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National Innovation Challenge Awards for Designing and Developing Energy Storage Devices for Rural Household/ Enterprise Applications

1. Context

In recent past, there is a rapid decline in the costs of renewable energy generation. For example, levelized solar energy costs in India are competitive or, in some cases, cheaper than the average cost of electricity for residential use. The adoption of renewable energy sources is therefore economically viable. Further, it has the potential to provide access to uninterrupted and clean electricity to almost all households of rural India. However, a major hurdle for the realization of the national dream of complete rural electrification is the absence of an economically viable energy storage solution that can be integrated with renewables, which are an intermittent energy sources. Cost effective and reliable integration of renewable energy with storage is therefore essential to provide an uninterrupted electricity supply.

2. Objective

The objective of this grand challenge is to develop cost effective, viable and reliable solutions that can address the challenge of energy access through an energy storage system integrated with appropriate renewable energy source (s).

3. Possible Technology Options

As the biggest contributor to the cost of the proposed system is the energy storage component, this grand challenge seeks innovative solutions in the area of energy storage. Possible energy storage technologies of interest could include, but are not limited, to electrochemical energy storage such as second use Li-ion batteries, Ultra-capacitors, Advanced Pb-Acid Batteries, Flow batteries etc.; Fuel cells might also be considered if suitable locally sourced (from the same establishment as the installation) fuel sources such as Bio-gas or photo-electrochemical water splitting can be employed for hydrogen generation; Thermal energy storage systems such as Thermal energy storage in brines or Supercritical CO₂ based thermal energy storage may also be proposed if techno-economically viable according to the afore-stated requirements. Innovative business solutions that use existing energy storage technologies that could meet the afore-stated requirements without large scale technology innovation will also be considered. Development of novel energy storage technologies that could meet the above requirements is a possibility. However, such proposals should clearly be at a Technology Readiness Level (TRL) that can translate to a product within the time frame of this grand challenge.

4. Challenges

Conventional storage technologies such as Lead-Acid or Li-Ion are not cost competitive with residential electricity costs in India. Average electricity cost of a rural household with approximately 2 kWh of daily usage is about Rs. 5 per kWh or less. Therefore, for widespread adoption, it is imperative



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that renewables integrated with energy storage should be cost competitive with the average electricity cost for residential use. However, such systems available on the market today have a levelized cost of >Rs. 30 per kWh. Furthermore, the upfront capital investment for an energy storage system integrated with renewables is very high and, in most cases, a major obstacle for adoption of clean energy sources. In addition, most storage technologies have not been fully benchmarked for operating in climatic conditions pertinent to India. It is beyond doubt that bringing clean and uninterrupted power to rural India will require innovative solutions that are specific to the socio-economic and climatic requirements of these regions.

5. Performance and Cost Benchmarks

The proposal should target the development of a system that meets the following conditions:

- 1) Un-interrupted power supply for at least 12 hours necessarily including night time (6 pm to 6 am) can be provided;
- 2) The total daily energy requirement for a single home is set at a minimum of 2 kWh while having a peak power capability of 5 kWh;
- 3) The system for an individual home need to be a grid integrable system capable of operating both off-grid as well as on-grid. The system for a small rural establishment should also have same capabilities.
- 4) The Levelized Cost Of Energy (LCOE)* for the proposed system, either being developed for a single home or for a small rural establishment should be <Rs. 10 per kWh (available government subsidies could be used for this calculation. Cost without government subsidies should also be provided);
- 5) As the capital cost of such systems are expected to be higher than conventional systems, innovative business approaches encouraging wider adoption without the requirement to buy out such a system should be included.

*The levelised cost of electricity takes into account Investment expenditures in year (including financing) , Operations and maintenance expenditures in year , Fuel expenditures in year , Electricity generation in year, Discount rate and Life of the system. The proposer would be required to provide this calculation as per standard practice in support of his application.

