

# Department of Science and Technology (Technology Mission Division-EWO)

## Call for Proposals:

### **Solar Energy Research and Development (SERD-2019)**

#### **1. Preamble**

Solar Energy Research Initiative targets to leverage Indian Research and Engineering capabilities to facilitate and enable the achievement of Sustainable Development Goal 7 and National Solar Mission objectives. The initiative promotes progression of the Technology Readiness Levels (TRL) for:

(a) Development of indigenous equipment/ systems for solar energy technologies (b) Developing specialized consumables, pastes, coatings, components etc (c) convergent solar energy innovative solution for both power and non-power application such as process heating, air-conditioning, agriculture, day lighting, desalination including other innovative cogeneration and poly-generation options etc. (d) Developing Modelling, testing and advanced characterization of state of art solar cells /devices/modules meeting global bench.

#### **2. Objectives of Call**

The objective of the call is to promote translational research utilising available lab scale know-hows to consolidate research outputs to advance current technologies in the related field to deliver potential solutions to solar sector industrial and societal applications. Lead Principal investigator should have a research team to foster interdisciplinary, multi-institutional networked research projects synergising strengths of respective partners to deliver efficient devices/systems meeting national needs. The call envisages close interaction between industry, academia and research institutions. Participation of industrial collaborator from early stage is desirable to build long term linkage and take up leads to develop technologies which could eventually find a space in market place. The outcome of the scientific endeavour under the call should be scalable. The deliverables of the projects have the potential to change business -as -usual scenarios. Special consideration will be given to the projects which identify prevalent and emerging India-Centric challenges in Solar Energy. Projects proposed in participation with the developer of solar system identifying the field level issues and providing the solution with innovative research-led engineering solution, would be given priority funding among the shortlisted project so as to deliver the outcomes by year 2022 when India celebrates its 75<sup>th</sup> years of independence. The relevance of the research should be established based on identified need.

### **3. WHO CAN APPLY**

The proposals are to be led by Faculties of recognized universities and academic institutions, scientists working in National and State Laboratories, R&D institutions and Research organizations recognized by DSIR individually or in consortium. Genuine and meaningful participation of industry (with statutory recognitions) having capability in the area and have potential to commercialize the developed technology is desirable. Preference will be given to work targeting to upgrade the TRL of existing work instead of switching into new area of research. The eligibility of each stream is outlined in the following section.

### **4. CALL STREAMS**

The proposals are invited under five different broad streams. An applicant can apply in any one of the five streams as Nodal Principal Investigator where he/she is best to deliver the outcome to country. **All applications of an individual would be summarily rejected if he/she applies in more than one stream as Nodal Principal Investigator.** The topics indicated in call are only illustrative and any other topic addressing call spirit may be considered. The call has five different streams :

#### **4.1 SOLAR EQUIPMENT & CONSUMABLES STREAM (SECS)**

**Focus:** Development of Equipment/Tools /Consumables for the solar sector.

**Eligibility:** The proposals have to be submitted with appropriate Institute – Industry - User partnership only. The proposals are to be led by faculties/ scientists working in regular position in recognized academic institutions, public funded R&D Institution/ Laboratories, DSIR recognized SIRO organization in partnership with other academic/ R&D organisation etc. Participation of industries/ start-ups and industry association is strongly recommended. The role of industry in the proposal should be tangible and it should show interest in promoting or encouraging the developed technology. The company/industry has to be willing to contribute in the form of industry attributable technical inputs and resources in kind. Financial participation of the industry will be viewed positively.

**Project Cost:** No ceiling

**Project duration:** Upto 3 Years

## 4.2 AFFORDABLE SOLAR INNOVATION STREAM (ASIS)

**Focus:** Development of frugal innovations for India centric requirements including development of solution to address the problems faced by developers of solar power plant/ solar parks.

**Eligibility:** The proposals are to be headed by faculties/ scientists working in regular position in recognized academic institutions, public funded R&D Institution/ Laboratories, DSIR recognized R&D organizations in partnership with other academic, R&D organisations, industries/ S&T based voluntary organisations and Users (Utility, Panchayat, Municipal Corporation etc.). Participation of industries/ start-ups is also welcome, where-ever applicable. The consortium team may include at least a user having interest in the intervention, a solution designer and a solution provider.

