transparently before they go to the redress committee or the courts of law;
- Provide technical services with GRC for keeping and updating records when necessary.

(5) Technology transfer

The Consultant shall carry out the technology transfer as an important aspect in design and supervision works. The Consultant shall provide the opportunity to Executing Agency officers and staffs to be involved in the working team of the Consultant during the design, contract administration and supervision works for their capacity building wherever possible. If requested by Executing Agency, the Consultant shall brief and demonstrate the survey and design procedure, the construction supervision and contract management process and procedures. The Consultant shall assist Executing Agency and its staff to build their capacity as a part of on the job training under the Project.

Chapter 4. Expected Time Schedule

The total duration of consulting services will be 42 months followed by 12 months of defects liability period. The implementation schedule expected is as shown in Table 4-1.

Table 4-1 Implementation Schedule Expected

Key Activities	Date	Duration in Months
Commencement of Consulting Services	6 months before NTP	6
Completion of detail design, preparation of drawings and tender documents	6 months after the Contract between Executing Agency and Consultant	
Tender process including prequalification	5 months after the Contract between Executing Agency and Consultant	5
End of EPC works of Power Evacuation System	36 months after NTP	36

Chapter 5. Staffing (Expertise required)

6 of Professional (A) consultants and 6 of Professional (B) consultants will be engaged, over 6 months' duration of consulting services, for a total of 146 man-months for Professional (A) and 215 man-months for Professional (B) consultants. Total consulting input is 361 man-months.

(1) Qualification of key Team Members

The qualification of key Team Members is shown in Table 5-1.

Table 5-1 Qualification of key Team Members

Professional A	
Designation	Qualification
Project Manger	Education: ➢ Bachelor degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as transmission line engineer ➢ Experience in transmission line projects (at least one shall be 400 kV transmission line) ➢ Experience of overseas projects ➢ Experience of leading a Consultants' team as Project Manager or Deputy ➢ Project Manager in projects (at least one as Team Leader)
Transmission Engineer	Education: ➢ Bachelor Degree in Electrical/Civil/Mechanical Engineering Experience: ➢ Experience in transmission line related field ➢ Experience in design and construction supervision in transmission line projects
Contract Expert	Education: ➢ Bachelor Degree of Mechanical / Electrical Engineering or Law/Commerce/Business administration Experience: ➢ Experience in working in transmission line as a contractor expert

O & M Expert	Education: ➢ Bachelor Degree of Mechanical or Electrical Engineering Experience: ➢ Experience in Transmission line engineer ➢ Experience of test run and operation or maintenance or management of 400 kV transmission line
Civil Engineer (Transmission Line)	Education: ➢ Bachelor Degree in Civil Engineering Experience: ➢ Experience in transmission line related field ➢ Experience in design and construction supervision in transmission line projects
Environmental and Social Expert	Education: ➢ Experience in safeguard related Field ➢ Experience as safeguard specialist
Professional B	
Designation	Qualification
Project Manger	Education: ➢ Bachelor degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as transmission line engineer ➢ Experience in transmission line projects (at least one shall be 400 kV transmission line) ➢ Experience of leading a Consultants' team as Project Manager or Deputy Project Manager in projects (at least one as Team Leader)
Assistant Project Manager	Education: ➢ Bachelor Degree of Electrical Engineering or Mechanical Engineering Experience: ➢ Experience as transmission engineer ➢ Experience in transmission line projects ➢ Experience of leading a Consultants' team as Project Manager or Deputy ➢ Project Manager in projects (at least one as Team Leader)

Transmission Engineer	Education: ➢ Bachelor Degree in Electrical/Civil/Mechanical Engineering Experience: ➢ Experience in transmission line related field ➢ Experience in design and construction supervision in transmission line projects
O & M Expert	Education: ➢ Bachelor Degree of Mechanical or Electrical Engineering Experience: ➢ Experience in transmission line engineer ➢ Experience of test run and operation or maintenance or management of 400 kV transmission line
Civil Engineer (Transmission Line)	Education: ➢ Bachelor Degree in Civil Engineering Experience: ➢ Experience in transmission line related field ➢ Experience in design and construction supervision in distribution line projects
Environmental and Social Expert	Experience: ➢ Experience in safeguard related field ➢ Experience as safeguard specialist in project

Consultant may propose other experts and supporting staffs required to accomplish the tasks outlined in the ToR.

(2) Scope of works for the respective personnel

Detailed information on the major tasks and duties each member of the detailed engineering design team and the construction supervision team shall perform is provided as follows:

No	Position	I or L	Major Tasks and Duties
A-1	Project Manager	I (Pro-A)	➢ Check and review the development document – Feasibility Study Report (FSR) and Detailed Project Report (DPR) for Power Evacuation System of Unit No. 10 and provide comments as required. ➢ Prepare the Design Concept or the Project Design Report, and to discuss and agree with BSPTCL on it before establishing the full scope. ➢ Prepare an updated Project Implementation Schedule, Project Cost Estimation, Cash Flow and Economic/Financial and Performance Analysis. ➢ Prepare the technical specification. ➢ Prepare Pre-qualification (P/Q) documents in accordance with JICA Guidelines for Procurement and the Indian Regulations for review and approval by BSPTCL for the Project, assist BSPTCL in P/Q Announcement, evaluate P/Q proposals in accordance with BSPTCL and JICA approved criteria and prepare draft and final P/Q Evaluation Reports to BSPTCL. ➢ Assist BSPTCL in the evaluation and tabulation of the contents of all bids for compliance with the tender specifications, reasonableness of prices and proposed time for completion of the work and any supply with any other guidance as required by BSPTCL and JICA. ➢ Assist BSPTCL in preparing Bidding Documents and relevant Drawings in accordance with JICA Guidelines and BSPTCL Guidelines and Practice. ➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Assist BSPTCL in the contract negotiation by preparing agenda for negotiations. During the contract negotiations, appropriate assistance shall be rendered to BSPTCL to facilitate the successful completion of the negotiations, including preparation of draft minutes of negotiation meeting. ➢ Establish a basic overall project construction schedule, preparation of project Program Evaluation and Review Technique (PERT) / Critical Path Method (CPM) network, budget and cash disbursement schedule for local cost. ➢ Establish a project management system and procedures to monitor and control the cost and time schedules to enable timely corrective measures. ➢ Assist construction supervision to ensure the compliance with the technical specifications and construction drawings. ➢ Assist coordination, supervision and inspection of all construction and erection activities. ➢ Review the Contractor's commissioning test report and obtain BSPTCL's approval.
A-2	Engineer (Transmission and Civil)	I (Pro-A)	➢ List and classify systematically the Technical Standards, Guidelines and Regulations for planning and developing of transmission line and related infrastructures in India. ➢ Check and review the development document – Feasibility Study Report (FSR) and Detailed Project Report (DPR) - for Power Evacuation System of and provide comments as required. ➢ Prepare Design Calculations, (Basic Designs) Drawings, Specifications and Bill of Quantities for Bidding and Contract Documents and Conceptual Designs to determine the capacity of equipment, layouts and arrangement of components, selection of equipment and materials including those related to environmental issues. ➢ Prepare the technical specification.

No	Position	I or L	Major Tasks and Duties
			➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Attend the bid receiving and opening meetings as well as to prepare the Minutes of Meeting. ➢ Review design and engineering activities of the EPC Contractors, all engineering drawing, documents and quality assurance documents to check technical acceptability, conformity with technical specifications and contractual scope, adherence to applicable codes and standards, operational and safety aspects, reliability and ease of maintenance and sound engineering practice. ➢ Provide technical, financial and administrative management supports to BSPTCL, including coordination and decision making actions, engineering and design activities related to construction works in order to ensure that quality control and engineering standards are consistently maintained within cost and time constraints throughout project implementation. ➢ Set up an effective system of project progress and status to BSPTCL. ➢ Advise the Social Development Expert and Environmental Expert to undertake environmental monitoring and take necessary actions. Also ensure the incorporation of the findings and supporting data into the project completion reports. ➢ Review proposal on quality assurance, quality control plan and delivery schedule prepared by the Contractor and obtain BSPTCL's approval. ➢ Regularly review production and delivery schedule by the Contractor ➢ Review factory testing procedures and factory test results submitted by the Contractor and obtain BSPTCL's approval. ➢ Formulate test and commissioning procedures as part of the integrated project management plan. ➢ Review the Contractor's testing procedures and obtain BSPTCL's approval.

No	Position	I or L	Major Tasks and Duties
A-3	Economist, Contract Expert	I (Pro-A)	➢ Prepare Bid Proposal Sheets. ➢ Prepare draft and final P/Q Evaluation Reports to BSPTCL. ➢ Attend and assist BSPTCL in conducting pre-bid conferences. ➢ Assist BSPTCL in answering Bidder's question, both technical and commercial question, and in issuing addenda to Bid Documents. ➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Prepare draft contract agreement.
A-4	O & M Expert	I (Pro-A)	➢ Prepare the operation and maintenance schedule and procedures ➢ Review and recommend Transmission line operation and maintenance manuals submitted by the EPC Contractor. ➢ Review and coordinate proper operation and maintenance procedures integrating the overall operation and maintenance philosophy, based on the operation and maintenance manuals submitted by the EPC Contractor.
A-5	Environment Expert	I (Pro-A)	➢ Supervise and monitor the project from Environmental viewpoint disposed soil, noise and etc. ➢ Supervise and monitor the project from Social viewpoint such as recruitment of non-skilled local workers, CSR and etc.
B-1	Assistant Project Manager	L (Pro-B)	➢ Collect and trace the past background for the originally planned Unit No. 10 (1 x 250 MW) and comment about the differences between the original and the current designs. ➢ Summarize a basic study for the conceptual design of Unit No. 10– design condition, engineering data, calculation formula, information criteria and specifications for plant systems and transmission line. ➢ Assist BSPTCL in P/Q Announcement. ➢ Evaluate P/Q proposals in accordance with BSPTCL and JICA approved criteria. ➢ Prepare draft and final P/Q Evaluation Reports to BSPTCL. ➢ Coordinate the works among the different Contractors. ➢ Examine, review drawings, procedures and designs submitted by or requested from the Contractor and obtain BSPTCL's approval. These include drawings and designs requiring approval from regulatory bodies. ➢ Check the construction methods and site works carried out by the Contractor and obtain BSPTCL's approval. ➢ Check approve the Contractor's quality assurance and control program and obtain BSPTCL's approval. ➢ Coordinate and supervise all tests according to the Contract. ➢ Review and recommend tentative taking over and acceptance certificates for the equipment, subject to prior approval of BSPTCL. ➢ [Train 6 BSPTCL staffs (3 maintenance staffs) for a period of one month in the home country of the Consultant with respect to all aspects related to maintenance technology of 400kV transmission line (e.g. periodic inspection and measures, preventing measures and etc.) Prepare the detailed contents and schedule of "training BSPTCL staffs for a period of one month in the home country of the Consultant.]

No	Position	I or L	Major Tasks and Duties
B - 2	Engineer (Transmission and Civil)	L (Pro-B)	➢ Summarize a basic study for the conceptual design of Power Evacuation System of Unit No. 10 design condition, engineering data, calculation formula, information criteria and specifications for plant systems and transmission line. ➢ Check and review of power evacuation surveys and investigations conducted by the Bidders. ➢ Check, review and clarify regarding the design and calculations submitted by the Bidders. ➢ Check, review and clarify regarding manufacture, fabrication, shop tests and installation drawings submitted by the Bidders. ➢ Check the test procedure for materials and equipment to be tested on site by the Contractor to obtain BSPTCL's approval and witness such tests, review and give recommendation regarding the test result of field test of materials and equipment performed by the Contractor. ➢ Provide necessary interpretation to BSPTCL project manager on technical and commercial issues. ➢ Prepare and update detailed and overall project disbursement schedule and issuance of payment certificates. ➢ Monitor and control work progress and initiate corrective measures. ➢ Prepare and update detailed and overall project physical target accomplishment. ➢ Check, examine and certify the work quantities performed by the Contractor. ➢ Check, examine and solve claims submitted by the Contractor. ➢ Check contractual matters (guarantee, insurance, claims, etc.). ➢ Inspect and direct preventive safety and environmental control measures. ➢ Check as-built drawings and obtain BSPTCL's approval. ➢ Check issuance of "Certificate of Ready" for commissioning certificates by the Contractor. ➢ Monitor manufacturing progress, testing and regular inspection and ensure compliance with contract documents. ➢ Witness factory test of major equipment and prepare corresponding certificates (equipment items and tests to be witnessed needs agreement between BSPTCL and the Contractor). ➢ Review inspection report on each factory inspection submitted by the Contractor. ➢ Coordinate and supervise all tests according to the Contract. ➢ Review and recommend tentative taking over and acceptance certificates for the equipment, subject to prior approval of BSPTCL. ➢ [Train 3 BSPTCL] staffs (3 maintenance staffs) with respect to all aspects related to maintenance technology of 400 kV transmission line (e.g. periodic inspection and measures, preventing measures and etc.) Prepare the detailed contents and schedule of "training BSPTCL staffs

No	Position	I or L	Major Tasks and Duties
B-3	Economist, Contract Expert	L (Pro-B)	➢ Prepare Bid Proposal Sheets. ➢ Prepare draft and final P/Q Evaluation Reports to BSPTCL. ➢ Attend and assist BSPTCL in conducting pre-bid conferences. ➢ Assist BSPTCL in answering Bidder's question, both technical and commercial question, and in issuing addenda to Bid Documents. ➢ Prepare the Evaluation Criteria for Technical, Commercial and Financial Bidding Evaluation. ➢ Prepare draft contract agreement.
B-4	O & M Expert	L (Pro-B)	➢ Prepare the operation and maintenance schedule and procedures ➢ Review and recommend Transmission line maintenance manuals submitted by the EPC Contractor. ➢ Review and coordinate proper maintenance procedures integrating the overall maintenance philosophy, based on the maintenance manuals submitted by the EPC Contractor.
B-4	Environment Expert	L (Pro-B)	➢ Supervise and monitor the project from Environmental viewpoint disposed soil, noise, and etc. ➢ Supervise and monitor the project from Social viewpoint such as recruitment of non-skilled local workers, CSR and etc.

Chapter 6. Reporting

Within the scope of consulting services, the Consultant shall prepare and submit reports and documents to Executing Agency as shown in Table 6-1. The Consultant shall provide electronic copy of each of these reports.

Table 6-1 Reports and Documents Schedule Expected

Category	Type of Report	Timing	No. of Copies
Consultancy Services	Inception Report	Within1 month after commencement of the services	10
	Monthly Progress Report	Every month	10
	Quarterly Progress Report	Every quarter	10
	Project Completion Report	At the end of Services	10
Construction Supervision	Quality Control Report	Every month	10
	Completion Report (and As-built Drawings, if any)	At the end of the Project	5
Training	Training Plan	At appropriate timing in accordance with the Inception Report	10
	Training Execution and Evaluation Report	Within 1 month after training	10
Environment and Social Safeguard	Environmental Monitoring Report	Every quarter	10
	Land Acquisition and Resettlement Monitoring Report	Every month	10
	Environmental and Social Safeguard Evaluation Report	At the end of the Project	20
Other Report	Technical Report	As required or upon request	As required

Contents to be included in each report are as follows:

- Monthly Progress Report: Describes briefly and concisely all activities and progress for the previous month by the 10th day of each month. Problems encountered or anticipated will be clearly stated, together with actions to be taken or recommendations on remedial measures for correction. Also indicates the work to be performed during the coming month.
- Inception Report: To be submitted within 1 month after the commencement of the services, presenting the methodologies, schedule, organization, etc.

(1) Detail Design

- Project Definition Report (20 copies), to be submitted in the 3rd month after the commencement of services, presenting the design criteria and standards.

- Draft Detailed Design Report (20 copies), to be submitted in the 6th month after the commencement of services, presenting detailed engineering design.
- Cost Estimate Report (20 copies), to be submitted in the 7th month after the commencement of services, presenting detailed cost estimate.
- Final Detailed Design Report (20 copies), to be submitted in the 8th month after the commencement of services, compiling all the items carried out during services.
- Final Design Report (20 copies), to be submitted in the 10th month after the commencement of services, finalizing detailed design, cost estimate, bid plan, bid evaluation criteria, technical evaluation criteria and bidding documents through the incorporation of comments on the Draft Design Report, provided by the Consultant.

(2) Tender Assistance

- Pre-qualification Document Report (20 copies), to be submitted in the 5th month after the commencement of the services, presenting the pre-qualification documents and its evaluation criteria.
- Bidding Document Report (20 copies), to be submitted in the 7th month after the commencement of the services, presenting the bidding documents and bid evaluation criteria.
- Pre-qualification Evaluation Report (15 copies) to present the results of the evaluation and to select the qualified applicants.
- Technical Evaluation Report (15 copies) to present the results of technical evaluation and to recommend the qualified applicants.
- Tender Evaluation Report (15 copies) to present the results of the tenders to select the most responsible contractors.

(3) Assistance in Environment and Resettlement Monitoring

- Environmental Monitoring Report (10 copies), to be submitted at every three (3) months after the commencement of the services, presenting the environmental impacts and implementation of environmental mitigation measures during and after the construction stage. Environmental monitoring forms attached as Figures 10.16-10 to 10.16-13 in the main body will be filled and attached to the Report.
- Land Acquisition and Resettlement Monitoring Report (10 copies), to be submitted at every

month during land acquisition and resettlement implementation period. RAP monitoring form will be filled and attached to the Report.

- Environmental and Social Safeguard Evaluation Report (20 copies), to be submitted by the end of the consulting services, presenting the EMP, EMoP and RAP prepared.

(4) Construction Supervision

- Quarterly Progress Report (15 copies), to be submitted at every three (3) months during construction, presenting the progress status of the Project.

- Operation and Maintenance Manual (20 copies) containing technical procedures for the appropriate operation and maintenance of all project facilities.

- Construction Completion Report (20 copies), to be submitted within three (3) months after completion of construction, which comprises a full size of as-built drawings for all the structures and facilities completed, and the final details of the construction completed together with all data, records, material tests results, field books.

Chapter 7. Obligations of the Executing Agency

A certain range of arrangements and services will be provided by the Executing Agency to the Consultant for smooth implementation of the Consulting Services. In this context, the Executing Agency will:

(1) Report and data

Make available to the Consultant existing reports and data related to the Project;

(2) Office space

Provide an office space in the Headquarters of the Executing Agency with necessary equipment, furniture and utility. However, the Consultant's requirement for office space, including necessary equipment, furniture and utilities, should be clearly stated in the proposal with its rental cost for the case where Executing Agency would be unable to provide such facilities;

(3) Cooperation and counterpart staff

Appoint counterpart officials, agent and representative as may be necessary for effective implementation of the Consulting Services;

(4) Assistance and exemption

Use its best efforts to ensure that the assistance and exemption, as described in the Standard Request for Proposal issued by JICA, will be provided to the Consultant, in relation to:

- work permit and such other documents;
- entry and exit visas, residence permits, exchange permits and such other documents;
- clearance through customs;
- instructions and information to officials, agent and representatives of the Borrower's Government;
- exemption from any requirement for registration to practice their profession; and
- privilege pursuant to the applicable law in the Borrower's Country.

Appendix II

Participation by Japanese enterprises in the Project

Participation by Japanese Enterprises in the Project

1. Results of company hearings and follow-up surveys

Concerning the feasibility of BTG, FGD, DCS, GIS, LL wire and participation by trading companies, the results of company hearings and follow-up surveys from the viewpoints of the Pre-Qualification conditions (PQ conditions), specification conditions, and eligible countries and manufacturers for tender are shown below.

(1) Boiler (including SCR, ESP)

- PQ conditions

  Table 1-1 shows PQ conditions for the boiler.

Table 1-1 Boiler prequalification conditions

Condition No.	Contents
I	For the boiler, the manufacturer has manufacturing equipment and operating performance of 1 year or more in a coal-fired thermal power station of 500 MW or higher in India.
II	The manufacturer has at least 15 years of operating performance (operation started in 2000 or earlier) in a coal-fired thermal power station with main steam temperature / reheated steam temperature of 593℃ / 593℃ or more. Operating performance by the parent company shall be admissible.
III	The manufacturer has at least 5 years of operating performance (operation started in 2010 or earlier) in a boiler with main steam temperature / reheated steam temperature of 600℃ / 600℃ or more. Operating performance by the parent company shall be admissible.
IV	The manufacturer has at least 1 year of operating performance (operation started in 2014 or earlier) in a coal-fired thermal power station with main steam temperature of 593℃ or more in India. Operating performance by the parent company shall be admissible.

Source: Prepared by Survey Team

- Specification conditions

  Table 1-2 shows the specification conditions for the boiler.

Table 1-2 Boiler specification conditions

Condition No.	Contents	Reason for setting
I	Assuming spiral tubes as the water-cooled walls of the boiler, the manufacturer shall have experience of supplying boilers with water-cooled walls having spiral structure in India.	There are two (2) types of water-cooled wall structures, i.e. vertical tubes and spiral tubes. The L&T-MHPS Boiler (LMB) is compatible with both types, however, the water-cooled walls of boilers supplied by BHEL and Doosan India in India are characterized by having spiral water-cooled walls.
II	The boiler shall have 2 or more RH temperature adjustment mechanisms.	Boiler RH temperature adjustment mechanisms in India are generally two (2) types, i.e. damper control and burner angle adjustment. The LMB is compatible with both types, however, the boilers supplied by BHEL and Doosan India in India are characterized by having only one type of mechanism, i.e. either damper control or burner angle adjustment.

Source: Prepared by Survey Team

- Eligible countries and manufacturers for tender

- The only Japanese affiliated enterprise that is eligible to bid based on PQ condition I is LMB, but IHI (considering entry to the Indian market) is not eligible. Also, the Indian company BHEL, and the South Korean firm Doosan India are eligible to bid.
- If PQ conditions II to IV are adopted in addition to PQ condition I, Doosan India can be excluded.
- Concerning specification condition I, LMB meets the condition but Doosan India can be excluded. Moreover, because the Alstom license of BHEL pertains to boilers with vertical tube structures, it will need to newly acquire a license and obtain technology concerning spiral tubes, so this could possibly exclude BHEL from the tender process.
- LMB can meet specification condition II, however, because the boilers made by Doosan India and BHEL only have one RH temperature adjustment mechanism, they will need to make design changes or introduce new technology, so this could possibly exclude them from the tender process.

- SCR and ESP that are included among boiler parts are generally directly supplied from EPC contractor or can be purchased from the contractor that receives the order for boiler parts. Generally speaking, because Indian coal has a high ash content, ESP tends to become large-scale. In the case where the LMB is included in the boiler parts, if it becomes necessary to adopt compact equipment in the detailed settings because the Project site area is limited, there is a stronger possibility that a moving dust collecting electrode, which is technology belonging to MHPS (former Hitachi Plant Construction) will be adopted.

<Observations>

- Since PQ condition I is included in PQ conditions concerning EPC contractors for NTPC and other coal-fired thermal power projects based on the Phased Manufacturing Program being promoted by GoI, it will be more acceptable to BSPGCL.
- Because PQ conditions II to IV specify numbers of years, the eligible contractors will increase if the tender announcement is delayed. Moreover, changing the operating performance according to the timing of the works is not realistic because it is difficult to explain the reason for setting.
- Concerning the reason for setting specification condition I, because Indian coal has a high ash content, the slag that attaches to furnace walls is more likely to detach and fall, this condition is necessary to suppress the resulting damage to furnace floors, and also because it is easier to conduct tube maintenance and repairs to leaks. However, since these are not decisive reasons, the condition is not realistic.
- Concerning the reason for setting specification condition II, it is necessary in order to cater to a wide range of coal types in the event the type of coal is changed in the future, however, since this is not a decisive reason, it is not realistic.

(2) Turbine and generator

- PQ conditions

  Table 1-3 shows PQ conditions for the turbine and generator.

Table 1-3 Turbine and generator prequalification conditions

Condition No.	Contents
I	For the turbine and generator, the manufacturer has manufacturing equipment and operating performance of 1 year or more in a coal-fired thermal power station of 500 MW or higher in India.

II	The manufacturer has at least 15 years of operating performance (operation started in 2000 or earlier) in a coal-fired thermal power station with main steam temperature / reheated steam temperature of 593℃ / 593℃ or more. Operating performance by the parent company shall be admissible.
III	The manufacturer has at least 5 years of operating performance (operation started in 2010 or earlier) in a boiler with main steam temperature / reheated steam temperature of 600℃ / 600℃ or more. Operating performance by the parent company shall be admissible.
IV	The manufacturer has at least 1 year of operating performance (operation started in 2014 or earlier) in a coal-fired thermal power station with main steam temperature of 593℃ or more in India. Operating performance by the parent company shall be admissible.

Source: Prepared by Survey Team

- Specification conditions

  None in particular

- Eligible countries and manufacturers for tender

- The Japanese affiliated enterprise that are eligible to bid based on PQ condition I are L&T-MHPS Turbine Generators (LMTG) and Toshiba JSW Power Systems (TJPS), and from Europe Alstom-Bharat Forge is eligible.
- If PQ conditions II to IV are adopted in addition to PQ condition I, Alstom-Bharat Forge can be excluded.

<Observations>

- Since PQ condition I is included in PQ conditions concerning EPC contractors for NTPC and other coal-fired thermal power projects based on the Phased Manufacturing Program being promoted by GoI, it will be more acceptable to BSPGCL.
- Because PQ conditions II to IV specify numbers of years, the eligible contractors will increase if the tender announcement is delayed. Moreover, changing the operating performance according to the timing of the works is not realistic because it is difficult to explain the reason for setting.

(3) Flue-gas desulfurization equipment

- PQ conditions

  None in particular

- Specification conditions

  Table 1-4 shows the specification conditions for FGD.

Table 1-4 Flue Gas Desulfurization specification conditions

Condition No.	Contents
I	It complies with the new environmental control standards

Source: Prepared by Survey Team

- Eligible countries and manufacturers for tender

- BHEL has the license of MHPS (former MHI) for FGD.
- LMB provides total AQMS packages up to SCR-ESP-FGD but it can also supply individual parts.
- IHI has ample experience of supplying FGD, however, the company has not yet decided on its policy for entering the Indian market, and it does not supply FGD as isolated units (it usually supplies in a set with the boiler).

<Observations>

- Since the owner is BSPGCL, which has little experience of building power stations and no knowledge about supercritical technology, a single package entailing an EPC contractor that can oversee the suppliers is recommended. Accordingly, after EPC contractor receives the order for the Project, FGD supply and installation company will be selected as one of BOP suppliers.
- Specification condition I is not deemed appropriate because an operator could receive the order based on false declarations at the time of tender.

(4) Dispersed control system

- PQ conditions
  None in particular
- Specification conditions
  None in particular
- Eligible countries and manufacturers for tender

- The eligible manufacturers are LMB, LMTG, TJPS, Yokogawa Electric Corporation, etc.

<Observations>

- In recent NTPC projects, tenders have been made by isolated DCS entities.
- Conventionally in new works including those in Japan, the main unit supplier of either upstream (DCS) equipment or downstream (boiler control, turbine control, generator control) equipment supplies together with the control equipment, however, in order for Yokogawa Electric Corporation, which has a certain degree of supply performance in the

Indian market, to receive the order, it is necessary for DCS tender to be conducted independently.

- Since the owner is BSPGCL, which has little experience of building power stations and no knowledge about supercritical technology, a single package entailing an EPC contractor that can oversee the suppliers is recommended. Accordingly, EPC contractor that receives the order for the project will select DCS supply and installation company.

(5) Gas insulated switchgear

- PQ conditions

  Table 1-5 shows PQ conditions for GIS.

Table 1-5 Gas insulated switchgear prequalification conditions

Condition No.	Contents
I	Either a spring mechanism or hydraulic mechanism can be adopted as the operating mechanism for the gas circuit breaker.
II	The manufacturer has experience of supplying outdoor GIS for at least 15 years.

Source: Prepared by Survey Team

- Specification conditions

  Table 1-6 shows the specification conditions for GIS.

Table 1-6 Specification conditions for Gas insulated switchgear

Condition No.	Contents
I	The SF6 gas leakage rate is less than 0.1 %/year.
II	GCB is a single-break type.
III	GCB has no capacitor
IV	The interval between bays in GIS is no greater than 3 meters.

Source: Prepared by Survey Team

➢ Eligible countries and manufacturers for tender

- According to PQ condition I, if the spring type is adopted, Chinese and South Korean manufacturers can be excluded (European manufacturers will be eligible).
- According to PQ condition II, through adopting the condition of having operating experience of at least 15 years concerning 420 kV GIS, an advantage is given to Indian and Chinese manufacturers.
- According to specification condition I, if the SF_6 gas leakage rate is set at less than 0.1 % per year, Japanese companies (Toshiba, Mitsubishi, Hitachi) can comply, but Chinese and South Korean companies can be excluded (European companies can comply), however, because it is difficult to conduct actual verification experiments, submission of a "Design basis document" shall be required.
- According to specification condition II, if the condition was limited to only the single-break type, since Chinese and South Korean companies would likely make offers with capacity of less than 550 kV, having 550 kV single-break type as the condition is effective for excluding manufacturers.
- According to specification condition III, since Chinese and South Korean companies insert a capacitor between electrodes in 550 kV equipment, this condition will be effective for excluding companies. By requiring a double-break CGB, since this requires a voltage sharing capacitor, a double excluding effect can be expected.
- Specification condition IV is advantageous for excluding Chinese and South Korean companies that make large-scale equipment. However, European manufacturers cannot be excluded with designs of 2.2-2.5 meters.

<Observations>

- Concerning specification condition I, since the SF_6 gas leakage rate is prescribed as 0.5 %/year in the international standard IEC62271-1, it is deemed to be common and also acceptable to BSPGCL (BSPTCL) to set SF6 gas leakage rate as a condition.
- Concerning specification condition II, there are merits for the customer such as reduction of cost and frequency of failures due to fewer parts, and reduced civil engineering costs due to more compact equipment.
- Concerning specification condition III, there is a merit for the customer in that long-term reliability is enhanced through elimination of accident causal factors.
- Concerning specification condition IV, there is a merit for the customer in that costs are reduced due to having smaller foundations (building area).
- Concerning the reasons for setting PQ condition I, it is possible to suppress performance decline due to oil or air leaks in a hydraulic or pneumatic system. Moreover, since the spring mechanism is becoming the mainstream type due to not requiring power to sustain

drive force and being easy to maintain (due to having fewer parts), it is deemed to be more acceptable to BSPGCL (BSPTCL).

- Concerning the reasons for setting PQ condition II, based on the fact that GIS overhaul inspection cycle is generally given as 12 years, a margin of three (3) years has been added to this for the test adjustment period, etc. after installation.

(6) Low loss wire

- PQ conditions

  Table 1-7 shows PQ conditions for the LL wire.

Table 1-7 Low loss wire prequalification conditions

Condition No.	Contents
I	The manufacturer has at least 20 years of operating performance with LL wire.
II	The manufacturer has supplied at least 2,000 kilometers of low loss wire.

Source: Prepared by Survey Team

- Specification conditions

  Table 1-7 shows the specification conditions for the LL wire.

Table 1-8 Low loss wire specification conditions

Condition No.	Contents
I	It is the LL-ACSR/UGS type that uses galvanized steel wire with strength of 1,960 MPa or more.
II	It is the LL-ACSR/AS type that uses galvanized steel wire with strength of 1,770 MPa or more.
III	It is either type I or II and satisfies the following wire specifications: - Weight: No higher than ACSR"Moose" - Tensile strength: No less than that of ACSR "Moose" - External diameter: No greater than that of ACSR "Moose" - DC electric resistance: No greater than 90 % the DC electric resistance of ACSR "Moose"

Source: Prepared by Survey Team

- Eligible countries and manufacturers for tender

- If it is conventional, low loss wire, Chinese, South Korean and Indian companies can be eligible, however, through setting PQ conditions I and II, such overseas manufacturers can be excluded, while four (4) Japanese companies (JPS, VISCAS, EXSYM, and KITANIHON ELECTRIC CABLE) become eligible.
- Due to specification conditions I, II, III, among the four (4) Japanese companies (JPS, VISCAS, EXSYM, KITANIHON ELECTRIC CABLE), the manufacturers that make galvanized steel wire and manufacturers that make aluminum coated steel wire are eligible for tender.

<Observations>

- Concerning the reasons for setting PQ conditions, since the transmission lines require high reliability against a background where it is difficult to construct new transmission lines due to land issues, the setting of conditions that require ample performance in long-term operation is likely to be acceptable to BSPTCL.
- Concerning the reasons for setting specification condition III, since this allows running costs to be reduced compared to the ACSR Moose type that is adopted as standard in India, this is likely to be acceptable to BSPTCL.

(7) Possibility of participation by a trading company

It is also possible for a trading company to become EPC contractor, however, under the Phased Manufacturing Program that is being advanced by GoI, since one of PQ conditions for NTPC and other coal-fired thermal power projects is that the contractor is a BTG manufacturer possessing manufacturing facilities in India, it is rare for trading companies to become EPC contractors. Moreover, in cases where a trading company is included in a consortium for power station construction projects, it is common for main unit suppliers to be not well versed in dealing with local regulations, government offices, business practices and contractors, however, since TJSW and L&T-MHPS, which have plants in India, possess ample knowledge in these areas, there is little advantage to be gained in using a trading company.

2. Policy for selecting the works contractor

It appears that the Project will be conducted as a yen loan undertaking, and procurement by GoI is usually conducted based on the international competitive tender method irrespective of the financing method. Since Japanese companies only won 10 % of orders for yen loan projects conducted in India between 2008-2012, in order to ensure that a Japanese company wins the order here, it is necessary to set a tender package and PQ conditions that are acceptable to BSPGCL while narrowing down the field of bidders and increasing the chances of a Japanese company winning the order. Since Japanese companies possess superior technology compared to overseas rivals in the field of supercritical thermal power, the tender package and PQ conditions will be set in view of the results of company hearings and follow-up surveys to ensure that this advantage is fully exploited.

Since NTPC (a state-run company) has previously installed a very large number of facilities, it is guessed that BSPGCL will treat NTPC tender package and PQ conditions as a model. Therefore, greater acceptability to BSPGCL can be realized through basing the tender package and PQ conditions on NTPC model.

Table 2-1 shows the list of tendering companies that are envisaged in view of past participation in coal-fired thermal power station-related tenders.

Table 2-1 List of tendering companies

Manufacturer	Origin of B/TG Technology	EPC Single Package	Boiler Package	TG Package	BOP Package
Indian Manufacturer					
BHEL	U.S/Europe	○	○	○	○
L&T Power	Japan	○	-	○	○
ISGEC	U.S/Europe	○	○	×	×
Indian JV or Subsidiary of overseas manufacturer					
L&T-MHPS Boiler	Japan	-	○	×	×
L&T-MHPS Turbine		-	×	○	×
TJPS		○	×	○	×
Doosan India	Korea	○	○	×	×
TBWES	U.S/Europe	-	○	×	×
ALSTOM INDIA		○	-	×	×
ALSTOM BHARAT FORGE		-	×	○	×
Chinese Manufacturer					
Harbin	China	○	○	○	×
Shanghai Electric		○	○	○	×
DONG FONG ELECTRIC		○	○	○	×
Overseas Manufacturer					
Toshiba	Japan	-	-	○	×
MHPS		-	-	-	×
Doosan Heavy Industry	Korea	-	○	-	×
Siemens	U.S/Europe	×	×	○	×
Foster Wheeler		○	○	×	×
B & W		-	○	×	×
Ansaldo		×	○	×	×
GE		-	×	○	×
POWER MACHINES		×	×	○	×

Note: ○: Has tender participation experience; ×: Unable to participate in tender; —: Has no experience of tender participation)

Source: Prepared by Survey Team

3. Tender package

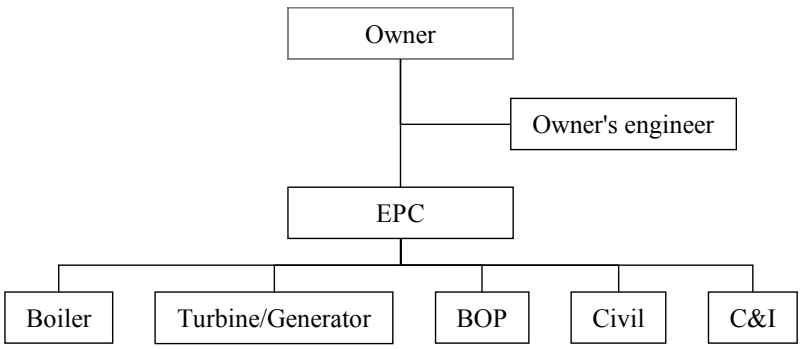
(1) Philosophy behind setting of the tender package

The tender package is one of the conditions that will determine whether or not a Japanese company receives the order. By adopting a large package (expanding the scope of supply), the number of eligible companies (the number of tender rivals) can be reduced, however, if a single Japanese company is unable to supply the package, it will be necessary to form a consortium that may need to include overseas companies. On the other hand, if the package is made too small, the number of eligible companies will increase and there will be greater opportunity for Japanese companies to participate in the respective fields, however, it will be necessary to narrow the field down via PQ conditions. The following paragraphs show a comparison of various tender package cases.

- Single package

This entails combining EPC, boiler supply, turbine and generator supply, BOP supply, civil engineering works, and instrumentation equipment supply into a single package and contracting it out to a single company. Since the whereabouts of responsibility is clear and there is a unified interface window with the owner's engineers, works supervision is relatively simple from the viewpoint of the owner's engineers. Accordingly, even with a relatively inexperienced owner such as BSPGCL, assistance can be provided from the owner's engineers and EPC contractor. L&T-MHPS and BHEL, which can supply all the items and execute all the works, are capable of responding to such a package tender. TJPS has the capacity to undertake the job of EPC contractor, however, because it cannot conduct the boiler supply, it is likely to form a consortium with an overseas company that can supply boilers.

Figure 3-1 shows the image of single package composition.



