



## Project Implementation Report

(1 July 2022 – 30 June 2023)

|   |   |
|---|---|
| Project Title:  | Organic Waste Streams for Industrial Renewable Energy Applications in India |
| GEF ID:   | 5087  |
| UNIDO ID:   | 120095  |
| GEF Replenishment Cycle:                                | <a href="#">GEF-5</a>   |
| Country(ies):   | India   |
| Region:   | <a href="#">SA - Southeast Asia</a>   |
| GEF Focal Area:   | <a href="#">Climate Change Mitigation (CCM)</a>                             |
| Integrated Approach Pilot (IAP) Programs <sup>1</sup> : | Not applicable  |
| Stand-alone / Child Project:                            | Stand-alone   |
| Implementing Department/Division:                       | <a href="#">ENE / ESI</a>   |
| Co-Implementing Agency:                                 | Not applicable  |
| Executing Agency(ies):                                  | United Nations Industrial Development Organization (UNIDO)                  |
| Project Type:   | <a href="#">Full-Sized Project (FSP)</a>                                    |
| Project Duration:                                       | 60 months (At Start)  |
| Extension(s):   | <a href="#">2 (45 months)</a>   |
| GEF Project Financing:                                  | US\$ 3,333,000  |
| Agency Fee:   | US\$ 316,635  |
| Co-financing Amount:                                    | US\$ 18,215,000   |
| Date of CEO Endorsement/Approval:                       | 2/25/2015   |
| UNIDO Approval Date:                                    | 3/18/2015   |
| Actual Implementation Start:                            | 4/30/2015   |
| Cumulative disbursement as of 30 June 2023:             | US \$ 2,779,793   |
| Mid-term Review (MTR) Date:                             | 11/11/2019  |
| Original Project Completion Date:                       | 4/30/2020   |
| Project Completion Date as reported in FY22:            | 12/31/2022  |
| Current SAP Completion Date:                            | 3/31/2024   |

<sup>1</sup> Only for GEF-6 projects, if applicable

|  |                 |
|--|-----------------|
| <b>Expected Project Completion Date:</b>       | 3/31/2024       |
| <b>Expected Terminal Evaluation (TE) Date:</b> | 2/29/2024       |
| <b>Expected Financial Closure Date:</b>        | 3/31/2025       |
| <b>UNIDO Project Manager<sup>2</sup>:</b>      | René VAN BERKEL |

## I. Brief description of project and status overview

| <b>Project Objective</b>   |   |
|--|---|
| <p>The overall objective of the project is to increase the use of industrial, commercial and/or municipal organic waste streams for industrial scale bio-methanation for renewable energy (RE) applications in Small and Medium Enterprises (SMEs) to achieve renewable energy, environment and climate targets. The project, therefore, promotes the application of innovative and adaptive technology and business models in the target SME sectors to reduce their dependency on fossil fuels, whilst also managing organic wastes in environmentally sound manners. The project contributes to the GEF (5) Climate Change Strategic Objective 3: Promote investment in renewable energy technologies. The project set out to transform the market by using organic wastes for SME industrial energy applications in India by facilitating investment in innovative organic waste to industrial energy projects, through technology and market demonstration, development of appropriate financial support mechanisms/instruments, development of technical specifications, capacity building and by strengthening the policy and regulatory environment. Industries in India, many of which are energy intensive and generate large quantity of organic waste from their processes, stand to benefit from implementation of bio-methanation technology and the useful application of biogas (industrial fuel or for bio-CNG applications).</p> |   |
| <b>Project Core Indicators</b>   | <b>Expected at Endorsement/Approval stage</b> |
| Cumulative direct reduction of GHG over the period 2015-2035 (20 years)  | 228,000 tCO <sub>2eq</sub>                    |
| Energy generated annually from biogas through projects installed over the period 2015- 2035  | 16.310 MWh                                    |
| Installed power generation capacity  | 3.7 MW <sub>eq</sub>                          |

