



**Ministry of New and Renewable Energy, Government of India**

**invites**

**Expression of Interest**

**for**

**Energy Storage Demonstration Projects for Supporting Renewable Generation**

Ministry of New and Renewable Energy

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## **1. Energy Storage for Renewable Energy**

### **1.1 Need for energy storage**

Renewable energy sources are strategic national resource. Harnessing these sources will put India on the path to a cleaner environment, energy independence, and a stronger economy. The renewable energy technologies can contribute to better air quality, reduce our reliance on fossil fuels and curb global warming, add good jobs to the economy and, protect environmental values such as habitat and water quality. Theoretically, the renewable resource is very large. Many of the technologies are technologically viable and many are well proven, but with exceptions their costs are high relative to fossil fuels. As such, renewable energy technologies are still evolving in terms of technological maturity, cost competitiveness.

The higher penetration of intermittent generation resources from wind and solar raises the issue of requiring additional fast grid balancing services in response to additional intermittency and fast up and down power ramps in the electric power system.

At present Indian grid operates without storage. Cost-effective ways of storing electrical energy can help make the grid more efficient and reliable, and may help to compensate for the variability inherent in wind and solar power. In addition in the area where at present diesel is used for electricity generation, energy storage solution can provide cost effective solution. This apart decentralized distributed power generation including through mini grids where the use of energy storage system is indispensable, efforts are required to optimize such system including making them cost effective.

Going forward the ability to store and regulate energy supply (both grid connected and off-grid) shall become a key aspect for renewable energy development. Scaling up deployment of renewable energy technologies shall require the integration of storage technologies. Effective energy storage solutions have the ability to meet these challenges and enhance deployment of renewable energy technologies through:

- Time Shift' for generated renewable energy to meet loads
- Integration of large scale renewable energy plants into transmission grids
- Improving the ability of distribution grids to absorb significant on-site renewable energy capacities
- Grid regulation (frequency regulation, contingency reserves etc.)
- Peak shaving of demand
- Off-grid system without diesel back ups
- Cost effective decentralized distributed power generation including mini-grid.

Energy storage can act as a capacity in the entire energy value chain- generation, transmission, distribution and loads. The greater use of storage will help the transition from centralized generation to distributed generation with attended benefits of improving energy access and availability, security, quality and efficiency.

### **1.2 Key areas for energy storage**

The Ministry of New and Renewable Energy (MNRE) has identified high potential application areas which are summarized below:

- Integration of grid interactive, on-site renewable energy generation capacities to local distribution grids, including micro grids over large industrial, commercial or residential

complexes. The sites may include large educational institutions, hospitals, hotels, shopping complexes, railway platforms, petrol pumps, bank ATMs, rural industrial hubs, post offices, defense installations etc.

- Integrating large-scale renewable energy projects (wind, solar, hydro etc.) to the transmission grids.
- Rural Micro Grids with diversified loads and renewable energy generation capacities. They can be grid interactive or stand-alone systems (off grid).

An illustrative list of benefits of energy storage in various application areas, is given at Annexure I.

## **2. Energy Storage Demonstration Projects**

### **2.1 Need for demonstration programme**

Looking at the increasing importance of energy storage for integrating renewable energy, the Ministry of New and Renewable Energy (MNRE) propose to support demonstration projects for energy storage to assess feasibility of energy storage technologies for small scale and grid connected MW scale renewable energy applications. The demonstration project are expected to help in acquiring the desired technical knowledge, economic & market assessment and insights on the approaches for shaping up a focused programme in this key area.

These demonstration projects are expected to generate awareness amongst users, about the economic benefit of energy storage technologies. These will also help in developing innovative approaches to finance energy storage technologies and also develop capacity to test and verify performance.

### **2.2 Broad goals of the programme**

The broad goals of the demonstration programme are as follows:

- To demonstrate Technical Performance, Value of Energy Storage and Potential Business models to support energy storage in priority Application areas.
- Based on the experience from demonstration projects, understand potential market size and ways to scale up deployment in key application areas.
- Identify policy measures to support the scale up, while reducing direct public support or subsidies.
- Develop protocol for effective validation of technical performance of storage technologies.
- Engage key stakeholder by attracting their participation in the demonstration programme and making them aware of the benefits of the technology, market potential, innovative ways of using the technology etc.