Source: Prepared by Survey Team

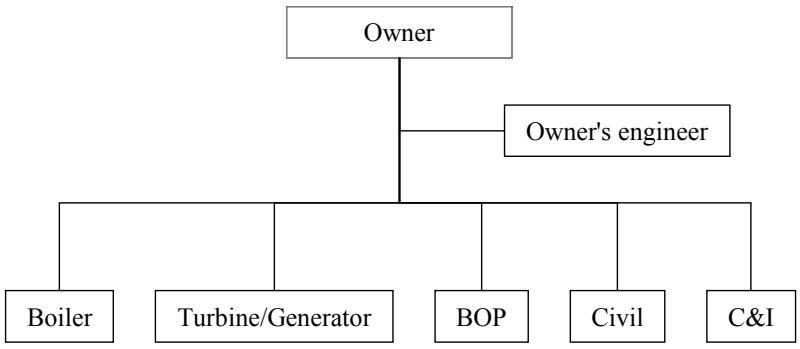
Figure 3-1 Image of single package composition

In this package, after EPC contractor receives the order, it either handles each component by itself or outsources work to other companies (Japanese companies or local companies) and it may even conclude a contract with a trading company in order to deal with the local laws, regulations, etc. It is also possible that a trading company may become EPC contractor, however, under the Phased Manufacturing Program that is being advanced by GoI, since one of PQ conditions for NTPC and other coal-fired thermal power projects is that the contractor is a BTG manufacturer possessing manufacturing equipment in India, and moreover TJSW and L&T-MHPS, which have plants in India, possess ample knowledge of local laws, regulations, trading companies are not usually included in the mix.

- Multi package

The work is broadly divided into boiler supply, turbine supply, BOP supply, civil engineering works and instrumentation equipment supply, and the owner's engineers conduct EPC. In this case, tender is conducted for each component so there are more opportunities for Japanese companies that possess technological advantage to participate and compete in terms of price, however, it is necessary to set PQ conditions for each component. Moreover, because of the large number of package components, the workload placed on the owner's engineers in having to supervise the tenders and works is extremely large. In the case of an inexperienced owner such as BSPGCL, there is thus a large possibility that this will lead to higher construction costs arising because of delays in the works. From the viewpoint of companies taking part in the tender process, there is less advantage for companies such as L&T-MHPS and BHEL that can undertake the works as a single package.

Figure 3-2 shows the image of the multi package composition. However, concerning BOP supply, civil engineering works and instrumentation equipment supply, it is also possible to separate according to the boiler supply and turbine and generator supply packages.



Source: Prepared by Survey Team

Figure 3-2 Image of multi package composition

(2) Recommended package from the viewpoint of works supervision

For an owner such as NTPC that has abundant experience of building power stations, it is possible to reduce costs by incorporating detailed specifications into individual packages under the multi package approach. Therefore, NTPC tender packages are shifting from the single type to the multi type. However, because the owner here is BSPGCL, which has little experience of power station construction and does not possess much supercritical technology, the single package is recommended for easier works management. Moreover, similar opinions were obtained in interviews with L&T-MHPS and TJPS.

4. Pre-Qualification conditions

(1) Philosophy behind setting of Pre-Qualification conditions

Numerous PQ conditions that give an advantage to Japanese companies can be considered. These can broadly be divided into I conditions pertaining to objective facts for which false declarations cannot be made in the tender stage, and II conditions that can be falsely declared in the tender stage. Examples of the first type include requiring possession of a factory in India for maintenance, ownership of operating performance (years) using supercritical technology and so on. Examples of the latter type include the ability to meet new discharge controls (NOx, SOx, particulate, mercury), compliance with the period from NTP to start of operation, compliance with the planned cost and so on. Japanese companies have an advantage under both types of conditions, however, it is better to set PQ conditions according to the first type because even if a bidder makes false declarations concerning the second type and wins the contract, it cannot be replaced later on in the construction process when it is found not to possess the ability it claimed to have.

[Basic awareness and handling of BHEL]

Since BHEL has the capacity to undertake the role of EPC contractor (the entire package of EPC, boiler supply, turbine and generator supply, BOP supply, civil engineering works, and instrumentation equipment supply) for supercritical power generation facilities, it is one of the most capable bidders that always participates in competitive tenders in India. Moreover, because it is a government-affiliated enterprise, it has a lot of political influence. Therefore, even if PQ conditions are set in such a way to give the advantage of Japanese companies and exclude BHEL, there is a possibility that government circles will revise conditions in BHEL's favor, thereby also opening the tender process to Chinese, South Korean and European companies. Therefore, rather than adopting PQ conditions that completely eliminate BHEL, it is better to adopt conditions that can be satisfied by BHEL while at the same time eliminating Chinese, South Korean and European companies, and let the Japanese companies compete for the order based on price performance after the initial sorting. Such an approach is thought to

be given Japanese companies the best chance of success.

(2) Prequalification conditions for each item of equipment

- PQ conditions for EPC contractor

As was mentioned in the recommended package from the viewpoint of works supervision in section 3(2), it is advisable to adopt the single package for easier works management and to have an EPC contractor (for consolidating the suppliers). Table 4-21 shows the envisaged PQ conditions in such a case. Also, Table 4-2 shows the list of companies that can participate in the tender in the case where PQ condition I is set.

Table 4-1 prequalification conditions concerning operating performance

Condition No.	Contents
I	The company, or its subsidiary (with financing of 51 % or higher) or its JV (with financing of 51 % or higher), is a BTG manufacturer that has manufacturing equipment in India; moreover, it has operating performance of 1 year or more in a coal-fired thermal power station of 500MW or higher in India.

Source: Prepared by Survey Team

Table 4-2 List of companies eligible for tender

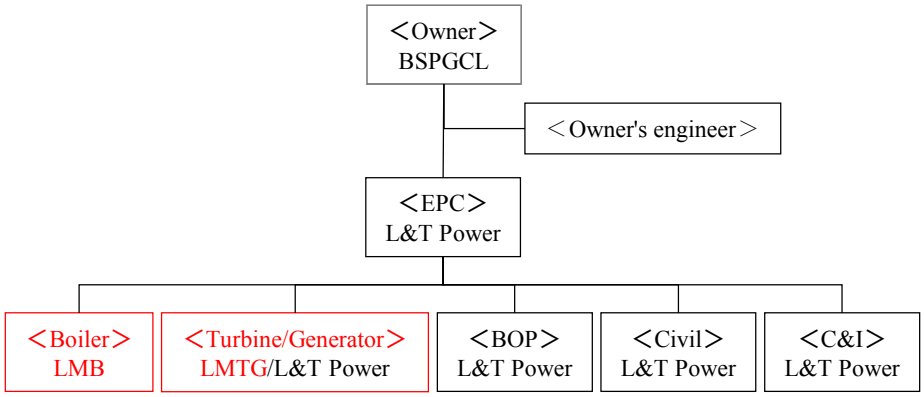
		PQ condition I	Consortium partner
BHEL	Indian company	○	Unnecessary
L&T-MHPS	Japanese companies	○	Unnecessary
TJPS		○	Doosan India
Doosan India	South Korean company	○	TJPS
Alstom-Baharat Forge	European company	○	None
Other companies [1] (17 companies)	Others	×	—

Note: ○: Satisfy conditions; ×: Not satisfy conditions; —: Not applicable

Source: Prepared by Survey Team

[1] -Toshiba and MHPS, Alstom, and Doosan satisfy PQ condition I, however, they are excluded here because it is guessed that TJPS and L&T-MHPS, Alstom-Baharat Forge, and Doosan India will make bids based on their past performance in coal-fired thermal power projects in India.
- ISGEC satisfies PQ condition I, however, it is excluded because it has no past performance. TBWES satisfies PQ condition I, however, it is excluded because it has little experience of entering tenders as part of a consortium.

If PQ condition I is set, the companies or consortiums that satisfy this and are eligible to bid are likely to be L&T-MHPS, TJPS-Doosan and BHEL (three (3) companies) as shown in Figure 4-1 through Figure 4-3. L&T-MHPS consortium includes the Indian enterprise L&T Power, while the TJPS-Doosan consortium will entail outsourcing part of the package to the South Korean enterprise Doosan, but it will be a competition between BHEL and two (2) consortiums that include Japanese companies. By encouraging such a competition between these three (3) entities, the chances of a Japanese company (L&T-MHPS or TJPS) winning the order will be higher. Here, since Alstom-Baharat Forge and TBWES have little past experience of forming consortiums for tender, there is deemed to be little chance they will do so here.

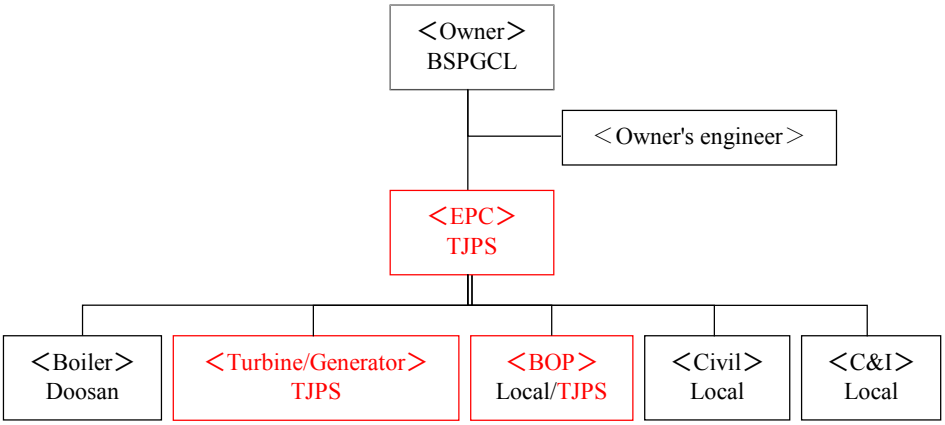


Note: Japanese companies in red

Source: Prepared by Survey Team

Figure 4-1 L&T-MHPS tender composition image

In the L&T-MHPS tender composition, it is guessed that Japanese companies will participate in the boiler part (LMB) and the turbine part (equipment supply only, LMTG). Here, since L&T-MHPS can also handle the turbine part, TJPS does not participate in the turbine part.

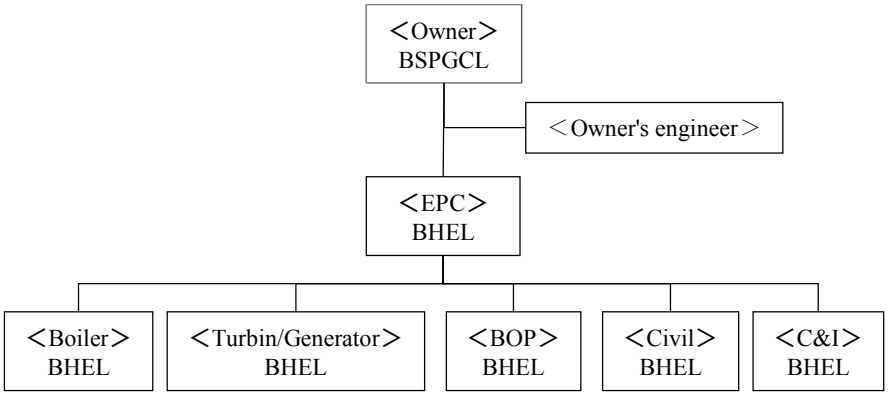


Note: Japanese companies in red

Source: Prepared by Survey Team

Figure 4-2 TJPS tender composition image

In the TJPS tender composition, it is guessed that TJPS will participate as EPC contractor and in the turbine part and BOP part (turbine-related equipment). Concerning participation by L&T-MHPS in the boiler part, since this entails no merit for L&T-MHPS, which can also handle the turbine part, it is excluded from the examination. However, if the Government of Japan and JICA give full backing with a view to realizing all-Japanese implementation, it may consider participation (according to the results of the hearing).



Source: Prepared by Survey Team

Figure 4-3 Bharat Heavy Electricals Limited tender composition image

It is guessed that the BHEL tender composition will comprise entirely BHEL.

<Reference: Other PQ conditions>

Here, concerning operating performance, PQ conditions II to IV that are shown in Table 4-3 can be considered. However, because PQ conditions II to IV specify numbers of years, the eligible contractors will increase if the tender announcement is delayed. Moreover, concerning PQ condition IV, the operating performance (including scheduled performance) of Alstom-Baharat Forge and Doosan India is from 2015, and since this is no very different from 2013-2014 by other enterprises including Japanese companies, it is not an advantageous condition. Moreover, because no explanation can be given for the reason for setting, the condition is not realistic.

Table 4-3 Prequalification conditions pertaining to operating performance

Condition No.	Contents
II	The manufacturer has at least 15 years of operating performance (operation started in 2000 or earlier) in a coal-fired thermal power station with main steam temperature / reheated steam temperature of 593℃ / 593℃ or more outside of India. However, this does not include Indian companies.
III	The manufacturer has at least 5 years of operating performance (operation started in 2010 or earlier) in a boiler with main steam temperature / reheated steam temperature of 600℃ / 600℃ or more. Operating performance by the parent company shall be admissible, and this does not include Indian companies.
IV	The manufacturer has at least 1 year of operating performance (operation started in 2014 or earlier) in a coal-fired thermal power station with main steam temperature of 593℃ or more in India. Operating performance by the parent company shall be admissible, and this does not include Indian companies.

Source: Prepared by Survey Team

Table 4-4 shows the list of companies eligible for tender in the case where PQ conditions I to IV are considered.

Table 4-4 List of companies eligible for tender (prequalification condition I-IV)

Companies eligible for tender	PQ condition I		PQ condition II	PQ condition III	PQ condition IV
BHEL	○	→	○	○	○
L&T-MHPS	○	→	○ (1997 start of operation)[2]	○ (1998 start of operation)	○ (2014 start of operation)[2]
TJPS	○	Making consortium	○ (1998 start of operation)[3]	○ (2000 start of operation)[3]	○ (2012 start of operation)[3]
Doosan India	○	→	× (2017 scheduled start of operation)[4]	× (2017 scheduled start of operation)[4]	× (2015 start of operation)
Alstom-Baharat Forge	○	→×	× (2011 start of operation)[5]	× (2013 start of operation)	× (2012 start of operation)[5]
Other companies[6]	×		—	—	—

Note: ○: Satisfy conditions; ×: Not satisfy conditions; —: Not applicable

Source: Prepared by Survey Team

[2] MHPS performance

[3] Toshiba performance

[4] Doosan performance

[5] Alstom performance

[6] - Toshiba and MHPS, Alstom, and Doosan satisfy PQ condition I, however, they are excluded here because it is guessed that TJPS and L&T-MHPS, Alstom-Baharat Forge, and Doosan India will make bids based on their past performance in coal-fired thermal power projects in India.
- ISGEC satisfies PQ condition I, however, it is excluded because it has no past performance. TBWES satisfies PQ condition I, however, it is excluded because it has little experience of entering tenders as part of a consortium

➢ PQ conditions for gas circuit breaker suppliers

Table 4-6 shows the list of companies eligible for tender in the case where PQ conditions shown in Table 4-5 are set.

Table 4-5 prequalification conditions for gas circuit breaker suppliers

Condition No.	Contents
I	Either a spring mechanism (mechanical) or hydraulic mechanism can be adopted as the operating mechanism for the gas circuit breaker.
II	The manufacturer has experience of supplying outdoor GIS for at least 15 years.
III	The SF6 gas leakage rate is less than 0.1 %/year.

Source: Prepared by Survey Team

Table 4-6 List of gas circuit breaker suppliers eligible for tender

		PQ conditions1	PQ conditions2	specification conditions
Toshiba	Japanese companies	○	○	○
Mitsubishi		○	○	○
Hitachi		○	○	○
Indian companies		○	△	△
Siemens	European companies	○	○	○
ABB		○	○	○
Hyosung	Chinese and South Korean companies	×	△	△
Hyundai				

Note: ○: Satisfies conditions; ×: Doesn't satisfy conditions; —: Not applicable

Source: Prepared by Survey Team

➢ PQ conditions for LL wire suppliers

Table 4-8 shows the list of companies eligible for tender in the case where PQ conditions shown in Table 4-7 are set.

Table 4-7 Prequalification conditions for LL wire suppliers

Condition No.	Contents
I	The manufacturer has at least 20 years of operating performance with LL wire.
II	The manufacturer has supplied at least 2,000 kilometers of low loss wire.
III	It is the following type and satisfies the following wire specifications: - It is the LL-ACSR/UGS type that uses galvanized steel wire with strength of 1,960 MPa or more, or it is the LL-ACSR/AS type that uses galvanized steel wire with strength of 1,770 MPa or more. - Weight：No higher than ACSR “Moose” - Tensile strength: No less than that of ACSR “Moose” - External diameter: No greater than that of ACSR “Moose” - DC electric resistance: No greater than 90 % the DC electric resistance of ACSR “Moose”

Source: Prepared by Survey Team

Table 4-8 List of LL wire suppliers eligible for tender

Companies eligible for tender		PQ condition I	PQ condition II	PQ condition III
JPS	Japanese companies	○	○	○
VISCAS		○	○	○
EXSYM		○	○	○
KITANIHON ELECTRIC CABLE		○	○	○
APAR Co. Starlite Co.	Indian companies	×	×	×
LS Cable	South Korean company	×	×	×
ZTT	Chinese company	×	×	×

Note: ○: Satisfies conditions; ×: Doesn’t satisfy conditions; —: Not applicable

Source: Prepared by Survey Team

Appendix III

Cost estimation support system

Annual Fund Requirement(Total)

Base Year for Cost Estimation: Apr, 2015 — FC & Total: million JPY
Exchange Rates: Rs. = JPY 1.9 — LC : million Rs.
USD = JPY 120.3
Price Escalation: FC: 1.8% LC: 1.3%
Physical Contingency 5%
Physical Contingency for Consultant 5%

Item	Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION	13,421	54,485	116,943	19	7	33	127	48	219	2,345	10,680	129,119	2,003	8,324	81,651	2,232	8,970	169,865	4,004	16,800	216,571	2,655	9,636	168,111	37	20	75	0	0	0
A-1) Procurement / Construction(Power Station)	11,701	51,415	109,389	0	0	0	0	0	0	2,020	9,928	127,365	1,745	7,417	79,672	1,871	8,235	168,107	3,588	16,389	215,374	2,477	9,446	167,572	0	0	0	0	0	0
A-2) Procurement / Construction(Transmission Line)	0	1,491	2,832	0	0	0	0	0	0	0	414	787	0	645	1,225	0	431	820	0	0	0	0	0	0	0	0	0	0	0	0
A-3) Consulting services(Power Station)	1,210	1,117	3,332	19	7	33	127	48	219	159	187	515	84	104	282	190	149	473	416	411	1,196	178	190	539	37	20	75	0	0	0
A-4) Consulting services(Transmission Line)	510	463	1,390	0	0	0	0	0	0	165	151	452	173	157	472	171	155	465	0	0	0	0	0	0	0	0	0	0	0	0
B. NON ELIGIBLE PORTION	0	10,894	20,698	0	2	4	0	13	24	0	2,370	4,503	0	1,529	2,905	0	1,586	3,013	0	3,456	6,566	0	1,933	3,674	0	5	9	0	0	0
B-1) Subtotal(Power Station)	0	10,471	19,895	0	2	4	0	13	24	0	2,234	4,244	0	1,380	2,622	0	1,448	2,752	0	3,456	6,566	0	1,933	3,674	0	5	9	0	0	0
B-2) Subtotal(Transmission Line)	0	423	803	0	0	0	0	0	0	0	137	259	0	149	282	0	138	262	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL (A+B)	13,421	65,379	137,641	19	9	37	127	61	243	2,345	13,050	133,622	2,003	9,853	84,556	2,232	10,556	172,878	4,004	20,256	223,137	2,655	11,569	171,785	37	25	84	0	0	0
C. Interest during Construction	7,878	0	7,878	0	0	0	0	0	0	304	0	304	547	0	547	811	0	811	1,309	0	1,309	1,613	0	1,613	1,636	0	1,636	1,659	0	1,659
C-1) Subtotal(Power Station)	7,631	0	7,631	0	0	0	0	0	0	292	0	292	518	0	518	771	0	771	1,268	0	1,268	1,572	0	1,572	1,594	0	1,594	1,616	0	1,616
C-2) Subtotal(Transmission Line)	247	0	247	0	0	0	0	0	0	11	0	11	28	0	28	40	0	40	41	0	41	41	0	41	42	0	42	43	0	43
D. Front End Fee	125	0	125	120	0	120	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-1) Subtotal(Power Station)	120	0	120	120	0	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D-2) Subtotal(Transmission Line)	4	0	4	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL (A+B+C+D)	21,424	65,379	145,644	140	9	157	127	61	243	2,653	13,050	133,930	2,549	9,853	85,103	3,043	10,556	173,690	5,313	20,256	224,446	4,268	11,569	173,398	1,672	25	1,720	1,659	0	1,659
E. JICA finance portion incl. IDC (A+C+D)	21,424	54,485	124,946	140	7	154	127	48	219	2,653	10,680	129,427	2,549	8,324	82,198	3,043	8,970	170,676	5,313	16,800	217,879	4,268	9,636	169,724	1,672	20	1,711	1,659	0	1,659

Annual Fund Requirement

Base Year for Cost Estimation: Apr, 2015 — FC & Total: million JPY
Exchange Rates: Rs. = JPY 1.9 — LC : million Rs.
USD = JPY 120.3
Price Escalation: FC: 1.8% LC: 1.3%
Physical Contingency 5%
Physical Contingency for Consultant 5%

Item	Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION																														
Ⅰ) Procurement / Construction of Lot 1	11,701	51,415	109,389	0	0	0	0	0	0	2,020	9,928	127,365	1,745	7,417	79,672	1,871	8,235	168,107	3,588	16,389	215,374	2,477	9,446	167,572	0	0	0	0	0	0
1 Civil Works	0	9,394	17,849	0	0	0	0	0	0	0	2,100	3,989	0	1,527	2,900	0	1,404	2,668	0	2,856	5,426	0	1,508	2,865	0	0	0	0	0	0
2 Steam Generator Island	4,716	7,350	18,681	0	0	0	0	0	0	931	1,451	3,689	1,012	1,578	4,011	368	573	1,456	1,556	2,425	6,164	849	1,323	3,361	0	0	0	0	0	0
3 Turbine Generator Island	3,561	3,430	10,078	0	0	0	0	0	0	611	589	74,628	371	357	45,293	1,020	982	124,557	990	954	120,948	569	548	69,464	0	0	0	0	0	0
4 Balance of Plant	1,203	9,300	18,873	0	0	0	0	0	0	214	1,655	28,906	164	1,269	22,166	242	1,874	32,722	389	3,009	52,533	193	1,493	26,064	0	0	0	0	0	0
5 Raw Water Intake Pump Hose & Intake Line	0	600	1,140	0	0	0	0	0	0	0	134	255	0	98	185	0	90	170	0	182	347	0	96	183	0	0	0	0	0	0
6 Railway Siding	0	330	627	0	0	0	0	0	0	0	65	124	0	43	82	0	43	82	0	120	227	0	59	113	0	0	0	0	0	0
7 Initial Spares	674	1,435	3,400	0	0	0	0	0	0	67	144	8,377	0	0	0	0	0	0	135	287	16,754	472	1,005	58,639	0	0	0	0	0	0
8 Environmetnal Facilities	0	6,000	11,400	0	0	0	0	0	0	0	1,068	2,029	0	819	1,556	0	1,209	2,297	0	1,941	3,688	0	963	1,830	0	0	0	0	0	0
9 Erection, Testing & Commitioning	0	2,450	4,655	0	0	0	0	0	0	0	436	829	0	303	575	0	462	877	0	840	1,597	0	409	777	0	0	0	0	0	0
10 Physical Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Overhead Construction Charges	0	226	430	0	0	0	0	0	0	0	67	126	0	29	56	0	29	56	0	75	142	0	26	49	0	0	0	0	0	0
12 Training of O&M Staff and Mobilisation Cos	0	30	57	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	16	30	0	11	21	0	0	0	0	0	0
13 Other Costs	0	5,274	10,021	0	0	0	0	0	0	0	1,384	2,631	0	686	1,303	0	686	1,303	0	1,740	3,307	0	778	1,478	0	0	0	0	0	0
14 Base cost for JICA financing	10,153	45,819	97,210	0	0	0	0	0	0	1,824	9,096	19,106	1,547	6,708	14,293	1,630	7,352	15,599	3,070	14,445	30,515	2,082	8,218	17,697	0	0	0	0	0	0
15 Price escalation	991	3,147	6,970	0	0	0	0	0	0	100	359	783	114	356	790	152	490	1,084	347	1,164	2,558	277	778	1,755	0	0	0	0	0	0
16 Physical contingency	557	2,448	5,209	0	0	0	0	0	0	96	473	994	83	353	754	89	392	834	171	780	1,654	118	450	973	0	0	0	0	0	0
Ⅱ) Consulting services	1,210	1,117	3,332	19	7	33	127	48	219	159	187	515	84	104	282	190	149	473	416	411	1,196	178	190	539	37	20	75	0	0	0
1 Base cost	1,054	995	2,945	18	7	31	117	45	202	144	171	469	75	94	254	165	133	419	356	362	1,044	149	165	464	30	17	63	0	0	0
2 Price escalation	98	69	229	0	0	0	4	1	6	8	7	21	6	5	15	15	9	32	40	29	96	20	16	50	5	2	8	0	0	0
3 Physical contingency	58	53	159	1	0	2	6	2	10	8	9	25	4	5	13	9	7	23	20	20	57	8	9	26	2	1	4	0	0	0
Total (Ⅰ + Ⅱ)	12,911	52,532	112,722	19	7	33	127	48	219	2,179	10,115	21,398	1,829	7,522	16,120	2,061	8,384	17,991	4,004	16,800	35,923	2,655	9,636	20,963	37	20	75	0	0	0
B. NON ELIGIBLE PORTION																														
a Procurement / Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost for JICA financing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Administration cost	0	2,966	5,636	0	1	2	0	6	11	0	563	1,070	0	424	806	0	473	900	0	945	1,796	0	552	1,048	0	2	4	0	0	0
d Taxes & Duties	0	7,505	14,259	0	1	2	0	7	13	0	1,670	3,174	0	956	1,816	0	975	1,852	0	2,511	4,770	0	1,382	2,625	0	3	6	0	0	0
1 Base cost	0	6,690	12,712	0	1	2	0	6	12	0	1,530	2,908	0	865	1,643	0	870	1,654	0	2,213	4,204	0	1,202	2,284	0	3	5	0	0	0
2 Price escalation	0	457	868	0	0	0	0	0	0	0	60	115	0	46	87	0	58	110	0	178	339	0	114	216	0	0	1	0	0	0
3 Physical contingency	0	357	679	0	0	0	0	0	1	0	80	151	0	46	86	0	46	88	0	120	227	0	66	125	0	0	0	0	0	0
e VAT	0																													
f Import Tax	0																													
Total (a+b+c+d+e+f)	0	10,471	19,895	0	2	4	0	13	24	0	2,234	4,244	0	1,380	2,622	0	1,448	2,752	0	3,456	6,566	0	1,933	3,674	0	5	9	0	0	0
TOTAL (A+B)	12,911	63,003	132,616	19	9	37	127	61	243	2,179	12,348	25,641	1,829	8,902	18,743	2,061	9,833	20,743	4,004	20,256	42,489	2,655	11,569	24,637	37	25	84	0	0	0
C. Interest during Construction	7,631	0	7,631	0	0	0	0	0	0	292	0	292	518	0	518	771	0	771	1,268	0	1,268	1,572	0	1,572	1,594	0	1,594	1,616	0	1,616
1 Interest during Construction(Const.)	7,629	0	7,629	0	0	0	0	0	0	292	0	292	518	0	518	771	0	771	1,268	0	1,268	1,571	0	1,571	1,593	0	1,593	1,616	0	1,616
2 Interest during Construction (Consul.)	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Front End Fee	120	0	120	120	0	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL (A+B+C+D)	20,662	63,003	140,368	140	9	157	127	61	243	2,472	12,348	25,934	2,347	8,902	19,261	2,832	9,833	21,513	5,272	20,256	43,757	4,226	11,569	26,208	1,630	25	1,678	1,616	0	1,616
E. JICA finance portion incl. IDC (A + C + D)	20,662	52,532	120,473	140	7	154	127	48	219	2,472	10,115	21,690	2,347	7,522	16,638	2,832	8,384	18,762	5,272	16,800	37,191	4,226	9,636	22,535	1,630	20	1,669	1,616	0	1,616

Administration Cost = 5%
VAT= 6% of the expenditure in local currency of the eligible portion
Import Tax= 6%

Annual Fund Requirement(Transmission Line)

Base Year for Cost Estimation: Apr, 2015
Exchange Rates Rs. = JPY 1.9
USD = JPY 120.3
Price Escalation: FC: 1.8% LC: 1.3%
Physical Contingency 5%
Physical Contingency for Consultant 5%

FC & Total: million JPY
LC : million Rs.

Item	Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION																														
Ⅰ) Procurement / Construction of Lot 2	0	1,491	2,832	0	0	0	0	0	0	0	414	787	0	645	1,225	0	431	820	0	0	0	0	0	0	0	0	0	0	0	0
1 Tower	0	354	672	0	0	0	0	0	0	0	118	224	0	118	224	0	118	224	0	0	0	0	0	0	0	0	0	0	0	0
2 Strings	0	77	146	0	0	0	0	0	0	0	17	32	0	40	76	0	20	38	0	0	0	0	0	0	0	0	0	0	0	0
3 Conductor	0	338	643	0	0	0	0	0	0	0	74	140	0	177	336	0	88	168	0	0	0	0	0	0	0	0	0	0	0	0
4 Ground-wire	0	21	40	0	0	0	0	0	0	0	5	9	0	11	21	0	5	10	0	0	0	0	0	0	0	0	0	0	0	0
5 Fibre Optic Distribution Panel	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6 Survey & Soil investigation	0	64	121	0	0	0	0	0	0	0	42	81	0	21	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Tower Construction	0	222	422	0	0	0	0	0	0	0	74	141	0	74	141	0	74	141	0	0	0	0	0	0	0	0	0	0	0	0
8 Stringing Work	0	61	116	0	0	0	0	0	0	0	13	25	0	32	60	0	16	30	0	0	0	0	0	0	0	0	0	0	0	0
9 River Crossing Foundation Work	0	119	225	0	0	0	0	0	0	0	0	0	0	79	150	0	40	75	0	0	0	0	0	0	0	0	0	0	0	0
10 Design Work	0	8	14	0	0	0	0	0	0	0	3	6	0	3	6	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
11 Testing	0	18	34	0	0	0	0	0	0	0	12	23	0	6	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Misc(Approval & compensation and etc.)	0	53	100	0	0	0	0	0	0	0	18	33	0	18	33	0	18	33	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost for JICA financing	0	1,334	2,534	0	0	0	0	0	0	0	375	712	0	578	1,099	0	380	723	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	71	135	0	0	0	0	0	0	0	15	28	0	31	58	0	25	48	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	86	163	0	0	0	0	0	0	0	25	47	0	36	68	0	25	48	0	0	0	0	0	0	0	0	0	0	0	0
Ⅱ) Consulting services	510	463	1,390	0	0	0	0	0	0	165	151	452	173	157	472	171	155	465	0	0	0	0	0	0	0	0	0	0	0	0
Base cost	452	419	1,248	0	0	0	0	0	0	149	138	412	154	142	424	149	138	412	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	34	22	76	0	0	0	0	0	0	8	5	19	11	8	26	14	9	31	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	24	22	66	0	0	0	0	0	0	8	7	22	8	7	22	8	7	22	0	0	0	0	0	0	0	0	0	0	0	0
Total (Ⅰ + Ⅱ)	510	1,953	4,222	0	0	0	0	0	0	165	565	1,239	173	802	1,697	171	586	1,285	0	0	0	0	0	0	0	0	0	0	0	0
B. NON ELIGIBLE PORTION																														
a Procurement / Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost for JICA financing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Administration cost	0	111	211	0	0	0	0	0	0	0	33	62	0	45	85	0	34	64	0	0	0	0	0	0	0	0	0	0	0	0
d Taxes & Duties (Lot 2)	0	312	592	0	0	0	0	0	0	0	104	197	0	104	197	0	104	197	0	0	0	0	0	0	0	0	0	0	0	0
e VAT	0																													
f Import Tax	0																													
Total (a+b+c+d+e+f)	0	423	803	0	0	0	0	0	0	0	137	259	0	149	282	0	138	262	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL (A+B)	510	2,376	5,025	0	0	0	0	0	0	165	702	1,499	173	951	1,980	171	724	1,547	0	0	0	0	0	0	0	0	0	0	0	0
C. Interest during Construction	247	0	247	0	0	0	0	0	0	11	0	11	28	0	28	40	0	40	41	0	41	41	0	41	42	0	42	43	0	43
Interest during Construction(Const.)	246	0	246	0	0	0	0	0	0	11	0	11	28	0	28	40	0	40	41	0	41	41	0	41	42	0	42	42	0	42
Interest during Construction (Consul.)	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Front End Fee	4	0	4	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL (A+B+C+D)	762	2,376	5,276	0	0	0	0	0	0	181	702	1,514	202	951	2,008	212	724	1,587	41	0	41	41	0	41	42	0	42	43	0	43
E. JICA finance portion incl. IDC (A + C + D)	762	1,953	4,473	0	0	0	0	0	0	181	565	1,255	202	802	1,726	212	586	1,325	41	0	41	41	0	41	42	0	42	43	0	43

5,025

Administration Cost = 5%
VAT= 6% of the expenditure in local currency of the eligible portion
Import Tax= 6%

Pre-Conditions for Cost Estimation

1. General Conditions

Exchange Rate

			Rs.	
(1)	JPY/USD	USD 1 =	120.3	JPY
(2)	LC/USD	USD 1 =	62.4	Rs.
(3)	JPY/Rs.	Rs. 1 =	1.9	JPY

Price Escalation

(1)	FC	1.8%	LC	1.3%	

Physical Contingency

Construction	5.0%	Consultant	5.0%

Base Year for Cost Estimation: 2015/4

Schedule

Start 2016/4 End 2022/10

Billing Rate of Consultant

	FC JPY	LC Rs.
Pro-(A)	3,049,000	0
Pro-(B)	0	385,000
Supporting Staff	0	225,000

2. Others

Rate of Tax

VAT	6.0%	Import Tax	6.0%

Rate of Administration Cost

5.0%

Rate of Interest During Construction

Construction	1.40%	Consultant	0.01%

Rate of Front End Fee

0.1%

Payment Method for Interest during construction: loan-covered

Front End Fee: loan-covered

Fiscal Year

Apr - Mar

VAT and Import TAX

	VAT		Import TAX	
	FC	LC	FC	LC
Construction/Procurement Works	FALSE	FALSE	TRUE	FALSE
Consultant Services	FALSE	FALSE	FALSE	FALSE
Land Acquisition	FALSE	FALSE	FALSE	FALSE

Advanced Payment and Retention Money

	Advanced Payment	Retention Money
Construction	10.0%	20.0%
Consultant Services	15.0%	25.0%

Timing of RM Payment

Completion	5.0%
After12M later	8.0%

Payment timing of Retention Money

50% to be paid when taking over certificate has been issued for the works
and the remaining 50% to be paid on expiry of the defects Notifications period.