| <b>Baseline</b>  |
|--|
| <p>The National Master Plan (NMP) for development of waste-to-energy in India was developed in 2002 by the Ministry of New and Renewable Energy (MNRE) under the then UNDP-GEF bio-methanation project. This identified 14 organic waste generating industries which had a high potential for renewable energy generation at the time estimated to total 1,997 MWe by 2017. The analysis showed that bio-methanation could be technically and commercially viable in sectors as diverse as food processing, pulp and paper, breweries, distilleries, tanneries, cattle, poultry and cassava sectors.</p> <p>The NMP provided the baseline project since it provided the ground work for the development of organic waste to energy (OWtE) in India. In line with the NMP, MNRE had undertaken a number of programmes in the area of recovery of energy from urban and industrial wastes, including incentive schemes to trigger and accelerate the deployment of biogas projects. The baseline government support programme (energy from urban, industrial and agricultural wastes/residues during 12<sup>th</sup> Plan period, 2012-2017 included incentive schemes for industrial waste bio-energy generation (up to 20% capital grant with an upper cap or 40% in sewage treatment plants) which did contribute to expansion of biogas only projects, subject to a number of eligibility criteria, conditions and caps. The programme was implemented through state nodal agencies and was applicable to developers to set-up waste to energy projects on the basis of Build, Own and Operate (BOO), Build, Own, Operate and Transfer (BOOT), Build, Operate and Transfer (BOT) and Build, Operate,</p> |

<sup>2</sup> Person responsible for report content

#### Lease and Transfer (BOLT)

The major success of MNRE programmes had been in power generation predominantly by large-scale industries. As for smaller-scale projects, there had been three national programmes supporting biogas and waste to energy from MNRE. These programmes primarily targeted small scale biogas (family or community size up to 250kW) in rural areas. There had been limited uptake by SMEs which, due to their size, typically require further technical support for the introduction of innovative technologies.

As part of the PPG phase the 14 sectors of the NMP were further studied to select priority SME sectors with the most promising potential for the use of organic waste streams for bio-methanation. This resulted in four prioritised sectors where, despite large potential, the existing organic waste resource remained largely underutilized for energy conversion. These four sectors were poultry, sugar, fruit and vegetable and cattle.

The stakeholders' consultations during the PPG identified several key barriers including: limited awareness about the biogas waste to energy technologies and its potential benefits; limited demonstration projects providing practical evidence of feasibility in these four industrial sectors; seasonal availability of large volume organic waste streams; lack of innovations and application of (international) best techniques; inadequate and poor experience in design and construction of biogas projects among biogas technology and project developers; capital intensive nature (high establishment costs); high Operation and Maintenance (O&M) cost of biogas technology; limited availability of equity and loans; lack of funding support from financial institutions due to low return on investments and high perceived risk and limited knowledge about biogas business models.

Please refer to the explanatory note at the end of the document and select corresponding ratings for the current reporting period, i.e. FY23. Please also provide a short justification for the selected ratings for FY23.

In view of the GEF Secretariat's intent to start following the ability of projects to adopt the concept of adaptive management<sup>3</sup>, Agencies are expected to closely monitor changes that occur from year to year and demonstrate that they are not simply implementing plans but modifying them in response to developments and circumstances or understanding. In order to facilitate with this assessment, please introduce the ratings as reported in the previous reporting cycle, i.e. FY22, in the last column.

| Overall Ratings <sup>4</sup>  | FY23                                | FY22                                  |
|---|-------------------------------------|---------------------------------------|
| Global Environmental Objectives (GEOs) / Development Objectives (DOs) Rating  | <i>Satisfactory (S)</i>             | <i>Satisfactory (S)</i>               |
| The four innovative demonstration projects currently being constructed with the technical and financial support of the project have a cumulative bio-CNG generation capacity of 25.44 tons/day which is equivalent to 5.3 MW electrical energy output. They will also generate approximately 225 tons of Fermented Organic Manure (FOM) daily which will partially replace chemical fertilisers in agriculture. Once all four operate at full capacity the annual energy generation may approach double the project's target. |                                     |                                       |
| Implementation Progress (IP) Rating   | <i>Moderately Satisfactory (MS)</i> | <i>Moderately Unsatisfactory (MU)</i> |
| The project team and the Expert Appraisal Group (EAG) are closely monitoring the construction and implementation four innovative demonstration projects and providing them necessary assistance during the site visits.   |                                     |                                       |
| Overall Risk Rating   | <i>Moderate Risk (M)</i>            | <i>Moderate Risk (M)</i>              |

<sup>3</sup> Adaptive management in the context of an intentional approach to decision-making and adjustments in response to new available information, evidence gathered from monitoring, evaluation or research, and experience acquired from implementation, to ensure that the goals of the activity are being reached efficiently

<sup>4</sup> Please refer to the explanatory note at the end of the document and assure that the indicated ratings correspond to the narrative of the report

The project demonstrates a diversity of innovative bio-methanation technologies for mixed feedstocks, which carry limited techno-economic performance risks which are expected to be resolvable during start up and commissioning with the technical expertise already mobilized by the project.