## **3. Invitation for Expression of Interest (EoI)**

MNRE invites Expression of Interest (EoI) from national entities interested in developing and deploying renewable energy integrated energy storage solutions for demonstration purposes, one each in the following application areas:

- Integrating large-scale wind and solar generation into the transmission grids.
- Rural Micro Grids
- Micro grids in commercial, industrial, residential, defense or other applications
- Large scale standalone systems

Electricity customers, Group of customers, distribution companies, transmission companies, storage technology providers/vendors, system integrators, generators, electricity services companies or consultants, etc. may apply. Applicants should be legally registered entity in India. A Consortium may also be allowed as long the consortium meets the qualification criteria, and as long as there is a clearly defined leader of the consortium. A party can apply for all application areas subjected to maximum of one application per application area as an individual applicant or part of consortium.

### **3.1 Technologies**

Any storage technology may be used. However preference would be given to those technologies and vendors which have a demonstrable track record, and are expected to experience significant cost-performance improvements with scale.

The storage capacities could be electrical, thermal or a combination of the two. However, thermal storage for solar thermal MW scale projects is not supported under this programme.

MNRE will evaluate proposals (EoI) on the extent to which the investment is justified based on realizable revenue streams from various stakeholders, and minimum subsidy support required. However the Ministry appreciates that many benefits may not be monetized today in absence of appropriate policy and willingness of stakeholders to pay.

The goal is to deliver maximum impact (e.g. MWh delivered) with minimum assistance per MWh by monetizing benefits from multiple value streams.

## **4. Proposals**

The proposal shall be submitted in the prescribed format as given in Annexure II.

### **4.1 Evaluation criteria**

Evaluation would be carried out for each application area separately and projects selected based on final evaluation scores.

The evaluation will be done in two phases:

- Screening for Technical Qualification
- Final evaluation score

The Technical Qualification would be a qualitative evaluation of the following dimensions

- Uniqueness, innovation, scalability, demonstrability, impact of Application and Business Model
- Qualification and Track Record of the Applicant
- Experience and Track record of the proposed technology
- Quality of the overall proposal and methodology

Minimum of 25% of overall rating on any of the dimensions would be needed. Applications with unacceptable levels of risks, level of grant needed, level of scale, or lack of clarity/details/ quality of information provided may also be rejected.

Final evaluation scores would be calculated as per the Table 1.

**Table 1: Evaluation Criteria**

| S.no | Criteria   | Description   | Weight |
|------|--|---|--------|
| 1    | Storage Cost Index   | INR/kWh capacity/cycle/round trip efficiency (compared to the best, qualified offer – bench mark (BM)); | 25     |
| 2    | Relative assistance needed   | Grant/kWh of storage capacity (relative to BM).   | 25     |
| 3    | Uniqueness, Innovation, scalability, demonstrability, impact of Application and Business Model | Rating 1-20; relative rating v/s BM   | 20     |
| 4    | Qualification and Track Record of the Applicant  | Rating 1-10; relative rating v/s BM   | 10     |
| 5    | Experience and Track record of the proposed technology   | Rating 1-10; relative rating v/s BM   | 10     |
| 6    | Quality of the overall proposal and methodology  | Rating 1-10, relative rating v/s BM   | 10     |

All indices to be computed so that higher the score, better it is. Hence cost and grant indices would be inverted to align the direction of all scores.

**Evaluation Score =  $\Sigma$  (Relative rating x Weight)**

#### 4.2 Application and award process

The steps, description and time frames are given in Table 2.

**Table 2: Timeline for Application and Award Process**

| S.no | Step   | Description   | Time frame                |
|------|--|---|---------------------------|
| 1    | Application Process  |   |                           |
| 1.1  | Draft Application  | Published on the web-site                           | 24 July 2014              |
| 1.2  | Stakeholder consultation   | With potential applicants, experts, regulators etc. | Before 10 August 2014     |
| 1.3  | Meeting of the Standing Committee on Energy Storage and Hybrid solutions | For direction & approval                            | Between 10-22 August 2014 |
| 1.4  | Final Request for Proposal (RfP) for Energy Storage Applications         | Published on Web-site and important media           | 29 August 2014            |
| 2    | Evaluation of Proposals  |   |                           |
| 2.1  | Receipt of proposals   |   | 22 September 2014         |
| 2.2  | Technical Screening  | Screen proposals meeting minimum criteria.          |                           |
| 2.3  | Final evaluation   | Based on evaluation scores.                         | 31 October 2014           |
| 3    | Award of grant   |   |                           |
| 3.1  | Discussions with Top Ranked  | To clarify, reconfirm key                           | 10 November 2014          |

