

Funding Opportunity Announcement (FOA) in Converting Sunlight to Storable Fuels, Energy-rich chemicals and Biochemicals (IC#5)

jointly by

Department of Biotechnology & Department of Science and Technology

1. PREAMBLE

Mission Innovation (MI) is a global initiative of 23 countries and the European Union to accelerate the global clean energy innovation. As a part of this initiative, the participating countries have committed to double their government's clean energy research and development (R&D) investments over five years while encouraging greater level of private sector investments in clean energy technologies. These additional resources will dramatically accelerate the availability of the advanced technologies that will define a future global energy mix that is clean, affordable, and reliable. Mission Innovation was announced on November 30, 2015, as world leaders came together in Paris to undertake ambitious efforts to combat climate change.

MI countries have agreed to double their R&D investments from base year of 2015 in five years i.e. by 2020. Government of India has given the responsibility to Department of Biotechnology (DBT), Ministry of Science & Technology through Department of Biotechnology [with strong participation from Department of Science and Technology (DST)] to coordinate the Indian MI activities (Please see details at www.mission-innovation-india.net).

India along with 23 other countries is a member of all Mission Innovation (MI) challenges for clean energy development and is co-lead in three challenges. India has taken lead in MI activities by arranging country workshops on seven innovation challenges and has also organized MI International workshops/ conferences on Smart Grids and Sustainable Biofuels. MI India Team has identified priority areas in seven challenges where international cooperation and mutually beneficial engagements can be established. Converting Sunlight is one of the Mission Innovation Challenge.

Solar energy is one of the most important sustainable energy sources on the planet, and enough energy strikes the earth in the form of sunlight to fulfill all of mankind's energy needs. However, the transition from fossil fuels to cleaner solar fuels has been hindered by low maturity and the high cost of conversion technologies. Producing carbon-neutral clean fuels and developing breakthrough

energy storage chemicals, will not only contribute to mitigating climate change; they will also serve to enhance energy security and will provide opportunities for economic development across the globe.

A key challenge in converting sunlight is to discover affordable ways to obtain these fuels and energy storage chemicals. Research and Development (R&D) in converting sunlight challenge is still in the realm of basic research, which makes it an attractive proposition for scientific collaboration. The **Converting Sunlight Innovation Challenge** intends to strengthen and expand collaboration nationally and internationally including the private sector engagement. The key challenge ranges from development of stable and cost effective materials to studies on process economics, to an efficient reactor design and process scale-up with demonstration of technology.

There is a strong need to continue support for R&D in areas of Converting Sunlight and an effective cooperation between researchers of MI countries is one of best ways to giving this a special boost.

Considering the fact that the research areas under this initiative may fall in domain of both DBT and DST, this call for funding is on behalf of both DBT and DST to derive synergies and avoid any potential overlap.

2. OBJECTIVES:

The objective of this Call is to undertake **joint Research & Development (R&D) with member MI countries** in the field of **Converting Sunlight**, the next generation of technologies that can capture and bottle the energy of the sun. Obtaining these fuels and energy storage chemicals is a challenge with great opportunities. The research may aim at exchange of best practices in stable and recyclable material, process economics and engineering, integrated with an efficient reactor design. (For more details, please refer to Description of this innovation challenge available at www.mission-innovation-india.net).

3. PURPOSE:

The purpose of this joint call between Department of Biotechnology and Department of Science and Technology, Ministry of Science and Technology on **Converting Sunlight** is to discover scalable, non-toxic materials and processes to convert sunlight into storable fuels. Also the purpose is to conduct Research, Development and Demonstration (RD&D) to foster technology innovations that are technically feasible, robust and eventually cost-effective. It is expected to evolve research leads for developing technology options, practices and business models tunable to local as well as global needs. The Funding Opportunity Announcement (FOA) also encourage visit of Post-Docs and researchers to enhance international collaboration and exchange of research ideas.

4. SCOPE:

This funding opportunity will financially support activities towards design, research & development and demonstration (RD&D) that can address the issue of development of widely affordable, ways to convert sunlight into storable solar fuels.

The project is to be led by academics/ scientist from Indian scientific / R&D institution with the participation of at least one MI country.

5. IDENTIFIED RESEARCH PRIORITIES:

Indicative list of R&D priority areas identified for this call are listed below. However, this list is not exhaustive and proposals aimed at addressing any other major research challenge in the area could be submitted. In all proposals need and relevance of proposal to address research challenge must be established and overreaching goal of the proposal need to be highlighted.

Physicochemical:

- Stable, non-toxic, recyclable material as catalyst for water splitting, H₂ production and CO₂ reduction.
- Discovering electro-catalysts for selective and efficient water oxidation and conversion of CO₂ into fuel.
- Accelerating the discovery and in-depth understanding of photo-catalysts and photoactive materials for solar driven CO₂ reduction reactions.
- Design and engineering of devices for production of energy rich chemicals.
- Design of CAPEX and OPEX friendly bioreactor systems and material development.

Biological:

- Photocatalysis
- Photoelectrochemical cells
- Improved biomass processing operations, including cell rupture, lipid extraction, biomass conversion.
- Design and large-scale demonstration of cultivation systems.
- Life-cycle analysis and techno-economic assessment of large-scale cultivation processes.
- Expanded portfolio of products for better cost economics, host engineering/strain improvement of micro algae and cyanobacteria for improvement of photosynthetic efficiency, production of bio-chemicals, secretory biofuel molecules and precursors.
- Biocatalyst improvement using synthetic biology for Photo-bio electrochemical reduction of CO₂.
- Process up-scaling and demonstration of technology in above systems.

Physicochemical and Biological:

- Process economics and LCA studies for photo-catalysis, photo-electrochemical cells and photo-bio electrochemical CO₂ reduction.
- Photo assisted Bio-Hydrogen production.