Defect Liablity Period

12 months

Cost Breakdown for Package

USD	=JPY	120.3
Rs.	=JPY	1.9

item	Local	Total
	Rs.	JPY
Land Acquisition Cost		0

Civil Works Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
BTG Island				2,100,000,000	0	2,100,000,000	3,990,000,000
CW System				180,000,000		180,000,000	342,000,000
Water Treatment				560,000,000		560,000,000	1,064,000,000
Coal Handling Plant				3,857,000,000		3,857,000,000	7,328,300,000
Ash Handling Plant				380,000,000		380,000,000	722,000,000
Oil Handling Plant				17,000,000		17,000,000	32,300,000
Non-plant Builidings				17,000,000		17,000,000	32,300,000
Inplant Roads & Drains				783,000,000		783,000,000	1,487,700,000
Piling Works & Foundation				1,500,000,000		1,500,000,000	2,850,000,000
Total					0	9,394,000,000	17,848,600,000

Steam Generator Island Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Boiler			39,200,000	6,690,000,000	4,715,760,000	6,690,000,000	17,426,760,000
Boiler Auxiliaies				660,000,000		660,000,000	1,254,000,000
							0
							0
							0
							0
Total					4,715,760,000	7,350,000,000	18,680,760,000

Turbine Generator Island Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Steam Turbines			18,500,000	1,050,000,000	2,225,550,000	1,050,000,000	4,220,550,000
Steam Turbine Auxiliaries			7,400,000	1,760,000,000	890,220,000	1,760,000,000	4,234,220,000
Generator			3,700,000	440,000,000	445,110,000	440,000,000	1,281,110,000
Generator Auxiliaries				180,000,000		180,000,000	342,000,000
							0
							0
Total					3,560,880,000	3,430,000,000	10,077,880,000

Balance of Plant

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Plant Water Systems				1,460,000,000	0	1,460,000,000	2,774,000,000
Coal Handling Plant (CHP)				3,320,000,000	0	3,320,000,000	6,308,000,000
Fuel Oil Handling Plant (FOP)				600,000,000		600,000,000	1,140,000,000
Ash Handling Plant (AHP)				1,050,000,000		1,050,000,000	1,995,000,000
Miscellaneous Balance of Plant				1,270,000,000		1,270,000,000	2,413,000,000
BTG Island				460,000,000		460,000,000	874,000,000
BOP Island				130,000,000	0	130,000,000	247,000,000
Swithyard Island			5,000,000	300,000,000	601,500,000	300,000,000	1,171,500,000
Control & Instrumentation			5,000,000	710,000,000	601,500,000	710,000,000	1,950,500,000
Total					1,203,000,000	9,300,000,000	18,873,000,000

Raw Water Intake Pump Hose & Intake Line

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Raw Water Intake Pump Hose & Intake Line				600,000,000		600,000,000	1,140,000,000
						0	0
						0	0
						0	0
						0	0
							0
Total					0	600,000,000	1,140,000,000

Railway Siding

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Railway Siding				330,000,000		330,000,000	627,000,000
						0	0
						0	0
						0	0
						0	0
						0	0
Total					0	330,000,000	627,000,000

Initial Spares

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Steam Generator Island			2,900,000	710,000,000	348,870,000	710,000,000	1,697,870,000
Turbine Generator Island			2,100,000	330,000,000	252,630,000	330,000,000	879,630,000
Balance of Plant : Mechanical				245,000,000		245,000,000	465,500,000
Electrical / Control & Instrumentation			600,000	120,000,000	72,180,000	120,000,000	300,180,000
Others				30,000,000		30,000,000	57,000,000
							0
Total					673,680,000	1,435,000,000	3,400,180,000

Environmetnal Facilities

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
ESP				100,000,000	0	100,000,000	190,000,000
SCR				1,050,000,000		1,050,000,000	1,995,000,000
FGD				4,850,000,000		4,850,000,000	9,215,000,000
							0
							0
							0
Total					0	6,000,000,000	11,400,000,000

Taxes & Duties

Loan Coverage Ratio 0

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Tax on Supply				4,810,000,000		4,810,000,000	9,139,000,000
Tax on Civil Works				585,000,000		585,000,000	1,111,500,000
Service Tax on Erection & Commisioning				359,000,000		359,000,000	682,100,000
Tax on Supply of ESP, SCR & FGD				637,000,000		637,000,000	1,210,300,000
Tax on Civil Works of ESP, SCR & FGD				25,000,000		25,000,000	47,500,000
Service Tax on Erection & Commisioning of ESP, SCR & FGD				130,000,000		130,000,000	247,000,000
Total					0	6,546,000,000	12,437,400,000

Erection, Testing & Commitioning

Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
BTG Island				1,620,000,000		1,620,000,000	3,078,000,000
BOP Island				650,000,000		650,000,000	1,235,000,000
Swithyard Island				70,000,000		70,000,000	133,000,000
Plant Control & Instrumentation				110,000,000		110,000,000	209,000,000
							0
							0
Total					0	2,450,000,000	4,655,000,000

Physical Contingency

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Physical Contingency				0		0	0
							0
							0
							0
							0
							0
Total					0	0	0

Overhead Construction Charges

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Establishment Charges				113,100,000		113,100,000	214,890,000
Audit & Account				113,100,000		113,100,000	214,890,000
							0
							0
							0
							0
Total					0	226,200,000	429,780,000

Training of O&M Staff and Mobilisation Cost

Loan Coverage Ratio 100

item	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Training of O&M Staff and Mobilisation Cost				30,000,000		30,000,000	57,000,000
							0
							0
							0
							0
							0
Total					0	30,000,000	57,000,000

Other Costs

Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Start-up Fuel & Power				500,000,000		500,000,000	950,000,000
Legal Expenses				22,900,000		22,900,000	43,510,000
Construction Insurance				22,900,000		22,900,000	43,510,000
R & R				2,200,000,000		2,200,000,000	4,180,000,000
CSR Activities				350,000,000		350,000,000	665,000,000
Margin Money for Working Capital				1,178,400,000		1,178,400,000	2,238,960,000
Accommodation Facility				1,000,000,000		1,000,000,000	1,900,000,000
Total					0	5,274,200,000	10,020,980,000

Implementation Schedule

	2016	2017	2018	2019	2020	2021	2022	2023	2024	Month
										0
Pledge										0
Signing of Loan Agreement										0
										0
Consulting Services for Power Station										0
Review of Previous Study including FS										3
Design and Engineering - Preparation of Project Design Report										6
Preparation of Pre-Qualification Documents										6
Approval of P/Q Documents										6
P/Q Announcement and P/Q Application Submission by Prospective Bidders										6
Evaluation of P/Q Application										6
Approval of P/Q Evaluation Report										6
Preparation of Tender Documents										6
Approval of Tender Documents										6
Tender Period (EPC Tender)										4
Evaluation of Tender and Approval										2
EPC Contract Negotiation										2
Consulting Services for Evacuation System										0
Proposal, Review and Approval of Study Report by CEA										6
										0
Land Acquisition	0	0	0	0	0	0	0	0	0	0
Civil Works	0	0	7.6	10	9.2	6.4	6.8	0	0	40
Steam Generator Island	0	0	3.45	7.6	2.76	4.6	4.6	0	0	23
Turbine Generator Island	0	0	1.54	2.24	6.16	1.68	2.36	0	0	14
Balance of Plant	0	0	4.8	8.4	12.4	7.6	6.8	0	0	40
Raw Water Intake Pump Hose & Intake Line	0	0	4.18	5.5	5.06	3.52	3.74	0	0	22
Railway Siding	0	0	4.65	6.2	6.2	7.75	6.2	0	0	31
Initial Spares	0	0	0	0	0	0	6	0	0	6
Environmetnal Facilities	0	0	4.8	8.4	12.4	7.6	6.8	0	0	40
Taxes & Duties	0	0	10	10	10	10	10	0	0	50
Erection, Testing & Commitioning	0	0	6.24	9.88	15.08	11.44	9.36	0	0	52
Physical Contingency	0	0	10.4	10.4	10.4	10.4	10.4	0	0	52
Overhead Construction Charges	0	0	15.5	10.4	10.4	10.4	5.2	0	0	52
Training of O&M Staff and Mobilisation Cost	0	0	0	0	0	6	6	0	0	12
Other Costs	0	0	13	10.4	10.4	10.4	7.8	0	0	52

Cost Breakdown for the Consulting Services

	USD = JPY	120.3
	Rs. = JPY	1.9
Consulting Services	Service Tax	14.5%

	Unit	Qty.	Foreign Portion (JPY) Rate	Foreign Portion (JPY) Amount ('000)	Local Portion Rs. Rate	Local Portion Rs. Amount ('000)	Combined Total ('000) JPY
A Remuneration							
1 Professional (A)	M/M	340	3,049,000	1,036,660	0	0	1,036,660
2 Professional (B)	M/M	551	0	0	385,000	212,135	403,057
3 Supporting Staffs	M/M	594	0	0	225,000	133,650	253,935
Subtotal of A				1,036,660		345,785	1,693,652
B Direct Cost							
1 International Airfare		29	600,000	17,400		0	17,400
2 Domestic Airfare		297		0	4,500	2,673	5,079
3 Domestic Travel		297		0	3,000	891	1,693
3 Accommodation Allowance	Month	340		0	360,000	122,400	232,560
	Month	551		0	2,000	1,102	2,094
	Month	594		0	2,000	1,188	2,257
4 Vehicle Rental	Month	297		0	60,000	17,820	33,858
5 Office Rental(6m2 per person)	M/M	1485		0	45,000	400,950	761,805
6 International Communications	Month	79		0	25,000	3,950	7,505
7 Domestic Communications	Month	79		0	3,500	553	1,051
8 Office Supply	Month	79		0	80,000	12,640	24,016
9 Office Furniture and Equipment	Month	79		0	500,000	79,000	150,100
10 Report Preparation	Month	79			80,000	6,320	12,008
Subtotal of B				17,400		649,487	1,251,425
C Service Tax(Local Portion*14.5%)		1				144,300	
Subtotal of C						144,300	
Total (A+B)				1,054,060		995,272	2,945,077

Manning Schedule for the Consulting Services

		Position	Billing Rate F/C JPY	Billing Rate LC/ Rs.	2016 4 5 6 7 8 9 10 11 12 1 2 3	2017 4 5 6 7 8 9 10 11 12 1 2 3	2018 4 5 6 7 8 9 10 11 12 1 2 3	2019 4 5 6 7 8 9 10 11 12 1 2 3	2020 4 5 6 7 8 9 10 11 12 1 2 3	2021 4 5 6 7 8 9 10 11 12 1 2 3	2022 4 5 6 7 8 9 10 11 12 1 2 3	2023 4 5 6 7 8 9 10 11 12 1 2 3	2024 4 5 6 7 8 9 10 11 12 1 2 3	Total
A	1	Project Manager	3,049,000	0	1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1		77
A	2	Process Engineer	3,049,000	0	1	1 1 1 1								5
A	3	Mechanical Engineer (Boiler)	3,049,000	0	1	1 1 1 1		1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			37
A	4	Mechanical Engineer (Turbine)	3,049,000	0	1	1 1 1 1			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			31
A	5	Electrical Engineer (Generator)	3,049,000	0	1	1 1 1 1		1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			36
A	6	I & C Engineer	3,049,000	0	1	1 1 1 1			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			33
A	7	Mechanical Engineer (BOP)	3,049,000	0	1	1 1 1 1		1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			39
A	8	Environmental & Chemical Expert	3,049,000	0	1	1 1 1 1						1 1 1		8
A	9	O & M Expert (Mechanical)	3,049,000	0							1 1 1 1 1 1 1 1	1 1 1 1		12
A	10	O & M Expert (Electrical)	3,049,000	0							1 1 1 1 1 1 1 1	1 1 1 1		12
A	11	Civil Engineer	3,049,000	0	1	1 1 1 1 1	1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1					36
A	12	Economist	3,049,000	0		1 1 1 1 1 1 1								7
A	13	Contract Expert	3,049,000	0		1 1 1 1 1 1 1								7
B	1	Project Manager	0	385,000	1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1		77
B	2	Assistant Project Manager	0	385,000			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1		64
B	3	Mechanical Engineer (Boiler)	0	385,000	1 1 1			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1			48
B	4	Mechanical Engineer (Turbine)	0	385,000	1 1 1				1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			28
B	5	Electrical Engineer (Generator)	0	385,000	1 1 1				1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			28
B	6	Mechanical Engineer (BTG Auxiliaries)	0	385,000					1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			23
B	7	Electrical Engineer (BTG Auxiliaries)	0	385,000						1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			10
B	8	C & I Engineer(BTG)	0	385,000	1 1 1			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			32
B	9	Mechanical Engineer (BOP)	0	385,000	1 1		1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1			55
B	10	Electrical Engineer (BOP Mech.)	0	385,000						1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			12
B	11	C & I Engineer(BOP Mech.)	0	385,000						1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			11
B	12	Electrical Engineer (BOP Elec.)	0	385,000					1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1			26
B	13	C & I Engineer(BOP Elec.)	0	385,000				1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			18
B	14	Civill Engineer(Power Plant)	0	385,000			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1			47
B	15	Civill Engineer (Others)	0	385,000				1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1	1 1 1 1			23
B	16	Economist	0	385,000		1 1 1 1 1								5
B	17	Contract Expert	0	385,000		1 1 1 1 1 1 1					1			8
B	18	O & M Expert (Elec.)	0	385,000						1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1			11
B	19	O & M Expert (Mech.)	0	385,000						1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1		15
B	20	Envirionmental & Chemcal Expert	0	385,000		1 1 1 1 1 1 1 1 1 1 1 1					1 1			10
		[Total of Pro-A]			**9**	**58**	**19**	**37**	**82**	**72**	**48**	**15**	**0**	**340**
		[Total of Pro-B]			**6**	**41**	**39**	**68**	**122**	**163**	**102**	**10**	**0**	**551**
		[Total of Pro-A+Pro-B]			15	99	58	105	204	235	150	25	0	891
		Total Cost of FC for Each Month(Pro-A)			27,441,000	176,842,000	57,931,000	112,813,000	250,018,000	219,528,000	146,352,000	45,735,000	0	1,036,660,000
		Total Cost of FC for Each Month(Pro-B)			0	0	0	0	0	0	0	0	0	0
		Total Cost of LC for Each Month(Pro-A)			0	0	0	0	0	0	0	0	0	0
		Total Cost of LC for Each Month(Pro-B)			2,310,000	15,785,000	15,015,000	26,180,000	46,970,000	62,755,000	39,270,000	3,850,000	0	212,135,000
C	1	Office manager	0	225,000	1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1		79
C	2	Bilingual Secretary	0	225,000	1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1		79
C	3	Secretary	0	225,000		1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 1 1 1 1 1 1 1 1			120
C	4	Computer Operator-IT Technician	0	225,000			1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1	1 1 1 1 1 1 1 1 1 1 1 1			60
C	5	CAD Operatator	0	225,000			2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2		128
C	6	Wathcman	0	225,000			2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2 2 2 2 2 2 2 2 2	2 2 2 2		128
C	7		0	225,000										0
C	8		0	225,000										0
		Above for Lot 1 & Lot 2	0	0										0
			0	0										0
		[Total of Supporting Staff]			**6**	**36**	**104**	**108**	**108**	**108**	**100**	**24**	**0**	**594**
		Total Cost of LC for Each Month(SS)			1,350,000	8,100,000	23,400,000	24,300,000	24,300,000	24,300,000	22,500,000	5,400,000	0	133,650,000
		Grand Total			**21**	**135**	**162**	**213**	**312**	**343**	**250**	**49**	**0**	**1,485**

Annual Distribution of Cost

Item		Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
		FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Lot 1																															
1	Civil Works	100%	100%	0%	0%	0%		0%	0%		22%	22%		16%	16%		15%	15%		30%	30%		16%	16%		0%	0%		0%	0%	
2	Steam Generator Island	100%	100%	0%	0%	0%		0%	0%		20%	20%		21%	21%		8%	8%		33%	33%		18%	18%		0%	0%		0%	0%	
3	Turbine Generator Island	100%	100%	0%	0%	0%		0%	0%		17%	17%		10%	10%		29%	29%		28%	28%		16%	16%		0%	0%		0%	0%	
4	Balance of Plant	100%	100%	0%	0%	0%		0%	0%		18%	18%		14%	14%		20%	20%		32%	32%		16%	16%		0%	0%		0%	0%	
5	Raw Water Intake Pump Hose & Intake Line	100%	100%	0%	0%	0%		0%	0%		22%	22%		16%	16%		15%	15%		30%	30%		16%	16%		0%	0%		0%	0%	
6	Railway Siding	100%	100%	0%	0%	0%		0%	0%		20%	20%		13%	13%		13%	13%		36%	36%		18%	18%		0%	0%		0%	0%	
7	Initial Spares	100%	100%	0%	0%	0%		0%	0%		10%	10%		0%	0%		0%	0%		20%	20%		70%	70%		0%	0%		0%	0%	
8	Environmetnal Facilities	100%	100%	0%	0%	0%		0%	0%		18%	18%		14%	14%		20%	20%		32%	32%		16%	16%		0%	0%		0%	0%	
9	Taxes & Duties	100%	100%	0%	0%	0%		0%	0%		23%	23%		13%	13%		13%	13%		33%	33%		18%	18%		0%	0%		0%	0%	
10	Erection, Testing & Commitioning	100%	100%	0%	0%	0%		0%	0%		18%	18%		12%	12%		19%	19%		34%	34%		17%	17%		0%	0%		0%	0%	
11	Physical Contingency	100%	100%	0%	0%	0%		0%	0%		23%	23%		13%	13%		13%	13%		33%	33%		18%	18%		0%	0%		0%	0%	
12	Overhead Construction Charges	100%	100%	0%	0%	0%		0%	0%		29%	29%		13%	13%		13%	13%		33%	33%		12%	12%		0%	0%		0%	0%	
13	Training of O&M Staff and Mobilisation Cost	100%	100%	0%	0%	0%		0%	0%		10%	10%		0%	0%		0%	0%		53%	53%		38%	38%		0%	0%		0%	0%	
14	Other Costs	100%	100%	0%	0%	0%		0%	0%		26%	26%		13%	13%		13%	13%		33%	33%		15%	15%		0%	0%		0%	0%	
	Land Acquisition					0%			0%			0%			0%			0%			0%			0%			0%			0%	
15	Consultant	100%	100%	100%	2%	1%	1.2%	11%	4%	7.8%	14%	17%	15.4%	7%	9%	8.3%	16%	13%	14.5%	34%	36%	35.1%	14%	17%	15.4%	3%	2%	2.3%	0%	0%	0.0%

Annual Fund Requirement

Base Year for Cost Estimation: Apr, 2015 — FC & Total: million JPY
Exchange Rates: Rs. = JPY 1.9 — LC : million Rs.
USD = JPY 120.3
Price Escalation: FC: 1.8% LC: 1.3%
Physical Contingency 5%
Physical Contingency for Consultant 5%

Item	Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION																														
Ⅰ) Procurement / Construction of Lot 1	11,701	51,415	109,389	0	0	0	0	0	0	2,020	9,928	127,365	1,745	7,417	79,672	1,871	8,235	168,107	3,588	16,389	215,374	2,477	9,446	167,572	0	0	0	0	0	0
1 Civil Works	0	9,394	17,849	0	0	0	0	0	0	0	2,100	3,989	0	1,527	2,900	0	1,404	2,668	0	2,856	5,426	0	1,508	2,865	0	0	0	0	0	0
2 Steam Generator Island	4,716	7,350	18,681	0	0	0	0	0	0	931	1,451	3,689	1,012	1,578	4,011	368	573	1,456	1,556	2,425	6,164	849	1,323	3,361	0	0	0	0	0	0
3 Turbine Generator Island	3,561	3,430	10,078	0	0	0	0	0	0	611	589	74,628	371	357	45,293	1,020	982	124,557	990	954	120,948	569	548	69,464	0	0	0	0	0	0
4 Balance of Plant	1,203	9,300	18,873	0	0	0	0	0	0	214	1,655	28,906	164	1,269	22,166	242	1,874	32,722	389	3,009	52,533	193	1,493	26,064	0	0	0	0	0	0
5 Raw Water Intake Pump Hose & Intake Line	0	600	1,140	0	0	0	0	0	0	0	134	255	0	98	185	0	90	170	0	182	347	0	96	183	0	0	0	0	0	0
6 Railway Siding	0	330	627	0	0	0	0	0	0	0	65	124	0	43	82	0	43	82	0	120	227	0	59	113	0	0	0	0	0	0
7 Initial Spares	674	1,435	3,400	0	0	0	0	0	0	67	144	8,377	0	0	0	0	0	0	135	287	16,754	472	1,005	58,639	0	0	0	0	0	0
8 Environmetnal Facilities	0	6,000	11,400	0	0	0	0	0	0	0	1,068	2,029	0	819	1,556	0	1,209	2,297	0	1,941	3,688	0	963	1,830	0	0	0	0	0	0
9 Erection, Testing & Commitioning	0	2,450	4,655	0	0	0	0	0	0	0	436	829	0	303	575	0	462	877	0	840	1,597	0	409	777	0	0	0	0	0	0
10 Physical Contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 Overhead Construction Charges	0	226	430	0	0	0	0	0	0	0	67	126	0	29	56	0	29	56	0	75	142	0	26	49	0	0	0	0	0	0
12 Training of O&M Staff and Mobilisation Cost	0	30	57	0	0	0	0	0	0	0	3	6	0	0	0	0	0	0	0	16	30	0	11	21	0	0	0	0	0	0
13 Other Costs	0	5,274	10,021	0	0	0	0	0	0	0	1,384	2,631	0	686	1,303	0	686	1,303	0	1,740	3,307	0	778	1,478	0	0	0	0	0	0
14 Base cost for JICA financing	10,153	45,819	97,210	0	0	0	0	0	0	1,824	9,096	19,106	1,547	6,708	14,293	1,630	7,352	15,599	3,070	14,445	30,515	2,082	8,218	17,697	0	0	0	0	0	0
15 Price escalation	991	3,147	6,970	0	0	0	0	0	0	100	359	783	114	356	790	152	490	1,084	347	1,164	2,558	277	778	1,755	0	0	0	0	0	0
16 Physical contingency	557	2,448	5,209	0	0	0	0	0	0	96	473	994	83	353	754	89	392	834	171	780	1,654	118	450	973	0	0	0	0	0	0
Ⅱ) Consulting services	1,210	1,117	3,332	19	7	33	127	48	219	159	187	515	84	104	282	190	149	473	416	411	1,196	178	190	539	37	20	75	0	0	0
1 Base cost	1,054	995	2,945	18	7	31	117	45	202	144	171	469	75	94	254	165	133	419	356	362	1,044	149	165	464	30	17	63	0	0	0
2 Price escalation	98	69	229	0	0	0	4	1	6	8	7	21	6	5	15	15	9	32	40	29	96	20	16	50	5	2	8	0	0	0
3 Physical contingency	58	53	159	1	0	2	6	2	10	8	9	25	4	5	13	9	7	23	20	20	57	8	9	26	2	1	4	0	0	0
Total (Ⅰ + Ⅱ)	12,911	52,532	112,722	19	7	33	127	48	219	2,179	10,115	21,398	1,829	7,522	16,120	2,061	8,384	17,991	4,004	16,800	35,923	2,655	9,636	20,963	37	20	75	0	0	0
B. NON ELIGIBLE PORTION																														
a Procurement / Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost for JICA financing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Administration cost	0	2,966	5,636	0	1	2	0	6	11	0	563	1,070	0	424	806	0	473	900	0	945	1,796	0	552	1,048	0	2	4	0	0	0
d Taxes & Duties	0	7,505	14,259	0	1	2	0	7	13	0	1,670	3,174	0	956	1,816	0	975	1,852	0	2,511	4,770	0	1,382	2,625	0	3	6	0	0	0
1 Base cost	0	6,690	12,712	0	1	2	0	6	12	0	1,530	2,908	0	865	1,643	0	870	1,654	0	2,213	4,204	0	1,202	2,284	0	3	5	0	0	0
2 Price escalation	0	457	868	0	0	0	0	0	0	0	60	115	0	46	87	0	58	110	0	178	339	0	114	216	0	0	1	0	0	0
3 Physical contingency	0	357	679	0	0	0	0	0	1	0	80	151	0	46	86	0	46	88	0	120	227	0	66	125	0	0	0	0	0	0
e VAT	0																													
f Import Tax	0																													
Total (a+b+c+d+e+f)	0	10,471	19,895	0	2	4	0	13	24	0	2,234	4,244	0	1,380	2,622	0	1,448	2,752	0	3,456	6,566	0	1,933	3,674	0	5	9	0	0	0
TOTAL (A+B)	12,911	63,003	132,616	19	9	37	127	61	243	2,179	12,348	25,641	1,829	8,902	18,743	2,061	9,833	20,743	4,004	20,256	42,489	2,655	11,569	24,637	37	25	84	0	0	0
C. Interest during Construction	7,631	0	7,631	0	0	0	0	0	0	292	0	292	518	0	518	771	0	771	1,268	0	1,268	1,572	0	1,572	1,594	0	1,594	1,616	0	1,616
1 Interest during Construction(Const.)	7,629	0	7,629	0	0	0	0	0	0	292	0	292	518	0	518	771	0	771	1,268	0	1,268	1,571	0	1,571	1,593	0	1,593	1,616	0	1,616
2 Interest during Construction (Consul.)	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Front End Fee	120	0	120	120	0	120	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL (A+B+C+D)	20,662	63,003	140,368	140	9	157	127	61	243	2,472	12,348	25,934	2,347	8,902	19,261	2,832	9,833	21,513	5,272	20,256	43,757	4,226	11,569	26,208	1,630	25	1,678	1,616	0	1,616
E. JICA finance portion incl. IDC (A + C + D)	20,662	52,532	120,473	140	7	154	127	48	219	2,472	10,115	21,690	2,347	7,522	16,638	2,832	8,384	18,762	5,272	16,800	37,191	4,226	9,636	22,535	1,630	20	1,669	1,616	0	1,616

Administration Cost = 5%
VAT= 6% of the expenditure in local currency of the eligible portion
Import Tax= 6%

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (million JPY)			Total (million JPY)		
	Total	JICA Portion	Others	Total	JICA Portion	Others	Total	JICA Portion	Others
Civil Works	0	0	0	17,849	17,849	0	17,849	17,849	0
Steam Generator Island	4,716	4,716	0	13,965	13,965	0	18,681	18,681	0
Turbine Generator Island	3,561	3,561	0	6,517	6,517	0	10,078	10,078	0
Balance of Plant	1,203	1,203	0	17,670	17,670	0	18,873	18,873	0
Raw Water Intake Pump Hose & Intake Line	0	0	0	1,140	1,140	0	1,140	1,140	0
Railway Siding	0	0	0	627	627	0	627	627	0
Initial Spares	674	674	0	2,727	2,727	0	3,400	3,400	0
Taxes & Duties	0	0	0	14,259	14,259	0	14,259	14,259	0
Erection, Testing & Commitioning	0	0	0	4,655	4,655	0	4,655	4,655	0
Physical Contingency	0	0	0	0	0	0	0	0	0
Overhead Construction Charges	0	0	0	430	430	0	430	430	0
Training of O&M Staff and Mobilisation Cost	0	0	0	57	57	0	57	57	0
Other Costs	0	0	0	10,021	10,021	0	10,021	10,021	0
Base cost for JICA financing	10,153	10,153	0	87,057	87,057	0	97,210	97,210	0
Consulting Services	1,210	1,210	0	2,122	2,122	0	3,332	3,332	0
Land Acquisition	0	0	0	0	0	0	0	0	0
Administration Cost	0	0	0	5,636	0	5,636	5,636	0	5,636
VAT	0	0	0	0	0	0	0	0	0
Import Tax	0	0	0	0	0	0	0	0	0
Interest during construction	7,631	7,631	0	0	0	0	7,631	7,631	0
Front End Fee	120	120	0	0	0	0	120	120	0
Total	29,268	29,268	0	184,731	179,095	5,636	213,999	208,362	5,636

Breakdown of Cost	Total	JICA Portion	Others
2016	157	154	4
2017	243	219	24
2018	25,934	21,690	4,244
2019	19,261	16,638	2,622
2020	21,513	18,762	2,752
2021	43,757	37,191	6,566
2022	26,208	22,535	3,674
2023	1,678	1,669	9
2024	1,616	1,616	0
Total	140,368	120,473	19,895

Work schedule

Item	Year	1 year												2 year												3 year												4 year												5 year											
	Month	-1	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Construction start																																																																		
Design of boiler, turbine, and power generator civil engineering																																																																	
Detailed design for boiler, turbine, and power generator																																																																
Base construction for boiler																																																																
Manufacturing and on-site supply of boiler steel frame																																																																
Steel frame construction for boiler																																																																
Desing of pressure-resistant boiler parts																																																															
Manufacturing of pressure-resistant boiler parts																																																															
On-site supply of pressure-resistant components for boiler																																																															
Installation of pressure-resistant boiler parts																																																															
On-site supply of main pipe construction materials																																																															
On-site supply of pump and motor																																																															
Boiler water pressure test																																																															
Lighting of boiler																																																															
Start of coal burning																																																															
Base construction for turbine and power generator building																																																															
Base construction for turbine and power generator																																																															
Construction for turbine and power generator building																																																															
Crane construction of the ceiling of the turbine/power generator building																																																															
Design of turbine																																																															
Manufacturing of turbine																																																															
On-site supply of turbine																																																															
Design of power generator																																																															
Manufacturing of power generator																																																															
On-site supply of power generator																																																															
Installation of turbine and power generator																																																															
On-site supply of turbine construction materials																																																															
On-site supply of power generator construction materials																																																															
On-sote supply of DCS/C&I materials																																																															
Turning of turbine and power generator																																																															
Steam blow																																																															
Ventilation																																																															
First parallel																																																															
Test run																																																															
Delivery and start of commercial running																																																														
Construction of mill and coal bunker building																																																														
ESP building construction																																																															
Water supply facility construction																																																														
Waste water processing facility construction																																																													
Cooling tower construction																																																													
Cooling water facility construction																																																												
Stalk construction																																																												
Fire control facility construction																																																											
Coal transportation facility																																																											
Coal ash processing facility																																																										

Pre-Conditions for Cost Estimation

1. General Conditions

Exchange Rate

			Rs.	
(1)	JPY/USD	USD 1 =	120.3	JPY
(2)	LC/USD	USD 1 =	62.4	Rs.
(3)	JPY/Rs.	Rs. 1 =	1.9	JPY

Price Escalation

(1)	FC	1.8%	LC	1.3%	

Physical Contingency

Construction	5.0%	Consultant	5.0%

Base Year for Cost Estimation: 2015/4

Schedule Start 2016/4 End 2022/10

Billing Rate of Consultant

	FC JPY	LC Rs.
Pro-(A)	3,049,000	0
Pro-(B)	0	385,000
Supporting Staff	0	225,000

2. Others

Rate of Tax

VAT	6.0%	Import Tax	6.0%

Rate of Administration Cost 5.0%

Rate of Interest During Construction

Construction	1.40%	Consultant	0.01%

Rate of Front End Fee 0.1%

Payment Method for Interest during construction loan-covered

Front End Fee loan-covered

Fiscal Year Apr - Mar

VAT and Import TAX

	VAT		Import TAX	
	FC	LC	FC	LC
Construction/Procurement Works	FALSE	FALSE	TRUE	FALSE
Consultant Services	FALSE	FALSE	FALSE	FALSE
Land Acquisition	FALSE	FALSE	FALSE	FALSE

Advanced Payment and Retention Money

	Advanced Payment	Retention Money
Construction	10.0%	20.0%
Consultant Services	15.0%	25.0%

Timing of RM Payment

Completion	5.0%
After12M later	8.0%

Payment timing of Retention Money

50% to be paid when taking over certificate has been issued for the works
and the remaining 50% to be paid on expiry of the defects Notifications period.

Defect Liablity Period 12 months

Cost Breakdown for Package

USD =JPY 120.3

Rs. =JPY 1.9

item	Local	Total
	Rs.	JPY
Land Acquisition Cost		0

Tower Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Steel	ton	3,588		96,703		347,000,000	659,300,000
Earthing	set	150		7,067		1,060,000	2,014,000
Acessories	set	150		37,600		5,640,000	10,716,000
							0
							0
							0
							0
Total					0	353,700,000	672,030,000

Strings Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Single suspension insulator string	set	757		53,686		40,640,000	77,216,000
Double tension insulator string	set	316		105,791		33,430,000	63,517,000
Jumper insulator string	set	95		29,579		2,810,000	5,339,000
						0	0
						0	0
						0	0
						0	0
Total					0	76,880,000	146,072,000

Conductor Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
ACSR Moose	km	728		442,500		322,140,000	612,066,000
Accessories	set	1		16,340,000		16,340,000	31,046,000
						0	0
						0	0
						0	0
						0	0
						0	0
Total					0	338,480,000	643,112,000

Ground-wire Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Garvanized steel wire	km	61		71,499		4,340,000	8,246,000
Accessories	set	1		770,000		770,000	1,463,000
OPGW	km	62		192,569		11,920,000	22,648,000
Accessories	set	1		3,870,000		3,870,000	7,353,000
Total					0	20,900,000	39,710,000

Fibre Optic Distribution Panel Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Fibre Optic Distribution Panel	set	1		730,000		730,000	1,387,000
Total					0	730,000	1,387,000

Survey & Soil investigation Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Survey	km	59		49,576		2,920,000	5,548,000
Soil Investigation	lot	1		740,000		740,000	1,406,000
Land Clearance	lot	1		60,000,000		60,000,000	114,000,000
Total					0	63,660,000	120,954,000

Tower Construction Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Foundation	Cu. M	5,967		15,284		91,200,000	173,280,000
Erection	ton	3,469		20,585		71,410,000	135,679,000
Auxiliary work	lot	1		59,400,000		59,400,000	112,860,000
Total					0	222,010,000	421,819,000

Stringing Work Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Conductor, GW	km	59		873,854		51,470,000	97,793,000
OPGW	km	59		158,234		9,320,000	17,708,000
Total						60,790,000	115,501,000

River Crossing Foundation Work Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
River Crossing Foundation Work	lot	1		118,670,000		118,670,000	225,473,000
Total					0	118,670,000	225,473,000

Design Work Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Design Work	lot	1		7,500,000		7,500,000	14,250,000
						0	0
						0	0
						0	0
						0	0
						0	0
						0	0
Total					0	7,500,000	14,250,000

Testing Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Testing	lot	1		18,000,000		18,000,000	34,200,000
Total					0	18,000,000	34,200,000

Misc(Approval & compensation and etc.) Loan Coverage Ratio 100

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Misc(Approval & compensation and etc.)	lot	1		52,500,000		52,500,000	99,750,000
Total					0	52,500,000	99,750,000

Taxes & Duties (Lot 2) Loan Coverage Ratio 0

	unit	Quantity	Unit Price		Cost		Total
			Foreign	Local	Foreign	Local	
			USD	Rs.	JPY	Rs.	JPY
Taxes & Duties				251,000,000		251,000,000	476,900,000
Tax on Consulting Service				60,700,000		60,700,000	115,330,000
							0
							0
							0
							0
Total					0	311,700,000	592,230,000

Implementation Schedule

	2016	2017	2018	2019	2020	2021	2022	2023	2024	Month
	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	4 5 6 7 8 9 10 11 12 1 2 3	
										0
Pledge										0
Signing of Loan Agreement										0
										0
Consulting Services for Evacuation System										0
Proposal, Review and Approval of Study Report by CEA		1 1 1 1 1 1								6
										0
Land Acquisition	0	0	0	0	0	0	0	0	0	0
Tower	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	0	36
Strings	0	0	5 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	23
Conductor	0	0	5 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	23
Ground-wire	0	0	5 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	23
Fibre Optic Distribution Panel	0	0	2 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	0	26
Survey & Soil investigation	0	0	6 1 1 1 1 1 1 1 1	3	0	0	0	0	0	9
Tower Construction	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	0	36
Stringing Work	0	0	5 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	23
River Crossing Foundation Work	0	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	18
Design Work	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	6 1 1 1 1 1 1	0	0	0	0	30
Testing	0	0	6 1 1 1 1 1 1 1 1	3	0	0	0	0	0	9
Misc(Approval & compensation and etc.)	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	0	36
Taxes & Duties (Lot 2)	0	0	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	12 1 1 1 1 1 1 1 1 1 1 1 1	0	0	0	0	36

Cost Breakdown for the Consulting Services

USD	= JPY	120.3
Rs.	= JPY	1.9
Service Tax		14.5%

	Unit	Qty.	Foreign Portion (JPY)		Local Portion Rs.		Combined Total
			Rate	Amount ('000)	Rate	Amount ('000)	('000) JPY
A Remuneration							
1 Professional (A)	M/M	146	3,049,000	445,154	0	0	445,154
2 Professional (B)	M/M	215	0	0	385,000	82,775	157,273
3 Supporting Staffs	M/M	252	0	0	225,000	56,700	107,730
Subtotal of A				445,154		139,475	710,157
B Direct Cost							
1 International Airfare		12	600,000	7,200		0	7,200
2 Domestic Airfare		120.3		0	4,500	1,083	2,058
3 Domestic Travel				0	3,000	0	0
3 Accommodation Allowance	Month	146		0	360,000	52,560	99,864
	Month	215		0	2,000	430	817
	Month	252		0	2,000	504	958
4 Vehicle Rental	Month	120.3		0	60,000	7,220	13,718
5 Office Rental	M/M	613		0	45,000	165,510	314,469
6 International Communications	Month	40		0	25,000	2,000	3,800
7 Domestic Communications	Month	40		0	3,500	280	532
8 Office Supply	Month	40		0	80,000	6,400	12,160
9 Office Furniture and Equipment	Month	40		0	500,000	40,000	76,000
10 Report Preparation	Month	40			80,000	3,200	6,080
Subtotal of B				7,200		279,187	537,655
C Service Tax (Local Portion*14.5%)		1				60,700	
Subtotal of C						60,700	
Total (A+B)				452,354		418,662	1,247,812

Manning Schedule for the Consulting Services

		Position	Billing Rate		2016												2017												2018												2019												2020												2021												2022												2023												2024												Total
			F/C JPY	LC/ Rs.	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	
A	1	Project Manager	3,049,000	0																					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																			40
A	2	Transmission Engineer	3,049,000	0																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																										30
A	3	Sub-Station Engineer	3,049,000	0																											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																										28
A	4	Survey Engineer	3,049,000	0																							1	1	1	1	1	1	1	1	1	1																																																																																		10
A	5	Civil Engineer (Transmission Line)	3,049,000	0																																					1	1	1	1	1	1	1	1																																																																												8
A	6	Civil Engineer (Sub-Station)	3,049,000	0																																																	1	1	1	1	1	1	1	1	1	1	1	1																																																	12
A	7	Envirionmental & Chemcal Expert	3,049,000	0																					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																																18
B	1	Project Manager	0	385,000																					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																		40
B	2	Assistant Project Manager	0	385,000																								1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																				35
B	3	Transmission Engineer	0	385,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																			35
B	4	Sub-Station Engineer	0	385,000																											1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																							30
B	5	Survey Engineer	0	385,000																							1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																										20
B	6	Civil Engineer (Transmission Line)	0	385,000																																			1	1	1	1	1	1	1	1	1	1																																																																								10
B	7	Civil Engineer (Sub-Station)	0	385,000																																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																	20
B	8	Envirionmental & Chemcal Expert	0	385,000																					1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																																								25
		[Total of Pro-A]			**0**												**10**												**54**												**46**												**36**												**0**												**0**												**0**												**0**												**146**
		[Total of Pro-B]			**0**												**11**												**72**												**79**												**53**												**0**												**0**												**0**												**0**												**215**
		[Total of Pro-A+Pro-B]			0												21												126												125												89												0												0												0												0												361
		Total Cost of FC for Each Month(Pro-A)			0												30,490,000												164,646,000												140,254,000												109,764,000												0												0												0												0												445,154,000
		Total Cost of FC for Each Month(Pro-B)			0												0												0												0												0												0												0												0												0												0
		Total Cost of LC for Each Month(Pro-A)			0												0												0												0												0												0												0												0												0												0
		Total Cost of LC for Each Month(Pro-B)			0												4,235,000												27,720,000												30,415,000												20,405,000												0												0												0												0												82,775,000
C	1	Office manager	0	225,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																			36
C	2	Bilingual Secretary	0	225,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																			36
C	3	Secretary	0	225,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																		36
C	4	Computer Operator-IT Technician	0	225,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																		36
C	5	CAD Operatator	0	225,000																									1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1																																																	36
C	6	Wathcman	0	225,000																									2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2																																																		72
C	7		0	225,000																																																																																																																		0
C	8		0	225,000																																																																																																																	0
		Above for Lot 1 & Lot 2	0	0																																																																																																																	0
			0	0																																																																																																																	0
		[Total of Supporting Staff]			**0**												**0**												**84**												**84**												**84**												**0**												**0**												**0**												**0**												**252**
		Total Cost of LC for Each Month(SS)			0												0												18,900,000												18,900,000												18,900,000												0												0												0												0												56,700,000
		Grand Total			**0**												**21**												**210**												**209**												**173**												**0**												**0**												**0**												**0**												**613**