| <b>S.no</b> | <b>Step</b>   | <b>Description</b>   | <b>Time frame</b> |
|-------------|---|--|-------------------|
|             | Applicants on details of the proposals  | points   |                   |
| 3.2         | Due-diligence/ investigation to reconfirm key aspects of the proposal   | Reference checks, expert views   | 20 November 2014  |
| 3.3         | Firming up pre-sanction conditions, payment schedule, implementation plans and final announcement of the awardees | Key conditions that must be met, before award of grant. Issue of LOI for award of grant. This may include regulatory approvals if any, customer commitment, or part of the financing that must be tied up etc.                         | 28 November 2014  |
| 4           | Detailed agreement for receipt of grants  | These may cover issues such as obligations of the grantee, reporting requirements, performance warranties, agreement to publish performance results, confidentiality issues etc.   | 15 December 2014  |
| 5           | Monitoring and Validation Manual for the Project  | These will cover issues such as Technical Performance, testing methods and data collection mode, Validation of revenue models, operating costs, operational problems, feedback from stakeholders, impact of use of energy storage etc. |                   |
| 6           | Publishing of results   | The results may be shared after pre-agreed time frames.  | March 2016        |

## Benefits of energy storage in various application areas

| Application area                                       | Description, Illustrative list  | Illustrative Application Goals   |
|--|---|--|
| Integration of large scale Renewable Farms             | <ul style="list-style-type: none"> <li>• Wind</li> <li>• Solar</li> <li>• Hydro</li> <li>• Mix (at the evacuation SS)</li> </ul>  | <ul style="list-style-type: none"> <li>• Improved Scheduling accuracy</li> <li>• Output smoothing</li> <li>• Fault ride through capability</li> <li>• Reduction of peak transmission capacity required</li> <li>• Improvement in power transmitted during peak load hours.</li> </ul>  |
| Rural Micro Grids                                      | <ul style="list-style-type: none"> <li>• Micro Grids integrating residential loads, community loads, local commercial and industrial loads, irrigation loads</li> <li>• Grids for rural industrial hubs</li> <li>• Irrigation grids</li> </ul>  | (Improved) cost of delivered power (a factor of efficiency, depth of discharge, capital cost/kWh, storage life etc)  |
| Grid Interactive Micro Grids /Large standalone systems | <ul style="list-style-type: none"> <li>• Large commercial complexes such as shopping complex, resorts, IT/BPO offices, hospitals, educational institutions etc.</li> <li>• Industrial zones, SEZs</li> <li>• Residential complexes, gated communities</li> <li>• Standalone systems such as petrol pumps, ATMs, street lights etc.</li> </ul> | <ul style="list-style-type: none"> <li>• Improved Power quality (voltage, frequency), availability for consumers.</li> <li>• Reduction of diesel consumption</li> <li>• Reduction of peak load (power consumed during peak hours)</li> <li>• Reduction of peak load (KVA)</li> <li>• Improved cost of delivered power (including procured power, grid power, renewable generation etc.)</li> </ul> |



## Format for Submitting Expression of Interest

### 1. Profile of the applicants

#### 1.1. Leader

##### 1.1.1. Registration, Legal Details of the Organization

|  |  |
|--|--|
| Name of the Organization                         |  |
| Unique Identification Number/registration number | {PI provide a copy of Certificate of Incorporation)          |
| Corporate Office Address                         |  |
| Registered Office Address                        |  |
| Web-site   |  |
| Authorized person                                | (PI attach authorization letter by the Board/Governing Body) |
| Name   |  |
| Designation                                      |  |
| Phone  |  |
| e-mail ID  |  |
| Affiliated business group                        |  |