**Project Cost:** Not exceeding Rs. 50 lakhs (excluding overheads)

**Project Duration:** Upto 2 Years

## 4.3 SOLAR TECHNOLOGY DEMONSTRATION STREAM (STDS)

**Focus:** Leading to enhancement of the Technology Readiness level of the Device / Process System to lab /fields demonstration.

**Eligibility:** The proposals have to be submitted in the institute – industry / user partnership only. The proposals are to be led by faculties/ scientists working in regular position in recognized academic institutions, public funded R&D Institution/ Laboratories, DSIR recognized SIRO organization in partnership with other academic/ R&D organisation, state line departments, S&T based voluntary organisation, etc. Participation of industries/ start-ups and industry association is strongly recommended. The role of industry in the proposal should be tangible and it should show interest in promoting or encouraging the developed technology. The company/industry has to be willing to contribute in the form of industry attributable technical inputs and resources in kind. Cash contribution will be added advantage. Preference will be given to proposed work targeting to

upgrade the TRL of previous work done by the group rather than supporting new area of research.

**Project Cost:** Up to 5 crores for the credible scale prototype / Facility / demonstration system. The cost of instrumentation research, testing and characterization equipment used in labs should not exceed 30% of project cost. The plant and fabrication cost is not covered in this 30% ceiling.

**Project duration:** Upto 3 years

#### **4.4 CONVERGENT SOLAR SOLUTION STREAM (CSSS)**

**Focus:** Leading to potentially viable deployment at a credible scale for technology in real field set up. Other renewable resources like hydro ,wind, bio-gas etc. may also be integrated as per the site location. Unique selling point (USP) of such demonstration must be aptly mentioned in proposal.

**Eligibility:** The proposals have to be submitted in the consortium mode only The proposals are to be led by faculties/ scientists working in regular position in recognized academic institutions, public funded R&D Institution/ Laboratories, DSIR recognized R&D organizations in partnership with other academic, R&D organisations, industries and Users (Utility, Panchayat, Municipal Corporation etc.). Participation of industries/ start-ups is also welcome, where-ever applicable. The consortium should essentially include at least a user having interest in the intervention, a solution designer and a solution provider. The role of solution designer and provider may be assumed by the same organization, if the organization has required expertise and experience.

**Project cost:** No ceiling for setting up field system, provided the partnering user demonstrates willingness to validate the technology through providing tangible inputs to the project. Sharing of resources is welcome as it signifies commitment and participation of stakeholders.

**Project duration:** Upto 3 years establishing techno-socio-economic viability

## **4.5 APPLIED RESEARCH SOLAR STREAM (ARSS)**

**Focus:** Proposal leading to establishment of proof of concept and to explore disruptive innovative ideas with a view to showcase the unique advantages of the idea over existing option. Only project evolving exceptional scientific research having potential for breakthrough will be supported. The projects related to photovoltaic and thermal of incremental nature will not be supported.

**Eligibility:** The proposals are to be led by faculties/ scientists working in regular position in recognized academic organizations / public funded R&D Institutions/ laboratories, central and state government autonomous organisations.

**Project Cost:** Total project cost not exceeding 150 lakh (indicative) where-in equipment cost is limited to around 30% of the project cost.

**Project duration:** Upto 3 years

## **5. CALL DATES**

**OPENING DATE :** 12<sup>th</sup> August 2019

**CALL CLOSING DATE:** 11<sup>th</sup> October 2019

## **6. SPECTRUM OF ACTIVITIES SUPPORTED**

The spectrum of activities focusses on translational research to convert available know how to useful product /process etc. It also includes applied research aimed at performance enhancement of existing devices and systems. The strategy for sustainability of intervention and post intervention also needs to be explicitly stated. The applicants are advised to indicate TRL level at the beginning and end of the project.

## **7. ASSESSMENT CRITERIA**

The proposal relevant to call objectives will be evaluated based on following criteria:

- a. Need assessment and demand for proposed work.
- b. Scientific appropriateness of deliverable of proposed approaches and technical merit (Superiority of proposed work over existing alternatives)
- c. Expertise, Existing infrastructure, Facilities and track record of team.
- d. Proposal formulation, Literature/patent/field review, qualified objectives, methodology and work plan, clear and well defined deliverables.

- e. Potential to proliferate clean energy deployment, competitiveness of performance/ cost.

However, weightage of the criteria will vary depending upon the anticipated output in identified stream.