Annual Distribution of Cost

Item		Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
		FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
Lot 2																														
1	Tower	100%	100%	0%	0%	0%		0%	0%		33%	33%		33%	33%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%	
2	Strings	100%	100%	0%	0%	0%		0%	0%		22%	22%		52%	52%		26%	26%		0%	0%		0%	0%		0%	0%		0%	0%	
3	Conductor	100%	100%	0%	0%	0%		0%	0%		22%	22%		52%	52%		26%	26%		0%	0%		0%	0%		0%	0%		0%	0%	
4	Ground-wire	100%	100%	0%	0%	0%		0%	0%		22%	22%		52%	52%		26%	26%		0%	0%		0%	0%		0%	0%		0%	0%	
5	Fibre Optic Distribution Panel	100%	100%	0%	0%	0%		0%	0%		8%	8%		46%	46%		46%	46%		0%	0%		0%	0%		0%	0%		0%	0%	
6	Survey & Soil investigation	100%	100%	0%	0%	0%		0%	0%		67%	67%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%		0%	0%	
7	Tower Construction	100%	100%	0%	0%	0%		0%	0%		33%	33%		33%	33%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%	
8	Stringing Work	100%	100%	0%	0%	0%		0%	0%		22%	22%		52%	52%		26%	26%		0%	0%		0%	0%		0%	0%		0%	0%	
9	River Crossing Foundation Work	100%	100%	0%	0%	0%		0%	0%		0%	0%		67%	67%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%	
10	Design Work	100%	100%	0%	0%	0%		0%	0%		40%	40%		40%	40%		20%	20%		0%	0%		0%	0%		0%	0%		0%	0%	
11	Testing	100%	100%	0%	0%	0%		0%	0%		67%	67%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%		0%	0%	
12	Misc(Approval & compensation and etc.)	100%	100%	0%	0%	0%		0%	0%		33%	33%		33%	33%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%	
13	Taxes & Duties (Lot 2)	100%	100%	0%	0%	0%		0%	0%		33%	33%		33%	33%		33%	33%		0%	0%		0%	0%		0%	0%		0%	0%	
	Land Acquisition					0%			0%			0%			0%			0%			0%			0%			0%			0%	
	Consultant	100%	100%	0%	0%	0%	0%	0%	0%		33%	33%		34%	34%		33%	33%	0%	0%	0%		0%	0%		0%	0%	0%	0%	0%	0%

Annual Fund Requirement

Base Year for Cost Estimation: Apr, 2015 — FC & Total: million JPY
Exchange Rates: Rs. = JPY 1.9 — LC : million Rs.
USD = JPY 120.3
Price Escalation: FC: 1.8% LC: 1.3%
Physical Contingency 5%
Physical Contingency for Consultant 5%

Item	Total			2016			2017			2018			2019			2020			2021			2022			2023			2024		
	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total	FC	LC	Total
A. ELIGIBLE PORTION																														
Ⅰ) Procurement / Construction of Lot 2	0	1,491	2,832	0	0	0	0	0	0	0	414	787	0	645	1,225	0	431	820	0	0	0	0	0	0	0	0	0	0	0	0
1 Tower	0	354	672	0	0	0	0	0	0	0	118	224	0	118	224	0	118	224	0	0	0	0	0	0	0	0	0	0	0	0
2 Strings	0	77	146	0	0	0	0	0	0	0	17	32	0	40	76	0	20	38	0	0	0	0	0	0	0	0	0	0	0	0
3 Conductor	0	338	643	0	0	0	0	0	0	0	74	140	0	177	336	0	88	168	0	0	0	0	0	0	0	0	0	0	0	0
4 Ground-wire	0	21	40	0	0	0	0	0	0	0	5	9	0	11	21	0	5	10	0	0	0	0	0	0	0	0	0	0	0	0
5 Fibre Optic Distribution Panel	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
6 Survey & Soil investigation	0	64	121	0	0	0	0	0	0	0	42	81	0	21	40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
7 Tower Construction	0	222	422	0	0	0	0	0	0	0	74	141	0	74	141	0	74	141	0	0	0	0	0	0	0	0	0	0	0	0
8 Stringing Work	0	61	116	0	0	0	0	0	0	0	13	25	0	32	60	0	16	30	0	0	0	0	0	0	0	0	0	0	0	0
9 River Crossing Foundation Work	0	119	225	0	0	0	0	0	0	0	0	0	0	79	150	0	40	75	0	0	0	0	0	0	0	0	0	0	0	0
10 Design Work	0	8	14	0	0	0	0	0	0	0	3	6	0	3	6	0	2	3	0	0	0	0	0	0	0	0	0	0	0	0
11 Testing	0	18	34	0	0	0	0	0	0	0	12	23	0	6	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 Misc(Approval & compensation and etc.)	0	53	100	0	0	0	0	0	0	0	18	33	0	18	33	0	18	33	0	0	0	0	0	0	0	0	0	0	0	0
1 Base cost for JICA financing	0	1,334	2,534	0	0	0	0	0	0	0	375	712	0	578	1,099	0	380	723	0	0	0	0	0	0	0	0	0	0	0	0
2 Price escalation	0	71	135	0	0	0	0	0	0	0	15	28	0	31	58	0	25	48	0	0	0	0	0	0	0	0	0	0	0	0
3 Physical contingency	0	86	163	0	0	0	0	0	0	0	25	47	0	36	68	0	25	48	0	0	0	0	0	0	0	0	0	0	0	0
Ⅱ) Consulting services	510	463	1,390	0	0	0	0	0	0	165	151	452	173	157	472	171	155	465	0	0	0	0	0	0	0	0	0	0	0	0
Base cost	452	419	1,248	0	0	0	0	0	0	149	138	412	154	142	424	149	138	412	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	34	22	76	0	0	0	0	0	0	8	5	19	11	8	26	14	9	31	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	24	22	66	0	0	0	0	0	0	8	7	22	8	7	22	8	7	22	0	0	0	0	0	0	0	0	0	0	0	0
Total (Ⅰ + Ⅱ)	510	1,953	4,222	0	0	0	0	0	0	165	565	1,239	173	802	1,697	171	586	1,285	0	0	0	0	0	0	0	0	0	0	0	0
B. NON ELIGIBLE PORTION																														
a Procurement / Construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost for JICA financing	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
b Land Acquisition	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Base cost	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Price escalation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Physical contingency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
c Administration cost	0	111	211	0	0	0	0	0	0	0	33	62	0	45	85	0	34	64	0	0	0	0	0	0	0	0	0	0	0	0
d Taxes & Duties (Lot 2)	0	312	592	0	0	0	0	0	0	0	104	197	0	104	197	0	104	197	0	0	0	0	0	0	0	0	0	0	0	0
e VAT	0																													
f Import Tax	0																													
Total (a+b+c+d+e+f)	0	423	803	0	0	0	0	0	0	0	137	259	0	149	282	0	138	262	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL (A+B)	510	2,376	5,025	0	0	0	0	0	0	165	702	1,499	173	951	1,980	171	724	1,547	0	0	0	0	0	0	0	0	0	0	0	0
C. Interest during Construction	247	0	247	0	0	0	0	0	0	11	0	11	28	0	28	40	0	40	41	0	41	41	0	41	42	0	42	43	0	43
Interest during Construction(Const.)	246	0	246	0	0	0	0	0	0	11	0	11	28	0	28	40	0	40	41	0	41	41	0	41	42	0	42	42	0	42
Interest during Construction (Consul.)	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
D. Front End Fee	4	0	4	0	0	0	0	0	0	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
GRAND TOTAL (A+B+C+D)	762	2,376	5,276	0	0	0	0	0	0	181	702	1,514	202	951	2,008	212	724	1,587	41	0	41	41	0	41	42	0	42	43	0	43
E. JICA finance portion incl. IDC (A + C + D)	762	1,953	4,473	0	0	0	0	0	0	181	565	1,255	202	802	1,726	212	586	1,325	41	0	41	41	0	41	42	0	42	43	0	43

5,025

Administration Cost = 5%
VAT= 6% of the expenditure in local currency of the eligible portion
Import Tax= 6%

Breakdown of Cost	Foreign Currency Portion (million JPY)			Local Currency Portion (million JPY)			Total (million JPY)		
	Total	JICA Portion	Others	Total	JICA Portion	Others	Total	JICA Portion	Others
Tower	0	0	0	672	672	0	672	672	0
Strings	0	0	0	146	146	0	146	146	0
Conductor	0	0	0	643	643	0	643	643	0
Ground-wire	0	0	0	40	40	0	40	40	0
Fibre Optic Distribution Panel	0	0	0	1	1	0	1	1	0
Survey & Soil investigation	0	0	0	121	121	0	121	121	0
Tower Construction	0	0	0	422	422	0	422	422	0
Stringing Work	0	0	0	116	116	0	116	116	0
River Crossing Foundation Work	0	0	0	225	225	0	225	225	0
Design Work	0	0	0	14	14	0	14	14	0
Testing	0	0	0	34	34	0	34	34	0
Taxes & Duties (Lot 2)	0	0	0	592	592	0	592	592	0
Base cost for JICA financing	0	0	0	100	100	0	100	100	0
Consulting Services	510	510	0	880	880	0	1,390	1,390	0
Land Acquisition	0	0	0	0	0	0	0	0	0
Administration Cost	0	0	0	211	0	211	211	0	211
VAT	0	0	0	0	0	0	0	0	0
Import Tax	0	0	0	0	0	0	0	0	0
Interest during construction	247	247	0	0	0	0	247	247	0
Front End Fee	4	4	0	0	0	0	4	4	0
Total	762	762	0	4,217	4,006	211	4,979	4,768	211

Breakdown of Cost	Total	JICA Portion	Others
2016	0	0	0
2017	0	0	0
2018	1,514	1,255	259
2019	2,008	1,726	282
2020	1,587	1,325	262
2021	41	41	0
2022	41	41	0
2023	42	42	0
2024	43	43	0
Total	5,276	4,473	803

Appendix IV

Reduction of the estimated cost of the Project

(Format 1)

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

Survey period: February 2015～February 2016

Total Project cost initially estimated: 143.597 billion yen

Total Project cost after cost cutting review: 140.368 billion yen

Total Project cost breakdown (Total PJ Cost):

Construction cost	20,531 million yen
Equipment cost	82,047 million yen
Soft component cost	0 million yen
Design supervision cost	2,945 million yen
Interest during construction	7,630 million yen
Front-end fee	120 million yen
Escalation	7,201 million yen
Administration cost	5,636 million yen
Tax	14,258 million yen
Total	140,368 million yen

List of cost cuts in re-examination of planning stage and design methods

Measure No.	Cost cutting item	Reduced cost (unit: 100 million yen)	Separate page No.
1. Re-examination of the planning stage			
I Compilation of the optimum plan via linkage of three (3) assistance methods			
I－1	Reduction of the works period and construction cost through switching the manufacture and welding of the boiler house structure and turbine and generator house structure from on-site to implementation in the factory	67 million yen	1
I－2	Reduction of the works period and construction cost through adopting modular boiler panels, headers, etc.	110 million yen	2
II Re-examination of auxiliary facilities			

Measure No.	Cost cutting item	Reduced cost (unit: 100 million yen)	Separate page No.
III Setting of an appropriate works period			
IV Setting of appropriate project scale			
2. Re-examination of design methods			
V Thorough rationalization of specifications and equipment			
V - 1	Reduction of equipment costs through sharing of water intake equipment with Units No.6-9	1.744 billion yen	3
V - 2	Reduction of equipment costs through elimination of the in-station boiler via installation of steam system connecting pipes with Units No.8/9	298 million yen	4
V - 3	Reduction of building equipment costs through adoption of outdoor GIS	74 million yen	5
VI Re-examination of structure (design thinking)			
Total: I to VI		2.293 billion yen	
Factors affecting the reduced cost (2.293 billion yen): Contingency, interest during construction, front-end fee, escalation, administration cost and taxes		936 million yen	
Total cost reduction		3.229 billion yen	
Cost reduction rate		2.2 %	

Note:

- If any of the above items do not apply, leave them blank.
- Summarize the contents of the above cost reductions on Formats 2 and 3. (No more than 1 page for each item)

(Format 2)

Separate page No.: 1

Measure No.: Ⅰ－1

Cost cutting item: Reduction of the works period and construction cost through switching the manufacture and welding of the boiler house structure and turbine and generator house structure from on-site to implementation in the factory

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

[Revised contents]

(1) Original plan: Onsite manufacture and welding process

Transport the unprocessed steel materials onto the site.

- Transport the manufacturing equipment, power tools, measuring instruments, inspection instruments and welding machines onto the site.
- Conduct the cutting, assembly and welding of steel members and implement welding inspection.
- After conducting sand blasting and coating work, use heavy machinery to carry onto the site.
- Use heavy machinery to implement installation by bolting and welding.

(2) After review: Factory manufacture and welding process

- Transport the unprocessed steel materials to the factory.
- Conduct the cutting, assembly and welding of steel members and implement welding inspection in the factory.
- Provisionally assemble according to the size of the transport vehicle, and conduct sand blasting and coating work in the coating booth at the factory.
- Transport onto the site according to the works schedule.
- Use heavy machinery to implement installation by bolting and welding.

Through implementing manufacture and welding work in this way, it will be possible to secure quality and shorten the works periods. As a result, the construction cost can be also reduced.

[Amount of cost reduction]

Amount of reduction 67 million yen

[Effect]

Reduction of the works period and construction cost

(Format 2)

Separate page No.: 2

Measure No.: I－2

Cost cutting item: Reduction of the works period and construction cost through adopting modular boiler panels, headers, etc.

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

[Revised contents]

(1) Original plan: connection and processing of individual parts:

- Transport the manufacturing equipment, power tools, welding machines and inspection instruments onto the site.
- Implement the assembly of boiler panels, headers, SH and RH tubes onsite.
- Weld all the connections and implement welding inspection.
- Carry onto the site and implement installation.

(2) After review: Adoption of the modular method

- Transport the boiler panels, headers, SH and RH tubes to the factory.
- In the factory, assemble these items into modules, weld them and implement welding inspection.
- Transport the panel and tube modules onto the site.
- Implement welding and installation of each module.
- Only implement welding inspection on the parts that are welded onsite.

Through adopting the above modular method, it is possible to secure the quality of welded parts and reduce the works period through reducing inspection and installation work. As a result, it will be possible to reduce the construction cost.

[Amount of cost reduction]

Amount of reduction 110 million yen

[Effect]

Reduction of the works period and construction cost

(Format 2)

Separate page No.: 3

Measure No.: V－1

Cost cutting item: Reduction of equipment costs through sharing of water intake equipment with Units No.6-9

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

[Revised contents]

(1) Original plan:

- Water intake tower and bridge : For Units No.6-9－1 unit
- For Unit No.10－1 unit
- Water intake pump : For Units No.6/7－3 units x 50 % (1 spare unit)
  For Units No.8/9－3 units x 50 % (1 spare unit)
  For Unit No.10－3 units x 50 % (1 spare unit)
- Grit chamber :For Units No.6-9－3 units x 100 % (1 spare unit)
  For Unit No.10－2 units x 100 % (1 spare unit)
- Raw water makeup pump : For Units No.6/7－3 units x 50 % (1 spare unit)
  For Units No.8/9－3 units x 50 % (1 spare unit)
  For Unit No.10－3 units x 50 % (1 spare unit)

(2) After review

- Water intake tower and bridge: For Units No.6/10－1 unit
- Water intake pump : For Units No.6/10－4 units x 100 % (1 spare unit)
- Grit chamber : For Units No.6/10－4 units x 100 % (1 spare unit)
- Raw water makeup pump : For Units No.6-9－5 units x 50 % (1 spare unit)
  For Unit No.10－3 units x 50 % (1 spare unit)

Through sharing equipment as shown above, it will be possible to reduce the quantities of equipment and thereby cut equipment costs.

[Amount of cost reduction]

Amount of reduction 1.744 billion yen

[Effect]

Reduction of equipment costs

(Format 2)

Separate page No.: 4

Measure No.: V－2

Cost cutting item: Reduction of equipment costs through elimination of the in-station boiler via installation of steam system connecting pipes with Units No.8/9

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

[Revised contents]

(1) Original plan: In-station boiler installation

Install an in-station boiler as an auxiliary steam supply source during starting and stopping of the unit (steam flow rate: 70 t/h, steam pressure: 16 bar, steam temperature: 285 ℃)

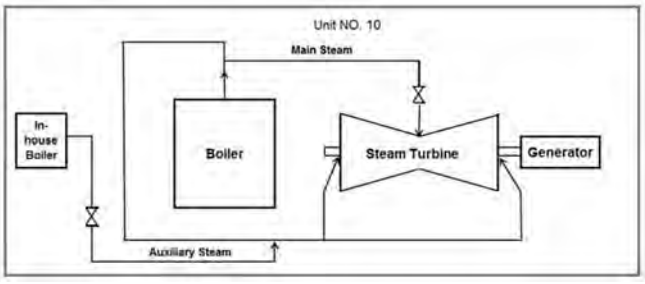
(2) After review: Elimination of the in-station boiler

Steam supply to Unit No.10 through installation of a steam connecting pipe from Units No. 8/9 Through eliminating in-house boiler equipment in the manner described above, it will be possible to reduce equipment costs.

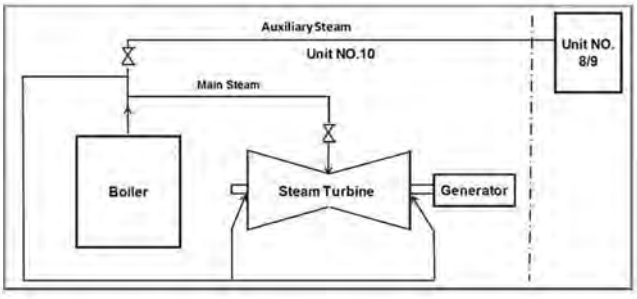
[Amount of cost reduction] Amount of reduction: 298 million yen

[Effect] Reduction of equipment costs

〈System diagram before review〉



〈System diagram after review〉



Source: Prepared by the Survey Team

(Format 2)

Separate page No.: 5

Measure No: V－4

Cost cutting item: Reduction of building equipment costs through adoption of outdoor GIS

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

[Revised contents]

(1) Original plan:

Adoption of an indoor GIS

(2) After review:

Adoption of an outdoor GIS

Through adopting an outdoor GIS as indicated above, it will be possible to reduce GIS house equipment costs.

[Amount of cost reduction]

Amount of reduction 74 million yen

[Effect]

Reduction of equipment costs

(Format 3)

ODA COST COMPREHENSIVE IMPROVEMENT PROGRAM
【Name of measure: Re-examination concerning the planning stage Ⅰ Compilation of the optimum plan via linkage of three (3) assistance methods】

Cost reduction through onsite manufacture of steel members
for boiler house structure and turbine and generator house

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project
Outline: Reduction of the works period and construction cost through switching the manufacture and welding of the boiler house structure and turbine and generator house structure from on-site to implementation in the factory

Effect
Reduction of works period and construction cost and securing of quality (700 million yen cost reduction)

Demerits of onsite manufacture and welding	Merits of factory manufacture and welding
〈Cause of work delays〉 ・Even if cutting and processing machinery is used, errors are apt to arise when cutting steel members. ・The work is influenced by the weather, which could lead to work delays. 〈Quality problems〉 ・It is necessary to take steps to prevent foreign materials (flying ash) contaminating the welding surfaces. ・It is necessary to guard against rusting caused by rain. ・All welded parts must be welded by hand. ・Because the coat is uneven, rusting is apt to occur.	〈Shortening of the works period〉 ・Accurate cutting of steel-structure parts by cutting machinery ・Automatic welding is possible. ・Because the manufacture and welding are not influenced by the weather, schedule management is made easier. 〈Quality control〉 ・Welding surfaces only need to be treated for corrosion. ・A uniform coat can be achieved because work is conducted inside a coating booth.

(Format 3)

ODA COST COMPREHENSIVE IMPROVEMENT PROGRAM

【Name of measure: Re-examination concerning the planning stage Ⅰ Compilation of the optimum plan via linkage of three (3) assistance methods】

Reduction of cost through adopting modular boiler panels, headers, etc.

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

Outline: Reduction of the works period and construction cost through adopting modular boiler panels, headers, etc.

Effect

Reduction of works period and construction cost and securing of quality (110 million yen cost reduction)

Demerits of individual member connection and processing	Merits of the modular approach
〈Cause of work delays〉 ・Installation of individual members means that more time is required for connecting. ・The work is influenced by the weather, which could lead to work delays. ・It is necessary to install more scaffolding for welding and inspections.	〈Shortening of the works period〉 ・Connecting modules is easier. ・Automatic welding is possible. ・Because the work is not influenced by the weather, schedule management is made easier. ・Because the welding parts are consolidated, the number of inspection scaffolds can be reduced.
〈Quality problems〉 ・It is necessary to take steps to prevent foreign materials (fly ash) contaminating the welding surfaces. ・It is necessary to guard against rusting caused by rain. ・All welded parts must be welded by hand.	〈Quality control〉 ・Welding surfaces only need to be treated for corrosion. ・Since openings are oriented in the same direction, control of foreign materials is easier.

Demerits of individual member connection and processing	Merits of the modular approach
・Because individual members are used, it is difficult to control foreign materials during temporary storage.	

(Format 3)

ODA COST COMPREHENSIVE IMPROVEMENT PROGRAM
【Name of measure: Thorough rationalization of specifications and equipment V Thorough rationalization of specifications and equipment】

Cost reduction through sharing of water intake tower with Units No. 6-9

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project
Outline: Reduction of equipment costs through sharing of water intake equipment with Units No.6-9

Effect
Equipment cost reduction (1.74 billion yen cost reduction)

[Comparison of equipment quantities]

Equipment	Unit No.	Before review	After review
Water intake equipment and bridge	Units No.6-9	1	1
	Unit No.10	1	
Water intake pump	Units No.6/7	9 (Spare:3)	4 (Spare:1)
	Units No.8/9		
	Unit No.10		
Grit chamber	Units No.6-9	5 (Spare:2)	4 (Spare:1)
	Unit No.10		
Raw water makeup pump	Units No.6/7	9 (Spare:3)	8 (Spare:2)
	Units No.8/9		
	Unit No.10		

(Format 3)

ODA COST COMPREHENSIVE IMPROVEMENT PROGRAM

【Name of measure: Thorough rationalization of design methods V Thorough rationalization of specifications and equipment】

Elimination of the in-station boiler via installation of steam system connecting pipes with Units No.8/9

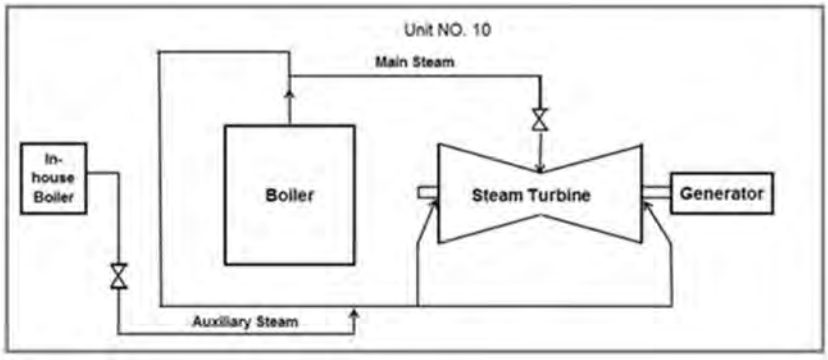
Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

Outline: Reduction of equipment costs through elimination of the in-station boiler via installation of steam system connecting pipes with Units No.8/9

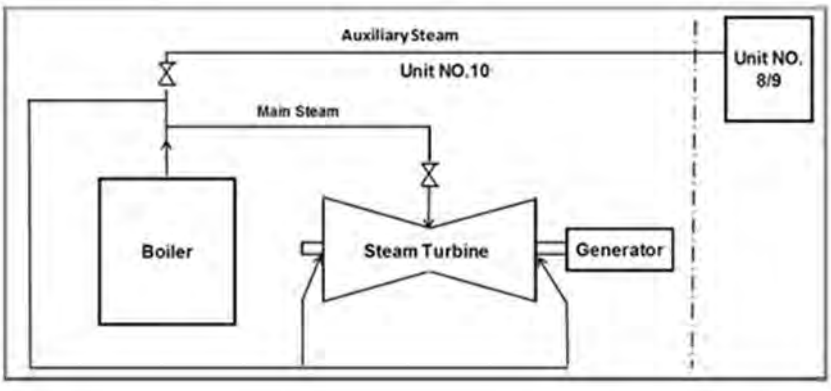
Effect

Equipment cost reduction (300 million yen cost reduction)

〈System diagram before review〉



〈System diagram after review〉



(Format 3)

ODA COST COMPREHENSIVE IMPROVEMENT PROGRAM

【Name of measure: Thorough rationalization of design methods Thorough rationalization of specifications and equipment】

Reduction of GIS house through adoption of outdoor GIS

Project name: The Republic of India Preparatory Survey on Barauni Supercritical Thermal Power Project

Outline: Reduction of building equipment costs through adoption of outdoor GIS

Effect

Equipment cost reduction (70 million yen cost reduction)

〈Before review: Image of indoor GIS>

〈After review: Image of outdoor GIS〉

Source: Toshiba Transmission & Distribution Systems Division homepage (www.toshiba-tds.com/tandd/products/giswitchgear/jp/agis.htm)

Appendix V

Risk management sheet

Risk Management Sheet

Risk	(Occurrence) / (Impact)	Occurrence probability analysis / Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
1.Stakeholder risk					
Low commitment by the government in development projects (policy priority, commitment to provide support including financial support)	Low	➢ Since the government recognizes the need for new power sources in consideration of the demand for power in the state, the probability of occurrence is low.	➢ Hold discussions within the government regarding the degree of priority of the Project. ➢ Confirm the necessity of the Project and assess the impacts in the event where it is cancelled.	➢ Immediately reflect in the Project plan. ➢ Periodically conduct policy discussions to confirm the necessity of the Project and its compatibility with policies.	-
	High	➢ Even if the Project is cancelled due to lack of government commitment, the need for new power sources in consideration of the demand for power in the state will still remain. Even if a new F/S is implemented, since any new undertaking would start later than the Project, there would be a major impact on the early resolution of the power shortage.			
Feasibility of sustaining the policy priority following a change of administration	Low	➢ Because delays in resolving the power shortage could result in lower support for the government among citizens, the probability of occurrence is low.	➢ Inform the concerned agencies and citizens that the Project aims to realize early resolution of the power shortage and has obtained approval from the state government. ➢ In order to sustain the Project validity, assess the impact in the event of cancellation.	➢ Immediately reflect in the Project plan. ➢ Have regular opportunities to provide information on the Project contents to the mass media. As well as giving information on such occasions, update the Project plans on the Web. ➢ Confirm the demand and supply situation and verify the validity of the Project every year.	-
	High	➢ Even if the Project is cancelled due to a change of government and change in policy direction, the need for new power sources in consideration of the demand for power in the state will still remain. Even if a new F/S is implemented, since any new undertaking would start later than the Project, there would be a major impact on the early resolution of the power shortage.			
Compatibility with the needs of non-governmental citizens in general	Low	➢ Since construction of the power station will lead to the stable supply of power and provide employment opportunities, thereby providing benefits for the local citizens, there is little chance it will be seen not to be compatible with public needs in general.	➢ Conduct information provision and explanations concerning the Project necessity and benefits. ➢ Provide compensation in the case where construction of the ash pond leads to resettlement or makes it necessary to restore means of livelihood.	➢ Explain to local citizens the need for stable power supply and the impacts of the Project including creation of employment and positive impact on the local economy. ➢ Examine the contents of compensation together with affected citizens.	-

Risk	(Occurrence) / (Impact)	Occurrence probability analysis / Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
	High	➢ If a specific group of citizens that claims rights over ownership rights of the ash pond starts an opposition movement, any delay in the resolution of the power shortage due to delay in the construction schedule will exert a major impact over citizens.			
Possibility of confrontation with existing interests	-	➢ None in particular	-	-	-
In the case of a project that utilizes private sector funds, the feasibility of capital participation or provision of funds in the project operating entity	-	➢ Since it is planned to finance the Project through a JICA yen loan and financing from the Project proponent, there will be no utilization of private sector funding.	-	-	-
2.Executing agency risk					
2.1 Capacity risk					
Conferral of appropriate resources and authority to the implementing agency					
(1) Financial resources	High	➢ The implementing agency has authority to execute budget, however, it needs to undergo procedure to obtain approval from its superior agency if its goes over budget or unscheduled costs arise.	➢ Specifically describe and share with related officials the position-separate decision making authority and job duties.	➢ Stipulate that the state government will compensate for any funding shortfalls in the implementing agency within L/A issue conditions. ➢ Require submission of decision-making authority and position-separate job duties regarding Project implementation in the implementing agency.	-
	High	➢ The implementing agency does have stipulations concerning decision-making authority and position-separate job duties, however, the specific contents are unclear.			
(2) Human resources	Medium	➢ In addition to the operation and maintenance of the existing Units No.6-9, BTPS will need to establish a dedicated operation and maintenance setup for Unit No.10. ➢ It is possible that there will be a shortage of human resources who can perform operation and maintenance for Unit No.10.	➢ Although this is a turn-key project, strive to absorb as much operating know-how as possible during the construction period.	➢ Prepare an O&M manual. ➢ Through having operators vigorously participate in general commissioning, acquire operating know-how. ➢ Conduct exchange of opinions with nearby advanced supercritical projects.	-

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
	Large	➢ If there is a shortage of human resources who can conduct the operation and maintenance of supercritical plant, it will be impossible to operate the facilities and the resulting power shortage will widely impact the local residents.			
Reliability of the financial management and procurement processes, and technical capability of the administrative department	Low	➢ There is a system where the State Power Corporation (HD) takes the initiative to implement an internal audit once a year. Concerning financial accounting, an accounting corporation conducts irregular audits, so there is low risk of improprieties arising in the financial management and procurement process.	➢ Adopt a system for having accounting audits periodically implemented by an audit corporation, and improve transparency in financial accounting. ➢ Improve the overall level regarding financial management and procurement processes through having personnel who have experience similar projects act as trainers for new employees. ➢ Invite external experts to implement the training needed for financial management.	➢ Periodically implement accounting audits by external auditors. ➢ Actively recruit personnel who are well-versed in financial management and procurement processes. ➢ Implement training by external experts.	-
	Medium	➢ The human resources that are well-versed in financial management and procurement processes in large projects are limited. In line with the outflow of human resources from the financial and procurement departments due to transfers, there is a risk that high performance cannot be anticipated in these departments.			
Actual application of rules including freedom from political pressure		➢ None in particular	-	-	-
Reliability of own funding capacity	High	➢ Procedure for paying unscheduled costs is clearly prescribed, however, because the procedure up to procuring funds is complicated, it is difficult to obtain funds quickly and reliability isn't high.	➢ Prepare a system whereby the funding plan can be continually managed by computer and timely fund management can be conducted. ➢ Increase the frequency of audits to ensure the proper management of funds.	➢ Build a computer-based financial management system. ➢ Implement audits on fundraising and budget execution conditions.	-
	Low	➢ Spending over budget is a report item in audits, and stringent management is needed regarding fundraising.			
Reliability of financial management capacity	Low	➢ Human resources who are well-versed in financial management are assigned, so prompt response can be anticipated when issues arise in this area. Moreover, the reliability of financial data is secured through implementation	➢ Prepare a system whereby the funding plan can be continually managed by computer and timely fund management can be conducted.	➢ Build a computer-based financial management system. ➢ Implement timely fund management and information sharing.	-

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
		of accounting audits by external agencies.	➢ Conduct monthly management and share information on funding plans and the disbursement situation. ➢ Secure regular opportunities to discuss and report on fund management and share information with superior agencies.		
	High	➢ Financial data is compiled into semi-annual reports, however, financial conditions are not managed in a timely manner and there is concern over delays in responding to changes in the financial situation.			
Possibility of delays in payments to contractors, etc.	Medium	➢ Authority to grant approval concerning the appropriateness of works contents and invoices is given to people on the ground. Also, approval and payment procedures on the ground are clearly specified, so there is little risk of payments being delayed.	➢ Share information about payment procedures and build a setup that allows detailed checking for any payment delays. ➢ Implement rapid procedures through computerizing payment procedures. ➢ Share information concerning the progress of works.	➢ Build a system that allows status in payment procedures to be confirmed in detail. ➢ Simplify payment procedures (further assignment of authority).	
	Medium	➢ When unscheduled costs arises, it is necessary to obtain approval from superior agencies. Depending on the approval procedure in the superior agency, any delays in payment to contractors could cause the work to stop and impact the schedule for the start of operation.			-
Possibility of a lack of financial or technical capacity of the local government and community in the case of the mediation agency or dispersed project in case of TSL, etc.	Low	➢ Since there are numerous mediation agencies that have ample experience of work implementation based on bilateral assistance between governments, it is possible to conduct transparent selection of contractors.	➢ Select subcontractors based on selection criteria. ➢ For selection of mediated entities, compile appropriate criteria according to the subcontractor selection criteria that are implemented in superior agencies. ➢ Configure incentives for giving priority to outstanding performance in the work fields concerned.	➢ When selecting the mediation agency, do so based on a transparent selection process. ➢ Implement periodic performance reviews of matters for which budget has been executed.	
	High	➢ No criteria have been compiled for specifically eliminating political pressure, etc. in mediated entities. Moreover, since there is no mechanism for accurately evaluating mediated entities, there is concern over risks that may arise due to low performance in such entities.			-

Risk	(Occurrence) / (Impact)	Occurrence probability analysis / Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
2.2 Governance risk					
Cooperation setup between related departments, and complicated implementation setup	Low	➢ Decision making procedures are respectively prescribed in the central government, state government and power corporation.	➢ Establish a periodic consultation agency geared to Project implementation in order to share information on issues and current conditions among concerned persons. ➢ Clearly define responsibility between related parties in Project implementation.	➢ Establish an agency for discussions geared to Project implementation between related agencies in the central government and state government, and periodically share issues and conditions.	-
	Medium	➢ There are no clear procedures or hardly any past record regarding cross-organizational cooperation, division of duties and procedures.			
Delays in the Diet approval, etc. required for borrowing	Low	➢ In India, since development of infrastructure including construction of power stations is a pressing issue, there is little risk of the Diet opposing the ruling administration.	➢ Obtain approval for the Project from the central and state governments based on DPR. ➢ Make appeals to the main ruling party Diet members concerning the necessity of the Project.	➢ Make government overtures geared to urgently obtaining DPR approval. ➢ Stage periodic contact opportunities and study workshops for important Diet members, etc.	-
	Large	➢ In the event where Diet is slow to give approval for the yen loan, the Project will be delayed.			
2.3 Fraud & corruption risk					
Appropriateness and effectiveness of financial and procurement management rules, etc.	Medium	➢ The current government in India is working on strengthening accounting audits and revising the law with a view to eliminating corruption, so the risk here is receding.	➢ Adopt a composition that ensures transparent Project activities.	➢ Implement procurement activities based on fair competitive tender, etc. ➢ Maintain and strengthen accountability concerning procurement activities and financial management.	-
	Large	➢ If works prices are forced up by corruption, this could have an adverse impact on the Project progress.			
3.Project risk					
3.1 Design risk					
Adoption of excessively high technologies (power generation)	High	➢ Since this is the first time for the implementing agency to adopt units with supercritical steam conditions, there is a high possibility that schedule delays will arise due to lack of technology at times of maintenance.	➢ Develop human resources from the short, medium and long-term viewpoints. ➢ Conduct assistance based on employment of abundantly experienced engineers and consultants. ➢ Acquire know-how from nearby power stations that have already adopted the technology and from manufacturers.	➢ Assign staff from the construction stage to acquire knowledge and skill concerning equipment structures and operating methods from instructors dispatched by the manufacturers. ➢ Introduce manufacturers that have local plants, thereby ensuring prompt handling in the event of problems. ➢ Hold periodic technical discussion meetings with manufacturers with a view to enhancing technical capability.	-
	High	➢ Although there is a lack of knowledge and skill concerning operation and maintenance, long-term effects can be mitigated through adopting highly reliable instruments.			

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
				➢ Prepare an original manual that consolidates know-how, and implement workshops and troubleshooting training within the implementing agency.	
Adoption of excessively high technologies (power transformation)	High	➢ Since this is the first time that GIS will be adopted, there is a high risk of failures and supply interruptions arising during construction and operation due to lack of technology.	➢ Develop human resources from the short, medium and long-term viewpoints. ➢ Conduct assistance based on employment of abundantly experienced engineers and consultants. ➢ Acquire know-how from manufacturers. In particular, since GIS uses gases that can harm human health, fully understand the precautions in handling.	➢ Assign staff from the construction stage to acquire knowledge and skill concerning equipment structures and operating methods from instructors dispatched by the manufacturers. ➢ Hold periodic technical discussion meetings with manufacturers with a view to enhancing technical capability. ➢ Prepare an original manual that consolidates know-how, and implement workshops and troubleshooting training within the implementing agency.	-
	Medium	➢ Through adopting highly reliable instruments, the impacts of failures and supply interruptions can be limited.			
Appropriateness of the Project scope (power transmission)	Medium	➢ Since the primary connection point (Gaihat s/s) onwards is not included in the scope, in the event where development is delayed, there is a possibility that partial load operation (or stoppage) will arise due to flow limitations.	➢ Promptly review from the primary connection point onwards and include in the Project plan. Design capacity upon fully considering potential for connecting to other power sources.	➢ While also considering the utilization of external consultants, compile a plan that harmonizes with nearby power source development plans including NTPC equipment, etc., and examine the schedule in step with the start of operation of the power station. ➢ If the primary connection point is a load center, consign development of the distribution network to the power distribution corporation.	➢ Examine connection to a separate new load center. In that case, share information with the power distribution corporation to ensure that plans advance smoothly. Increase the potential connection capacity based on 220 kV transmission lines and linking transformers.
	Medium	➢ Even when output limitations are imposed due to the immaturity of transmission lines, a certain degree of transmission can be realized by passing through neighboring switch stations.			
Reliability of the Project monitoring setup	Low	➢ In addition to internal audits, a system of external audits by third party agencies has been established, so highly reliable Project monitoring can be anticipated.	➢ Introduce a system for setting deadlines for confirming corrections regarding the points that are highlighted in audits (correction items). ➢ In addition to conventional internal and external audits, introduce a system so that the Project superior agency also conducts monitoring.	➢ Compile an implementation plan and implementation guidelines for implementing efficient audits according to the ISO method, and implement audits based on them. ➢ In the monitoring, confirm in detail that the internal audit is functioning, and improve the internal audit so that it is more effective.	-
	Medium	➢ Any corrections made in monitoring are checked in the next year's monitoring, however, because the interval between audit implementation and confirmation of corrections is so long, there is concern that problems will be left untouched.			

