



**INDIA**

**DISTRIBUTION REFORM, UPGRADES & MANAGEMENT PROGRAM  
(DRUM)**

# **Proposal for Soil Investigation At two locations in Andaman & Nicobar Islands**

January, 2010

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The views expressed in this document do not necessarily reflect the views of the United States Agency for International Development or the United States Government

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## **DISCLAIMER**

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## **1. BACKGROUND**

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The Distribution Reform, Upgrades and Management (DRUM) Project is an ambitious joint undertaking sponsored by India's Ministry of Power (MOP) and the U.S. Agency for International Development (USAID) focused on "the last mile" of the electricity network. The three dimensions to the DRUM goal are to:

1. Create Centers of Excellence in distribution
2. Test new concepts (technology, business process, etc.)
3. Identify possible "breakthroughs" that will help to accelerate the pace of reform

Under this program, DRUM team led by PA Government Services, is working with three reforming distribution utilities, Maharashtra State Electricity Distribution Company Ltd. (MSEDCL), Bangalore Electricity Supply Company (Bescom) and Madhya Gujarat Vij Company Ltd (MGVCL) to create a replicable, sustainable, upgradeable and model for creating a center of excellence. At the same time, three pilot locations, Aurangabad Division-I in MSEDCL, Umreth Subdivision in MGVCL and Dodaballapur Subdivision in Bescom have been selected to implement the model of excellence to develop a learning curve for each of these utilities.

The DRUM team envisages that availability, reliability and cost of power supply coupled with good customer relations are the key ingredients of customer satisfaction. The resultant definition of success under the DRUM paradigm is embodied the following formula:

$$\mathbf{ARC + GCR = CS}$$

$$\mathbf{\Sigma (Availability + Reliability + Cost) + Good Customer Relations = Customer Satisfaction}$$

The Indian power sector is characterized by inadequate and insufficient power supply. About 1.25% of the GDP was draining in the technical and commercial losses of the power distribution system. The situation is more acute during the peak load conditions. There are other chronic problems also associated with the dilapidated network and other inefficiencies which are imbedded in the system. DRUM program focus is to create a learning curve for the entire nation so that it can be replicated to have sustained benefit.

DRUM program is also working intensively for 'Market Development of Renewable Energy'. Renewable energy supplies 18 percent of the world's final energy consumption, counting traditional biomass, large hydropower and new renewable technologies (wind, small hydro, solar geothermal, biomass and bio fuels). Out of this, energy supplied through new renewable technologies alone represents 2.4 percent in developed countries and in some developing countries. Renewable energy replaces conventional fuels in four distinct sectors: power generation, hot water and space heating, transport fuels and rural (off-grid) energy. The multi-sectoral use of renewable energy makes it imperative from the point of view of long term energy supply security, decentralization of energy supply particularly for the benefit of the rural population, environmental benefits and sustainability.

Like in other developing countries, there is a wide gap between demand and supply of energy in India. In several developing countries such as India, there are large sections of the population living in areas without access to electricity. There is also considerable environmental and resource degradation because of a higher dependence on fossil fuels. This dependence on fossil fuels, which are imported, exacerbates India's foreign exchange debt burden. These factors, along with India's large endowment of renewable resources, suggest

that the development of RE (renewable energy) will be an important contributor in meeting the challenge of providing clean power in India.

The Electricity Act 2003 provides for the Independent Power Producers (IPP) to set up renewable power plants for captive use, third party sale, power trading and distribution.

In pursuance of this Act, India has been pursuing a three-fold strategy for promotion of renewable energy:

- Providing budgetary support for research, development and demonstration of technologies,
- Facilitating institutional finance through various financial institutions, and
- Promoting private investment through fiscal incentives, tax holidays (lower customs duty, sales tax, and excise tax exemption), depreciation allowance and remunerative returns for power fed into grid.

However, there is a need to optimize utilization of India's vast potential for energy generation from renewable and to alleviate the severe energy crunch faced by the country. The renewable energy needs to be integrated into the national energy planning thereby enabling the creation of a balanced energy-mix. This in turn calls for taking renewable energy technologies beyond the stage of research and development, for demonstrating the commercialization of renewable energy technologies.

As part of its effort, DRUM has associated itself for preparation of detailed project report for two numbers of Solar PV power plant having 5 MW and 1 MW capacity each at two locations in Andaman and Nicobar Islands. The more details about site specifics are available in the Annexure – 1.

This document is a call for proposals by PA government Services from reputed organizations to undertake the work as laid down in the Statement of Work (Section 2).