## II. Targeted results and progress to-date

Please describe the progress made in achieving the outputs against key performance indicator's targets in the project's **M&E Plan/Log-Frame at the time of CEO Endorsement/Approval**. Please expand the table as needed.

| Project Strategy  | KPIs/Indicators  | Baseline   | Target level  | Progress in FY23   |
|---|--|--|---|--|
| <b>Component 1 – Strengthening the policy and institutional framework through a strengthened policy and regulatory framework</b>                          |  |  |   |  |
| Outcome 1: Strengthening the policy and institutional framework through a strengthened policy and regulatory framework                                    |  |  |   |  |
| Output 1.1: An updated and tailored roadmap for increased use of waste-to-energy practices in the target SME sectors                                      | NMP for organic waste to energy  | NMP not updated since 2002   | New NMP to 2027 published   | The project organized a seminar on the National Bioenergy Programme (NBP) on 18 <sup>th</sup> November 2022, during which the Hon. Minister of Power and Minister of New and Renewable Energy launched National Bioenergy Programme and digitally launched the Biogas & Bio-Urja portal. The Bio-energy programme includes re-establishment of waste-to-energy programme for which a of ₹ 600 Cr (~USD75 million) has been allocated until to 31.03.2026.<br><br>Several initiatives, schemes launched by the other ministries such as Ministry of Oil, Petroleum and Natural Gas (MoPNG) (regarding biofuels), Ministry of Housing and Urban Affairs (MoHUA) (regarding municipal waste management), Ministry of Chemicals and Fertilizers (MoCF) are fostering biogas applications, collectively contributing to India's goal of maximising waste to energy generation). The ongoing project activities support the organic waste to energy initiatives of MNRE. |
|   | Specific Revised strategic action plan/road map for organic waste to energy for SMEs | No clear strategies for SMEs   | Clear action plan for organic waste to energy for SMEs            |  |
|   | Certificate of authenticity from the government for support programmes               | No certificate issued prior to subsidy allocation                      | Certificate of authenticity for support programmes prepared       | PSC (at its 2 <sup>nd</sup> meeting) decided that certificate of authenticity is not required.   |
| <b>Component 2 – Demonstration of the most relevant financially feasible technologies in selected sectors</b>   |  |  |   |  |
| Outcome 2.1: Demonstrated technical and financial viability of projects in the range of 0.25 – 2 MW (or equivalent thermal energy)                        |  |  |   |  |
| Output 2.1.1: Techno-financial and strategic assessment of most suitable business models  | Number of assessments of business and technology models available                    | No assessments of appropriate models carried out                       | 2-3 models assessed appropriate for the four priority sectors     | The ToR for the techno financial and strategic assessment of most suitable business model is developed. The targeted models will be developed during the remaining project period.   |
| Output 2.1.2: A 'Consolidation Matrix' on appropriate financial models and schemes suitable for SME financing for innovative technology financing in SMEs | Matrix on appropriate financial models   | No matrix available to assist in selecting appropriate financial model | Matrix developed  | Specific matrix not yet developed, however, project is promoting business approach for biomethanation projects, based on two additional revenue streams (arising from sale of by-products, including fermented organic manure, and from environmentally sound disposal of organic waste), in addition to the earlier sole focus on feasibility based on sales of biogas as renewable energy.   |
|   | Due diligence guidelines for organic waste to energy projects                        | No due diligence guidelines developed                                  | Due diligence guidelines for the different technologies developed | The development of due diligence guidelines for organic waste-to-energy projects is underway.  |