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
Project implementation setup in the case of a regional dispersed undertaking	High	➢ Although there are currently no problems with the local community, communication geared to Project implementation does not apply to all details.	➢ Build opportunities for periodic communication with the local community and promote local employment. ➢ In implementing the Project, clarify the responsibilities and roles of each agency and share these among the concerned persons.	➢ Organize systematic public hearings to explain Project implementation and announce the implemented contents to the local community. ➢ Implement periodic information exchange among related agencies and share any problems in implementation.	-
	High	➢ The Project has been planned on a top-down basis, but the whereabouts of responsibility for the Project plan are unclear.			
Inappropriateness of the procurement package	Low	➢ Inappropriateness can be reduced by grasping the number of packages and adjusting between packages.	➢ Implement periodic procurement progress meetings by the consultants and contractors.	➢ Avert delays through grasping procurement progress and anticipating the schedule.	-
	Low	➢ Most materials can be procured from nearby cities, however, electrical items may need to be procured from further afield.			
Insufficient capability of contractors	Medium	➢ Because the number of power facility construction projects in India is increasing, there is a growing shortage of skilled workers.	➢ Employ consultants and contractors that have a past record of constructing supercritical facilities.	➢ Periodically monitor the works progress and hold weekly and monthly schedule meetings to quickly discover problems and take corrective measures.	-
	Medium	➢ There is risk of delay in constructing supercritical facilities (high-chrome steel welding, etc.), and it is difficult to secure quality.			
Vulnerability to inflation of project costs due to external factors	Medium	➢ Due to difficulty in securing the planned, long-term use of heavy machinery and special vehicles, this could cause works delays.	➢ The contractor should quickly secure heavy machinery and special vehicles, establish transportation routes and grasp the authorization processes of related government agencies.	➢ Grasp the companies that hold heavy machinery and special vehicles, their addresses and specifications, and update and administer transportation plans. ➢ Grasp the witnessed inspection schedule for factory products, and conduct prompt corrective measures in the event of problems.	-
	Low	➢ Although payment by the client based on intermediate payment forms from the consultant should not impart any difficulties to procurement by contractors, there is some risk of delays arising due to delays in transportation.			
Vulnerability to reduced demand caused by external factors	Low	➢ Since the demand for electric power is steadily increasing, there is little risk of output constraints being imposed. Moreover, because efficiency is higher than in neighboring plants, operation can be continued even if the demand for power goes down.	➢ Secure long-term demand by identifying regular consumers and promote the electrification of ordinary households.	➢ Cooperate with the government in implementing preferential tax measures, electricity tariff discounts, etc. in order to attract new companies and acquire ongoing power consumers.	-

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
	Medium	➢ Imposition of load restrictions could cause reduced revenue, leading to delay in recovery of construction costs and harming the integrity of the implementing agency.			
3.2 Program/donor risk					
Development of peripheral related works (fuel)					
(1) Interruption of coal procurement due to changes in the coal supply system or failure by the coal corporation to achieve production plans.	Medium	➢ Although system changes are geared to realizing efficient supply rather than hindering it, because increased production by the coal corporation depends on the development of new coal mines, there is a possibility that plans will be delayed due to holdups in obtaining environmental authorization and land.	➢ Apply to the central government for coal supply with a view to binding a procurement contract with the coal corporation.	➢ Submit application for the necessary quantity and quality of coal to a Permanent Linkage Committee (long-term) composed of central government agencies such as CEA/MoP/MoC, etc.	➢ Apply for the company's own mining district and purchase imported coal.
	Small	➢ Since the procurement contract signed with the coal corporation includes a provision for compensating shortages with imported coal, the impact is reduced.			
(2) Non-attainment of ash receiving quotas by cement operators, etc.	Medium	➢ Currently (as of January 2016), there are no promising ash using businesses around BTPS, so there is some risk that trade quotas will not be achieved.	➢ Recruit operators who are willing to receive ash. ➢ Install ash shipping equipment based on a railway for Unit No. 10 (currently being planned).	➢ As in the existing units, conduct subscription for the receiving of fly ash, and promote low-cost, mass removal of ash by rail in order to attract interest from operators situated far away from the power station.	➢ Examination is required concerning expansion of the ash pond, attraction of new operators willing to receive ash, utilization for filling in old mines and other alternatives.
	Medium	➢ The phased utilization targets required by MoEF will not be realized. ➢ From the medium to long-term viewpoint, suspension of power generation due to filling of the ash pond would have widespread consequences for citizens.			
(3) Shortage of transportation cargo trucks (BOBRN)	Large	➢ Currently (as of January 2016), coal trucks are mainly the BOXN type (open top), so there is a high possibility there will be a shortage of BOBRN (bottom opening) type trucks.	➢ Coordination with Indian Railways. ➢ Install equipment for receiving coal from BOXN coal trucks for Unit No. 10 (currently being planned).	➢ Confirm and coordinate coal transportation and arrangements for BOBRN coal trucks through making applications for coal supply and providing opportunities for review of the rail equipment F/S report by Indian Railways.	➢ Seek efficient operation of BOXN truck receiving facilities and request Indian Railways and MoR to purchase more BOBRN trucks.
	Small	➢ BOBRN will slowly become more widespread in future. The shortage of such trucks should be resolved by the			

Risk	(Occurrence) / (Impact)	Occurrence probability analysis / Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
		time operation of Unit No. 10 starts, so any impacts will be reduced.			
Establishment of peripheral businesses (power transmission)					
(1) Delays in construction of connected substations and transmission systems beyond them.	Small	➢ Since transmission lines and transformation substations can be constructed within the authority of BSPTCL, the possibility of delays is low.	➢ Complete the installation of transmission lines to consumer areas before the start of operation at the power station. ➢ Following declaration of construction of the power station, promptly present to the Standing Committee.	➢ Implement mutual confirmation of progress via information sharing and schedule meetings, etc. between BSPGCL/BSPTCL. ➢ Following declaration of construction of the power station, promptly present to the Standing Committee.	➢ Conduct ample discussions concerning ways to handle delays and other problems by inviting participation of experts (third parties).
	Small	➢ Because transmission can be implemented to an extent via neighboring substations in the event of restricted output due to delays in development of the transmission system, any impacts will be limited.			➢ Conduct ample discussions concerning ways to handle delays and other problems by inviting participation of experts (third parties). ➢
Policy and system reforms necessary for manifesting the development effects	-	➢ None in particular	-	-	-
Cooperation setup with related donors, etc.	-	➢ None in particular	-	-	-
3.3 Delivery quality risk					
Feasibility of measuring development effects	Small	➢ Since operation indicators and effect indicators are based on general operating performance, it isn't difficult to measure and acquire data.	➢ Following the start of Project operation, periodically measure and record the maximum output, operating rate, in-station factor, heat rate, and unit stoppage times and so on.	➢ Construct the departments in charge of monitoring operating performance (data acquisition, recording, analysis, reporting, etc.) within the station and conduct detailed system design.	-
	Small	➢ None in particular			
Lack of post-completion monitoring due to geographical dispersion of sub-projects	Medium	➢ An audit system has been established and accounting audits are implemented by an external agency, however, these are only implemented once a year (external audits are irregular). There is concern that problems pertaining to corrective items will arise due to the infrequent nature of monitoring.	➢ Review the frequency of internal auditing and ensure that close auditing can be performed.	➢ Revise the current auditing guidelines concerning the auditing frequency and items to ensure that corrections can be appropriately implemented based on the audit system.	-
	Low	➢ Performance auditing is conducted and corrections are confirmed in accounting inspections. Moreover, budget execution is checked in a timely manner in the internal system, so there is little risk of budget execution problems arising.			

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
Sustainability of the development effect	High	➢ Tariffs tend to be set politically in reflection of public opinion, so there may be a situation where the Project investment cannot be recovered through business revenue.	➢ In the case where Project funds run short, clearly prescribe a mechanism for the state government to loan funds. ➢ Establish a mechanism so that tariffs are set by a politically neutral agency based on general consideration of power demand, investment costs, etc. and the decision making process is transparent. ➢ Establish regular opportunities for consultations on maintenance planning so that the administrative department and field department can communicate closely.	➢ Ask the state government to commit to loaning funds to the power corporation. ➢ Appeal to GoI to make the tariff setting process transparent. ➢ Establish periodic consultations concerning maintenance among related persons, and build a mechanism so that plans can be appropriately set.	-
	Medium	➢ The system for responsibility for maintenance is clearly specified and maintenance plans are compiled, however, there is risk that plans will not properly reflect actual conditions and that budgets will not be executed based on plans.			
Possibility of impact on Project implementation due to natural disasters, etc.	High	➢ The Project site has been inundated by flooding in the past, and it is possible that similar flooding will occur again. ➢ Since Eastern India and Nepal are situated on the boundary between continental plates, there is a high probability of earthquakes.	➢ Concerning flooding, since the power station site, water intake tower, grit chamber and ash pond will be shared with Units No. 8/9, design and execution will be conducted for construction of Units No. 6-9 as is currently planned. ➢ Concerning earthquakes, comply with anti-seismic standards in India and conduct anti-seismic design in consideration of the position of faults.	➢ Concerning flooding, both the consultant and implementing agency should implement design and supervision for the construction works for Units No. 8/9. ➢ Concerning earthquakes, rather than employ a local consultant, use a consultant based in an advanced country or country that experienced earthquakes.	➢ Concerning flooding, implement additional works to the project to ensure that the required site elevation and embankment are secured (securing of appropriate contingency cost).
	Low	➢ Since it is planned to construct the main structures inside embankments at an elevation that is higher than surrounding land and past peak flood levels, the impact from flooding will be low. ➢ Since the Project area is designated as seismic zone IV requiring stringent load conditions in IS, the impact on Project implementation will be low.			
Impact on Project implementation due to the local public order situation, etc.	High	➢ Since site acquisition procedures had not finished at the time of this survey and some local citizens were campaigning for the suspension of topographical and geological investigation of the ash pond, there is a high possibility that opposition demonstrations will arise during construction.	➢ Explain the Project necessity and contents of environmental measures to related agencies and local citizens and secure their understanding and consent.	➢ In addition to the government's EIA approval procedure stage, hold timely public explanation meetings during the construction works too in order to explain the contents of mitigation measures to the local community.	-

Risk	(Occurrence) (Impact)	Occurrence probability analysis Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
	Low	➢ Because the main structures will be constructed on the same site as Units No. 8/9, the impact of demonstrations on the construction works will be low.			
Possibility of improper or unlawful use of the Project	Low	➢ There is a system for the Project implementation contents to undergo amendment based on internal and external audit. Audits include procedures for amending improper or unlawful uses, so there is little risk of such an occurrence happening.	➢ Conduct thorough education concerning legal compliance. ➢ Implement periodic hearings for related officials. ➢ Implement work audits.	➢ Implement education concerning legal compliance. ➢ Implement periodic hearings for stakeholders. ➢ Implement audits based on detailed audit plans.	-
	Low	➢ Budget execution procedures are clearly stipulated and numerous officials are involved in the work procedures. Accordingly, there is little possibility of the Project being used for improper or unlawful purposes.			
Increase in maintenance costs due to improper use, etc. of facilities	Medium	➢ Information is conveyed to personnel concerned with legal compliance, and the compliance situation is confirmed in audits. However, awareness of the need to comply with labor health and safety legislation is generally low, and there is concern over troubles arising from violations of health and safety law.	➢ Implement detailed training on legal compliance also targeting subcontractors. ➢ Conduct periodic patrols concerning legal compliance and make detailed corrections. ➢ In order to conduct the appropriate maintenance of facilities, prepare the quality control setup and documents and make related personnel aware of them via training.	➢ Implement legal compliance activities. ➢ Construct a system of quality control documents and implement training in maintenance work. ➢ Implement audits by external experts who are well-versed in facilities maintenance. ➢ Revise the audit written procedures stipulating the need for prompt correction of the audit results and confirmation of the need for corrections.	-
	High	➢ The management setup concerning facilities performance is inadequate. As a result of improper operation management, there is a possibility that maintenance costs will spiral and Project life will be shortened due to reduced efficiency and equipment troubles.			
Possibility of imbalanced benefits for specific demographics	Low	➢ Because stable supply of power and securing of employment impart benefits to a wide range, this rarely happens.	➢ Give ample information on the Project contents and confirm performance in meetings with stakeholders, etc.	➢ Implement analysis of the Project benefits, impacts, etc. and conduct active consultations with the local community and stakeholders from the initial stage of the Project.	-
	Low	➢ None in particular			

Risk	(Occurrence) / (Impact)	Occurrence probability analysis / Impact analysis	Measures to be implemented by implementing agencies	Specific contents of countermeasures	Alternatives in case specific measures cannot be implemented (or are ineffective)
Narrow scope of benefit from the development effects	Low	➢ Because stable supply of power and securing of employment impart benefits to a wide range, this rarely happens.	➢ Give ample information on the Project contents and confirm performance in meetings with stakeholders, etc.	➢ Implement analysis of the Project benefits, impacts, etc. and conduct active consultations with the local community and stakeholders from the initial stage of the Project.	-
	Low	➢ None in particular			
4. Other risk					
None in particular	-	-	-	-	-
5. Overall risk rating					
None in particular	-	-	-	-	-

Appendix VI

List of reference literature

List of reference literature

- The Air (Prevention and Control of Pollution) Act, 1981 amended 1987
- The Air (Prevention and Control of Pollution) (Union Territories) Act
- The Environment (protection) Act
- The National Environment Tribunal Act
- The National Environment Appellate Authority Act
- The Indian Forest Act
- The Forest (Conservation) Act
- The State/Union Territory Minor Forest Produce (Ownership of Forest Dependent Community) Act
- Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Right 6) Act, 2006
- The Wildlife (Protection) Act
- The Wild Life (Protection) Amendment Act
- LAA,1894
- Ordinance to amend LAA, 2014
- The Water (Prevention and Control of Pollution) Act
- The Prevention of Cruelty to Animals Act
- The Biological Diversity Act
- The National Green Tribunal Act
- The Public Liability Insurance Act
- Coal Mines Nationalization Act, 1973
- Indian Electricity Rules, 1956
- The Air (Prevention and Control of Pollution) Rules, 1983
- The Water (prevention and control of pollution) Rules, 1975
- The Noise Pollution (Regulation and Control) Rules (February 2000)
- IS:398-2(1996), Aluminium conductors for overhead transmission purposes
- IS:398-5(1992), Aluminium conductors for overhead transmission purposes
- IS:731(1971), Porcelain insulators for overhead power lines with a nominal voltage greater than 1000 V
- IS:802-1-1(1995), Code of Practice for Use of Structural Steel in Overhead Transmission Line Towers
- IS:875-3(1987), Code of Practice for Design Loads (Other than Earthquake) for Buildings and Structures
- IS:2309(1989), Code of practice for the protection of buildings and allied structures against

lightning

- IS:3043(1987), Code of practice for earthing
- IS:5182, Methods for Measurement of Air Pollution
- IS:5613-3-1(1989), Code of Practice for Design, Installation and Maintenance for Overhead Power Lines
- IS:10500(2012), Drinking Water Standards
- IRC:S6(2014), Standard Specifications and Code of Practice for Road Bridges Section II
- National Ambient Air Quality Standards
- National Data Centre, IMD, Pune, Monthly mean maximum & minimum temperature and total rainfall based upon 1901-2000 data
- National Atlas of India, 1981
- National Policy on Rehabilitation and Resettlement, 2007
- GoI, National Action Plan on Climate Change
- GoI, India Meteorological Department
- CEA, 12th National Electricity Plan
- CEA, 13th National Electricity Plan
- CEA, Executive Summary of Power Sector
- CEA, LOAD GENERATION BALANCE REPORT 2015-16
- CEA, (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulation, 2010
- CEA, General Guideline for 765/400/220/132 kV Sub-station & Switch-Yard of Thermal/Hydro Power Projects, June 2012
- CEA, (Installation and operation of meters) Regulation, 2006
- CEA, (Installation and operation of meters) Amendment Regulation, 2010
- CEA, Manual on Transmission Planning Criteria
- MoP, perspective plan
- MoP, Perspective Transmission Plan
- MoEF, Environmental (Protection) Rules, Schedule I, 1986
- MoEF, S.O.123(E), The Noise Pollution (Regulation and Control) Rules
- MoEF/CPCB, Notification S.O.384 (April 1994)/S.O.935 (October 1998)
- MoEF, S.O.1533(E), EIA Notification
- MoEF, S.O.2265(E), Hazardous Wastes (Management,Handling and Transboundary Movement) Rules, Notification, 2008
- MoEF, S.O 2804, Notification (November 2009)
- MoEF, Notification G.S.R. 02(E)
- MoEF, EIA Notification, 2006

- MoEF, Minutes of the 17th Standing Committee Meeting
- Ministry of New and Renewable Energy, All India Renewable Energy Regulatory and Policy Data Base
- MoC, COAL DIRECTORY OF INDIA 2013-14
- CERC, Indian Electricity Grid Code Regulations, 2010
- CBIP, Manual on Transmission Lines, July 2014
- CPCB, Water Use Criteria
- Water resources systems division, Water Resources Information System of India
- Hydromet Division, India, District Rainfall,
- India Meteorological Department, Atlas of Windroses, 1971-90
- Soil Remediation Circular July 2013 Revision
- Champion and Seth Vegetation Classification
- Right to Fair Compensation and Transparency in LARR[1]
- LARR Overview
- LARR 1st Schedule
- GoB Finance Department, Economic Survey 2014-15
- GoB, Bihar State Action Plan for Climate Change
- BSPGCL, Business Plan for Bihar State Power Generation Company for control period FY 2013-14 to FY 2015-16
- Bihar State Disaster Management Authority, Earthquake - Perspective of Bihar
- BSEB, BTPS Phase-1 (2x110MW) and Phase-2 (2x250MW) Section-VI Tender Drawings for Ganga Water Supply Package (October 2011)
- BSPGCL/BSPTCL, Tariff Order 2015-2016
- CIL, Road Map for Enhancement of Coal Production
- IFC, Environmental, Health and Safety Guidelines (Thermal Power Plants) (December 2008)
- IUCN, Red data list (February 2015)

[1] Right to Fair Compensation and Transparency in Land Acquisition, Rehabilitation and Resettlement Act (LARR)

Appendix VII

Presentation materials

➢ Kick-Off Meeting 2015.3.18

Kick-Off Meeting on Study of the Preparation for Construction on Barauni Thermal Power Station (660MW x 1) Project in Bihar

March 2015

JICA Study Team

Kyushu Electric Power Co., Inc.

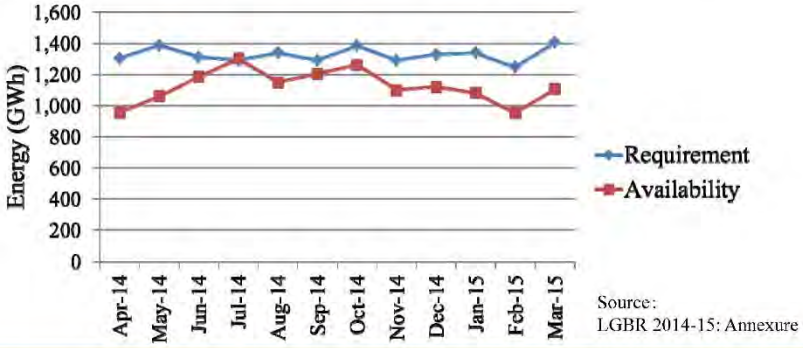
Contents

1. Project Overview
2. Introduction of JICA Study Team
3. Schedule
4. Policy of Work
5. Work Plan
6. Conclusion

Kyushu Electric Power Co., Inc.

1. Project Overview(1/5)

- Bihar's GDP growth rate by state in 2013 was 8.9%, which is much higher than 5% for the entire India
- Bihar's power supply shortfall was 15.3% in the end of March 2013

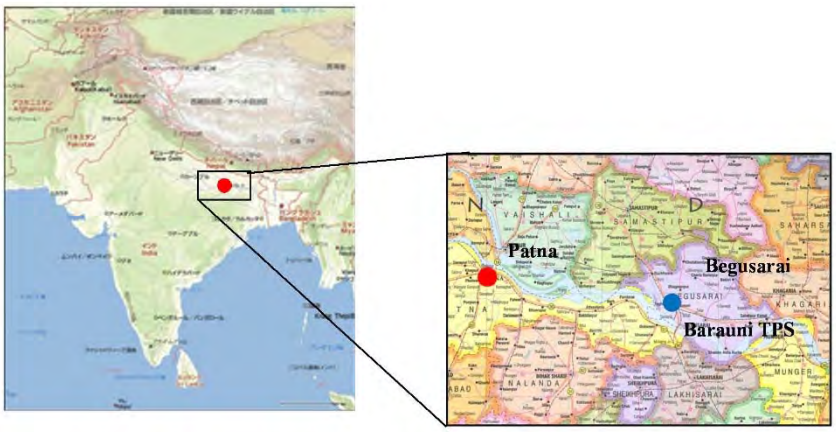


Source:
LGBR 2014-15: Annexure

Kyushu Electric Power Co., Inc. 1

1. Project Overview(2/5)

- Project Site



Kyushu Electric Power Co., Inc. 2

1. Project Overview(3/5)

➢ Purpose of the Project

The purpose of the Project is to construct a 660 MW-class coal-fired thermal power station (unit No. 10) with higher specifications than supercritical-pressure at the Barauni TPS in Bihar.

➢ Purpose of the Study

The purpose of the Study is to collect basic information and data necessary for examining the feasibility of the Project. The Study includes objectives, scope of works, project costs, implementation schedule and method, organizational arrangement, and environmental and social consideration etc.

Kyushu Electric Power Co., Inc. 3

1. Project Overview(4/5)

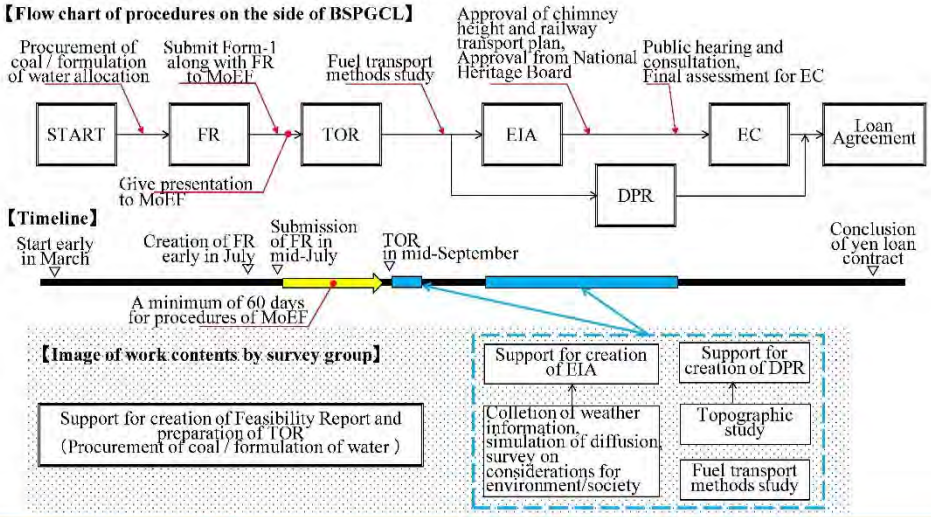
➢ Outline of Barauni Thermal Power Station

Unit	Equipment specification	Rated output (MW)	Commencement of commercial operation	Present situation	Manufacturer	Remarks
No. 1	Coal-fired subcritical pressure type unit	15	Jan.26,1966	Abolished	Yugoslavian	
No. 2		15	Jan.16,1963			
No. 3		15	Oct.20,1963			
No. 4		50	Nov. 9, 1969	Shutdown	Polish	Shutdown on Apr. 24, 1996 due to an environmental pollution problem
No. 5		50	Dec. 1, 1971	Shutdown		Shutdown on Mar. 15, 1995 due to an environmental pollution problem
No. 6		110	Dec. 1,1984	R&M/LE * ongoing	BHEL made	Scheduled date is Jun 2015 (Progress rate:65%....as of 8 Dec)
No. 7		110	Mar. 31,1985	R&M/LE * ongoing		Scheduled date is Mar 2015 (Progress rate:90%....as of 8 Dec)
No. 8		250	-	Under construction		Scheduled date is Feb 2016 (Progress rate:70-80%....as of 8 Dec)
No. 9		250	-	Under construction		Scheduled date is Mar 2017 (Progress rate:70-80%....as of 8 Dec)

Kyushu Electric Power Co., Inc. 4

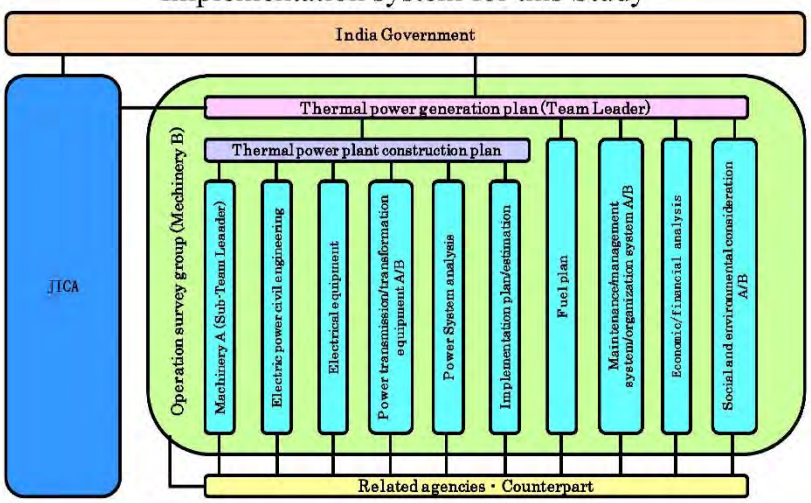
1. Project Overview(5/5)

Procedures of EIA, FR, and DPR in India



2. Introduction of the JICA Study Team-(1/3)

Implementation system for this Study



2. Introduction of the JICA Study Team (2/3)

Name	Responsible for	Company
Michio Mihara	**Team Leader** / Thermal Power Generation Plan	Kyushu Electric Power Co., Inc
Yasunori Sakamoto	**Sub Team Leader**/ Machinery A	
Yoshihumi Mitsunaga	Thermal Power Plant Construction Plan	
Masahiro Muku	Electric Power Civil Engineering	
Shinji Kuba	Power Transmission / Transformation Equipment A	
Hiroyuki Koga	Power Transmission / Transformation Equipment B	
Kiyotaka Tsukimoto	Pwer System Analysis	
Takeshi Baba	Economic / Financial Analysis	

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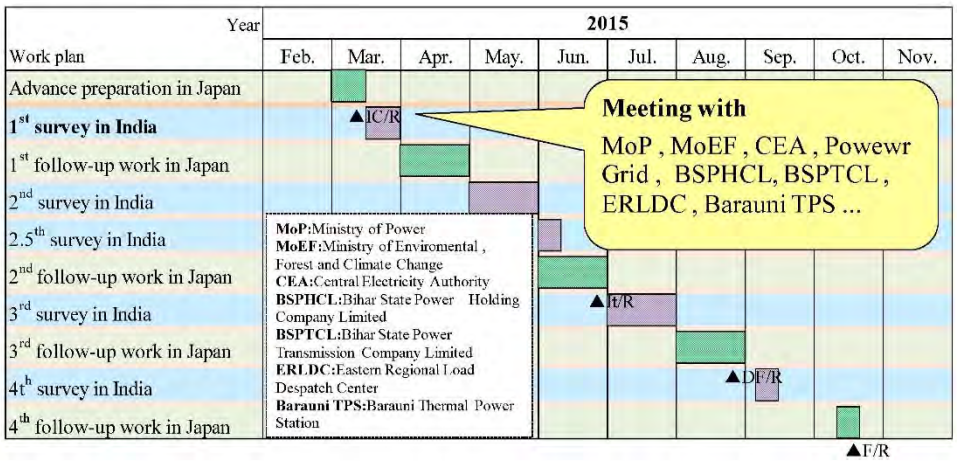
2. Introduction of the JICA Study Team (3/3)

Name	Responsible for	Company
Koichi Nakayama	Fuel Plan	Kyuden International Corporation
Shigeru Urakawa	Implementation Plan / Estimation	West Japan Engineering Consultants Inc.
Manabu Sakaguchi	Consideration to environment / society A	ERM Japan Ltd.
Yohei Suzuki	Consideration to nvironment / society B	
Motohisa Sakurai	Electrical Equipment	Electric Power Development Co.,Ltd.
Junya Fujita	Maintenance / Management System / Organization System A	
Toshiyuki Ota	Maintenance / Management System / Organization System B	
Kiyotaka Okuma	Machinery B / Operation Survey	Kyushu Electric Power Co., Inc

Kyushu Electric Power Co., Inc. 8

3. Schedule (1/2)



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3. Schedule (2/2)

Date	Main Contents	Location
19.Mar | 21.Mar	Kick-off Meeting with BSPGCL (19.Mar) Meeting with Counterparts Collecting a Information and Data	Patna
23.Mar | 25.Mar	Kick-off Meeting with Barauni TPS (23.Mar) Site Survey Collecting a Information and Data	Barauni
27.Mar | 30.Mar	Meeting with BSPGCL Meeting with Counterparts Collecting a Information and Data	Patna

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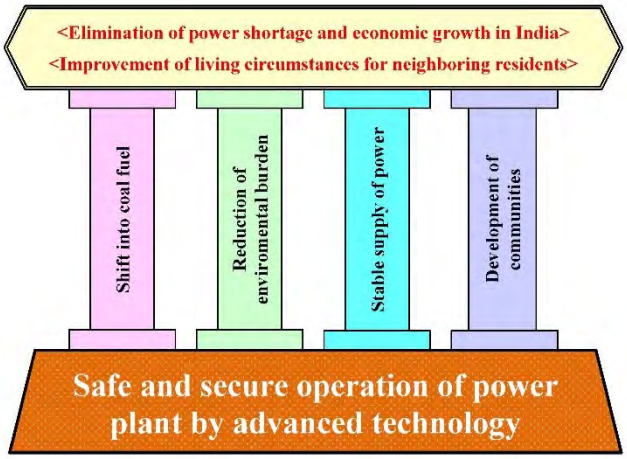
4. Policy of Work



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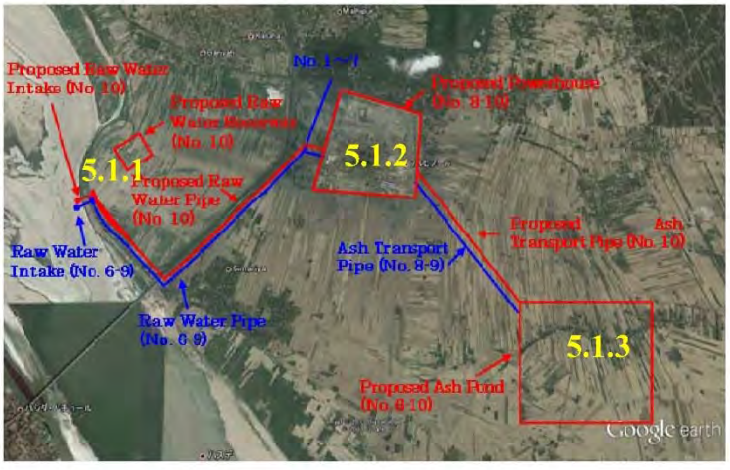
5.1 Civil Engineering

Major Civil Engineering Structures to be Considered by JICA Study Team

5.1.1
Raw water system

5.1.2
Foundations of machineries and equipment at powerhouse site

5.1.3
Ash disposal system



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5.1.1 Raw Water System

- Major Issues
  - ✓ Since the raw water system for Unit 6-9 does not have enough ability to take additional water required for Unit 10, the raw water system for Unit 10 should be newly installed.

Item	Unit 6-9	Unit 10
Required amount of water (cusec)	45	33(tentative)
Water intake equipment capacity (cusec)	50	33(tentative)

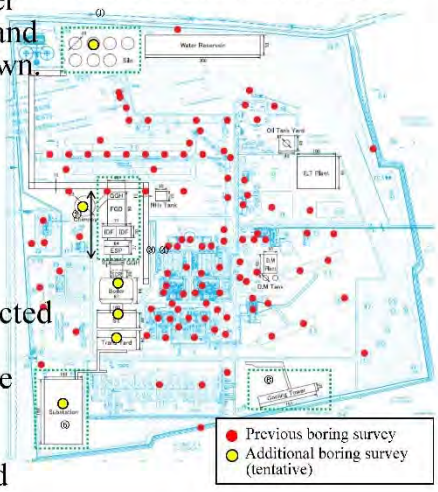
- Study and Design
  - ✓ Additional lands have to be acquired. Additional topographical and geological survey will be carried out by JICA Study Team.
    - Restrictions on new/additional land acquisition
  - ✓ Preliminary design will be conducted in consideration of:
    - To minimize new/additional land acquisition
    - To draw the river water stably

Kyushu Electric Power Co., Inc. 13

5.1.2 Foundations of machineries and equipment

- Major Issues
  - ✓ Geological information/data under the proposed major machineries and equipment for Unit 10 are unknown.

<Location of Additional Boring Survey>



- Study and Design
  - ✓ Additional geological survey including laboratory test will be carried out by JICA study Team.
  - ✓ Preliminary design will be conducted in consideration of:
    - Area of liquefaction in surface ground during earthquake
    - Countermeasures against liquefaction of surface ground

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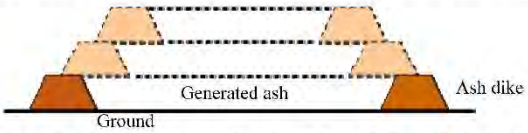
5.1.3 Ash Disposal System (1/2)

➢ Major Issues

✓ The ash disposal area for Unit 10 is planned to be shared with Unit 6-9. The area would lack capacity to storage the generated ash during 25 years operation, in case ash utilization notified by MoEF is not promoted at all.

Case	Height of ash pond/dike
Ash is utilized as a notification by MoEF	Approx. 4m
Ash is not utilized at all	Over 20m



✓ The preliminary study conducted by JICA Study Team in 2014 guesses the ground of ash disposal area is soft.

✓ For Japanese standards, heavy metals seepage from ash disposal area is strictly prohibited.

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5.1.3 Ash Disposal System (2/2)

➢ Study and Design

✓ Additional topographical and geological survey will be carried out by JICA Study Team.

✓ Preliminary design will be conducted in consideration of:

- Possible capacity of ash pond
- Stability of embankment dike and its foundation ground
  - Mechanical stability against ash pressure and hydraulic pressure of back of dike
  - Measures to prevent scour of dike during flood
- Prevention of water seepage
- Drainage method of rainfall within ash disposal area

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5.1.4 Topographical and Geological Survey

<Planned Topographical and Geological Survey Items (tentative)>

Survey item			Location
Topographical survey			Raw water system site and ash disposal system site
Geological survey	In-situ measurement	Boring survey	Raw water system site, powerhouse site and ash disposal system site
		Standard penetration test	
		On site permeability test	Ash disposal system site
	Laboratory test	Wet density testing of soil	Raw water system site, powerhouse site and ash disposal system site
		Soil particle density testing	
		Moisture ratio test	
		Particle size distribution test	
		Liquid and plastic limit test	Powerhouse site
		Uniaxial compression test	
		Triaxial compression test	Ash disposal system site

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5.2 Guidelines for Environmental and Social Considerations

Objectives

- Encourage Project proponents etc. to have appropriate consideration for environmental and social (E&S) impacts
- Ensure that JICA's support for and examination of E&S considerations are conducted
- Outline JICA's responsibilities and procedures, along with its requirements for project proponents (PP)
- Ensure transparency, predictability, and accountability in its support for and examination of E&S considerations

Associated Projects: Transmission Lines and Railway ?

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SCOPING

- JICA Study Team prepares scoping draft based on collected information, field surveys and consultations with PP etc.
- PP etc. conduct consultations with local stakeholders on the projects. JICA Study Team incorporates the results of consultations into its TOR.
- Based on TOR, JICA Study Team conducts E&S considerations studies. JICA Study Team incorporates the results of studies into related reports.
- The Advisory Committee gives advice on Scoping and meetings of the Advisory Committee are open to the public.

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ESIA study

- JICA Study Team prepares draft reports, incorporating the results of E&S considerations studies, and explains to PP etc. to obtain comments.
- Consultations with local stakeholders are conducted after draft report disclosure.
- The Advisory Committee gives advice on draft report and meetings of the Advisory Committee are open to the public.

