Department of BioTechnology, Government of India

सत्यमेव जयते

BioE3 Biotechnology for Economy, Environment & Employment

birac Ignite Innovate Incubate

DBT-BIRAC Joint Call for Proposals on *"Carbon Capture and its Utilization"* for "*Fostering High Performance Biomanufacturing*" under BioE3 Policy

1. Background

The **BioE3** (**Bio**technology for **E**conomy, **E**nvironment & **E**mployment) **Policy** for '*Fostering High Performance Biomanufacturing*' has been approved by Union Cabinet in August 2024. The Policy lays down the framework for high-performance Biomanufacturing, to accelerate the development and scale up of Bio-based products in the country. Biomanufacturing can fundamentally transform the global economy from today's consumptive manufacturing paradigm to the one based on regenerative principles, and will play a pivotal role in promoting '*Green Growth'* while driving country's Bioeconomy.

2. Scope of the Call

Carbon Capture and its Utilization has been identified as one of the thematic sectors under the BioE3 Policy for '*fostering high-performance biomanufacturing'*. Biotechnological interventions to capture and utilize carbon dioxide (CO_2) as a feedstock to create value-added products by harnessing the metabolic capabilities of microorganisms provide promising avenues for mitigating climate change and creating greener bio-economic opportunities.

Hence, DBT and BIRAC, intend to foster an innovative ecosystem for enabling development and deployment of technologies for carbon capture and its utilization with focus on energy efficiency, cost economics, sustainability and scalability for eventual industrial deployment.

In view of this, DBT and BIRAC invite proposals on ***"Carbon Capture and its Utilization***" with the objective to develop energy efficient approaches for carbon capture from industrial and direct air emissions and its biological conversion to fuels, chemicals, materials and other novel products with the potential to drive the sustainable and carbon neutral circular economic opportunities. Further, the call also considers the potentially integrated solutions using existing and advanced high

throughput technologies like biophotonics, electro-catalysis, and biorefineries with a focus on retrofitting existing technologies for carbon capture solutions for industrial setups. The proposals will be invited under the two categories:

(i) Discovery & Application-oriented Integrated Network Research

(ii) Bridging the Gaps for Industrial scale up

2.1. Discovery & Application-oriented Integrated Network Research (Expected Outcomes-TRL : 3-5)

Under this category, the proposals are invited to develop proof-of-concept and/or translation of leads to demonstrate biotechnological and bioprocess solutions for carbon capture and its utilization for product development. The proposals should aim to refine and validate technologies in controlled settings at laboratory and bench scale that may have the potential for further scaling up in real-time and factory setups. They should target bioprocess demonstrations up to 100 litres with globally competitive yields at the research and development stage. The following are the major areas of intervention under this category:

- **Microbial Platforms for Carbon Capture and its Utilization**
  - Improved microbial strains (Algae, Cyanobacteria, Yeast & Chemotrophs, etc.) and engineered carbonic anhydrase or relevant enzymes for improved titres for CO_2 capture & conversion to biofuels, chemicals, biomaterials, nutraceuticals, etc.
  - Soil, aquatic & marine microbial platforms for Direct Air Capture and Storage (SynComs; PGPRs; Microbes-Biochar, hybrid biological-chemical pathways, etc.).
  - Development of non-model organisms of industrial importance such as algae, cynobacteria, acetogens, and methanotrophs, etc. as platforms for biological CO_2 capture and utilization, including development of genome-scale metabolic models, estimation of metabolic fluxes, development of genome integration strategies and synthetic biology tools etc. required for the development of genetically altered superior organisms as host organisms.
- **Transformative Innovations for disruptive CCU concepts**, including novel theories, early-stage designs for catalytic systems, synthetic biology integration, and feasibility studies for transformative pathways.

2.2. Bridging the Gaps for Industrial Scale up (Expected Outcomes-TRL: 5-7)

Under this category, the proposals are invited for industrial translation i.e. scale up of technologies with established PoC that have reached the early validation stage and are ready for late stage validation/scale-up. Following are thrust areas under this category:

2.2.1 Demonstration of existing bio-based processes and technologies for CCU for product development in a CO_2 driven biorefinery approach

- *Algal-Based Carbon Capture Technologies:* Algal-based Photo Bioreactor technology pilot scale demonstration at the scale of 100-and above with relatively higher CO_2 concentration (Lab) to make it compatible for demonstration at industrially deployable scales.
- *Bioenergy Integrated Carbon Capture Utilization Storage:* Microbial Electrobiorefinery for CO_2 sequestration and its conversion to platform chemicals i.e. Formate, Acetate and derivatives etc. at competitive scales of 100 litre and above.
- *Deployment of genetically modified organisms for industrial scale up:* Deregulation processing of genetically modified organisms' potential for carbon capture from the industrial exhaust related to field trial for 100L or above capacity for industrial translation.