## **8. INDICATIVE PROJECT TOPICS**

Disclaimer: Topics given are not prioritized and are the suggestions received from various stakeholders. Submissions of the project proposal on these topics do not indicate preferential treatment or otherwise. The onus of establishing need and demand of the research convincingly rests on proposal through supportive facts and data.

The interdisciplinary and transformative R&D proposals leading to development of efficient devices and systems that could be adopted in the real field/industry utilization with well-identified /suitably quantified, scientific and technological gaps would be preferred. Proposal on fundamental science, material science and study of properties etc. would not be acceptable under the call. The scientific outcome of the proposal should have clear connection with application in industrial/ societal application.

The following research area emanating from several scientific discussions and consultations with stakeholders. However, any other topic which could lower the cost of solar energy through technological innovations can also be proposed. In all cases, the proposal should be developed based on clearly felt a need and demand for the research endeavor.

### **The indicative thematic research topics are:**

#### **Solar Energy Equipment / Tools for Solar Sector**

- ❖ IV tester for cells and modules
- ❖ Sheet resistance measurement setup with calibration to some standard
- ❖ Laser Cutter / Scriber
- ❖ Spectral response, Quantum efficiency set system for large area (156mm \*156 mm) solar cell
- ❖ Single side etcher for lab/ shop floor
- ❖ System for detection of non-uniform grid line printing
- ❖ Test Setup for Modules to conform Potential induced degradation resistant
- ❖ Regeneration setup to reverse Light Induced Degradation (LID)
- ❖ Tabber for cut cells

#### **Thermal**

- ❖ High Efficiency Power blocks and related components (heat exchangers, compressors, expanders, etc.) with targeted capacities and efficiencies:

- Medium (150°C) to high temperature (300 °C) CSP technology based ORC systems.
- Supercritical/ultra supercritical steam power cycles based systems
- Supercritical CO<sub>2</sub> based Brayton cycle based systems.
- Low capacity Stirling and alternate Engines.
- ❖ Indigenization of Key CSP System Components taking in to account material availability and manufacturing capability; Development of medium capacity prime movers and components.
- ❖ Dust mitigation for thermal systems in India's context.
- ❖ Life cycle stability and thermal cycling fatigue issues.
- ❖ Support Structure related studies including new low cost materials, Material compatibility, Protective coatings, design optimization for cost, stability under wind and thermal loads.
- ❖ Heliostats, Dishes and Parabolic troughs: Cost effective Designs, Reducing of Tracking Power and Costs, Cleaning systems etc.
- ❖ Receiver related issues: Maximization of efficiency & Minimisation of Optical & Thermal Losses: Optimization of receiver geometry, Radiation shields and windows, etc., Coatings, Integral Receivers, Heat transfer fluid specific (air, CO<sub>2</sub>, direct steam, etc.) designs.
- ❖ Characterization and performance testing standards and facilities for components of CSP technologies such as Reflectors (including materials and coatings), Receivers (including selective coatings for high temperature applications, intensity profiling, etc) Prime movers, Heat exchangers and Heat transfer fluids.
- ❖ Benchmarking of optical and thermal design codes/methodologies and layouts for Dish, Heliostat and Parabolic trough/ Linear Fresnel fields
- ❖ Thermal desalination of brackish sea water to produce potable water; material related issues and novel cost effective technologies.
- ❖ Integration of poly-generation (multi input and multi-output) technologies/novel thermodynamic cycles and configurations
- ❖ Material Compatibility issues such as corrosion, erosion, thermal stability and volume expansion
- ❖ Matching up overall system dynamics with designed storage (Charging, discharging, cost effective heat transfer enhancement techniques, heat transfer issues)
- ❖ System hybridization / integration, packing arrangement, heat transfer fluid compatibility, size-to-capacity ratio
- ❖ Design of systems based on fast charging and controlled discharging, especially for Electro chemical /Thermo-chemical Systems

## **Photovoltaics**

- ❖ Fabrication of Silicon based devices, non-silicon devices, organic solar cell, dye sensitized solar cell, hybrid solar cell, Perovskite solar cell, Transparent solar cell
  - Large area devices with target efficiency equal or greater than current international benchmarks

- Pre-commercial scale devices encompassing novel processes of high through put, better power conversion efficiency, stability, reliability etc. with commensurate reduction in cost
  - Large-area perovskite mini-modules (10,000 hours' stability)
  - Fabrication of devices/modules on substrate; glass, plastic, steel, cloth, paper etc.
- ❖ Import substitution of cost effective precursors/components/ systems/dyes/ inks/ jigs/ high purity material etc.
    - Development of energy harvesting modules
    - Development of efficient metallization paste/ encapsulation and supportive materials
    - Dust repellent/ self-cleaning coatings/systems.