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EIA: Scope of work and Schedule (1/2)

Contents of work
➢ Environment and Social Baseline ➢ Laws and regulations, standards, etc. (environmental impact assessment, disclosure of information, etc.) ➢ Deviation from JICA Environmental Guidelines (April 2010) and method to resolve it ➢ Role of relevant agencies ➢ scoping study ➢ Stakeholders meeting for scoping ➢ Impact assessment (basically including quantitative prediction) ➢ Mitigation measures (avoidance, minimization and compensation) ➢ Alternative analysis ➢ Environment management plan and a monitoring plan (implementation system, method, expense, etc.) ➢ Budget, financial source and implementation system

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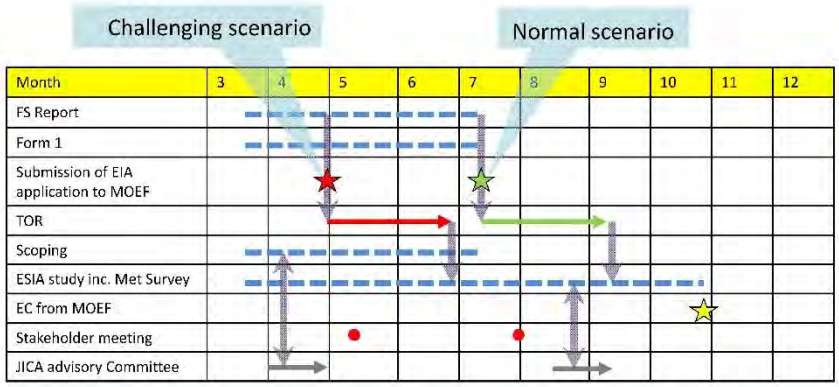
EIA: Scope of work and Schedule (2/2)

- Challenge 1: Obtain TOR from MoEF as early as possible
- Challenge 2: Shorten the EIA study period (e.g. monitoring)
- Challenge 3: Obtain EC from MOEF by the end of October 2015



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Social: Scope of work and schedule

- Preparation of Resettlement Action Plan (RAP)
- Confirmation of past land acquisition

Scope of work for RAP

Contents of work
➢ Analysis of legal framework concerning relocation of residents
➢ Necessity of relocation of residents and an alternative plan
➢ Socioeconomic survey (population census survey, property and land survey and livelihood and living survey)
➢ Formulation of a plan of compensation to lost property and measures for livelihood rehabilitation and survey of re-acquisition price
➢ Relocation destination development plan (as required)
➢ Grievance mechanism
➢ Implementation system
➢ Implementation schedule
➢ Expense and financial source
➢ Method of monitoring and evaluation at termination of the Project
➢ Draft plan of participation of residents

Scope of work for confirmation of past land acquisition(1/2)

Contents of work
➢ History of acquisition of land and relocation of residents in the past(1/2) - Magnitude of acquisition of land and relocation of residents in the past - Laws and rules applied to acquisition of land and relocation of residents in the past - Necessary conditions for beneficiaries of compensation to lost property and measures for livelihood rehabilitation - Actual results of compensation to lost property (especially whether or not they are the compensation based on re-acquisition price.) - Actual results of assistance to relocation and measures for livelihood rehabilitation - State of implementation of consideration to socially disadvantaged people - Claim handling procedure and state of its implementation

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Scope of work for confirmation of past land acquisition(2/2)

Contents of work
➢ History of acquisition of land and relocation of residents in the past(2/2) - Implementation system - Implementation schedule - Expense and financial source - Monitoring system and state of its implementation - Record of consultation with residents ➢ Follow-up survey of the residents affected by acquisition of land and relocation of residents in the past ➢ Validation of past compensation and analysis on deviation from JICA Environmental Guidelines based on the two points mentioned above

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Schedule for Social Study

Month	3	4	5	6	7	8	9	10	11	12
RAP										
Preparation										
Social economic survey										
Entitlement matrix										
Stakeholder consultation										
RAP preparation										
Confirmation of past land acquisition										
Preparation										
Document review										
Follow up survey										
Stakeholder consultation										

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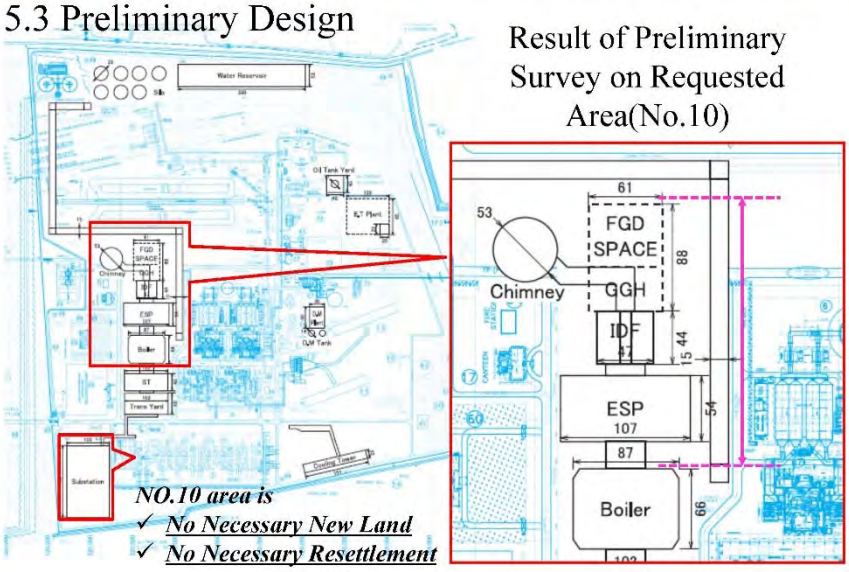
5.3 Preliminary Design

Result of Preliminary Survey on Requested Area(No.10)



NO.10 area is

- ✓ ***No Necessary New Land***
- ✓ ***No Necessary Resettlement***

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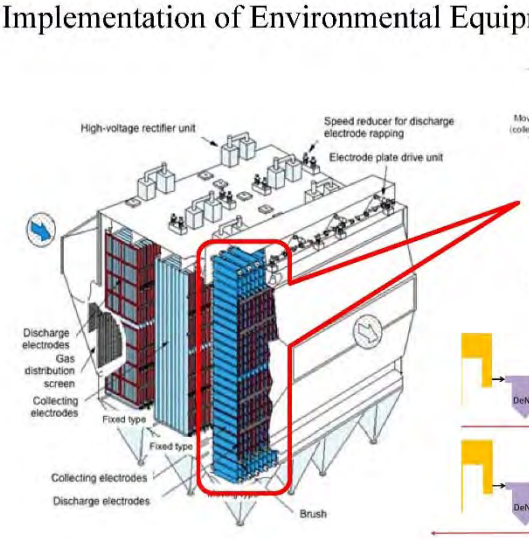
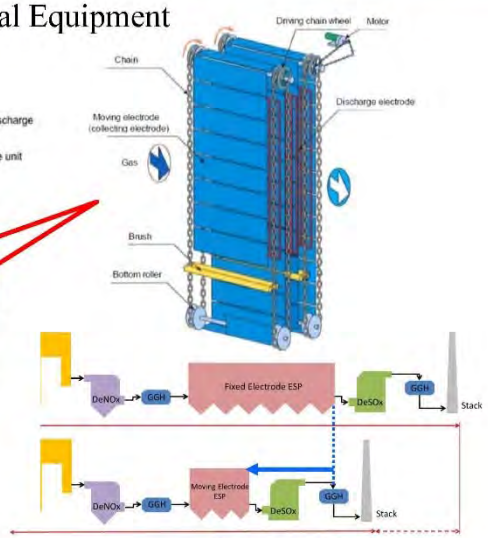
Implementation of Environmental Equipment



Moving Electrode ESP



Reduction of the Length

Optimization of Environmental equipment composition

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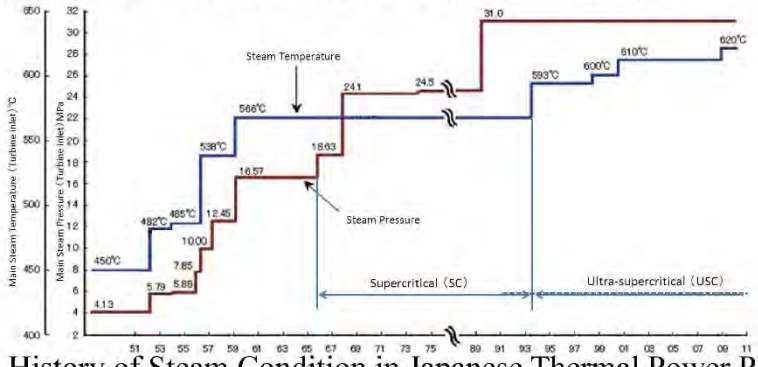
5.4 Implementation of Coal-Fired Technology

What is Super Critical Power Plant?

- Main Steam Pressure: over 22.064 Mpa (Critical pressure)
- Main Steam Temperature: over 374 ℃ (Critical temperature)
- Its installation in Japan has started in Mid- 1960's



History of Steam Condition in Japanese Thermal Power Plant

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5.5 Power Evacuation(1/2)

➢ Route of 400kV transmission lines

A 400 kV new transmission lines need to be planned for the construction of a 660MW SC unit. The connection candidates are as follows.

Case 1: LILO (Line in Line out) of
Muzaffarpur SS to Biharshariff SS
Case 2: LILO of Muzaffarpur SS to Purnea (new) SS
Case 3: LILO of BARH TPS to Kahalgaon TPS
Case4: Direct to Hazipur SS* bus
*to be planned to upgrade to 400 kV from 220 kV in 2015

5.5 Power Evacuation(2/2)

➢ 400kV switchyard

A 400 kV GIS need to be planned for the construction of a 660MW SC unit.

➢ Power System Analysis

✓ The team will implement power system analysis and confirm stability. Power Flow study, Short circuit study, Dynamic and transient stability study

The team will explain contents of this business to the related organizations such as ERLDC, power transmission line owners (such as Power Grid and Power Links), substation owners (such as NTPC)

Study chart

	Transmission & Switchyard	System Analysis
First Survey	・Collect Information about procedure required for new connection and Connection Destination candidate etc.	・Collect the data and Information about Demand forecast, Development plan ・System analysis with existing power flow and elements data
Analysis in Japan	・Analyze connection destination in terms of power flow, cost and designate line route	・Specify analysis precondition and calculate load flow, System stability after modeling
Second Survey	・Investigate the route of Lines and confirm connection preconditions	・Analysis Operation with the agency confirm system stability
Analysis in Japan	・Equipment Design, and examine cost, Procurement and construction schedule of power transmission line ・If needed, examine equipment specification of connection destination	
Third Survey	・Explain the validity of connection to the related Organization and obtain their consent.	

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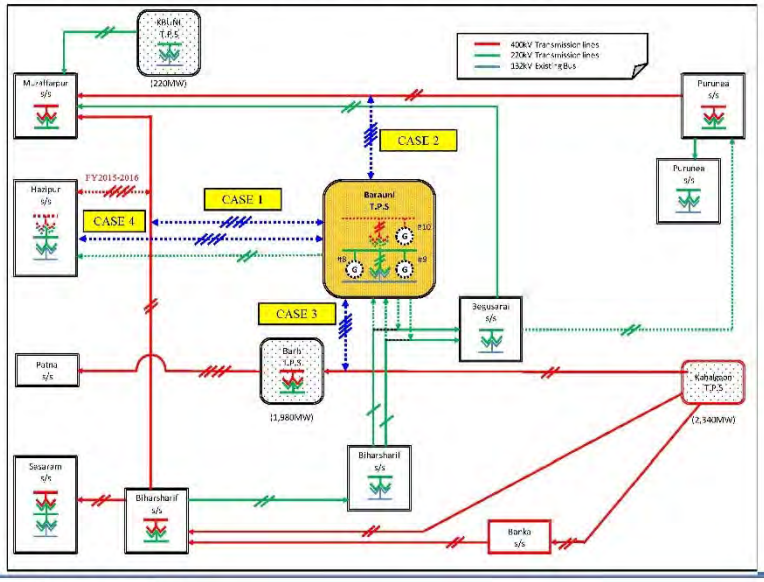
[Route of power transmission lines (Case1-4)]



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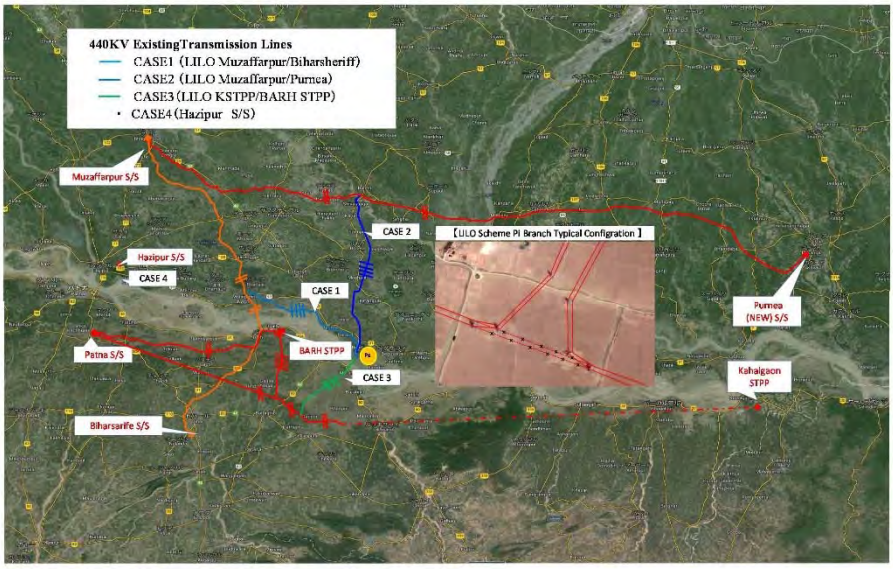
[Route Map (Case1-4)]



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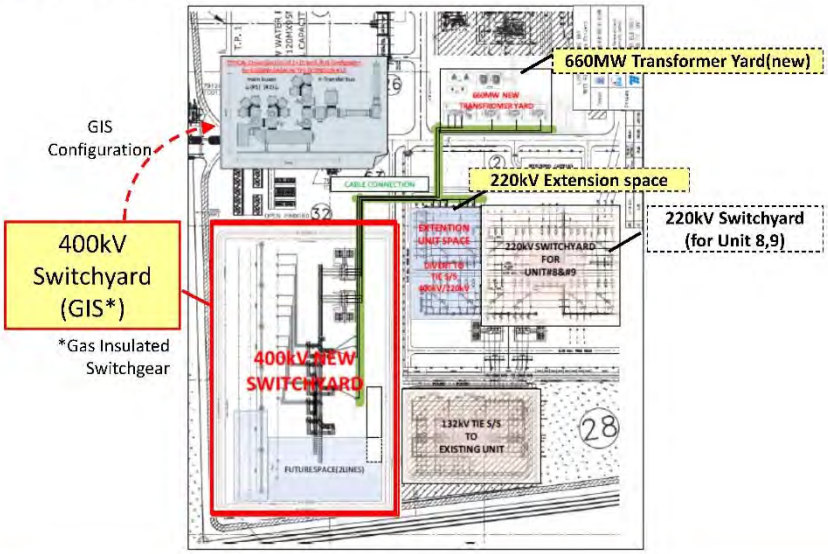
[400kV Switchyard Layout]



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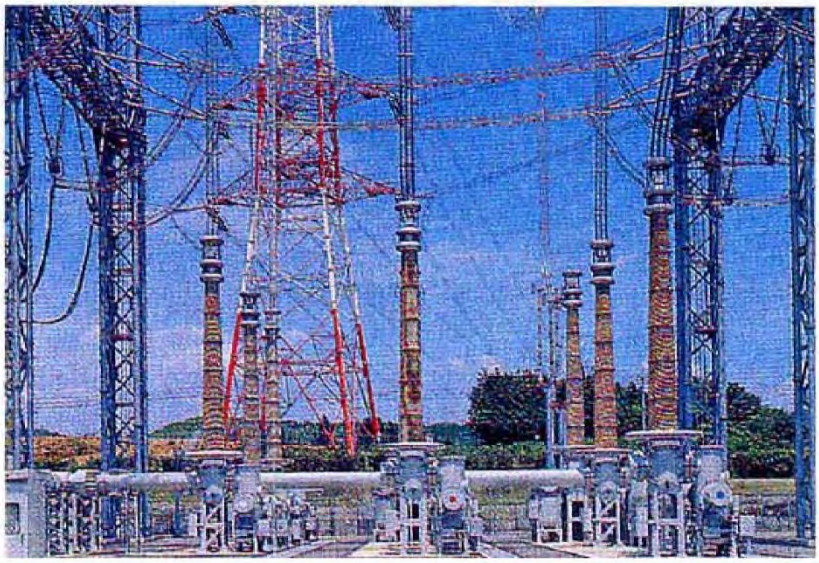
500kV GIS substation Nishikyushu S/S kyushuEPCO



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5.6 Electrical Equipment and Measurement Control System

To verify the concept of protecting electric facilities, emergency power supplies, and ability to respond to electric failures etc. of the existing Barauni Thermal power Station

Key points in this survey as follows;

- ➢ Electrical Equipment
  - ✓ Obtain information such as the Single line diagram, design concept for Electrical facilities, Emergency Power supply system etc.
  - ✓ Analyze the above information/data and verify key electrical issues/problem
- ➢ I & C
  - ✓ Obtain information such as the Control System overall, Sequence Schematic Diagram, Specification for Control System etc.
  - ✓ Analyze the above information/data and verify key I&C issues/problem

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5.7 Fuel Supply Plan (1/3)

5.7.1 Coal Block Allocation

- Coal Block Allocation (Current situation & Prospect)
  - ✓ Reconfirm the situation of the coal block allocated to the BTPS (Urma Paharitola coal block) and review the prospect of coal supply to the proposed 660 MW unit.

5.7.2 Fuel Requirement & Properties

- Coal Requirement
  - ✓ Review coal requirement for the proposed 660MW unit
- Coal Properties (Sampling & Analysis)
  - ✓ Fuel sampling and analysis will be implemented to update coal property data, and the updated data will be used as preconditions for preliminary design of the proposed 660MW unit.

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5.7 Fuel Supply Plan (2/3)

5.7.3 Fuel Supply & Transportation

- Coal Reserves
  - ✓ Review coal reserves of coal block (s) allotted to BTSP.
- Coal Transportation
  - ✓ Review draft coal transportation plan for the proposed 660MW unit based on the expansion plan for units No. 8 and No. 9 . It includes;
    - Traffic Projection
    - System Design
    - Construction, Civil works
    - Cost Estimation etc.

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5.7 Fuel Supply Plan (3/3)

5.7.4 Coal Ash Utilization

- ✓ Estimate discharge volume of coal ash from the proposed 660MW unit and investigate effective utilization of coal ash and potential environmental impact

5.8 Business implementation and Administration

Key information to be obtained in this survey as follows;

- ➢ Business Implementation/Administration System for Electric Power Business in India and Bihar State
- ➢ Detail information such as Organization, Function, Facilities and Financial situation in Bihar State Power Generation Company Limited (BSPGCL).
- ➢ Detail information such as Operation and Maintenance situation in Barauni Power Station.
- ➢ Other necessary information from related Companies.

5.9 Project Execution Schedule (1/3)

PES indicates the duration of detailed designing of each facility, procurement, construction work, testing, commissioning and other items, such as EIA acceptance and site acquisition procedure and so on, that affect the schedule with Bar Chart.

- Laws, rules, regulations and authorities related to installation of facilities in the power station.
- Practical construction schedule of No. 8^{th} and 9^{th} units.
- Topography and geological survey (record) for construction and set up of heavy construction machine and equipment.
- Weather investigation (record) to allocate work load effectively and to avoid the season that may delay the term of work.

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5.9 Project Execution Schedule (2/3)

- Schedule of preparation and approval of EIA, land acquisition procedure and approval by the governing authorities.
- Schedul of detailed design and construction work on site including procurement procedure and other relevant procedures.

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5.9 Project Execution Schedule (3/3)

- Based on the primary and secondary survey results, Construction method, Topography and Geological feature, Weather investigation including EIA and Land-acquisition procedure will s be totally examined.

  ⇩

  The most suitable and possible schedule will be proposed.

- The above proposed will be reported and explained to the counterparts and related agencies.

  ⇩

Additional survey will be conducted for deciding the most feasible schedule, based on the findings and comments from the counterparts and related agencies.

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5.10 Rough Estimation of Project Cost (1/2)

Project cost is generally estimated by;

- Rough estimation method
- Unit price / Contract unit price method
- Combined unit price method
- Unit price integration method

Among the above, the most suitable method will be adopted from the view of cost reduction.

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5.10 Rough Estimation of Project Cost (2/2)

[Followings shall be examined in the 2nd Survey in India]

- Latest construction methods and techniques according to Occupational Safety and Health Law.
- Leveling of the work load and work force injection in the whole construction period.
- Efficient sharing and usage of construction machines and equipment among working groups.

[Contents of the 3rd Follow up Work in Japan]

- Based on the examination of the above survey results, Estimation Summary Table with cost reduction will be proposed.

5.11 Finance (1/2)

- Primary objectives for research & interviews with C/P and related parties are designing the project to be financially viable and bankable through the following steps
  - ✓ To deepen our understandings of the current situation of power sector in Bihar (demand outlook, consumers profiles, etc.)
  - ✓ To collect information on the current overview of BSPHCL and subsidiaries (organizational profile, capital assets, planned capital investment, recent key performances & challenges, etc.)
  - ✓ To review the recent financial performance of BSPHCL and subsidiaries,
  - ✓ To clarify the project scheme in terms of the flow of funds and repayment resources,
  - ✓ To confirm the current situation of tariff regulation, actual tariff, revenue gap, and subsidies from government, etc.,

5.11 Finance (2/2)

- Based on the result of survey in India, follow-up work in Japan will take the following steps
  - ✓ To examine the viability of the project scheme drafted based on the survey in India, through discussion with JICA HQ, considering the Yen loan necessary procedures both in Japan and India
  - ✓ To consider the preliminary fund procurement scheme (defining presumable scale of Yen loan) based on approximate cost estimation, which is to be improved according to the ongoing technical survey & inputs, and consensus-building status with C/P
  - ✓ To consider the preliminary terms & conditions for Yen loan through discussion with JICA HQ (interest rate, repayment period, grace period, etc.)
  - ✓ To formulate a financial model for calculation of financial IRR and economic IRR for a quantitative evaluation of the project
  - ✓ To execute sensitivity analysis based on different assumptions (construction cost, fuel cost, O&M cost, tariff level, and technical conditions)

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5.12 Workshop with the Indian counterpart in Japan

The purpose of the Workshop is to deepen the understanding of ultra-supercritical-pressure coal-fired power plants, the environmental conservation system (regulation aspect) and the environmental facilities

- Investigative tour of USC thermal power stations
- Investigative tour of of the manufacturing plants of a heavy electric machinery manufacturers and an electric wire manufacturer

Reihoku I :SC Coal-fired TPS (1995-)
Reihoku II :USC Coal-fired TPS (2003-)

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5.13 Other Works

- Support for Formulation of Operation Effect Index
- Preparation of a Project Execution Schedule
- Formulation of Implementation Method
- Preparation of the Risk Control List
- Review of Safety Measures
- Support for preparation of DPR and it's approval

6. Conclusion

Items	By whom	By when
Confirmation with related organizations regarding the flow till L/A and various procedures (formulation of C/P)	BSPGCL	27/Mar.
Confirmation of documents necessary for procedures on each process (ex. FR, DPR)	BSPGCL	27/Mar.
Check on relocation of residents in the ash-dumping spot	Barauni TPS	25/Mar.
Collection of information regarding formulation of water allocation	To be checked	27/Mar.
Collection of information regarding fuel procurement	To be checked	25/Mar.
Check on construction status of No.8/9 and condition of planned site No.10	Barauni TPS	25/Mar.
Survey and review of destination for new transmission line connection	To be checked	25/Mar.
Discussion regarding date of workshop, contents of training, and selection points of trainer	BSPGCL	27/Mar.

➢ Presentation Document 2015.7.28

Welcome

Shri Bijendra Pd. Yadav

Hon'ble Energy & Finance Minister

Govt. of Bihar

Preparatory Survey for Construction of Barauni Thermal Power Station (660MW x 1) Project in Bihar

28th July 2015

JICA Study Team

Contents

1. Project Overview
2. Introduction of JICA Study Team
3. Policy of Work
4. Work Plan
5. Main Findings (as of July 2015)
6. Request to DOE and BSPGCL
7. Steps Forward for official applications
8. Expected Activities around State Government's Approval
9. Documents prepared by JICA team for this visit

1. Project Overview

➢ Purpose of the Project

The purpose of the Project is to construct a 660 MW-class coal-fired thermal power station (unit No. 10) with higher specifications than supercritical-pressure at the Barauni TPS in Bihar.

➢ Purpose of the Study

The purpose of the Study is to collect basic information and data necessary for examining the feasibility of the Project. The Study includes objectives, scope of works, project costs (cost analysis), implementation schedule and method, organizational arrangement, and environmental and social consideration etc.

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2. Introduction of the JICA Study Team

Name	Responsible for	Company
Michio Mihara	**Team Leader** / Thermal Power Generation Plan	Kyushu Electric Power Co., Inc
Yasunori Sakamoto	**Sub Team Leader** / Machinery A	
Yoshihumi Mitsunaga	Thermal Power Plant Construction Plan	
Masahiro Muku	Electric Power Civil Engineering	
Shinji Kuba	Power Transmission / Transformation Equipment A	Kyuden International Corporation
Shigeru Maeda	Power Transmission / Transformation Equipment B	Kyushu Electric Power Co., Inc
Kiyotaka Tsukimoto	Pwer System Analysis	
Takeshi Baba	Economic / Financial Analysis	Kyuden International Corporation

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2. Introduction of the JICA Study Team

Name	Responsible for	Company
Tomoyuki Tajima	Fuel Plan	Kyuden International Corporation
Shigeru Urakawa	Implementation Plan / Estimation	West Japan Engineering Consultants Inc.
Manabu Sakaguchi	Consideration to environment / society A	ERM Japan Ltd.
Yohei Suzuki	Consideration to environment / society B	
Motohisa Sakurai	Electrical Equipment	Electric Power Development Co.,Ltd.
Kazutaka Hata	Maintenance / Management System / Organization System A	
Toshiyuki Ota	Maintenance / Management System / Organization System B	
Kiyotaka Okuma	Machinery B / Operation Survey	Kyushu Electric Power Co., Inc

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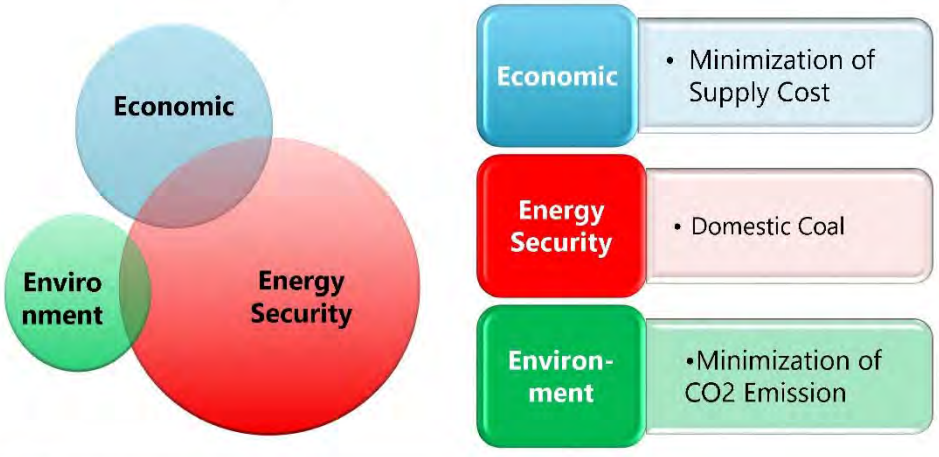
3. Policy of Work

Maximization of 3E (Economic, Energy Security, and Environment) should be considered for sustainable growth.



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4. Work Plan

Activities	Survey Items	Work Plan
1. Civil Engineering	- Raw Water System - Foundation of Machineries and Equipment - Ash Disposal System - Topographical and Geological Survey	-1st Field Survey -1st to 3rd Field Survey
2. Environmental and Social Consideration	- Scoping - ESIA Study	-1st Field Survey -2nd to 3rd Field Survey
3. Preliminary Design	- Design condition - Facilities that can be dismantle - Boiler, Turbine, Electrical Equipment , I & C, and BOP	-1st Field Survey -1st to 3rd Field Survey
4. Power Evacuation	- Power System Analysis - Route of 400 kV Transmission Lines - 400kV Switchyard	-1st to 3rd Field Survey

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4. Work Plan

Activities	Survey Items	Work Plan
6. Fuel Supply Pan	- Coal Requirement - Rail Infrastructure for Fuel Coal/Oil Transportation - Coal Ash Utilization	-1st Field Survey -1st to 3rd Field Survey
7. Business implementation and Administration	- Maintenance System, Management System, and Organization System	-1st to 3rd Field Survey
8. Rough Estimation of Project Cost	- Work Load and Work Force for Construction - Rough Estimation of Project Cost	-2nd Field Survey -3rd Field Survey
9. Finance	- Current overview of BSPHCL and Subsidiaries - Clarifying of the Project Scheme - Current Situation of Tariff Regulation, Actual Tariff, and Revenue Gap, etc.	-1st Field Survey -2nd Field Survey

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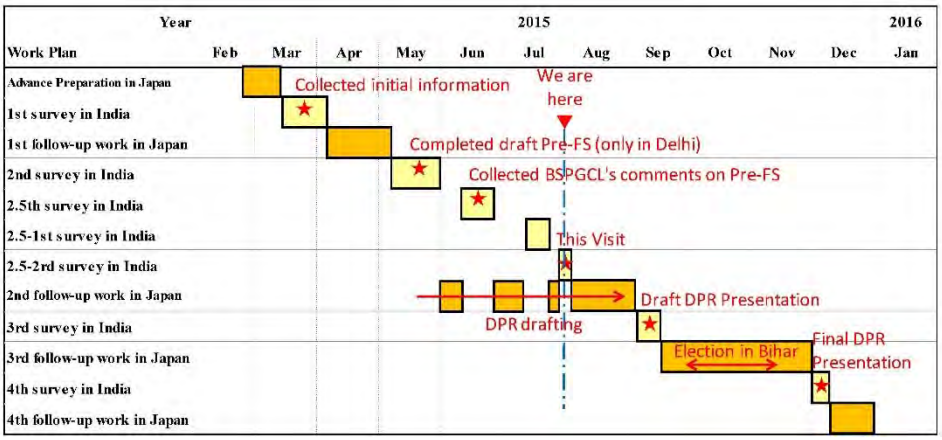
4. Work Plan



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5. Main Findings (as of July 2015)

5-1. Main features of the plant
5-2. General Plot Plan
5-3. Common Facilities with existing No.8/9
5-4. Ash Pond Strategy
5-5. Transmission Lines
5-6. Total Construction Cost and Expected Tariff
5-7. Expected Project Schedule

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5-1. Main Features for this plant

Particulars		Parameters
Gross Output		660 MW
Performance	Plant Total	42%
	Boiler	87.7%
	Turbine HeatRate	1791 kcal/kWh
Boiler	Type	Supercritical once-through
	Minimum Load	BMCR 40%
AQCS		ESP, FGD (Space Provision only)
Turbine	Type	Tandem Compound, 4 Cylinders (HP+IP+LP(A)+LP(B))
	Steam Condition	Pressure: 24.5 MPa Temperature: 593/593 ℃
	Rotating Speed	3000 rpm

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5-1. Main Features for this plant

Particulars		Parameters	
Generator	Voltage/Capacity	20 – 27 kV / 780 MVA	
	Power Factor	0.85 PF	
Generator Transformer		3 Nos. Single Phase 260 MVA, 20 – 27 kV 420 / √3 kV	
Switchyard		400 kV GIS	
Cooling System		Induced Draft Cooling Tower with river water make-up	
Chimney		275m, Single Flue type	Expected New Regulation
Environmental Emissions (at stack end)	Dust	50 mg/Nm^3	30 mg/Nm^3
	SOx	625 mg/Nm^3 (for worst)	100 mg/m^3
	NOx	485 mg/Nm^3 (for worst)	100 mg/m^3

Note : Above emissions can be controlled by installing necessary environmental facilities (i.e. FGD, SCR) if new and stricter regulation is enforced in future.

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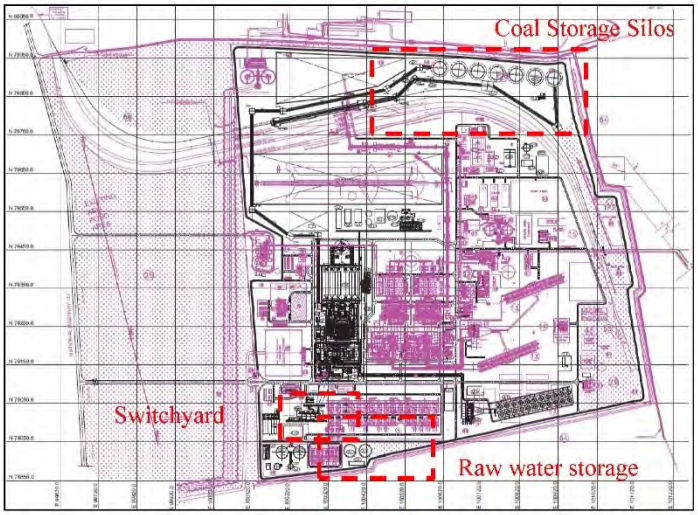
5-2. General Plot Plan



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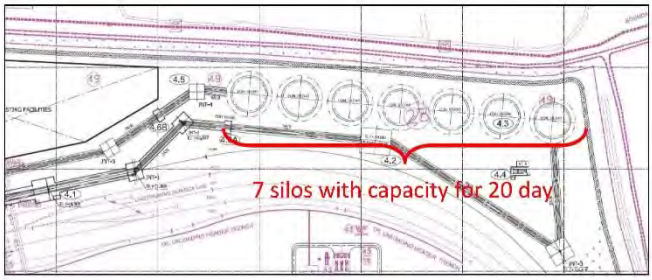
- Coal Storage Silos instead of open-air type
  - ✓ Silos will cause for expensive construction cost, if possible, alternative open-air type to be sought again for possibility.



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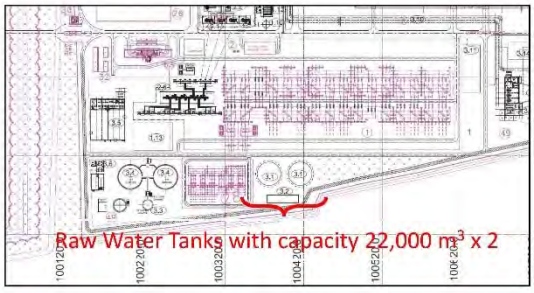
➢ Raw water storage capacity for 1 day consumption

✓ Same concept as No.8/9



22,000 (m^3)x 2 / 1,840 (m^3/h) (Water Requirement in Case 1 of WBD)
= 24 (hours)

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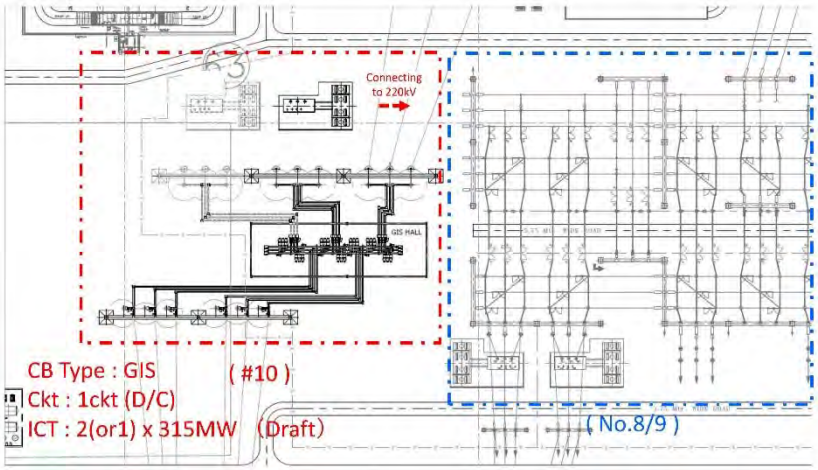
➢ Switchyard Arrangement using 400 kV GIS



BTPS Switchyard Layout (No.8/9 and 10) (Draft)

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5-3. Common Facilities with existing No.8/9

This project is independently planned with existing No.8/9, however, to reduce the constructive/operational cost, below items are to be examined at early stage.

Items	Problem	Recommendation and/or Solution
Water Intake Facility	Additional construction cost for dedicated intake well for No.10	Optimize intake pumps common between No.8/9 and 10.
Fuel Oil Supply Unit	Fewer opportunity to work only for every start-ups / shutdown, Dedicated unit to cost higher.	Common unit between No.8/9 and 10. (320 million INR down)
Common Auxiliary Steam System with No.8/9	Portable boiler to be requested for every start-ups	Common system with No.8/9 could supply steam mutually

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5-4. Ash Pond Strategy: Alternative analysis (No.8/9)

- During No.8/9 unit project development, a comprehensive search was carried out to identify alternate lands in the nearby area based on several criteria like distance from river, power plant, availability of contiguous land as single patch and sites with minimum R&R issues or government owned land.
- 5 Location were selected

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➢ Ash Pond Strategy: Alternative analysis (No.8/9)

Description of Area	Remarks
Site – A	• Bulk of the land was falling under double crop • Land mostly under private ownership. • Villagers not willing to give land for the project • DM, Begusarai suggested to find an alternative land
Site- B (Selected Site)	• **Identified about 500 acres – with 290 acres of govt land and remaining private land** • **To avoid R & R issues and also have more distance from Ganga (1.41 km) , it was decided to consider only – 290 acres of Govt land**
Site- C	• Site has bulk of land under private ownership and the people were not willing to give land • Two villages with approx population 300 lying within the area
Site- D	• ADM Begusarai, vide letter no. 2624 dated 28.10.2012, informed around 550 acres of land is under litigation • IOCL's pipeline is diagonally crossing the site
Site- E	• The land is around 25-30 feet below the ground level and is used to store flood water through ring bund when the water level of the river Ganges goes up. • The site is on other side of railway line and also NH and require crossing of both.

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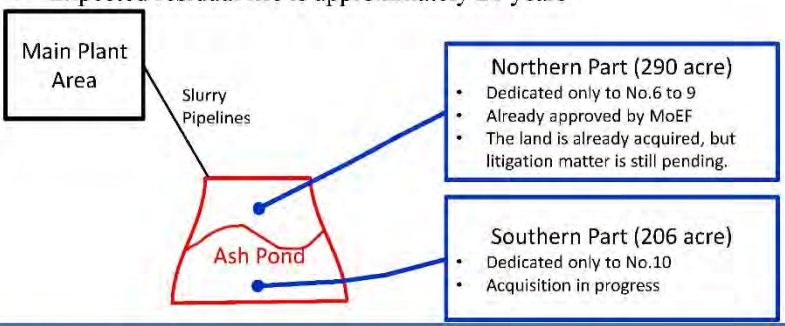
➢ Ash Pond Strategy for No.10

- Southern part of approved ash pond area was identified as ash pond for No.10 because;
  - ✓ The site was originally selected as part of proposed ash pond area for No.8/9
  - ✓ Land acquisition process has been already proceeded
  - ✓ There is no other alternative site available near the project site
  - ✓ Expected residual life is approximately 26 years



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➢ Expected Residual Life of Proposed Ash Pond

・Expected Ash Generation from No.6 to 10

	No.6/7	No.8/9	No.10
Output	110MW×2	250MW×2	660MW
Ash(t/year)	0.3×10^6	1.3×10^6	1.4×10^6
Ash(m^3/year)	0.4×10^6	1.8×10^6	1.9×10^6

・Expected Residual Life for Ash Pond

		Expected Residual Life (year)		
		Case1	Case2	Case3
Ash pond(acre)		290	496.5	206.5
Unit		No.6-10	No.6-10	No.10
ash utilization(%)	0	4	8	7
	20	5	9	8
	40	7	12	11
	60	10	16	15
	80	16	27	24
	100	41	70	62

➢ Calculation for Ash Generation (for reference)

・Coal consumption

$$= \frac{1}{\text{Thermal efficiency}} \times \frac{\text{Output} \times 3600}{\text{Gross Calorific Value}} \times \text{PLF} \times \text{Peak factor}$$

$$= \frac{100}{42} \times \frac{660 \times 3600}{3300 \times 4.18} \times \frac{90}{100} \times 1.07 \times 24 \times 365$$

$$= 3.5 \times 10^6 \text{ t/year}$$

・BA (weight) = Coal consumption × Ash ratio ×BA ratio

$$= 3.5 \times 10^6 \times \frac{44.6}{100} \times \frac{10}{100}$$

$$= 0.2 \times 10^6 \text{ t/year}$$

・FA (weight) = Coal consumption × Ash ratio × FA ratio

$$= 3.5 \times 10^6 \times \frac{44.6}{100} \times \frac{90}{100}$$

$$= 1.4 \times 10^6 \text{ t/year}$$

・Ash (volume) = BA (weight) × Bulk specific gravity(BA) +FA (weight) × Bulk specific gravity(FA)

$$= 0.2 \times 10^6 \times 1.39 + 1.4 \times 10^6 \times 1.25$$

$$= 1.9 \times 10^6 \text{ m}^3\text{/year}$$

- ➢ Thermal efficiency
  - ✓ No.6 - 9 : 34.4 %
  - ✓ No.10 : 42 %
- ➢ Coal Condition (Design coal)
  - ✓ Gross Calorific Value: 3,300 kcal/kg
  - ✓ Ash: 44.6%
- ➢ Ash condition
  - ✓ Fly ash : Bottom ash = 90 : 10
  - ✓ Bulk specific gravity(FA) = 1.25m^3/t
  - ✓ Bulk specific gravity(BA) = 1.39m^3/t

➢ Land Acquisition Status

206 acre = Private land (129.225 acre) + Government land (76.8875 acre)

Private land: 129.225 acre

- Land acquisition procedure completed
- Since the Government could not confirm the legal status of the ownership of the land (rent receipt), compensation has not been paid to these families.