## **2. STATEMENT OF WORK AND SPECIFICATIONS**

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### **SCOPE OF WORK**

The scope of work will cover under-soil investigation including field deployment, field investigation, laboratory testing and submission of soil investigation reports. In general the report will include: (a) detailed log of observations made during the field investigation, (b) results of laboratory tests including analysis of all results, basis, calculations and other related information along with charts, curves and drawings and (c) recommendations on appropriate foundations.

Soil investigation at the project sites will be conducted through standard boring methods, standard penetration tests, collection of disturbed and undisturbed soil samples, collection of water samples and laboratory tests. Location of all boreholes will be established from two reference grids and one benchmark and clearly shown in layout plan map. The contractor will arrange the supply of water and electric power to carry out field investigations. The work shall be carried out in conformity to relevant Indian or ASTM Standards and for each activity, the contractor will indicate the standard used.

### **TECHNICAL SPECIFICATION<sup>1</sup>**

For each borehole, the depth of termination will be approved by the site supervising engineer and noted in the field bore-log. Soil exploration depth will meet the following requirements:

1. Depth of bore for 15 meter or to a layer having consecutive SPT value of 100 or more for a continuous depth of 5.0 m whichever is met earlier.
2. If rock is encountered, depth of bore will be at least 3 meter inside the rock layer having total core recovery greater than 50%.

#### **A. Boring in Overburden Soil**

- Conducting Standard Penetration Test (SPT) at 1.5 m interval. Both field and corrected N values will be reported.
- Collection of disturbed and undisturbed soil samples and water samples for laboratory testing.
- Laboratory tests on disturbed/undisturbed soil samples:
  - i. Natural Moisture Content (NMC)
  - ii. Sieve and hydrometer analyses
  - iii. Atterberg limits & soil classification
  - iv. Specific gravity
  - v. Bulk density and dry density
  - vi. Consolidation analysis
  - vii. Unconfined compressive strength
  - viii. Tri-axial test
  - ix. Chemical analysis of soil and water samples for pH, sulphate, chloride and other organic content.
  - x. Soil resistivity test.

#### **B. Boring in Rock**

- Geological System
- Depth of rock strata and its variation over site
- Isolated boulder or massive rock formation
- Extent and characters of weathered zone
- The structures of rock including bedding planes, faults, fissures, cavities etc.
- Properties of rock material like strength, geological formation etc.
- Quality and quantity of returning drill water.
- Rock Quality Designator (RQD) value.

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<sup>1</sup>The specification have been developed using several sources including [www.iimshillong.in/news/pdf/TENDER\\_DOCUMENTS\\_for\\_Soil\\_Investigation.pdf](http://www.iimshillong.in/news/pdf/TENDER_DOCUMENTS_for_Soil_Investigation.pdf)

Rock samples are visually identified and tested in laboratory to yield the following information:

Visual identification:

- Texture
- Structure
- Composition
- Colour
- Grain Size
- Petrography

Laboratory tests:

- Specific gravity
- Porosity
- Water absorption
- Compressive strength

### **Boring in Overburden Soil**

For boring overburden soils, the boreholes will have a minimum diameter of 150 mm and be suitably lined throughout. To avoid suction, use augers of proper size for soft to firm clays. No water will be added while boring through cohesive soils and cohesion-less soils above the water table. Take adequate precautions to avoid caving and/or heaving of the bores. While boring through cohesion-less soil below water table, water level in the casing shall always be maintained at or above the water table. IS 6935 method will be used to determine water level in a borehole.

#### *Disturbed Samples*

In general the disturbed samples will be taken from borehole cuttings, split spoon sampler and cutting edge of undisturbed sampler for classification tests at the site. The samples shall be taken at 1.5 meter interval or at every identifiable change of strata, whichever is met earlier. If required, the disturbed samples should be sent to the laboratory for testing in air-tight containers.

#### *Undisturbed Samples*

Undisturbed samples in cohesive soils shall be taken from the boreholes at 1.5 meter intervals alternate with SPT or at every identifiable change of strata whichever is met earlier. Sampling procedures and samplers for recovering undisturbed samples will normally conform to IS 2132 specifications. Undisturbed samples are collected without hammering the sampler.

#### *Drilling in bed rock*

Drilling into fresh/weathered rock strata will be carried out using double tube core barrel of Nx size and diamond bits with water or bentonite slurry as drilling fluid run by a hydraulic feed machine. Minimum diameter of cores shall be 54 mm unless otherwise required. Each drill run will not exceed 1.5 meter in length and the core barrel shall be removed from the boreholes as often required to obtain the best possible core recovery. When any recovery is

less than 80% from a drill run, the next drill run shall be reduced to 50% of the previous length.