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|---|---|---|--|---|
|   | Establishment of a Technical Advice Committee to advise on technical merits of projects   | No Technical Advice Committee in existence                                  | Technical Advice Committee established made up of 5 experts                | Expert Advisory Group (EAG) has been established and is actively involved in monitoring the construction, erection and commissioning of the innovative pilot projects supported by the Project.   |
| Output 2.1.3: Detailed technology packages with specifications for identified technologies for target sectors (food processing, poultry, cattle and sugar-press mud) and applications (thermal, power, bio-CNG) and applications (e.g. thermal, power, bio-CNG) | Number of technology packages developed for the priority sectors                          | No technology packages or guidelines developed for SMEs in priority sectors | 4 Technology packages and guidelines (one per sector)                      | The activity is in progress and gathering inputs from outputs 2.1.4 – which is presently under the implementation.  |
|   | Guides on developing markets for by-products  | No guides for market development of by-products                             | Guides developed for market development for bio-CNG and organic fertiliser |   |
|   | Standardised financial and technical parameters for reporting in DPRs                     | No standardised parameters for feasibilities and DPRs                       | Standardised financial and technical parameters for reporting in DPRs      |   |
| Output 2.1.4: 2-4 innovative organic waste to energy projects installed and operating in selected SME sectors   | Number of organic waste to energy projects implemented with support from GEF              | No innovative systems installed   | 2-4 additional projects implemented with direct support from GEF.          | Four innovation demonstration projects were selected through competitive process led by Expert Advisory Group for the project's technical and financial support (the latter through interest subvention scheme). Each of these foresees co-digestion of diverse organic waste feed stocks and incorporates some kind of innovation, e.g. with regard to feed stock management, plant design and/or by-product valorization.<br><br>Pilot projects were sanctioned in Q2, 2022 and their construction and installation started from July 2022 and has been steadily progressing over the reporting period, however slower than expected, due to various factors, including uncommon erratic and intermittent rainfalls and long lead time for the delivery of equipment (including e.g. shortage of the semiconductor/chips required in their control panel). The EAG assisted with three rounds of on site monitoring during the reporting period, and demonstration projects are currently on track for commissioning before end of 2023 despite several measures taken to coverup previous delays taken by them the completion and successful demonstration of innovations before the end of the GEF project, that is 31 December 2022 became unattainable. |
|   | Number of innovative technologies   | No systems designed as co-digestion   | 2-4 innovative technologies included                                       |   |
|   | Number of co-digestion systems  |   | 1-2 co-digestion systems installed   |   |
|   | Installed capacity of new organic waste to energy projects (MW)                           | 0 installed   | Installed capacity of more than 3.7 MW                                     |   |
|   | Performance monitoring, evaluation reports and case studies on each GEF supported project | No dissemination material on organic waste to energy for SMEs               | 2-4 case studies   |   |

### Component 3 – Scale up of technologies in organic waste to energy applications in industry

Outcome 3.1: Sustainable replication model for effective scaling up of different technologies across target industries

|   |   |   |   |  |
|---|---|---|---|--|
| Output 3.1.1: Development of database and tools to identify and help SMEs to invest in innovative biogas projects | A master database of potential SMEs/ Industries for bio-methanation technology adoption | No national database of potential for SMEs and biogas | Master database developed for 4 priority sectors            | The waste resource mapping at the district level across India for the original four and additional five priority sectors has been completed and published. The information is directly accessible to project developers through online district-level GIS map accessible through <a href="https://bio-energy.isid4india.org/">https://bio-energy.isid4india.org/</a><br><br>The development of standardized long-term feedstock supply agreement is in progress. |
|   | Standardised long-term feedstock supply agreement                                       | Informal/non-standardised Feedstock supply agreements | Standardised long term feedstock supply agreement developed |  |