Government land: 76.8875 acre

- 85 families were identified previously as cultivators
- Revenue and land reforms deportment of Patna District, the subject land was not declared as Private land
- Land transfer process has not been started.

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➢ Need to Challenge Following Constrains;

Litigation for 290 acre land for ash pond for No.6 to 9 units

- Since the land was declared as government, land was transferred from Patna District to BSPGCL.
- Local community claimed the land title on said land and this subject was raised to court.
- The case has not been resolved. Status Quo.
- The next hearing will be held on August 2015.

76 acre Government land

- If above case finds in favor of the plaintiff, 76 acre Government land might be reviewed as private land and land acquisition procedure shall be taken.

Flood issue

- Since the area is close to the River Ganga, flood risk shall be appropriately addressed otherwise MoEF will not approve the land use as ash pond.

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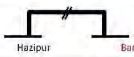
5-5. Transmission Lines

Potential connecting point on STU system

Connection Point	Result	Owner	Scheme	Observations
Hazipur (NEW)	○	STU		N-1 Condition: No transmission over loading Crossing a Ganga river: Not involve Transmision charge : Not involvePoten Other: Constructing delay
Samastipur (NEW)	–	STU		N-1 Condition: No transmission over loading Crossing a Ganga river: Not involve Transmision charge : Not involve Other: Not planned
Fatuha (NEW)	–	STU		N-1 Condition: No transmission over loading Crossing a Ganga river: Involve Transmision charge : Not involve Other: Place is unknown
Gaighat (NEW)	◎	STU		N-1 Condition: No transmission over loading Crossing a Ganga river: Involve Transmision charge : Not involve Other: Place is planning

- BSPTCL to determine the connecting point.
- BSPTCL to secure CEA approval on the connecting point
- Under preparation of detail root survey and cost estimation

5-6. Total Construction Cost and Expected Tariff

・Total Construction Cost

Total Construction Cost / BSPGCL Barauni #10 Expansion 1x660MW

Sl. Nr.	DESCRIPTION	Rs crores
1	CIVIL WORKS	1,010.00
i)	Power House; Boiler Area; Chimny; Switchyard & Transf, BTG Area	210.00
ii)	CW System, Water Treatment, Coal & Ash Handling System, Ash Dyke, BOP Area	570.00
iii)	Non-Plant Buildings and Misc. works incl. Inplant Roads & Drains etc.	80.00
iv)	Foundation Piling Works	150.00
2	STEAM GENERATOR ISLAND	1,088.40
3	TURBINE GENERATOR ISLAND	489.84
4	BALANCE OF PLANT	802.40
i)	Mechanical	580.00
ii)	Electrical	222.40
5	RAW WATER INTAKE PUMP HOUSE & INTAKE LINE	150.00
6	RAILWAY SIDING	0.00
7	INITIAL SPARES	178.36
8	TOTAL PLANT AND EQUIPMENT	2,709.00
9	TOTAL PLANT AND EQUIPMENT (INCLUDING CIVIL WORK) sum of item 1 & 8	3,719.00
10	FREIGHT (0%) & INSURANCE (0%) (ON BOP ITEM 4 ABOVE)	0.00
11	TAXES & DUTIES	560.00
12	ERECTION, TESTING & COMMISSIONING	260.00
	TOTAL DIRECT & INDIRECT COSTS sum of (item 8,9,10,11 & 12)	4,539.00

If silos are not applied,
ii) 570→290
Rs. 280 crores Saved

USD 1 = 62.4 INR

➢ Total Construction Cost and Expected Tariff

[Total project costs]

	Base case with coal silos	Without coal silos
Total construction costs	Rs. 4,539 Crores	Rs. 4,259 Crores (▲ 280)
Other project costs Physical contingency, overhead construction charges, preoperative expenses	Rs. 403 Crores	Rs. 390 Crores
IDC & finance charges	Rs. 79 Crores	Rs. 74 Crores
Total project costs	Rs. 5,021 Crores [Rs. 7.6 Crores/MW]	Rs. 4,723 Crores [Rs. 7.2 Crores/MW]

[Total levelised tariff]

Total levelized tariff	Rs. 3.75/kWh [Fix. 1.77, Var. 1.99]	Rs. 3.69/kWh [Fix. 1.70, Var. 1.99]
1st year tariff	Rs. 3.62/kWh [Fix. 1.77, Var. 1.99]	Rs. 3.55/kWh [Fix. 1.56, Var. 1.99]

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➢ Total Construction Cost and Expected Tariff

[Major Assumptions]

Particulars		Assumptions
Project capital structure	Total project cost	Rs. 5,021 Crores
	- Interest during construction(IDC)	Rs. 75 Crores
	Cost/MW	Rs. 7.6 Crores
	Debt Equity ratio	70:30
Technical operating parameters	Plant Load Factor	85%
	In-house electricity consumption	5.25%
	Gross heat rate	2,042 kcal/kWh [Converted from gross 42%]
	Gross calorific value of domestic coal	3,300 kcal/kg
	Specific consumption of coal	0.62 kg/kWh
Financial parameters	Interest rate	1.4%/year
	Payment period	25 years
Operational parameters	Domestic coal cost	Rs. 3,000/tonne
	O&M expenses	Rs. 19.54 lakh/MW [Escalation 6.29%/year]
	Depreciation	25 years for depreciation calculation as per CERC norms

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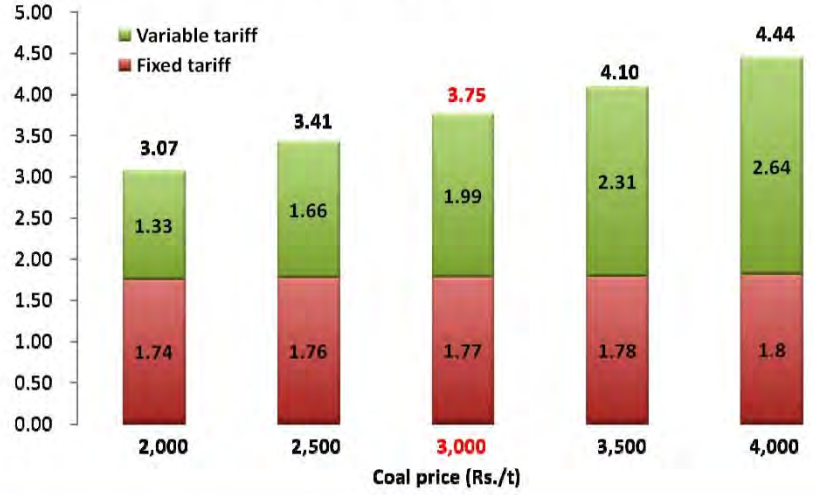
➢ Total Construction Cost and Expected Tariff

[Tariff sensitivity due to variation in coal price]



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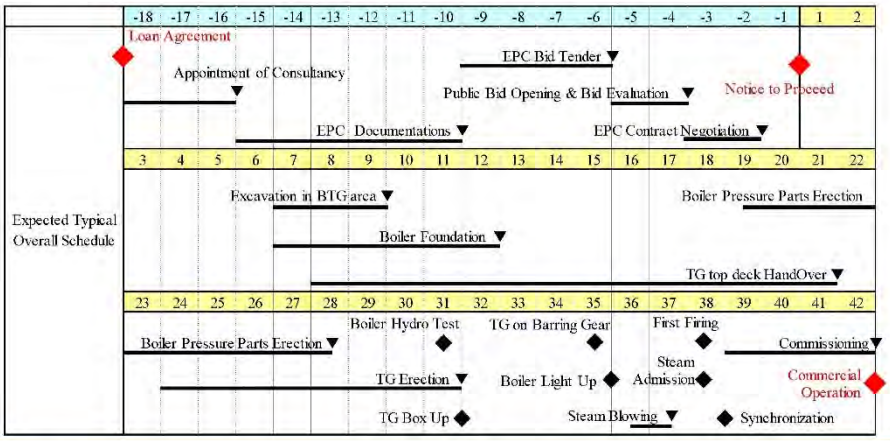
5-7. Expected Overall Schedule

Timeframe for construction at earliest case (typical) is;

- Bidding Stage (L/A to NTP) needs 18 months
- Construction Stage (NTP to COD) needs 42 months



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6. Request to DOE and BSPGCL

By 10th August, 2015

- Approval of Pre-Appraisal Report and Feasibility Report by the State Government
- Application of Coal Linkage, Water Allocation, Civil Aviation for Chimney
- Application of TOR of EIA

Latest By Mid-September, 2015

- Get Approval of TOR of EIA (this will be required by the end of August 2015)

Latest By the End of February, 2016

- Get Approvals of Water Allocation
- Get Approvals of Coal Linkage
- Get Approval of Civil Aviation for Chimney (275m)

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7. Steps Forward for official applications

Particulars	Authorities	Objective	Necessary/Support Documents
EIA	MoEF	Issue TOR	Form-1
Water Intake (additional 21 cusec)	WRD/CWC	Get Approval	Water Balance Diagrams
Chimney Height (275m)	Aviation Authorities	Get Approval	Height and Location Drawings
Coal Supply	MoC MoP (CEA)	Coal Linkage	Required Volume Calculation
Archaeological Check (if necessary)			

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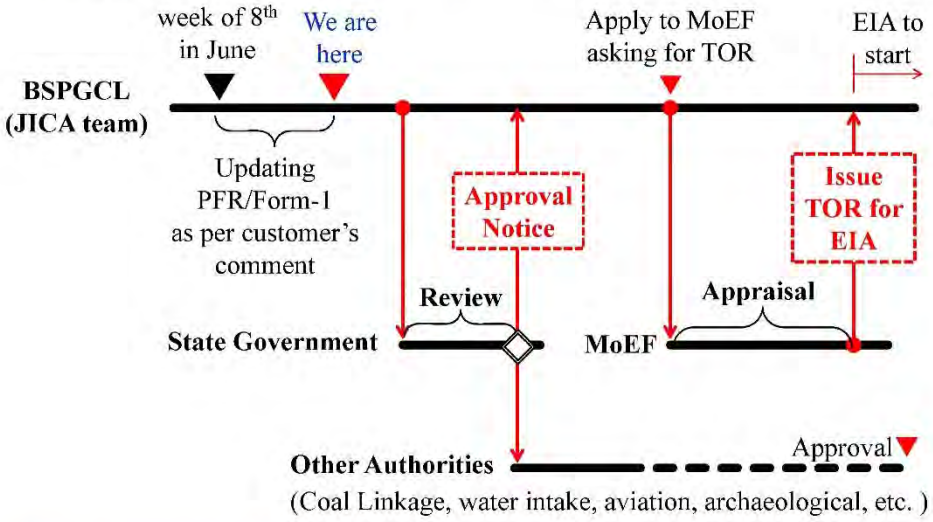
8. Expected Activities around State Government's Approval



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9. Documents prepared by JICA team for this visit

- For MoEF
  (1) Pre-Feasibility Report (small correction added from the one conveyed by Team to BSPGCL last visit. This contains necessary and enough information to apply to MoEF)
  (2) Form-1 (ditto)
- For State Government and internal promotion
  (3) Feasibility Report (further information added based on above PFR)
  (4) Cash Flow Expectation
  (5) Total Construction Cost Break-ups
  (6) Fuel Oil unit Review for possibility of common system with No.8/9
  (7) Coal Consumption Calculation, Parameters
- For WRD/CWC
  (8) Water Balance Diagram (Case 1 to 4; i.e. Minimum to Maximum)
- For Aviation Authority
  (9) Chimney Drawing, General Plot Plan

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Thank you for your kind attention!

Appendix VIII

Minutes of meetings

- Minutes of Meeting(1st field investigation)

Minutes of Meeting

For

The 1st Field Survey

On

The Preparatory Survey
on the Project for Construction
Of
Barauni Supercritical Coal Fired
Thermal Power Station
In
Republic of India

Agreed Upon Between

Bihar State Power Generation Company Limited

And

JICA Study Team

30th March, 2015

坂本康典

Mr. Yasunori Sakamoto	Mr. Manish Kumar Verma
Sub Project Manager	Managing Director
JICA Study Team	Bihar State Power Generation Company
Kyushu Electric Power Co., Inc	Limited

Bihar State Power Generation Company Limited (hereinafter referred to as "BSPGCL") including Barauni Thermal Power Station(hereinafter referred to as "BTPS") and JICA Study Team for the project for construction of Barauni Supercritical coal fired thermal power station in Republic of India (hereinafter referred to as "Team") had series of technical discussion to form mutual understanding on the scope of the project and pending items to be fulfilled by the both parties before the commencement of second field survey. Both parties agreed to record the following points as a conclusion of the discussions.

1. Agreed items between BSPGCL/BTPS and the Team

The details of agreed components at the time of the first field survey was clarified as follows :

(1) Steam Condition of the Generation Facilities

- The Team recommended to BSPGCL and BTPS the steam condition of 593/593 degree C and 24.5 MPa as a base case to design generation facilities, taking reliability and recent track record in India into consideration.
- BSPGCL agreed that the Team shall go into the preparation of feasibility report to have the approval of Bihar state government but BSPGCL's support to the Team are limited until the end of June because of the upcoming commissioning of Unit No.7 at BTPS.

(2) Coal Properties

- BSPGCL explained to the Team that coal allocation has been established for Barauni extension of 660 MW.
- BTPS and the Team agreed to use coal properties necessary for the design of the generation facilities out of most likely properties as shown in Attachment-1, coming from the design of Units No.8 and 9.

(3) Workshop related to supercritical technologies

- The Team explained that the workshop hosted by the Team shall be held in Japan around the middle of June, 2015 as shown in Attachment 2 and 3.
- The workshop is postponed by a request of BSPGCL because of the upcoming commissioning of Unit No.7 at BTPS (now under R&M work, the commercial operation date of Unit No.7 is scheduled in June, 2015).

(4) Topographical & Contour Survey and Geotechnical Investigation

- The Team recommended the topographical & contour survey and geotechnical investigation at the proposed raw water intake, powerhouse and ash pond site in order to design the civil structures.
- BTPS agreed and shall provide the existing topographic maps in AutoCAD format, reference point data including control points and benchmarks and land boundary information to the Team and a subcontractor (Survey Company).

(5) Environmental Monitoring

- The Team shall plan to conduct Environmental Monitoring necessary for EIA study.
- BTPS agreed to support the Team to conduct Environmental Monitoring from 7th April 2015.

(6) Form-1

- The Team explained to BSPGCL about "Form-1" which is part of EIA Scoping process required by MoEF.
- BSGPCL agreed to review/ update/ modify the draft Form-1 prepared by the Team and submit to MoEF in a timely manner.

(7) Stakeholder Meeting

- The Team explained to BSPGCL about JICA guideline which requests the project proponent to conduct a stakeholder meeting at EIA scoping stage.
- BSPGCL agreed to discuss with the Team how and when the stakeholder meeting shall be conducted and provide necessary support. The stakeholder meeting for scoping stage is tentatively planned during May 2015 when the EIA scoping is expected to be conducted by MoEF.

2. Information about Land Acquisition status

- BTPS explained that payment for land acquisition for a total area of 500.26 acre which will be used as for ash pond and ash pipeline has already paid to respective governments (496.51 acre for Patna district and 3.75 acre for Begusarai district). The land title has been officially transferred to BSPGCL except some portion of private lands (76.8876 acre) in Patna district.
- The timing of completion of all land acquisition for ash pond is depending on Patna district, and order from Supreme Court of India in the matter of litigation for the subjected 290 acres land for ash pond.

3. Answers for requested questionnaire from the Team

The answers for requested questionnaire in advance at the time of the first field survey are collected as shown in Attachment-4.

Concluded

ATTACHEMENT-1

Coal properties necessary for the design of 660MW generation facilities

These properties as below is identical to and coming from the "Detailed Project Report for 2x250MW Coal Based Extn, TPS at Barauni Dist. Begusarai in Bihar" (Units Nos. 8 and 9). This information shall be used for the design of the generation facilities of 660 MW.

Item		Unit	Design	Worst	Remarks
Assumed Gross Calorific Value		kcal/kg	3,300	3,100	As received
Technical Analysis	Fixed carbon	%	29.7	29.4	As received
	Volatile matter	%	17.7	20.6	
	Ash	%	44.6	40.0	
	Total Combined Moisture	%	8.0	10.0	
Element Analysis	Carbon	%	34.69	34.66	
	Hydrogen	%	2.43	2.26	
	Sulphur	%	0.3	0.00	
	Oxygen	%	9.27	12.33	
	Nitrogen	%	0.71	0.75	

ATTACHMENT-2

Tentative Workshop In Japan Schedule : From 9th June to 18th June（10days）

Date		Time	Contents	Workshop place
9-Jun	Tue	19:35(8-June)-7:10 08:00-09:30 13:15-13:20 13:30-15:00 15:10-15:25	・Travel from India to Narita(Japan)[JL749] ・Move to the Hotel by car (1.5 hours) （Lunch） ・Move to the meeting place by walk (5 minutes) **・Opening Meeting** ・Move to the Hotel in Tokyo by car (1.5 minutes)	JICA office
10-Jun	Wed	08:30-09:50 10:00-12:00 13:00-14:30 14:40-16:00	・Move to the workshop place by car (1.3 hours) **・Investigative tour/learning session In Isogo Coal-fired Thermal Power Station(USC)** （Lunch） **・Opinion exchanging/comparison and input session in the same Thermal Power Station** ・Move to the Hotel in Tokyo by car (1.3 hours)	Isogo Coal-fired Thermal Power Station (J-POWER/Electric Power Development Co.,LTD.)
11-Jun	Thu	09:00-10:00 10:00-12:00 13:00-14:30 14:40-15:50	・Move to the workshop place by car (1 hour) **・Investigative tour/learning session at Turbine and Generator manufacturing plants in Keihin** （Lunch） **・Opinion exchanging/comparison and input session and explanetion on GIS in the same manufactureing Plant** ・Move to the Hotel in Tokyo by car (1 hours)	Turbine and Generator manufacturing plants in Keihin (Toshiba Corporation)
12-Jun	Fri	08:30-10:30 10:30-12:00 13:00-15:00 15:00-17:00	・Move to the workshop place by cars (1 hour) **・Investigative tour/learning session at electric wire manufacturing plants in Numazu** （Lunch） **・Opinion exchanging/comparison and input session in the same manufactureing Plant** ・Move to the Hotel in Tokyo by car (1.8 hours)	Electric wire manufacturing plants in Numazu (Viacas Corporation)
13-Jun	Sat	Holiday		
14-Jun	Sun	09:10-10:00 10:30-12:30 12:40-13:40 13:40-14:10	・ Move to Haneda air port by cars (50 minutes) ・ Travel to Fukuoka air port by air plane (2 hours) （Lunch） ・ Move to the Hotel in Fukuoka by subway (30 minutes)	
15-Jun	Mon	9:10-11:30 13:00-15:30 15:30-17:00 17:00-17:20	・Move to the workshop place by cars (2.3 hours) （Lunch） **・Investigative tour/learning session at boiler manufacturing plants in Nagasaki** **・Opinion exchanging/comparison and input session in the same manufactureing Plant** ・Move to the Hotel in Nagasaki by car (20 minutes)	Boiler manufacturing plants in Nagasaki (Mitsubishi Hitachi Power Systems, Ltd.)
16-Jun	Tue	10:00-12:00 13:00-14:30 14:30-16:00 16:00-18:30	・Move to the workshop place by ferry etc. (2 hours) （Lunch） **・Investigative tour/learning session of Reihoku Coal-fired Thermal Power Station(USC)** **・Opinion exchanging/comparison and input session in the same Thermal Power Station** ・Move to the Hotel in Fukuoka by air plane and car (2.5 hours)	Reihoku Coal-fired Thermal Power Station (Kyushu Electoric Power Co.,Inc.)
17-Jun	Wed	09:00-09:30 10:30-12:30 12:40-13:40 13:40-14:30 14:40-16:20 16:30-16:40	・Move to Fukuoka air port by subway (30 minutes) **・Travel to Haneda air port by air plane (2 hours)** （Lunch） **・Move to the workshop place by cars (50 minutes)** **・Wrap up Meeting** ・Move to the Hotel in Walk (5 minutes)	JICA office
18-Jun	Thu	09:00-10:30 11:35-18:20	・Move to the Narita airport by car (1.5 hours) ・Travel from Narita(Japan) to India[JL749]	

ATTACHMENT-3

List of Participants for Workshop related to Supercritical Technology in Japan

	Name	Belong to	Title
1	Mr. Manish Kumar Verma	BSPGCL	Managing Director
2	Mr.		
3	Mr.		
4	Mr.		
5	Mr.		
6	Mr.		
7	Mr.		
8	Mr.		

- Minutes of Meeting(2.5th field investigation)

Minutes of Meeting

For

The 2nd Field Survey

On

The Preparatory Survey
for the Project for Construction
Of
Barauni Supercritical Coal Fired
Thermal Power Station
In
Republic of India

Agreed Upon Between

Bihar State Power Generation Company, Limited

And

JICA Study Team

12th June, 2015

坂本康典

Mr. Yasunori Sakamoto	Mr. Manish Kumar Verma
Assistant Manager	Managing Director
JICA Study Team	Bihar State Power Generation Company
Kyushu Electric Power Co., Inc	Limited

Bihar State Power Generation Company Limited (hereinafter referred to as "BSPGCL") and JICA Study Team for the project of construction of Barauni Supercritical Coal Fired Thermal Power Station in Bihar State of Republic of India (hereinafter referred to as "Team") had a technical discussion on description and schedule of drafting and submission of Feasibility Report and Form 1 (hereinafter referred to as "Documents"). Both parties agreed to record the following points as a conclusion for discussions.

1. Agreed items between BSPGCL and the Team

   The details of agreed components at the time of the second field survey were clarified as follows:

(1) Reviewing of the Documents by BSPGCL drafted by Team

(2) Explanation of the Documents to State Government by BSPGCL, in case of no major modifications

(3) Submission of the Documents to MoEF by BSPGCL

(4) Preparation of TOR by BSPGCL with support from JICA study team

Concluded

- Minutes of Meeting(2.5th-2 field investigation)

Minutes of Meeting

For

The 2.5-2nd Field Survey

On

The Preparatory Survey
for the Project for Construction
Of
Barauni Supercritical Coal Fired
Thermal Power Station
In
Republic of India

Agreed Upon Between

Bihar State Power Generation Company, Limited

And

JICA Study Team

29th July, 2015

坂本康典

Mr. Yasunori Sakamoto	Mr. Manish Kumar Verma
Sub Project Manager	Managing Director
JICA Study Team	Bihar State Power Generation Company
Kyushu Electric Power Co., Inc	Limited

Bihar State Power Generation Company Limited (hereinafter referred to as "BSPGCL") and JICA Study Team for the project of construction of Barauni Supercritical Coal Fired Thermal Power Station in Bihar State of Republic of India (hereinafter referred to as "Team") had a discussion regarding expected schedule for submission of Approval documents to State Government and BSPGCL. Both parties agreed to record the following points as a conclusion for discussions.

1. Agreed items between BSPGCL and the Team
   The details of agreed components at the time of the 2.5-2nd field survey were clarified as follows:

(1) Reviewing of Feasibility report by BSPGCL drafted by Team

(2) Get Approval of Feasibility Report to State Government by BSPGCL by 10th August, 2015

(3) Applications for Coal Linkage, Water Allocation, and Civil Aviation for Chimney by 10th August, 2015

(4) Application for TOR of EIA with Pre-Feasibility Report and Form-1 by 10th August, 2015, and get approval of TOR of EIA by Mid-September, 2015

(5) Get Approvals of Coal Linkage, Water Allocation, and Civil Aviation for Chimney by the End of February, 2016

Concluded

- Minutes of Meeting(3rd field investigation)

Minutes of Meeting

For

The 3rd Field Survey

On

The Preparatory Survey
for the Project for Construction
Of
Barauni Supercritical Coal Fired
Thermal Power Station
In
Republic of India

Agreed Upon Between

Bihar State Power Generation Company, Limited

And

JICA Study Team

22nd Dec, 2015

23.12.15

三原 道生

Mr. Michio Mihara
JICA Study Team leader
Deputy General Manager & Group Manager
Kyushu Electric Power Co., Inc

Mr. Manish Kumar Verma
Managing Director
Bihar State Power Generation Company
Limited

Bihar State Power Generation Company Limited (hereinafter referred to as "BSPGCL") and JICA Study Team for the project of construction of Barauni Supercritical Coal Fired Thermal Power Station in Bihar State of Republic of India (hereinafter referred to as "Team") had an intensive discussion about some issues taken up by BSPGCL on 22rd December 2015. Both parties agreed to record the following points as a conclusion for discussions.

1. Items to be solved for getting Approval of Feasibility Report from State Government

(1) High expected tariff prepared by the Team

(2) The land for ash dyke (common to that of No.6 to 9) is getting difficult to acquire under the current circumstance.

(3) The layout planned for No.10 may be getting difficult due to additional land for No.8/9 as per construction progress.

2. Agreed items between BSPGCL and the Team

(1) The Team will re-examine the produced tariff and inform BSPGCL by 10th January, 2016.

(2) BSPGCL will send a letter to JICA whether BSPGCL can make the project go forward or not by 15th January 2016, after analyzing the hearing for ash dyke at the Supreme Court which scheduled on 8th January 2016 and considering the tariff examination released by the Team.

Concluded

Kyushu Electric Power Co.,INC.

Attendance List

Date : 22nd Decenber

Subject : Meeting on the Study of the Preparation for Construction on Barauni Supercritical Coal-fired Thermal Power Station (660MW x1) in Bihar

No.	Name	Organization	Title
1	Pratyaya Amrit	Bihar State Power Holding Co.Ltd.	Chairman-cum-Managing Director
2	Manish Kumar verma	Bihar State Power Generation Co.Ltd.	Managing Director
3	Keshav Ranjan Parsad	BSPHCL	OSD To CMD
4	Manoj Kumar	BSPGCL	OSD
5	Rajan Prasad	BSPGCL	Chief Engineer, Oroject & Design
6	Suresh Prasad Singh	BSPGCL	Chief Engineer, Civil
7	Arvind kumar	BSPGCL	DGM (Finande)
8	Khagesh Choudhary	BSPGCL	EEE, MD Cell
9	Rajeev Kumar Singh	BSPGCL	EEE, Projedt & Design
10	Shankar Kumar	BSPGCL	ESE, Project & Design
11	Momoko Wada	JICA	Country Officer
12	Shashi Khanna	JICA India	Lead Development Specialist
13	Michio Mihara	JICA Study Team	Team Leader
14	Yasunori Sakamoto	JICA Study Team	Team Sub Leader
15	Yoshifumi Mitsunaga	JICA Study Team	
16	Manabu Sakaguchi	JICA Study Team	
17	Shigeru Maeda	JICA Study Team	
18	Kiyotaka Okuma	JICA Study Team	
19	Shigeru Urakawa	JICA Study Team	

- Overall plan

Date and time:		March 25, 2015 16:30 - 16:50
Place:		BSPGCL
Participants:	BSPGCL	Mr. Manish Kumar Verma (Managing Director) Mr. Khagesh Chaudhary (Electrical Executive Engineer)
	Survey team	Mr. Mihara, Mr. Mitsunaga

Discussion contents

Explanations were conducted and consensus was formed concerning the main unit steam conditions (main steam temperature, reheated steam temperature, and pressure) as the basic planning conditions for the thermal power station, and hearing was conducted concerning participants for workshop to be held in Japan in May.

- Target steam conditions for power station design
  - At the kick-off meeting held on March 19, 2015 (Thursday), MD requested explanation based on comparison when setting the ultra-supercritical steam conditions for the Project.
  - In selecting the power station specifications, explanation was given based on a supercritical/ultra-supercritical comparison sheet and the target design steam conditions (593/593 °C/24.5MPa) were more or less approved.
- Workshop and observation program in Japan
  - Outline explanation was given in the kick-off meeting held on March 19, 2015 (Thursday). The survey team requested that around five (5) participants be assembled for implementation around May, however, because the commissioning of R&M/LE works for Units No. 6/7 will be finalized in June, the local side responded that it will be difficult to dispatch personnel to Japan at this time and it requested that the period be deferred. Accordingly, the team took the matter home for further consideration.
- Future approach
  - JICA and the survey team want to refer to L/A signed in March 2016, however, this schedule is very tight for BSPGCL and it has very limited numbers of personnel who it can deploy. Moreover, because BSPGCL has no operating units that are earning revenue, it wants to concentrate on preparing for the start of operation of Units No. 6/7 (R&M/LE works in progress) and making up for delays in construction of Units No. 8/9. Therefore, it is OK to advance examination for the Project, but BSPGCL said it cannot conduct its procedures for it.
  - Because state government elections are scheduled for November, there is extremely strong pressure from the state government to conduct the commissioning of Units No. 6/7 following R&M/LE works and to speed up construction of Units No. 8/9.

・In light of revisions to the OECD guidelines and developments in the international situation, the survey team needs to form the Project this year. It proposed implementation with reduced burden on BSPGCL officials based on local subcontracting, however, no consensus was reached and it had to take the matter home for further examination.

Date and time:		July 28, 2015 13:00 - 16:00
Place:		BSPGCL
Participants:	MoP BSPHCL BSPGCL	Mr. Bijendra Pd. Yadav (Minister, MoP) Mr. Ravi Mittal (Finance Department, MoP) Mr. Pratyaya Amrit (Chairman, BSPHCL) Mr. Manish Kumar Verma (Managing Director, BSPGCL)
	JICA	Mr. Furukawa, Ms. Shashi Khanna
	Survey team	Mr. Mihara, Mr. Mitsunaga, Mr. Sakamoto, Mr. Baba, Mr. Tajima, Mr. Urakawa, Mr. Suzuki, Mr. Okuma

Discussion contents

Concerning the Feasibility Study Report (FSR) scheduled to receive the state government's approval, discussions were conducted on tariffs, water intake equipment and the ash pond.

- Tariffs
  - The secretary of the Finance Department has instructed that the tariffs be calculated while taking hedging of exchange risks into account. It was agreed to have BSPGCL and GoB scrutinize the results.

- Land for water intake facilities
  - It was originally planned to construct the grit chamber and water intake equipment for Unit No. 10 next to Units No. 6-9, however, in order to avoid acquiring new land, the plans were changed to include sharing of some equipment between Units No. 6-10 and so on. It was agreed to construct the water intake equipment for Units No. 6-10 within the proposed site for Units No. 6-9 (251m x 107m).

- Land for ash pond
  - It was originally planned to acquire 210 acres of land for the ash pond for Unit No. 10 (this was discussed and agreed with BSPGCL on the secretariat level), however, it was confirmed that the 290 acres of land that MoEF has approved for Units No. 8/9 will be shared.

- Environmental authorization procedures
  - BSPGCL and the survey team reached agreement on the following matters:
    - ✓ To review FSR submitted by the survey team
    - ✓ To obtain the state government's approval for FSR by August 10
    - ✓ To submit applications for water intake, stack permission and coal supply by August 10
    - ✓ To submit application for EIA TOR, Pre-FSR and Form 1 by August 10 and obtain approval by the middle of September.
    - ✓ To submit applications for water intake and stacks and obtain approval for the coal supply application by the end of February.

Date and time:		December 22 2015 11:10 - 12:30
Place:		BSPGCL
Participants:	BSPHCL BSPGCL	Mr. Pratyaya Amrit (CMD, BSPHCL) Mr. Manish Kumar Verma (MD, BSPGCL) Mr. Keshav R Prasad (OSD) Mr. Monoj Komar (OSD)
	JICA	Ms.Wada, Ms. Shashi Khanna
	Survey team	Mr. Mihara, Mr. Mitsunaga, Mr. Sakamoto, Mr. Maeda, Mr. Urakawa, Mr. Sakaguchi, Mr. Okuma

Discussion contents

The Project was suspended during the Bihar State elections that were held from September to November 2015, however, discussions were conducted concerning the future approach.

- Requests from JICA to BSPGCL
  - ・JICA side requested BSPGCL to complete the following items by December 31.
    - ✓ Approval of FSR by GoB
    - ✓ Ongoing environmental applications and submission to MoEF of PFR for issue of EIA TOR, Form-1 and Draft TOR.
    - ✓ Applications for coal, water intake and stacks
  - ・For BSPGCL, it said that the deadline of December 31 is not realistic and indicated that even if the deadline were changed, it would be very difficult to meet because of issues in the receipt of FSR approval.
- Issues concerning approval of FSR (CMD, MD)
  - ・BSPGCL submitted FSR to GoB in August, however, the following problems were pointed out.
    - ✓ Compared to the tariff of INR 4.2 /kWh targeted by BSPGCL, the Project tariff (first year) of INR 4.66 /kWh[1] is high. Moreover, INR 3,000/ton is sued as the price of coal in this, however, in the case where the coal price is INR 3,500/ton or the Project falls behind schedule, the tariff will become even higher as a result of higher interest during construction and so on.
    - ✓ Acquisition may even prove difficult for the 290 acre ash pond initially envisaged for Units No. 6-9 (under review in the high court).
    - ✓ Because land for the plant area is restricted, it is possible that the land planned for use in Unit No. 10 will be added to that for Units No. 8/9; hence there is a possibility that there

[1] INR 4.66/kWh is the scrutinized figure that was stated in DPR sent from the survey team to BSPGCL on December 11, while FSR tariff that was submitted on August 14 was INR4.93 /kWh (initial year). In consideration of the state undersecretary of finance's comments on July 28 that realistic figures with some room to spare should be adopted in order to avert cost overrun and so on later on, an extremely conservative figure was adopted and agreed with BSPGCL in advance.

will not be enough land for Unit No. 10.

- Ms. Wada explained that issues concerning tariffs can be examined but that the JICA side can do nothing about the land issues.

- According to the CMD, since land acquisition is the realm of BSPGCL, it will be examined by BSPGCL in light of the court's verdict. However, depending on the court's findings, it will decide whether or not to cancel the Project.

➢ Other matters

- Since BSPGCL mentioned the possibility of the project being cancelled, Ms. Wada touched on the timing of the discovery of the ash pond site acquisition issue (pointing out that the Minister of MoP was positive in the discussions of July 28, 2015) upon stating that a lot of money has already been invested in the Project and that it is necessary to give explanations to the Government of Japan.

- The CMD said that it won the case in the high court in August but that an appeal had subsequently been lodged. He said that the problem had arisen in the past month and that, since the decision would be made in the high court, neither BSPGCL nor JICA held any responsibility.

- DPR prepared by the survey team was submitted to the MD and related persons after the meeting. However, DPR said that it couldn't make a review until the abovementioned issue was addressed.

➢ Future schedule

- January 8: BSPGCL will appear in court for a hearing into the ash pond land acquisition.
- January 10: The survey team will submit a revised tariff plan to BSPGCL.
- January 15: On receiving the above land and tariff findings, BSPGCL will send a letter to JICA concerning whether or not to proceed with the Project.

➢ Fuel Plan

Date and time:		March 19, 2015 (Friday) 11:00 - 17:00
Place:		BSPGCL
Participants	BSPGCL	Mr. R.K. Tiwari (Super Intending Engineer) Mr. R.B.Singh (Executive Engineer, Electrical) Mr. Rajeev Singh(2x250 MW Extension)
	Survey Team	Mr. Nakayama
Discussion contents		

The BSPGCL fuel planning manager was asked about the current situation of coal linkage (coal block allocation, etc.) in BTPS.

➢ Coal linkage to Units No. 8/9

・Since allocation from the originally planned Urma Pahari Tolacoal block development were delayed and eventually cancelled, a new application has been submitted for supply from five (5) other coal blocks.

・The GOI currently allocates 43 coal blocks to government-affiliated enterprise PSUs (including BSPGCL, NTPC, etc.), while BSPGCL has applied for 5 coal blocks corresponding to its need, and it appears that 1 (or 2) of these will be allocated from MoC (Assessment is currently being conducted by MoC and its response is awaited).

➢ Outline of secured coal linkage

Situation	Target Units	Supply source	Supply quantity	Quantity
Already secured	No.6/7	Eastern Coal Field Ltd.	1.1 million tons/year	Grade 4 (GCV 6,100-6,400 kcal/kg)
	No.8/9	Eastern Coal Field Ltd.	1.54 million tons/year (tapering coal linkage)	Grade 10 (GCV 4,300-4,600 kcal/kg)
Additionally applied for	No.8/9		2.327 million tons/year 58.18 million tons (25 years) 69.81 million tons (30 years) 81.45 million tons (35 years)	

➢ Caution points when submitting application for coal

・When submitting applications for coal blocks, the intended generating facilities (for example, BTPS Units No. 8/9, etc.) must be identified, and coal cannot be diverted to other facilities.

・The allocated coal blocks are not necessarily already developed; they also include blocks that are currently under development or must be developed from now on (including blocks that haven't been developed at all). The entities that receive allocation must implement development themselves (or

by employing contractors).

- Before submitting an application for allocation of a coal block, it is necessary to obtain approval from the state government and then from GoI. Accordingly, when applying for application of a coal block for Unit No. 10, it is first necessary to obtain these approvals.
- Unlike PSUs, allocation of coal blocks to private enterprises is done by auction, and auction is currently in progress. (Following a series of scandals surrounding coal blocks, the Supreme Court cancelled almost all coal block allocations in September 2014, and since then allocations have been decided by auction).