The time required to drill through a certain depth, amount of core recovery, Rock Quality Designator (RQD), physical condition, length of pieces of core, joints, colour of water residue, loss of water during drilling, hydraulic pressure, weathering and evidence of disturbance etc. would be observed and noted in the drilling log. For guidance IS:5313 shall be referred to. Use appropriate standards for presenting data and storing core samples.

## **LABORATORY TESTS**

Laboratory tests, using the standard practice, would be carried as per relevant Indian/International Standard Codes. The contractor will provide the name of laboratories, for approval, where the tests will be carried out. The contractor shall also provide a time schedule for laboratory tests.

### *Index Property Tests*

Laboratory tests shall be carried out as per the relevant parts of IS:2720 to report the following properties:

- Natural Moisture Content
- Sieve and Hydrometer analyses
- Atterberg Limits & soil classification
- Specific gravity
- Bulk & Dry Density

### *Unconfined Compression Test*

Unconfined compression test will be carried out as per IS: 2720. Each unconfined compression test will comprise tests on a minimum of three soil specimens not less than 38 mm diameter and a height to diameter ratio of 2, together with the determination of natural moisture content and bulk densities. The water content of the specimen will be taken from the failure zone of the specimen. A bill of quantities for each unconfined compression test would be required.

### *Tri-axial Test*

Tri-axial test shall be conducted on the undisturbed samples as per the relevant sections of IS:2720 specifications. The report on this test would include the stress-strain diagrams as well as the Mohr circle envelopes.

### *Consolidation Test*

Consolidation test will be conducted on undisturbed samples as per IS:2720. Contractor will indicate in the proposal the loading and unloading stages applied on the test specimens. The co-efficient of consolidation, the coefficient of volume decrease and the coefficient of compressibility will be determined and reported.

### *Chemical Analysis*

Chemical analysis of soil and water samples will include pH value, sulphate, chloride and other organic content in ppm and percentage.

*Determination of Soil Absorption capacity*

*Percolation Test:*

Percolation test will be used to determine the permeability of the soil as per the following indicative procedure:

*Soil Resistivity Test*

The electrical resistivity test should be carried out according to the guidelines of IS:3043-1987 and IS:1892-1979 or per the ASTM G57 - 06 procedures (standard test method for field measurement of soil resistivity using the Wenner Four-Electrode method).

### **3. METHODOLOGY**

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Though the methodology to conduct various tests are explained above but still if the bidder proposes to use any further technologically advance equipments and methodology, then bidder is required to include a detailed methodology in their proposal for which scoring shall be done as per criteria mentioned in of this RFP document. If no value enrichment is envisaged then all the bidders shall be provided the equal maximum marks.

### REPORTS

On completion of each borehole the contractor will provide the preliminary bore-logs showing:

- a. Locations of the boreholes on a plan.
- b. Preliminary description of each stratum.
- c. Thickness of each stratum with the boundaries.
- d. Position, type and identification of each samples and in-situ test.
- e. Any in-situ test results available.
- f. Standing water level for each borehole.

#### *Draft and Final Report*

Three copies of the draft report will be provided. The report will include detailed bore-logs, subsoil section, field test results laboratory observations and test results both in tabular as well as graphical form, supporting calculations, interpretation of test results, and conclusions. The final report will incorporate any suggested modifications and the final report with amendments will be delivered in four copies along with a CD of electronic copy of the complete report.

The detailed report will include:

- a. Plan showing the position of all boreholes
- b. Description of regional geology of the site.
- c. Description of the procedures and standards of investigation and testing as well as a list of equipments used.
- d. Detailed borelogs, subsoil sections, laboratory and field test results both in tabular as well as in graphical form, showing variations of each of the soil properties with depths in each borehole.
- e. Cross section of all individual bore holes with reduced levels and coordinates showing the classification and thickness of individual stratum, position of ground water table, various in-situ tests conducted and samples collected at different depths and the rock stratum.
- f. Field and laboratory test results along with graphs and tables used for computation.
- g. Plot of SPT value (both field and corrected) with depth.
- h. Stress-strain diagrams as well as Mohr circle envelopes for unconfined compression tests, triaxial tests and shear strength of rock sample.
- i. Modulus of elasticity for rock samples.
- j. 'e' vs log(p), compression vs. log(t) or compression vs.  $\sqrt{t}$  plots depending upon the shape of the plot to determine the coefficient of consolidation  $C_v$  and time for 50% and 90% primary consolidation.