|   |  |   |  |   |
|---|--|---|--|---|
| Output 3.1.2: Specific financing mechanism established to reduce risk for investing in innovative biogas projects and sources of funds secured to ensure a healthy project pipeline | Financing facility established<br><br>Quantity (USD) of funding identified   | No financing facility available for organic waste for energy for SMEs<br><br>No dedicated funding for organic waste to energy | A financing facility established<br><br>10 MUSD identified as partial risk guarantee   | There are still insufficient learnings (from project and/or otherwise) to guide establishment of post-project financing facility.<br><br>Several initiatives, support schemes launched by the other ministries such as MoPNG, MoHUA, MoCF to increase the bio-CNG production from organic wastes have created conducive environment for the SMEs to invest into the bio-methanation projects in waste-to-energy sector. The government and other development agencies are developing necessary financing mechanisms to reduce the risks of investors and financing institutions.<br><br>Targets can potentially still be achieved |
| Output 3.1.3: Framework for Service Support Networks in different sectors/clusters set up   | No. of service support networks  | No service support networks dedicated to organic waste streams  | More than 10 service support networks established  | Activity has not started yet, needs input from outcome 2.1.   |
| Output 3.1.4: Quality standards, performance guidelines, and a standardization framework for innovative biogas projects in SMEs in place  | Needs assessment and roadmap for quality infrastructure for bio-methanation plants in SMEs (both for technology and for the outputs from technology) | No assessment or roadmap for the quality infrastructure for bio-methanation   | Needs assessment and roadmap for quality infrastructure for technology components<br><br>Needs assessment and roadmap for quality infrastructure for biogas products | Activity has not started yet, development of contracts can partially be done in parallel with pilots, but finalized only with sufficient learnings from outcome 2.1.<br><br>This output can be partially achieved in the remaining project period, but not tested.<br><br>The case studies of the four successful demonstration projects highlighting the innovations adopted and their impacts in terms of improvement in efficiency increment in throughput, reduction in the cost of production of energy and by-products, reductions in Green House Gas (GHG) emissions, etc. would become an important input.                |

#### Component 4 – Capacity building of public and private sector stakeholders

Outcome 4.1: Enhanced capacity of key players in target industries, promotion of knowledge and information sharing and dissemination of best practices

|  |   |                                      |                                  |  |
|--|---|--------------------------------------|----------------------------------|--|
| Output 4.1.1: Enhanced awareness and knowledge in key players in target 30 – 50 SMEs, 20 – 30 banks/FIs, technical institutions, manufacturers and other service providers in each of the selected states. | No. of training sessions targeted at financial institutes | None                                 | Nine training sessions           | 4 <sup>th</sup> PSAC meeting instructed UNIDO to freeze capacity building activities under project and channelize additional project funding to technology demonstrations. Following the advice of the 6 <sup>th</sup> PSAC meeting (19 <sup>th</sup> December 2022) an additional 178,500 USD will be allocated to support the innovative demonstration projects under the interest subvention scheme of the project. |
|  | No. of trained bank staff                                 | Zero                                 | 450                              |  |
|  | No. of training sessions targeted at SME sectors          | 0                                    | 9                                |  |
|  | 20% of female participation in training sessions          | 0                                    |                                  |  |
|  | No. of trained SMEs                                       | 0                                    | 450                              |  |
| Output 4.1.2: Knowledge products developed that are targeted at anaerobic digestion in industrial sector, including those to facilitate technology transfer.   | Established facilitation service for target clusters      | No facilitation service in existence | >9 facilitation events           | GIS based organic waste inventory with energy generation potential estimation tool launched 10 August 2021 during the webinar and presented before 220+ participants who joined this virtually.<br><br>The reports of organic waste mapping assessment are available on the microsite  |
|  | Knowledge platform establishment                          | None                                 | Knowledge platform establishment |  |
|  | Number of users of platform                               | None                                 | 200                              |  |
|  | Organic waste stream web portal established               | None                                 | 1                                |  |

|   |  |      |      |  |
|---|--|------|------|--|
|   | Number of users of website per year      | 0    | 1000 | under <a href="http://www.isid4india.org">www.isid4india.org</a> . Further knowledge and awareness documents will successively be added online on the same portal.   |
| Output 4.1.3: Capacity building mechanism for O&M, technical and service roles is established at state level to develop and retain skilled workforce for innovative biogas applications | No. of training sessions targeted at O&M | None | Nine | 4 <sup>th</sup> PSAC meeting instructed UNIDO to freeze capacity building activities under project and channelize additional project funding to technology demonstrations. Following the advice of the 6 <sup>th</sup> PSAC meeting additional 178,500 USD will be allocated to support the innovative demonstration projects under the interest subvention scheme of the project. |
|   | No. trained O&M personnel                | 0    | 200  |  |

### III. Project Risk Management

1. Please indicate the overall project-level risks and the related risk management measures: (i) as identified in the CEO Endorsement document, and (ii) progress to-date. Please expand the table as needed.