Date and time:		May 15, 2015 (Friday) 11:00 - 11:50
Place:		MoC
Participants	MoC	Mr. S.K. Shahi (Director, Coal Block Allotment)
	Survey Team	Mr. Mihara, Mr. Tajima

Discussion contents

Information was gathered and opinions were exchanged with MoC concerning fuel planning.

- Coal procurement method
  - There are 2 methods: Fuel purchase (FSA with CIL group: Coal Linkage) or own company mining (Coal Block Allocation)
- Coal Block Allocation
  - Consulting with CEA, coal block allocations are judged by MoC in light of the progress of construction of applicants power stations. As a benchmark, priority is given to power stations that will start operation by March 2017. So far tender/allocation has been completed for 67 coal blocks.
  - Last time (in February - March 2016), allocation of 43 coal blocks for government-affiliated enterprises has been publicly announced, and received 107 applications. The next announcement is now being discussed.
  - Allocations are made according to the required coal quantities and the distances between coal block and power plant.
  - 30 % minimum equity injection rule were deleted from the allocation regulations issued in February 2015.
- Coal block development
  - Mining licenses are granted by the state government where the mine is located to the company that has been allocated the mining rights.
  - The company allocated of mining rights can outsource mining work. In such cases, usually private sector enterprises undertake such mining work (in business planning terms, the coal corporation group does not undertake mining work under contract).
  - Private sector companies are prohibited from becoming stockholders in companies that hold mining rights.
  - In cases where public corporations outsource mining, it is necessary to conduct an open tender and such tender procedure may take a minimum of 6 months (1 year or more if the company is not accustomed to the procedure).
- Other points
  - In past regulations, the coal produced in each coal block and each power generating unit were identified and linked, however, more flexible administration became possible following last year's revision. For example, utilize the coal mined from a particular coal block, the Badam coal block, for any of the other

plants of such same owner, e.g. Unit No. 10 will be approved in case no objection has been provided by MoC during 30 business-day period after prior written application for such utilization (based on Rule 20 of the Coal Mines (Special Provisions) Rules, 2014).

・Moreover, the Indian Coal Mines Act (2015) Article 20 (1)/(2) and Article 31(2)(w)/(x) stipulates about swapping between owners. Concerning coal linkage too, it has become possible to swap between government-affiliated power generating companies providing that the rationale is explained.

Date and time:		May 26, 2015 (Tuesday) 11:00 - 12:30
Place:		Coal India Limited
Participants	CIL	Mr. G.K. Vashishtha (General Manager, Sales & Marketing)
	Survey Team	Mr. Tajima

Discussion contents

Information was gathered and opinions were exchanged with CIL concerning fuel planning.

- Coal linkage system
  - ・Concerning implementation of the new coal linkage system, discussions are being conducted among several ministries and government offices to finalize the reform targeting the end of 2015-2016. The secretariat is MoC additional secretary.
  - ・Concerning the new coal linkage system, firstly the mines to be allocated to respective sector (power, steel, etc.) will be decided, and then the coal linkage will be provided for respective users through competitive tender (including the tapering linkage).
  - ・In the case of the electric power sector, the power generator that presents the lowest power tariff becomes the successful bidder. Moreover, it is scheduled to give priority to allocation to power distribution companies (state-operated and privately sector operated) than power generating companies.
  - ・Successful bidders are entitled to receive LOA , however, it is required necessary for bidders to provide a memorandum with the power distribution company as a sort of proof having final consumers. For commencement of the actual coal supply in accordance with Fuel Supply Agreement, several conditions precedents have to be satisfied, e.g. signing of a PPA, environmental and forest authorizations, land acquisition, fundraising and so on.

Date and time:		June 9-12, 2015
Place:		BSPGCL, BTPS, RITES office in BTPS
Participants	BSPGCL (6/9-10)	Mr. S.S.P.Gupta (Superintending Engineer, person in charge of Badam coal block development) Mr. Brajesh Kumar (person in charge of ash)
	BTPS (6/11-12)	Mr. Arun Kumar Sinha(General Manager) Mr. K.N. Jha (person in charge of ash treatment for Units No. 8/9) Mr. Vinod Bhushan Dwivedi (person in charge of rail line for Units No. 8/9)
	RITES (6/11-12)	Mr. R.B.Roy (person in charge of rail line for Units No. 8-10) Mr. S. Kumar Mr. Kumar Rajiv Ranjan
	Survey Team	Mr. Tajima

Discussion contents

Information was gathered and opinions were exchanged concerning fuel planning.

- Coal procurement method
  - ・Coal procurement for Unit No.10 can either be fuel purchase (FSA with the coal corporation: Coal Linkage) or own company mining (Coal Block Allocation), but there is no strong preference either way at this moment.
  - ・Approval for the DPR by BSPGCL board of directors is required for the coal linkage application, then such application will be submitted to the SLC-LT for review through CEA and MoP.
  - ・Badam coal block was applied for and allocated upon considering the necessary quantity of coal for Units No. 8/9. In terms of scale, it was not allocated as a means of supplying Unit No. 10.
- Badam coal block development situation
  - ・Following decision of the allocation, guarantee deposit has been paid to MoC. The Vesting Letter from MoC is now awaited.
  - ・The said Vesting Letter gives a detailed description of the current condition of Badam coal block (the licenses and land rights secured by the previous allocated party, existing development consignment agreements, etc.), and BSPGCL will inherit all or part of these rights and contracts held by the former allocated party.
  - ・License-related pending matters still to be completed are the 2nd stage forest license (31 % of the overall coal block) and part of the private land acquisition (approximately 2 % of the overall coal block). Development permission has been secured for all other land.
  - ・It is scheduled to successively implement development for the land for which development permission has been secured, and it is estimated that between 38-44 months will be required before production of coal.

・Preparations are being conducted to implement the international tender for the coal block development consultant and Mine Developer and Operators within the Fiscal year.

- Situation in other plants

・Coal supply amount from CIL may shortfall about 35 % from its contractual volume. In the case of a public power generation company that procured from CIL, it is not common to separately procure such deficiency. In cases where coal supply is hindered, measures such as cutting coal consumption by reducing output, temporarily stopping operation and bringing forward or delaying periodic inspections, or simply suspending operation are taken.

・In the case of a large public power generator such as NTPC, it is also possible to directly procure from an overseas coal supplier, however, in the case of a small-scale state-run power generator, especially in a landlocked state, there is very little access to imported coal.

- Ash

・Concerning the utilization of fly ash discharged from Units No. 6-9, public tender documents for off taking fly ash are being prepared based on the conditions of receiving for 25 years (or the plant lifetime) with no quality guarantee (handing over as is basis).

・Usually a minimum sale price is set, however, from the viewpoint of effectively utilizing 100 % of fly ash, BSPGCL is willing to consider free-of-charge supply without setting any minimum price. Even if it obtains revenue from sale of fly ash, this will be treated as a separate account according to MoEF Notification No. 2804.

・So long as BSPGCL is making the utmost effort such as not setting the minimum price and so on, it is not likely that MoEF will impose penalties even in case fly ash utilization rate stipulated in Notification No. 2804 is not achieved.

・The fly ash utilization rate during operation of Units No. 6/7 (up to 2012) was around 90 % (since Notification No. 2804 required a rate of 75 % at that time in November 2012, this requirement was satisfied).

- Dedicated rail line-related matters

・Since the wagon hopper is intended for when Unit No. 10 is added, budget for wagon hopper is not included in the budget for constructing Units No. 8/9.

・During the Unit Nos. 8/9 design stage, since most of the freight cars owned by Indian Railways are BOXN wagons and a wagon tipper has been adopted for Units No. 6/7, BSPGCL was also intended to operate two (2) wagon tippers for Units No. 8/9, however, Indian Railways requested BSPGCL to additionally install the wagon hopper through reviewing the railway plan.
In the case where the wagon hopper is added to wagon tippler, since this will be a redundant installation for the scale of output of the Units No. 8/9, a compromise has been reached with Indian Railways by stating that the wagon hopper will be adopted when Unit No. 10 is constructed in future; hence it is not included in the budget for Units No. 8/9.

Date and time:		June 16, 2015 (Tuesday) 14:00 - 14:30 August 4, 2015 (Tuesday) 15:00 - 15:40
Place:		CEA
Participants	CEA	Mr. P.D. Siwal (Secretary & Chief Engineer, Thermal Project Planning & Development)
	Survey Team	Mr. Tajima
Discussion contents		

Information was gathered and opinions were exchanged with CEA concerning fuel planning.

【June 16】

- Handling of coal application and role of CEA
  - Generally speaking, priority handling is given to applications from State government concerning both applications for coal block allocation and applications for coal linkage.
  - CEA confirms status of acquisition, licensing of water rights and implementation of TOR regarding EIA in projects that are submitted for application, and it reports to MoC and SLC-LT.
- Timing of application for coal linkage
  - Applications are usually made following project approval by the state government.
  - Following application, SLC-LT makes a judgment following the above inquiring and reporting about the project progress by CEA.
  - Even if a project is included in the next five (5) -year plan, this does not preclude early application.
- Other points
  - Since Fiscal 2016-2017 will be the year for compiling the 13th plan for Fiscal 2017 onwards, it is desirable to address this issue this year 2015-2016.

【August 4】

- Coal linkage application method
  - Application method: Since the institutional reform concerning the allocation of coal resources is still in progress (due to be compiled in March 2016), there is currently no concrete application method.
  - Application format: In the application form that was used in the 12th plan, attachment of EIA TOR was required, however, this format is not currently used, so this is not an essential requirement.
  - Application destination: Whether the application is made to MoC, MoP or CEA, since it ends up being reviewed in SLC-LT, in which all agencies participate, GoB is free to decide which office to apply to.

➢ Execution planning/estimation

Date and time:		March 24, 2015 (Tuesday)10:00 - 17:00
Place:		BTPS
Participants	BTPS	Mr. Vinod Bhushan Dwivedi, Mr. Devendra Nath Nanda
	Survey Team	Mr. Sakamoto (Deputy Team Manager), Mr. Okuma, Mr. Fujita, Mr. Urakawa
Discussion contents		

Hearing was conducted on the machinery, execution and O&M.

➢ Progress of R&M/LE works

・Unit No.7: The boiler local commissioning tests will be implemented this month. The overall commissioning tests are scheduled for April with operation scheduled to start in June. The current rate of progress is 90 %.

・Unit No.6: The current rate of progress is 70 %. Mainly ESP foundation works are being conducted and ESP installation is scheduled to finish in December. There is a delay of around 3 months and operation is scheduled to start in March 2016.

➢ Progress of new installation works

・Unit No.8: BTG is progressing according to schedule. Works on the ash conveyor and ash treatment system are behind schedule. Works on the ash pond, which covers an area of 15 acres, are also being advanced. Work is scheduled to finish in December 2016 and BTG rate of progress is 80 %.

・Unit No.9: Procedures are being conducted with RITES concerning the ash rail transportation.

➢ Execution methods for Units No. 8/9 as reference for Unit No. 10

・BHEL, the works contractor, has the works guidelines. Since these represent company know-how, they need to be handled with care.

➢ Equipment and materials transport route

・The strength of the bridge crossing over the Ganges is an issue, however, BTPS is currently constructing a new bridge in Munger 60 kilometers east of BTPS and this is scheduled for completion in October 2015. Also, a bridge that links Patna (Rajendra Setu on the Ganga River) is undergoing repairs south of BTPS and this is also scheduled for completion in December 2015. Moreover, there is another bridge at Bagarpur that can be used for transporting equipment and materials from Kolkata. The issues concerning bridge utilization can be resolved during 2015. Rail transportation is another option. BHEL conducts business all over India and transports from a plant close to BHEL.

➢ Condition of equipment and materials yard

・From the view of quality control, it is necessary to enclose the yard with a fence, avoid placing equipment and materials sideways (piling) and to cover with sheeting to protect from dust.

Equipment and materials yard near the stacker/re-claimer

Date and time:		March 25, 2015 (Wednesday)10:00 - 13:00
Place:		BTPS
Participants	BTPS	Mr. Devendra Nath Nanda
	Survey Team	Mr. Okuma, Mr. Fujita, Mr. Urakawa
Discussion contents		

The scheduled construction site of BTPS Unit No. 10 was inspected.

- Conditions around the water intake point
  - Access road: It is planned to construct the access road for the pump installation and intake piping works on the left bank of Ganges River (according to the intake line) and away from residential areas.

(Water intake line)

  - Water intake point: It is planned to install the water intake pump in the central part of Ganges River (where depth of 20 meters can be secured even when the water level is low).
  - Grit chamber: Water obtained from the intake point will pass through the grit chamber to remove impurities, which will be allowed to settle and then returned to the river as sludge. Permission has already been receiving for linking a total output of 750 kW for pump motors for Units No. 8/9 (250 kW x 2) and Unit No. 10 (250 kW x 1).

- Unit No. 10 scheduled construction site
  - The site area from BTG to the chimney is 52,500 m^2.
  - Materials yard and processing area: A multipurpose zone is planned on the south side of the stacker/reclaimer, and this can be utilized as a materials yard and processing area during the construction works. Also, space can be secured between the Units No.8/9 raw water storage tank and Unit No. 10 construction site (from BTG to the chimney), however, it will be necessary to carefully survey the Unit No. 10 plot plan to make sure there is no interference.

(Raw water storage tank)

(Unit No. 10 construction area)

➢ Units No. 8/9 materials yard

- Many of the materials are placed sideways, and pipe ends are not capped for prevention of infiltration by foreign objects. Moreover, because rust prevention steps are not implemented on grooves of main valves, there is concern over rusting and infiltration by foreign materials.

(Temporary storage of a pump on the turbine floor)

- In construction of Unit No.10, it will be necessary to emphasize supply of materials and quality control (especially rust prevention and prevention of infiltration by foreign materials) in the equipment stock areas and processing areas.

➢ Economic and financial analysis

Date and time:		March 19, 2015 (Thursday)16:00 - 17:15
Place:		BSPGCL
Participants	BSPHCL	Mr. Arvind Kumar (DGM, Finance)
	Survey Team	Mr. Baba
Discussion contents		

Hearing was conducted with BSPGCL person in charge of finance concerning the mechanisms for borrowing funds and securing capital for repayment.

➢ Fundraising entities

- The fundraising that accompanies the capital outlay will be conducted not by BSPHCL but by BSPGCL and BSPTCL. BSPGCL's fundraising sources are, in order of size, PFC, the Rural Electrification Corporation (REC), government banks and so on. Loans to BSPGCL by PFC incur an extremely high interest rate of 12.25 % per annum.

➢ Tariff setting method

- The power generator, BSPGCL, and two (2) power distribution companies (North/South BSPDCL) have signed a PPA for 25 years. BSPGCL sells power to BSPDCL for a tariff (approximately INR 4.5 /kWh) on a cost plus 15.5 % ROA basis.
- For transmission companies the tariff is the total cost + 15.5 % ROA, and for distribution companies the ROA is 14 %. Under the most recent tariff revision, the ROA for power generating companies has been raised from 14 % to 15.5 %.
- The distribution company BSPDCL sells the power it receives to customers for INR 6.5 /kWh on average. Despite adding a certain level of margin, BSPDCL incurs a perennial deficit because it cannot fully retrieve cash due to Aggregate Technical & Commercial Loss (AT&C loss, inefficient transmission and distribution losses and lost revenue due to stolen power).
- Based on BSPGCL PPA, BSPDCL is obligated to furnish L/C from the bank using accounts receivable (A/R) as collateral; moreover, if it doesn't pay within 90 days of the invoice, it is stipulated that the PPA should be terminated. So far there have been no instances of default by BSPDCL.
- Accordingly, thought the tariff mechanism based on its total costs, BSPGCL is deemed to possess loan repayment capability.

Date and time:		March 20, 2015 (Friday) 16:00 - 17:15
Place:		BSPHCL
Participants	BSPHCL	Mr. Arvind Kumar（DGM, Finance） Mr. Rakesh
	Survey Team	Mr. Baba
Discussion contents		

Hearing was conducted with BSPGCL person in charge of finance concerning the mechanisms for borrowing funds and securing capital for repayment.

- Borrowing of funds for plant investment
  - BSPGCL mainly borrows funds for plant investment (Long Term Borrowings) from the following sources. It usually borrows 70 % of plant investment and finances the remaining 30 %.

(Million INR)

		End of March 2014	End of March 2013	Interest
Secured	Central Bank of India	500	－	11.25 %
	HUDCO[1]	4,070	－	12.50 %
Unsecured	PFC	13,471	4,927	12.25 %
	State government	2,496	2,396	11.50 %
Total		20,537	7,324	－

  - According to Mr. Arvind DGM, the addition of Unit No. 10 is essential for the state, where power shortages are chronic, and because current loans entail extremely high interest as shown above, a low-interest yen loan from JICA is very appealing.
  - According to Mr. Arvind DGM, MoF lends to state governments without adding any extra interest, and the state governments also lend without adding interest, however, it is thought that the Ministry and the state governments need to add some hedge cost to cover exchange risk.

- BSPGCL power generation cost
  - On confirming the current stance of BERC, competition is already working in the power generation market. Whereas the power sale price of NTPC is INR 4.0/kWh, BSPGCL sells power for INR 3.95/kWh (=power generation cost, authorized portion in Fiscal 2015) and is amply competitive, and BERC is unlikely to put too much pressure on BSPGCL to reduce tariff.
  - The power generation cost of BSPGCL is passed through on its tariff to BSPDCL without any margin, and the latest tariff is INR 3.95/kWh. If the tariff of BSPGCL is high, the retail tariff of the distribution company BSPDCL will also be high, however, since the tariff system (tariffs list already received) is already aimed at limiting the burden on poor people, there is hardly any pressure from the general public to reduce prices.

[1] Housing & Urban Development Corporation

Date and time:		May 15, 2015 (Friday) 11:10 - 11:35
Place:		STEAG
Participants	STEAG	Mr. Talwar (finance）, Mr. Asthana1
	Survey Team	Mr. Baba, Mr. Urakawa
Discussion contents		

In order to provide reference material for calculating the Unit No. 10 tariffs, information was collected on the cash flow model of Haryana Power Generation Corporation that was implemented by STEAG.

- STEAG opinions and advice
  - Discussion was conducted on the cost estimation contents made by the Survey Team. When interest during construction is taken into account, the costs becomes more than INR 8 crores/MW, however, considering that is INR 7 crores/MW at most, this is rather high.
  - Whereas equipment costs are roughly the same as in other projects, the civil works are the cause of the higher cost. The main reason is the need to strengthen ground and so on in order to build seven (7) coal silos of more than 60 meters in height. Explanation was given on the feasibility of building a coal yard instead.
  - Based on CERC guidelines, the key assumptions are confirmed: the debt-equity ratio (70:30)*, JICA loan conditions, thermal efficiency, coal price and other preconditions. Concerning the coal price, it was agreed to calculate assuming INR 3,000-4,000 /ton.

    Note: The JICA loan will account for up to 85 % of the total cost, with the remaining 15 % provided from equity, however, since the shareholder's equity cost is high and a ratio of 70:30 is adopted under the tariff calculation rules of the State of Bihar, this ratio has been adopted here.
  - Upon asking about the period between L/A and NTP, somewhere between 18 and 24 months was given. Below shows the shortest period (18 months) case.
    - ✓ Appointment of consultancy (3 months)
    - ✓ Preparation of EPC documentations (6 months)
    - ✓ EPC bid tender (4 months)
    - ✓ PQ(1 month)
    - ✓ Technical proposal by PQ shortlisted bidder (2 months)
    - ✓ Price proposal by technical shortlisted bidder (1 month)
    - ✓ Public bid opening & bid evaluation (2 months)
    - ✓ EPC contract negotiation & finalization (2 months)
    - ✓ Notice to proceed(=zero date) (1 month)

➢ Electric power civil engineering/Machine equipment

Date and time:		June 12, 2015 (Friday) 11:40 - 17:00
Place:		BTPS
Participants	BTPS	Mr. Arun Kumar Sinha (General Manager) Mr. V. K. Verma (Civil)
	STEAG	Mr. K.D Paul
	Survey Team	Mr. Muku

Discussion contents

A joint proposal for sharing of the Unit No. 10 water intake tower from Ganges River with Units No. 8/9 was made.

➢ Background to the joint proposal of the water intake tower

- Constructing the water intake tower, which entails in-river works, constructing only for Unit No. 10 is not advisable because of the expense and length of time required. Therefore, on hearing that BSPGCL once more intends to conduct tender for the Units No. 6-9 water intake works, it was decided to propose that the works specifications be revised so that space be secured for installation of the Unit No.10 water intake pumps and intake pipes (grit chamber after the water intake tower).

➢ Contents of proposal by the Survey Team

- Through revising the capacity and number of water intake pumps currently planned for Units No. 6-9, secure space for installation of the Unit No.10 intake pumps inside the water intake tower.

➢ Progress of the Units No. 6-9 water intake equipment works (Ganga Water Supply Package)

- The water intake pumps have not yet been procured, so the capacity and number of pumps can be changed without any problem. (The person in charge confirmed the situation under instructions from the GM).

➢ Opinions on the BTPS side

- It agrees with the proposal. BTPS requested that the proposal letter be sent by email so that it can officially examine it and reflect it in the tender documents. (It is scheduled to be sent at a later date by the Survey Team).

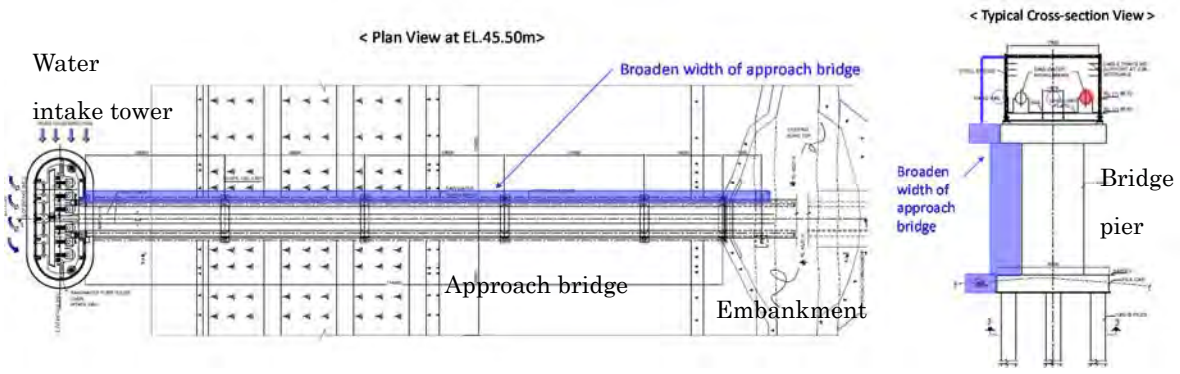
- Water intake tower

  Total capacity of the water intake pumps should be no greater than the current licensed water flow of 60cusec (6,116m^3/h). On hearing this instruction from the station manager, the composition of intake pumps was reviewed and once more explained as shown below. As a result, the minimum cost option of 4 units x 2,000 m^3/h (1 unit as standby) was adopted.

Unit No.	Permitted water flow (cusec)	Water intake pumps				
		Current plan	Original specifications revision proposal		Modified specifications revision proposal	
			Plan 1: Minimum cost	Plan 2: Similar reliability	Plan 1: Minimum cost	Plan 2: Similar reliability
No.6/7	10	3 x 1,275m^3/h (1 unit for standby)	4 x 2,550m^3/h (1 unit for standby)	3 x 2,550m^3/h (1 unit for standby)	4x2, 000m^3/h (1 unit for standby)	3 x 2,000m^3/h (1 unit for standby)
No.8/9	20	3 x 1,275m^3/h (1 unit for standby)		3 x 2,550m^3/h (1 unit for standby)		
No.10	—	—		2 x 2,550m^3/h (1 unit for standby)		2 x 2,000m^3/h (1 unit for standby)
Total	60 (including 35 others)	6 x1,275m^3/h	4 x 2,550m^3/h	6 x 2,550m^3/h	4 x 2,000m^3/h	5 x 2,000m^3/h

- Approach bridge

  It was also accepted that it is necessary to broaden the width of the approach bridge between the embankment and water intake tower in order to install the intake pipe from the water intake tower to the grit chamber.



(Top view of section between water intake tower and embankment) (Approach bridge cross section)

- Grit chamber

  It is a good idea to construct the grit chamber for Unit No. 10 in the dead space between the embankment and the grit chamber for Units No. 6-9.

- Future approach

  BTPS will officially examine the following proposal based on the above explanations:

  - ✓ Review of the capacity and number of water intake pumps (install 3 units x 2,000 m^3/h for Units No. 6-9).
  - ✓ Change the width of the approach bridge (taking into account 3 intake pipes).
  - ✓ Layout of the Unit No.10 grit chamber (construction between the embankment and grit chamber for Units No. 6-9)

Date and time:		June 12, 2015 (Friday)11:40 - 17:00
Place:		BTPS
Participants	BTPS	Mr. Arun Kumar Sinha (General Manager) Mr. V. K. Verma (Civil)
	STEAG	Mr. K.D Paul
	Survey Team	Mr. Muku

Discussion contents

The layout and specifications of main equipment in DPR proposal were explained, and opinions and requests were heard from BTPS side.

- Handling of shared facilities other than the power generating facilities
  - Concerning facilities other than the plant facilities (service building, etc.), it was confirmed whether or not they can be shared between Units No. 8/9 and Unit No. 10 (whether or not it is necessary to separately construct for Unit No. 10).
    As a result, as is shown in the following table, it is possible to share facilities except for the spare parts, etc. store and the open yard that will be used as equipment assembly space.

Summary of BTPS opinions concerning sharing of facilities between Units No. 8/9 and Unit No. 10

Equipment	Feasibility	Main contents
Service Building	○	・The GM, department managers (machinery, electricity, coal, operation, etc.) and accounting personnel fulfill duties in both Units No. 8/9 and Unit No. 10. ・Only repair staff and the Secondary Officer will be additionally needed in Unit No. 10. ・Apart from the service building, there is an office building, where the First Officer works.
Workshop	○	
Stores	×	・A separate store for Unit No. 10 is needed. ・Space on the east side of the water treatment plant for Units No. 8/9 can be used (refer to the following figure).
Canteen	○	・This will suffice providing that all staff members do not eat meals at the same time (meal times need only be staggered).
Fire Station	○	
Weigh Bridge	○	・The weigh bridge is installed next to the front gate and can weigh up to 62 tons.
Rain Water Harvesting Facility	○	
Open Yard	×	・A separate open yard (equipment assembly space) for Unit No. 10 is needed. ・Space can be used on the east side of Unit No.8 (it is currently used as an office by the water cooling tower equipment maker) (refer to the following figure).
Parking Space	○	・If appropriate space cannot be secured on the premises, the parking space can also be secured outside of the site (if no roof is needed, it can be placed on the green belt).

Main Gate	○	
Time Office & Security Office	○	
Stores for Security Office	○	
Security Cabin	○	・Same as the security office (do not have separate buildings).
Watch Tower	○	

(Layout of stores and open yards)

➢ Conditions of water intake facility works

- Developments for far
  - ✓ In the meeting with BSPGCL and BTPS on the Survey Team's visit to India in June, because the water intake facilities works are greatly delayed (work has not yet started on the water intake tower, grit chamber, etc.), it is scheduled to cancel the current contract and conduct tender again. In the meeting with BSPGCL on the previous visit (end of July), agreement was reached concerning the shared use of the water intake tower, water intake pump room, water intake tower approach bridge, grit chamber and plant water pump room.
  - ✓ Situation regarding new tender

    In order to cancel the current EPC contract with MBEC, application has already been made to the law court and the verdict is due in six (6) weeks. When cancellation of the contract is deemed to be appropriate, it is scheduled to implement the new tender.
  - ✓ Scope of finished work

    The water transmission pipe to Units No. 6/7 (from the grit chamber to the water tank in the power station) has already been installed up to just before the scheduled site of rails.

    Neither the water intake tower nor the grit chamber have been constructed, however, since 6 water intake pumps and 6 plant water supply pumps have been procured (they were not procured at the time of the visit in June), BSPGCL needs to conduct confirmation.

- ✓ Examination of alternatives

  The water intake facilities works are currently at a standstill and have not yet reached the renewed tender stage. Even if the water intake facilities works are delayed, a temporary alternative approach for directly taking water from the Ganges River is being considered to ensure that the start of operation of Units No. 8/9 (Unit No. 8 is scheduled for July 2016, and Unit No. 9 for October) is not hindered.

➢ Conditions of the ash pond

- Court situation
  - ✓ The Supreme Court's verdict, which was expected in August, has not yet been issued. This is because politicians have maneuvered to have the verdict announced after the state elections in order to prevent a favorable verdict for the government (power station side) having any impact on the election. The government side is not actively presenting evidential documents, even though it could accelerate the work if it did.
  - ✓ The current landowner only has a provisional license (issued by the government) for use of government-owned land. Moreover, this license states that the government is able to use the land in the case where such a need arises. This license could be presented to the court at any time, but the government has avoided doing so for the reasons described above, and it is sure that the case can still be won.

    Even assuming the case where the current landowner's rights are recognized (the government loses the case), it will still only be necessary to officially purchase the land. Irrespective of the court's decision, there will be no problem regarding acquisition of the ash pond.
  - ✓ Examination of alternatives

    Even if the works are delayed from the acquisition of the ash pond, an alternative method is being examined for disposing of ash in such a way that the start of operation of Units No. 8/9 is not hindered.

    Bottom ash will be disposed in the ash pond for Units No. 6/7 that has been secured near the oil refinery on the north side of the power station.

    All fly ash will be recovered by a cement company.

➢ Power transmission and transformation plan

Date and time:		June 12, 2015 (Friday) 11:00 - 11:30
Place:		BSTCL
Participants	BSTCL	Mr. J.P. Singh
	Survey Team	Mr. Kuba, Mr. Maeda
Discussion contents		

Concerning the site reconnaissance for the transmission line route, the reconnaissance contents, route, etc. were explained and discussions were held.

➢ Transmission line route

- BSPTCL requested that the northern transmission line route be adopted, stating that the southern route recommended by the Survey Team is inaccessible due to inundation during the rainy season from July to December and that the transmission line (660 MW) from BTPS is too important.
- BSPTCL consents to advancing work for connecting the transmission line to Gaighat, however, since it has requested PGCIL to compile the optimum transmission system plan for the State of Bihar, it requested that connection to Hajipur be added and that mention also be given to the feasibility of transmitting power to Shiwan via Hajipur.

➢ Confirmation of the number of lead-out lines

- Concerning the number of lead-out 220 kV lines from BTPS, upon checking with the local BTPS/BHEL concerning the acceptability of having 10 lines based on the results of system analysis, BSPTCL said that 10 would be fine.

Appendix IX

Photographs

Survey Photographs

First Field Survey　March 15 (Sunday) – April 10 (Friday), 2015

Date: 2015.3.18

Explanation of Ic/R at BSPGCL

Date: 2015.3.23

Explanation of Ic/R at BSPGCL

Date: 2015.3.23

Unit No. 10 scheduled construction site

(Next to Unit No.9)

Date: 2015.3.23

Survey of conditions at Units No. 8/9

(Units No. 8/9 turbine house)

Date: 2015.3.23

Survey of conditions at Units No. 8/9

(Unit No. 8 boiler house)

Date: 2015.3.23

Survey of conditions at Units No. 8/9

(Unit No. 8 turbine house)

Date: 2015.3.25

Survey of conditions at Units No. 6/7

(Units No. 6/7 wagon tippler)

Date: 2015.3.23

Survey of conditions at Units No. 8/9

(Units No. 8/9 coal storage yard)

Date: 2015.3.25

Survey of conditions at Units No. 8/9

(Units No. 8/9 fuel tanks)

Date: 2015.3.25

Survey of conditions at Units No. 6-9

(Units No. 6-10 water intake facilities scheduled construction site)

Date: 2015.3.25

Survey of conditions at Units No. 6-9

(Units No. 6-10 water intake tower scheduled construction site)

Date: 2015.3.25

Survey of conditions at Units No. 8/9

(Units No. 8/9 stores)

Date: 2015.3.25

BTPS personnel and Survey Team

(BTPS)

Second Field Survey　May 11 (Monday)-June 27 (Saturday), 2015

Date: 2015.5.12

TOSHIBA JSW POWER SYSTEMS PVT. LTD.

Survey of Chennai turbine factory

(Survey Team)

Date: 2015.5.12

TOSHIBA JSW POWER SYSTEMS PVT. LTD.

Survey of Chennai turbine factory

(Explanations / Q&As)

Date: 2015.5.13

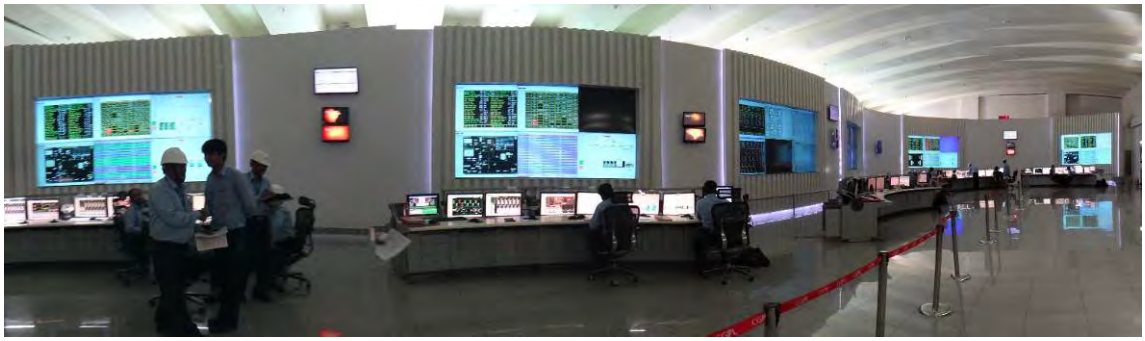
Survey of another power station

(TATA-Mundra Power Station, outside)

Date: 2015.5.13

Survey of another power station

(TATA- Mundra Power Station, turbine floor)



Date: 2015.5.13

Survey of another power station

(TATA- Mundra Power Station, central control room)

Date: 2015.5.13

Survey of another power station

(TATA- Mundra Power Station, view of the complex)

2.5 Field Survey June 8 (Monday)-August 27 (Thursday), 2015

Date: 2015.6.9

Discussions with BSPGCL

(BSPGCL conference room)

Date: 2015.6.11

Discussions with BSPGCL

(BTPS general manager's office)

Date: 2015.6.17

Survey of conditions at Units No. 6/7

(Units No.6/7 ash handling system, cooling tower)

Date: 2015.6.17

Survey of conditions at Units No. 8/9

(Units No. 8/9 raw water storage tank)

	
Date: 2015.6.17 Survey of conditions at Units No. 8/9 (Units No. 8/9 boiler-turbine house)	Date: 2015.7.28 Meeting with the Minister of MoP, BSPHCL, BSPGCL and JICA national officers (BSPGCL conference room)

Third Field Survey　September 2 (Wednesday) – December 29 (Tuesday), 2015

Date: 2015.9.8

Survey of conditions at Units No. 8/9

(Units No. 8/9)

Date: 2015.9.8

Survey of conditions at Units No. 8/9

(Survey Team)

Date: 2015.9.8

Survey of conditions at Units No. 1-3

(Units No. 1-3 turbine house)

Date: 2015.9.8

Survey of conditions at Units No. 4/5

(Units No. 4/5 turbine house)

Date: 2015.9.8

Survey of conditions at Units No. 6/7

(Unit No.7 boiler house, ESP, etc.)

Date: 2015.9.8

Survey of conditions at Units No. 8/9

(Unit No.9 boiler-turbine house, ESP, etc.)

Date: 2015.9.8

Survey of conditions at Units No. 6/7

(Units No.6/7 coal yard)

Date: 2015.12.22

Discussions with BSPHCL, BSPGCL and JICA officers

(BSPGCL conference room)

Appendix X

Survey Team Members

Survey Team Members

Name (Term)	Work Area	Affiliation
Michio MIHARA （February 2015 - June 2016）	Team Leader / Thermal power generation plan	Kyushu Electric Power Co., Inc.
Yasunori SAKAMOTO （February 2015 - February 2016）	Deputy Team Leader / Machinery A	
Yoshifumi MITSUNAGA （February 2015 - August 2015） Tatsunari HAYASHI （August 2015 - December 2015） Yoshifumi MITSUNAGA （December 2015 - June 2016）	Thermal power plant construction plan	
Masahiro MUKU （February 2015 - June 2016）	Electric power civil engineering	
Motohisa SAKURAI （February 2015 - June 2016）	Electrical equipment	Electric Power Development Co., Ltd.
Kiyotaka TSUKIMOTO （February 2015 - June 2016）	Power system analysis	Kyushu Electric Power Co., Inc.
Shinji KUBA （February 2015 - June 2016）	Power transmission and substation equipment A	Kyuden International Corporation[1]
Hiroyuki KOGA （February 2015 -June 2015） Shigeru MAEDA （July 2015 - June 2016）	Power transmission and substation equipment B	Kyushu Electric Power Co., Inc.
Shigeru URAKAWA （February 2015 - June 2016）	Implementation plan / Estimation	West Japan Engineering Consultants, Inc.
Koichi NAKAYAMA （February 2015 - April 2015） Tomoyuki TAJIMA （April 2015 - June 2016）	Fuel plan	Kyuden International Corporation

[1] July 2015: Transferred to Kyuden International Co., Ltd. from Kyushu Electric Power Co., Inc.

Name (Term)	Work Area	Affiliation
Junya FUJITA （February 2015 - July 2015） Kazutaka HATA （July 2015 - June 2016）	Maintenance structure / Organizational system A	Electric Power Development Co., Ltd.
Toshiyuki OTA （February 2015 - June 2016）	Maintenance structure / Organizational system B	Electric Power Development Co., Ltd.
Takeshi BABA （February 2015 - June 2016）	Economic and financial analysis	Kyuden International Corporation[2]
Manabu SAKAGUCHI （February 2015 - June 2016）	Environmental and social consideration A	ERM Japan Ltd.
Yohei SUZUKI （February 2015 - June 2016）	Environmental and social consideration B	
Kiyotaka OKUMA （February 2015 - June 2016）	Mechanical equipment B / Work coordination	Kyushu Electric Power Co., Inc.

2 July 2015: Transferred to Kyuden International Corporation from Kyushu Electric Power Co., Inc.