6. General System Requirements

- 1) Energy Storage device/system should be Human Safe, Temperature Tolerant for Tropical Ambient use.
- 2) Expected deliverable: Fully functional, containerized Energy Storage System (ESS) capable of receiving, storing and delivering electrical energy at specified rate(s) suitable as off grid stand-alone for an individual home or as an Off-grid-integrable application.
- 3) Energy Storage Battery/Medium Requirement: Shall provide its performance against temperature, time, number of Charge/Discharge cycles, humidity, voltage, current, Energy

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Storage Capacity (KWh) at Beginning of Life (BOL), and Energy Storage capacity(KWh) at End of life (EOL). Battery End of life shall not be less than 5 years.

- 4) Power Quality: For Grid interface application, the ESS shall not generate harmonics higher than 30% of the limits specified in the latest from the IEEE 519 standard.
- 5) Power Ramping: ESS should be capable of Power Ramping Up/Down +10% per minute subjected to the maximum availability of Energy Storage System
- 6) Grid Code Compliance: ESS shall comply with India CEA 2013 latest version, and UK Grid Code for battery storage grid application.
- 7) Emergency/Panic Button: ESS shall have Panic button to stop system under emergency condition, as per provision of IEC regulation.
- 8) The solution should specify End of Life Recycling/ Disposal method.

7. Who can apply?

- Faculties/Scientists working in regular position in recognized Academic Organization /Public funded R&D Institution/ Laboratories, DSIR recognized SIRO organization Technology Business Incubators (TBIs).Start-ups , Individual Innovators

8. Evaluation criteria (Indicative) and Process

Besides meeting the requirements specified in Item 5 &6 , the evaluation process will also include following :

- Design Innovation
- user friendly features and operating convenience
- Sturdiness

The jury will exercise the discretion to select the next best design(s) for Grand Challenge awards if none of the entries meet the criteria for energy storage device fully. In such case, entries meeting the requirement partially can be considered.

The selection will be based on the recommendations of a jury of experts constituted by the DST.

9. Documents required

- Duly filled in application form in prescribed format.
- Complete Integrated Energy Generation cum Storage Device Schematic with broad configuration. Complete Design document with specification need to be provided by shortlisted applicants in actual rural setting.
- Bio-data with full details of achievements, publications, patents and contribution in the area of *National Innovation Challenge Awards for Designing and Developing Energy Storage Devices for Rural Household/ Rural Enterprise Applications*



energy storage.

10. Awards

- The selected entries will get financial support of Rs.10 lakh for development and delivery of two working prototypes.
- The winning entries will get a cash award of Rs. 2 lakh, 1.5 lakh and 1 lakh each. In addition pilot demonstration of the selected units may also be supported in appropriate location. The selected applicants will be required to submit a formal proposal to DST, which will be evaluated by Expert Panel.

11. General Guidelines, Terms and Conditions

- Participant should submit design solutions/products owned by them or to which they have right to claim and use as owned by them. Suitable documents to this effect must be submitted along with the entry.
- Participant shall ensure that any submission made in the Challenge does not violate any of their or any third party's intellectual property rights, confidentiality, trade secret and violate any statutory provisions.
- Expert Panel and Innovation Committee shall in no event be liable for any violation of IPR, or license or permits etc. required from third party.
- DST, members of Expert Panel, Selected Jury, supporting organizations or any employee or agent shall not be liable for any costs incurred or loss or liability or loss in expectation of profits or loss due to failure of understanding the terms and conditions of the challenge or of any expected benefit of the participant in relation to entry and submission in the challenge.
- DST shall make all efforts to maintain confidentiality. The organizers, jury including concerned DST officials will be required to sign non-disclosure agreement and abide by DST's policy on conflict of interest.
- At any stage while evaluating the entries, DST/organiser shall be free to contact the Participants and carry out discussions on the matter submitted by the Participants for the purpose of understanding only. Any solicitation by participants in whatever form in respect of their entries shall not be entertained and entries of such participant shall be disqualified from the Innovation Challenge.
- DST may change the Terms and Conditions of participation at any time without prior notice, which will be notified through DST website. Kindly refer to organiser website from time to time.
- DST may disqualify a Participant/s from the Challenge for breach of any of the conditions of this Challenge, or discontinue this Challenge.
- In cases of any difference of views, decision of Secretary, DST shall be final and binding.
- Disputes, if any, are subject to the jurisdiction in the courts of Delhi only.