|   | (i) Risks at CEO stage                                   | (i) Risk level FY 22 | (i) Risk level FY 23 | (i) Mitigation measures  | (ii) Progress to-date   | New defined risk <sup>5</sup> |
|---|--|----------------------|----------------------|--|---|-------------------------------|
| 1 | Lack of government commitment to support the project.    | L                    | L                    | The project objectives and activities are in line with national policies and objectives. The project has achieved and is maintaining active involvement of representatives from concerned ministries to ensure their full support throughout the project and beyond                    | The ministry has signed the project agreement and annual work plans have been submitted and approved in successive project steering committees. The Project Executive Committee (PEC) & Project Steering-Cum-Advisory Committee (PSAC) meetings have been timely held. MNRE launched on 18 Nov 2022 its National Bioenergy Programme, which includes renewed government support for waste to energy sector  | <input type="checkbox"/>      |
| 2 | Lack of interest from industries to take up WTE projects | M                    | L                    | Development of detailed activity plans in close cooperation with in-country project partners, stakeholders and developers. A thorough stakeholder consultation process conducted during the project preparation phase identified industries with interest to develop and invest in WTE | The awareness generation in the waste-to-energy sector continued with:<br>(1) Seminar on National Bioenergy Programme on 18 November 2022. In which, MNRE launched its umbrella National Bioenergy Programme (NBP) with a budget of ₹ 600 crore for support for waste to energy projects until 31 March 2026; and<br>(2) A workshop on 'Bioenergy for Sustainable Development: Case Studies and Best Practices' on 12 May 2023. This included case studies of various bio-CNG, biomass and biogas projects were presented by the developers. Best practices and lessons learned in bioenergy sector and Decoding Code of Practice of BIS standards by NIBE) were presented. Following the presentations, Moderated panel discussion on 'Financing of waste-to-energy biomethanation projects – Challenges and opportunities was also conducted. | <input type="checkbox"/>      |
| 3 | Lack of interest from technology providers               | L                    | L                    | Technology advisors expressed their interest in the project during the PPG. Throughout the project, there has been regular and continued contact with manufacturers which should lead to their interest and participation.   | The relaunching of the support scheme by MNRE under its National Bioenergy Programme during the seminar on 18 November 2022 has spurred interest among the technology providers to set up new bio-methanation waste-to-energy plants.   | <input type="checkbox"/>      |

<sup>5</sup> New risk added in reporting period. Check only if applicable.