2.2.2. Innovations for Deployable Biocatalytic Solutions for Point Source Emissions Mitigation

Proposal focusing on innovations for design and scaling up the microbial, algal or enzymatic-based solutions towards deployable applications in carbon capture utilization, reducing hard-to-abate automobile and other point source exhaust emissions will be supported. The proposals should focus on the development of:

- *Living Devices for Carbon Capture & its Utilization:* Algal, microbial or enzyme-integrated physical tools for capturing the CO_2 and other GHGs with the potential of ready to install onsite on exhaust systems like automobile engine exhausts, industrial exhaust chimneys or exhaust pipes of power, agriculture, transportation and other industries.
- *Algal Based Carbon Capture Technologies:* Algae based catalytic converters for exhaust systems.

- *Demonstrating CCU technologies for CO_2 in exhaust emissions:* Technologies with bio-catalytic converters, biofilters, biochar and activated carbon-based adsorbents to capture and utilize the CO_2 in exhaust emissions.

3. Key Requirements for the Proposed Projects:

The proposed study should indicate mandatorily the following aspects in the proposal:

a. Name of the strain, procurement source, patents associated with the strain, tools used if the strains are genetically modified
b. Present TRL level of the technology and the TRL proposed to be attained at the end of project duration
c. Outline the minimal benchmark (titer/ productivity/scale) proposed to be attained for the selected process in terms of percentage of CO_2 targeted to be captured, and the scale of the process
d. Gap in the technology to be addressed and strategies proposed to address the gap
e. Sustainability of the process from an economic and environment point of view
f. Scalability of the technology and its commercialization potential

4. Mode of Submission

Proposals maybe submitted by both Academia and Industry applicants, either independently or as a collaborative project.

a. **For proposals from Academia/Research Institutions**: Interested applicants should submit the proposals in the prescribed format duly forwarded by the executive head of the institution through the Department's e-ProMIS portal (www.dbtepromis.nic.in)**.**

b. **For proposals from Industry and Industry-Academia collaboration**: Interested applicants should submit the proposals in the requisite format duly forwarded by the executive head of the Company/LLP/Institution by logging to the BIRAC website (www.birac.nic.in).

5. Eligible Organizations

5.1 Academic Organisations

a. Proposals may be submitted by interested applicants engaged in research activities at various Institutions/Universities/Societies/ Trusts/NGOs/Foundations/ Voluntary Organizations, recognized as a Scientific and Industrial Research Organization (SIRO).

b. The Principal investigator must have at least four years of the employment remaining in the institution at the time of proposal submission.

5.2 Industry

a. Eligibility criteria for the Industries will be as per "*Implementation Plan for the Biomanufacturing and Biofoundry Initiative*" attached at ANNEXURE I.

b. Pre-requisite documents required to be submitted by the Industry as per the BIRAC norms are as follows:

5.2.1 *Companies/Startups*

a. Incorporation certificate.

b. CA/CS certified shareholding pattern as per BIRAC format (Companies having a minimum of 51% Indian shareholding / individuals holding Indian passports are only eligible) mentioning UDIN number.

c. Details regarding in-house R&D facility, if any; or Incubation Agreement with recognized Incubator.

d. Audited financial details of latest last three financial years,

e. Copy of passports of the shareholders if required (in support of 51% eligibility criteria).

5.2.2 Limited Liability Partnership

a. Incorporation/Registration Certificate.

b. Partnership deed; CA/CS certified certificate which states that minimum half of the partners are Indian citizens mentioning UDIN number.

c. Copy of passports of Indian partners/subscribers

d. Research mandate/ details regarding in-house R&D facility, if any/ Incubation agreement

e. Audited financial details of the last three financial years;

Companies/LLP if recommended have to provide a declaration stating that Company/LLP is not in default of BIRAC OR any other organization. Further there are no Legal Proceedings going against the applicant.

6. Evaluation Criteria

The proposals will be evaluated as per existing norms of DBT and BIRAC.

7. Funding Modalities

a. Projects having academic partners only will be funded by DBT. Projects involving Academia and Industry or only Industry will be supported by BIRAC.

b. Extent of funding will depend on the proposed activities and will be in alignment with the "*Implementation Plan for the Biomanufacturing and Biofoundry Initiative*" attached at ANNEXURE-1.

c. Project duration will be upto 2 years, extendable upto 5 years based on the performance.

8. Scope of Intellectual Property Generated During the Duration of the Project

The Intellectual Property (IP) generated during the duration of the project will be in accordance with the IP Policy of DBT and BIRAC.

9. Discretion

DBT/ BIRAC shall reserve the discretion on determination of sanction of funding and processes as per its standard norms and such determination shall be final. The selection process is not open to review.

10. Contact Information

Any queries may be addressed to the e-mail: BioE3-CCU@dbt.nic.in

Last date for submission of proposals is 10th April 2025.

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