12. Call Stages and Dates

Call Opening Date: 03.06.2020

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Call Closing Date: 31.12.2020

Award Stages: Stage –I Shortlisting of finalists (By February 2021)

Stage -II Delivery of two working prototypes (By August 2021)

Stage-III Testing of Prototypes (Lab and Field Tests By February 2022)

Stage-IV Announcement of Successful Solutions (May 2022)

13. Application Format and Submission

Duly filled in applications should be submitted online at onlinedst.gov.in. Soft copy is also to be emailed to ranjith.krishnapai@gov.in on or before 31st December 2020.

14. Programme Officer at DST

Dr. Ranjith Krishna Pai, Scientist 'E', Room No: 01, S&T Block-III, Technology Mission Division, Department of Science and Technology (DST), Ministry of Science and Technology, Government of India, Technology Bhavan, New Mehrauli Road, New Delhi -110016



National Innovation Challenge for Designing and Developing Energy Storage System for Rural Households/ Establishment

COVER SHEET

Title of the proposed design:

Relevant Climatic Zone of India :

Design Category :

(Tick the appropriate) Rural Household/ Rural Establishment

Submitted by:

Name of the Proposer:

Designation :

Official Postal Address:

Phone:

Mobile:

Email:

Send to:

(Organizer's Address)

1.0 Technical Details (To be attached as Annexure)

It is desirable to cover the following aspects in the document:

- Brief summary of proposed Energy Storage System (not to exceed 150 words)
- Description of science behind the design/innovation
- Description of working of the design/ approach/innovation (use sketch/drawing, patent, photographs, video to explain the working)
- Technological challenges in manufacture of proposed Energy Storage System.
- Novelty of the design
- Indicate how your design/approach is better than the currently available approaches
- Cost details of the system including bill of materials



- Levelised Cost of Electricity Calculations

2.0 Details of relevant work done on Energy Storage System so far

- i) Development work done so far, including involvement of agencies, consultation with experts
- ii) Patenting of the design/innovation, if any
- iii) Techno-economic / market feasibility studies /reports, if any
- iv) Tie-up for design, fabrication etc with any external agencies, if any
- iv) Consumers / users feedback, if any
- v) Any other information.

3.0 Declaration

I / We declare that all the statements made in this application are true, complete and correct to the best of my/our knowledge and belief. In the event of any information, found false or incorrect, my/our candidature will stand cancelled and all my/us claims will be forfeited. I / We have read all the terms and conditions for participating in the design competition.

Place:

Signature of the proposer

Date:

Co-proposers

Name	Designation	Mobile Number	Signature

4.0 Endorsement from the Head of Organization

Certified that the Institute/ R&D Organization/ Industry welcomes participation of _____ as the Proposer and _____ as the Co-Proposer in the National Innovation Challenge for Designing and Developing Energy Storage System for



Rural Households/ Establishment.

Signature
(Designated Authority with seal)

Place:

Date:

5.0 BIOGRAPHICAL SKETCH

To be submitted separately for the Proposer and Co-Proposer/s from Institute/ R&D Institutions/Industry

Name :

Designation :

Name of the Institute or Industry :

Telephone No:

Mobile No:

Email:

Date of Birth : Gender (M/F) :

Education (Graduation onwards)

Sl No.	Institution	Degree Awarded	Year	Field of Study

Professional Career (Starting with the most recent employment)

Sl No.	Institution	Position	From (Date)	To (Date)



Proof of Experience Related to Energy Storage System

Achievement Details related to Energy Storage System, if any (Provide complete details and list all)

1. Research Papers: 2. Patents : 3. Prototypes and working models:

4. Others (Please specify):

List of three selected publications/patents relevant to the Energy Storage System (in chronological order) and attach copies of the same

1.

2.

3.

It is certified that the above particulars submitted are true and correct.

Place:

Signature :

Date :