6. ELIGIBILITY:

The proposals have to be led by qualified researchers/ professionals from Science, Technology and Engineering disciplines working in regular position at Indian institutions drawn from academia and public funded R&D laboratories.

The institutions/industries of Mission Innovation (MI) member countries are welcome to join the partnership with the lead Indian institute/ organization to carry out collaborative work. While there is no restriction on upper number of participating MI countries (which includes Australia, Austria, Brazil, Canada, Chile, China, Denmark, European Union, Finland, France, Germany, Italy, Japan, Mexico, Netherlands, Norway, Saudi Arabia, Sweden, United Arab Emirates, United Kingdom and United States), *participation of at least one organization (institution/industry/utility) from MI country is mandatory and the Indian PI is expected to submit proposals after agreement with PI of MI member countries. The participating MI organization has to be a legal entity as per statute of the host country.*

7. FUNDING:

This is a joint call of DBT and DST which will share the funding in equal proportions i.e. US\$ 3 million each

Total Funding Size:	US\$ 6 million or equivalent in local currency of participating MI country
Floor limit:	US \$ 0.2 million
Ceiling limit:	US \$ 1 million
Expected Number of Awards:	12

8. COMPONENTS OF FUNDING

- Additional research manpower especially hired for the project in India (existing research manpower will not be eligible for funding).
- Travel (domestic and international) for student / researcher mobility
- Dissemination activities and stakeholder workshops
- Contingent expenditure such as stationery, incidentals etc.
- Equipment (not exceeding 20 % of project cost), Where possible, researchers are advised to make use of existing facilities and equipment, including those hosted at MI countries. If equipment is needed as part of the research proposal, applicants must follow DST/DBT norm

for requesting equipment which will be made available only on the basis of strong dedicated requirement for the project.

- Field/Pilot demonstration in India (up to 50 % of project cost, if proposed).

9. EVALUATION CRITERIA

Integrated proposals which can address one or more research challenges right from R&D to development and demonstration at laboratory/ field level, wherever feasible as well as standalone proposal focusing on pressing challenges/issues with clear path to bring about out affordability, robustness and accessibility are welcome. It is mandatory that the research consortium is engaged in cutting edge R&D and has proven research and technical competence to execute the project. Besides, fulfillment of minimum eligibility and this requirement, the following criteria will be used in grant making decisions:

- I. Relevance to objectives of MI IC#5 on Converting Sunlight Innovation Challenge (IC#5).
- II. Potential for catalyzing R&D led breakthroughs for converting sunlight.
- III. Technical Innovation on improving the ways to capture solar energy towards usable fuels.
- IV. Addressing critical R&D issues requiring early stage grant funding that will allow development and testing of innovative technological solutions.
- V. Potential for accelerating the commercialization of processes.
- VI. Contribution of proposed work to enhance cost effectiveness and sustainability of sunlight conversion.

10. PROCESS

The evaluation process will be conducted in **two stages**:

- **Stage-I:** All interested applicants are invited to submit a Letter of Intent (LoI) in Consortium mode with agreement of MI member country researchers/ institutes / legally registered entity having research experience in the call theme.
- **Stage-II:** From these initial submissions, Evaluation Committee (EC) will shortlist the eligible applicants through peer review process. The EC will be constituted jointly by DBT and DST.

Applicants found eligible at **Stage-I** evaluation will be requested to submit detailed proposals for participation in **Stage-II** and these will be critically evaluated by constituted expert committees in India and in participating MI member country.

11. TIMELINES

Call for Letter of Intent (LoI)	1 st July 2018
Last date of submission of LoI Form	31 st August, 2018
Invitation for submission of detailed proposals	8 th Oct, 2018
Receipt of detailed proposals	11 th Feb, 2019
Evaluation of proposals and due diligence	2 nd April 2019
Announcement of Awards	25 th May 2019

12. GENERAL GUIDANCE ON PROPOSAL FORMULATION

The below guidance is not exhaustive but is designed to help interested organizations to develop proposals.

- Proposed projects should necessary be based on clean energy and should be truly innovative and transformational. Proposals should make clear how they are adding value and not duplicating an existing solution; multiple forms of innovation are eligible and will be considered. Proposals should also clearly illustrate how the work proposes to overcome technical barriers of the current issues in capturing the sunlight to storable solar fuels.
- Proposed projects should be oriented towards fundamental research and/or applied research, establish proof-of-concept in the early stages of development, defined broadly as the critical transition phase of idea/ concept to development thus making support from this grant would be most impactful.
- The maximum duration of the project **should not be more than 36 months**. Each project is subject to review at key milestones to continue funding.
- The project administrative costs should be kept to a minimum. The permanent equipment maximum upto 20% of the cost of project may be provided to the organization.
- In case, the partner is an institute/organization in MI member countries, a supporting **document from them is needed regarding their support to the project**. The participating MI researchers/ institutes need to provide supporting document from relevant authority in the MI country.
- The grant places strong emphasis on evidence-based results. Proposals must clearly define the indicators of success in the application form to show quantified tangible gain during the project lifecycle.

The grant also places a strong emphasis on sharing the results more widely. Project implementing organizations will be required to maintain an Open Access Policy.

13. SUBMISSION GUIDELINES

- A Soft copy (MS Word) should be e-mailed to **IC5@mission-innovation-india.net**
Please mention **MI-India-IC#5: Name of Principal Investigator/ Name of Institute** in the subject line of the email.

The mail should also be copied to:

- i. Dr. Sangita Kasture, Department of Biotechnology, MOS&T, GOI at sangita.kasture@nic.in and
- ii. Dr. Ranjith Krishna Pai, Department of Science and Technology, MOS&T at ranjith.krishnapai@gov.in