##### 1.1.2. Brief Description of Business, Organization's History Etc. (100 Words)

##### 1.1.3. Experience in Implementing Energy Storage (200 Words)

{PI include a list profiles of key projects undertaken}

##### 1.1.4. Financial Performance (Last 3 Years)

| Parameter (Rs Million) | 2011-12 | 2012-13 | 2013-14 |
|------------------------|---------|---------|---------|
| Revenue                |         |         |         |
| PAT                    |         |         |         |
| Net worth              |         |         |         |

(Please include last 3 years financial statements)

##### 1.1.5. Business Presence in India (200 Words)

(Activities carried out, legal structure etc)

#### 1.2. Consortium Partner

##### 1.2.1. Registration, Legal Details of the Organization

|  |  |
|--|--|
| Name of the Organization                         |  |
| Unique Identification Number/registration number | {PI provide a copy of certificate of Incorporation}          |
| Corporate Office Address                         |  |
| Registered Office Address                        |  |
| Web-site   |  |
| Authorized person                                | (PI attach authorization letter by the Board/Governing Body) |
| Name   |  |
| Designation                                      |  |
| Phone  |  |
| e-mail ID  |  |
| Affiliated business group                        |  |

**1.2.2. Brief Description of Business, Organization's History Etc. (100 Words)**

**1.2.3. Experience in Implementing Energy Storage (200 Words)**

{PI include a list profiles of key projects undertaken}

**1.2.4. Financial Performance (Last 3 Years)**

| Parameter (Rs Million) | 2011-12 | 2012-13 | 2013-14 |
|------------------------|---------|---------|---------|
| Revenue                |         |         |         |
| PAT                    |         |         |         |
| Net worth              |         |         |         |

(Please include last 3 years financial statements)

**1.2.5. Business Presence in India (200 Words)**

(Activities carried out, legal structure etc.)

**1.3. Consortium Financial Profile**

| Parameter (Rs Million) | 2011-12 | 2012-13 | 2013-14 |
|------------------------|---------|---------|---------|
| Revenue                |         |         |         |
| PAT                    |         |         |         |
| Net worth              |         |         |         |

(Simple sum of financial numbers of consortium members)

**1.4. Relative Roles of the Leader and Consortium Partners**

|                           | <b>Leader</b> | <b>Partner 1</b> | <b>Partner 2</b> |
|---------------------------|---------------|------------------|------------------|
| Financing                 |               |                  |                  |
| Technology (Supply)       |               |                  |                  |
| System Integration        |               |                  |                  |
| Customer/Site Acquisition |               |                  |                  |
| Project Development       |               |                  |                  |
| Monitoring and Validation |               |                  |                  |

### **1.5. Letters of Participation in the Consortium**

{Pl attach letters of participation from all the consortium partners)

## **2. Profile of the Storage Project**

### **2.1. Location**

#### **2.2. Brief Description of Project Location**

##### **2.2.1. Existing Facility**

#### **2.3. Potential Scalability/Replicability of the Application**

### **2.4. Technology**

#### **2.4.1. Brief Description of Proposed Energy Storage Technology**

#### **2.4.2. Experience/Performance Track Record of the Technology (If Possible 1- Page Brief on Important Implementations in the Past)**

#### **2.4.3. Third Party Tests and Verifications**

#### **2.4.4. Awards, Recognitions If any**

#### **2.4.5. Plans for Local Presence (Services, Manufacturing)**

### **2.5. Proposed Project**

#### **2.5.1. Size/Capacity of the Project- Energy Generation**

#### **2.5.2. Size of Associated Renewable Capacity**

#### **2.5.3. Project Cost (Energy Storage Component)**

| <b>Items</b>                               | <b>Rs Million</b> | <b>Comments</b> |
|--|-------------------|-----------------|
| Energy Storage                             |                   |                 |
| Storage Management Systems                 |                   |                 |
| Costs of civil structures                  |                   |                 |
| Cost of integration with existing facility |                   |                 |
| Design costs                               |                   |                 |
| Implementation supervision costs           |                   |                 |
| .....                                      |                   |                 |
| .....                                      |                   |                 |
| Spares supply                              |                   |                 |
| Preliminary Costs                          |                   |                 |
| Interest During Construction               |                   |                 |
| Margin Money                               |                   |                 |
| Contingency                                |                   |                 |
| Total Project Cost                         |                   |                 |