- k. Coefficient of volume decrease (mv) and coefficients of permeability. Pre-consolidation pressure for each test to recommended the anticipated settlement along with the time.
- l. Recommendation for the allowable bearing capacity of soil along with the depth of foundations (for shallow foundations).
- m. All capacity and settlement calculations provided in the appendix of the report.
- n. Recommendation on the type of cement to be used and any treatment to the concrete based on the chemical composition of soil and sub-soil water.
- o. Any other information of special significance encountered during the investigation and likely to have a bearing on the design and construction of foundations.
- p. Photographs of field and laboratory activities and all the core boxes shall be included in each copy of the report.

## 5. TIMELINES

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The important timelines are as follows:

S. No.	Output	Timeline from the start of the assignment
1	Award of Contract	$T_0$
2	Bore Log report (In stages), last date is mentioned.	$T_1 = T_0 + 21$ days
3	Draft Report	$T_2 = T_1 + 10$ days
4	Final report	$T_2 + 15$ days

The sub-contractor will be awarded a fixed price contract. However the prices are required to be quoted separately for both locations.

## 6. PROPOSAL SUBMISSION:

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Each applicant shall submit a proposal incorporating technical particulars and a price quotation. The technical particular should consist of Credentials, Team Structure etc. as outlined below:

### A. Credentials:

Prior experience will be evaluated according to the following criteria and the firm needs to submit the supporting documents for all the credentials:

- i) Years of Experience in similar field
- ii) Organizational structure and constitution
- iii) Methodology and work programme for the proposed assignments;
- iv) Qualification of key team members to be deployed in the work (full time & part time separately).
- v) Details of partner firms (if any) along the above (i) – (iv).

### B. Approach:

The proposal must include a section on applicant's approach and methodology to reflect its knowledge of the assignment as mentioned in methodology section.

**C. Team Structure:** The applicant shall form a team led by a senior professional with significant experience in similar area. The bidder is required to submit short CVs of the proposed personnel proposed to be deployed for the study.

### D. Price Quotation:

The applicant will have to quote the lump sum price for the entire assignment

1. Fixed fee for this assignment

Therefore, the format for submission of price quotation shall be as follows:

SI No	Particulars	AMOUNT	Total Cost
1	Fixed Fee for this assignment to complete all the stated task, analysis and report submission for Location at Port Blair	TO BE QUOTED	
2	Fixed Fee for this assignment to complete all the stated task, analysis and report submission for location at Rangat	TO BE QUOTED	
Total			

The quoted price should include all the expenses to be incurred for completion of all the stated tasks and taxes, duties and other statutory charges, if any.

The quotation shall remain valid till February 25, 2010.

The price should include all cost relating to the assignment and all applicable taxes.

**E. Proposal Content:**

The proposal shall be submitted in two separate parts, one for technical particulars incorporating credentials, project approach etc. and other for financial bid.

**F. Proposal Submission Date:**

The “Technical Bid” and financial bid should be submitted in two separate envelopes with respective marking in bold letters. No financial information shall be provided in the “Technical Bid”.

Both the sealed envelopes should reach the following office at the following address on or before 1700 hrs Indian Standard Time on January 27, 2010.

Praveen Goyal  
Deputy Chief of Party  
PA Consulting Group  
Mobile: +91 9818067160  
[Praveen.goyal@paconsulting.com](mailto:Praveen.goyal@paconsulting.com)

**G. Opening of Proposal:**

The proposals shall be opened at a prescheduled date and time at the office of the Chief of Party of the DRUM Project. The decision of the Chief of Party, DRUM will be final in this regard. The Chief of Party can reject any of the bids without assigning any reason thereof.

## ***7. EVALUATION CRITERIA:***

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The evaluation of bids will be graded according to the following categories and the following point scale.

<b>Category</b>	<b>Points</b>
Credentials and prior experience	10
Methodology	10
Team Structure	15
Price quotation	65
<b>Total</b>	<b>100</b>

**Final Selection:** The final selection shall be on the basis of the combined technical and financial score attained by the bidder on the parameters indicated above.

**Annexure A**

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Pre FR of sites at A&N islands for the purpose of implementation of SPV based power projects (5 MW + 1 MW)

**Salient Features :-**

Sl	Parameters	South Andaman	Middle Andaman	Remarks
01	Name of Location	Garacherama village	Rangat	
02	Latitude	11.4 E	12.3 E	
03	Longitude	92.44 N	92.55 N	
04	Nearest town	Portblair	Rangat	
05	Distance from nearest town	1 KM	To be assessed	Approx dist.
06	Area available	20-22 Acres	4-5 Acres	approximate
07	Land details	Open, elliptical	To be surveyed	
08	Capacity proposed	5 MW	1 MW	