### **Cost Effective Field Application**

- ❖ Renewable Energy Harvesting Devices with identified/targeted applications
- ❖ Solar pumps system for field irrigation
- ❖ Advance PV panel failure detection systems
- ❖ Smart networks for renewable integrated sources: Standalone / Grid interactive.
- ❖ Augmentation of distribution network with frugal control system to couple renewable power in rural areas.
- ❖ Cost effective smart system for Road / Roof top
- ❖ Development and field performance of smart grid systems for islanded and re-synchronizable systems
- ❖ Solar Cooking.

## **9. PROJECT FORMULATION GUIDELINES**

The proposals should clearly define the objectives and list the deliverables. For system / component / consumables related proposals, the deliverable should include a target performance and establish in the proposal ; how their proposed process/ product/system stands in comparison to comparable national and international ones in terms of performance and projected cost. The CV of the project investigators should be brief and highlight their competence and experience related to the proposed project area. Consortia may be formed wherever required by clearly explaining the need for forming the consortia and the roles and responsibilities of each partner. The industry partner should have proven standing and R&D capability in the area related to Solar Energy Technologies and should exhibit the potential to commercialize the products / systems developed under the proposal. The extent of participation and contribution of the industry partner should be clearly defined. Participating Industry would be required to invest within its own system i.e. production/ test lines and/or develop required infrastructure to adopt research leads and is expected to bring design and engineering capability for the benefit of the project. Contribution in cash, though welcome, is not mandatory for the projects submitted under this call.



## 10. ONLINE SUBMISSION OF PROPOSAL

Proposals are accepted **only online** at e-PMS under Technology Mission Division in the prescribed format till office time on closing date of proposal. Proposal format can be downloaded from Website <https://onlinedst.gov.in/Login.aspx> . Go to: Schemes And Formats : Technology Mission Division : Solar Energy Research Initiative programme : Download Call format. **Fill in the relevant Stream format only (out of five streams) in which you like to apply.** The proposal in any other formats will be summarily rejected. Kindly comply to the instructions as mentioned below during online submission of proposal:

a. Under **General Information** tab: In **Project Keyword:** Ensure to mention the **acronym** of relevant stream

1- Solar Equipment & Consumables Stream : **SECS**

2- Affordable Solar Innovation Stream : **ASIS**

3- Solar Technology Demonstration Stream : **STDS**

4- Convergent Solar Solution Stream : **CSSS**

5- Applied Research Solar Stream: **ARSS**

b. Under **Principle Investigator** tab: In **Co-Investigator List-** Please ensure to mention the details of all the persons involve in the project including collaborator .

c. Under **Suggested Referees** tab: At least 3 referees are mandatory to be mentioned

d. Under **Ongoing projects** tab: Declared those projects related to the Principle investigator.

e. Under **Submission** tab: **Certificate from PI (Pdf Max 800 Kb):** Please ensure certificate of all PI's and Co-PI's in the project team should be merged together and uploaded as a single pdf document.

f. Under **Submission** tab: **Endorsement from Head of Institute (Pdf Max 800 Kb):** Please ensure that certificate from relevant institutes (if any) of all PI's,Co-PI's ,collaborators ,Letter of Intent from beneficiary ( as applicable for selected stream) of project should be merged together and uploaded as a single pdf document.

g. Nomenclature for soft copy of Project proposal document: (PI first name –Institute -City) eg; if PI name is Dr. Anil Kumar and his affiliation is National Institute of Technology, Raipur then soft copy file name is Anil-NIT-Raipur.docx /Anil-NIT-Raipur.pdf

It is advised to submit the proposal at the earliest and not wait till last moment, as submission of proposal on the closing day of call may hamper due to congestion on server.

**11.For online submission problem :** Contact Portal Help-Desk Executive at 011-26590545.

**12.For any other Information:** Contact Programme officers: Mr. Vineet Saini, Scientist 'E' / Mr. Dharendra Tiwari ,Scientist B; Technology Mission Division (E&W), Department of Science & Technology (DST), Technology Bhavan, New Mehrauli Road, New Delhi- 110016 ( Ph 011-26590622/011-26590372).

\*\*\*\*\*