#### **2.5.4. Project Cost (Renewable Energy Component)**

Brief project cost estimates (Rs Million)

#### **2.5.5. Proposed Financing**

##### **2.5.5.1. Renewable Energy Component**

**2.5.5.1.1. Grant (approved/likely- name of programme under which availed)**

**2.5.5.1.2. Debt (potential source)**

**2.5.5.1.3. Equity (potential source)**

##### **2.5.5.2. Energy Storage**

**2.5.5.2.1. Grant (Expected under this Programme)**

**2.5.5.2.2. Grant from other sources**

**2.5.5.2.3. Debt (potential source)**

**2.5.5.2.4. Equity (potential source)**

## 2.6. Pre-application Commitments Obtained from Relevant Important Stakeholders

2.6.1. Electricity Customers

2.6.2. Renewable Energy Generator

2.6.3. Distribution Company

2.6.4. Transmission Company

2.6.5. Other Impacted Stakeholders (e.g. Regulators) if their Involvement is needed for the Success of the Proposed Project).

## 2.7. Financial Warranties/Guarantees given vis-à-vis Defined Technical Performance

### 3. Goals of the Project

#### 3.1. Technical Performance

| Parameter | Value, Unit of Measurement | Frequency of Measurement/Timing | Comments |
|-----------|----------------------------|---------------------------------|----------|
|           |                            |                                 |          |
|           |                            |                                 |          |
|           |                            |                                 |          |
|           |                            |                                 |          |
|           |                            |                                 |          |
|           |                            |                                 |          |

Please include all the storage technical parameters which are related to the performance goals / outcomes of the Project.

#### 3.2. Business Model for the Project

##### 3.2.1. Revenue Streams for Benefits Realized in the Proposed Projects by use of Energy Storage

| Revenue Item | Charge Basis | Paid by whom | Annual value Rs million | Remarks/Policy changes required |
|--------------|--------------|--------------|-------------------------|---------------------------------|
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |

| Revenue Item | Charge Basis | Paid by whom | Annual value Rs million | Remarks/Policy changes required |
|--------------|--------------|--------------|-------------------------|---------------------------------|
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
| <b>Total</b> |              |              |                         |                                 |

Please provide value for costs- as negative numbers, if they need to be incurred for realizing the revenue.

**3.2.2. Revenue Streams that can be Potentially Realized in the Future with Appropriate Policy Changes**

| Revenue Item | Charge Basis | Paid by whom | Annual value Rs million | Remarks/Policy changes required |
|--------------|--------------|--------------|-------------------------|---------------------------------|
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
| <b>Total</b> |              |              |                         |                                 |

**3.2.3. Revenue Streams that are attributed to the Renewable Energy Component**

| Revenue Item | Charge Basis | Paid by whom | Annual value Rs million | Remarks/Policy changes required |
|--------------|--------------|--------------|-------------------------|---------------------------------|
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
|              |              |              |                         |                                 |
| <b>Total</b> |              |              |                         |                                 |

Please ensure that values provided for energy storage don't include the revenue realizable due to renewable energy generation. Provide a split where needed.

**4. Monitoring and Validation Methodology**

Detailed monitoring plan to be submitted later after detailed negotiation. Provide a brief approach.

**4.1. Technical Performance**

**4.2. Financial Performance**

**4.3. Other Impacts**

Impacts on the proposed facility, T&D system, consumers systems, and overall society, if any.

**5. Implementation Plan**

(A Broad Plan to include elements of design, planning, financing, implementation, demonstration period and final sign off). Detailed plan to be submitted later.

**6. Proposer’s Recommendations**

**6.1. Ideas for Scaling-up and Replicating Use of the Technology**

**6.2. Policies needed to Maximize the Business Value of the Application**

**6.3. What Roles can the Applicant Play in Scaling-up Deployment of the Technology?**

**7. Checklist Of Documents Enclosed with the Application**

|   |        |
|---|--------|
| Copy of Certificate of Incorporation                                      | Yes/No |
| Annual Report of past three years (for all members of consortium)         | Yes/No |
| Letter of participation in Consortium (if case of consortium)             | Yes/No |
| Third Party Tests and Verifications report of energy storage technology   | Yes/No |
| Pre-application Commitments Obtained from Relevant Important Stakeholders | Yes/No |