|    |  |   |   |  |  |                          |
|----|--|---|---|--|--|--------------------------|
| 4  | Unsuccessful demonstration at selected sites<br>Lack of capacity to operate and maintain biogas plants | L | L | Suitable sites have been selected through careful analysis of target sectors and plants to ensure success of demonstration projects including:<br>- Identification of proven and innovative technologies<br>- Quality audit of equipment<br>- Implementation guidance by experts<br>- Training to the operating personnel in the industry  | The four selected demonstration projects were comprehensively assessed and vetted on relevant techno-economic and innovation parameters specified in the project document by the Expert Appraisal Group (EAG).<br>The UNIDO PMU and the Expert Appraisal Group (EAG) are closely monitoring the progress of those four projects through periodic site visits and providing necessary inputs to their developers.   | <input type="checkbox"/> |
| 5  | WTE technologies do not succeed  | L | L | There is limited technical risk since technologies are widely used in several other countries. Detailed assessment of suitable sites for technologies has been carried out and training from technology importers will be provided.  | WTE technologies are utilised in India have already proven successful elsewhere. Further technological improvements to be demonstrated through the project to improve efficiency and operability of bio-methanation which will further improve feasibility of bio-methanation.   | <input type="checkbox"/> |
| 6  | Lack of collaboration by key agencies  | L | L | A central co-ordination committee was foreseen to be established to facilitate project implementation. Members will include representatives of MoA, MoF, NDRC and MoE.   | Continuous stakeholder engagement was undertaken, through PSC and its Expert Advisory Group.   | <input type="checkbox"/> |
| 7  | Failure to achieve project outcomes and objectives after successful delivery of outputs.               | M | L | By making market players fully aware of the economic potential of biogas technologies and by equipping them with the capacity and tools to realize and capture the benefits of such potential, the project will generate a self-reinforcing market. In addition, the financial mechanisms that will be put in place will create a positive context that is expected to ensure the attainment of the project outcomes and their sustainability. | The understanding among the stakeholders seems to be good as they fully understand the multiple advantages of waste-to-energy initiatives, including waste management, renewable energy generation and nutrient/by-product recovery and use.   | <input type="checkbox"/> |
| 8  | Lack of technical capacity   | M | M | Strengthening and expansion of technical capability through training facility foreseen to be established in component 3. Training activities will be closely monitored and supported under M&E plan. Linkage to experts and specialized institutions for training and support will be established and coordinated.   | The project team is professionally well qualified. MNRE and PSC have requested the project to de-prioritize capacity building interventions under the project, in view of augmenting technical and financial support for innovative demonstration projects.  | <input type="checkbox"/> |
| 9  | Changes in the availability of the waste from industry   | L | L | Market and demand analysis. Continuous policy dialogue with the Government on the improvement of the sector development during the project implementation.   | Analysis of waste streams and experiences from existing projects undertaken. Project developed waste inventory at district level covering nine major organic waste streams. Anaerobic digestion of multiple feedstocks is being extensively promoted in the demonstration projects that are currently being constructed and installed<br><br>TOR for Guides on developing markets for by-products and Standardised long-term feedstock supply agreement is under implementation. | <input type="checkbox"/> |
| 10 | Industries' lack of resources to repay loans   | L | L | Stringent selection of borrowers through assessment and due diligence of each borrower's historic and future financial management capacity.  | The innovative bio-methanation demonstration projects were selected on the basis of provisional or final project loan sanction letter issued by the respective banks only after the comprehensive techno-financial due diligence and compliance of the statutory approvals by these respective banks.<br>The projects are being encouraged to get into long terms agreements for the feedstock supply and sale of bio-CNG and the by-product as Fermented Organic Manure (FOM)   | <input type="checkbox"/> |



|    |   |   |   |   |  |                          |
|----|---|---|---|---|--|--------------------------|
| 11 | Lack of co-finance  | L | L | Demonstration projects only selected on evidence of co-finance of the project   | The call for Expression of Interest launched in February 2021 to invite the demonstration of innovative organic waste to energy bio-methanation projects enabled the project developers to liaison with banks to secure the project loans to apply for the financial support scheme.   | <input type="checkbox"/> |
| 12 | Lack of interest among banks and FIs for large scale uptake.              | L | L | Banking sector was closely involved during the PPG phase and has shown their support of the project and technologies. Letters of commitment to invest have been provided by three banks.  | The Letter of Recommendations (LoR) were issued to the potential projects selected under the financial support scheme to facilitate project loan approvals from the proponent's preferred bank.  | <input type="checkbox"/> |
| 13 | In case any possible social and environmental safeguards issues occurred. | M | M | Carry out Environmental Impact Assessments as part of preparation of the technology interventions, including sanitary management of organic waste, ways to address potential odour problems caused by the biochemical process to convert waste to energy, etc.; Annual environment and safeguards M&E reports will be provided, which will follow up with necessary actions                                       | The demo projects are still under installation and commissioning stage and yet to start commercial operation to experience such issues.  | <input type="checkbox"/> |
| 14 | The technology or renewable resource is affected by climate change        | L | M | Changing patterns in temperature and rainfall may affect the availability of the renewable resource; due to the different sectors in different parts of the country, and the target of applying co-digestion, the risk is deemed low; Biogas technology is very little impacted by climate change   | The selected demonstration projects are resilient to the potential climate changes in near futures and are including the necessary design and engineering measures to tackle the temperature variations during the peak winter (and potentially summer) seasons. However, changing patterns in temperature and rainfall have affected their construction and commissioning timelines and may impact future performance due to supply and operational interruptions during increasingly frequently occurring unfavourable weather conditions. | <input type="checkbox"/> |
| 15 | Onset of the COVID19 pandemic   | M | M | Successive waves of the pandemic had adversely impacted project implementation at multiple levels during 2020-22, as (1) health and humanitarian crisis impacts firm's and government's capability to take on and complete project activities; (2) movement restrictions were preventing field work; (3) economic crisis did dent companies' working capital and balance sheets which deteriorated credit ratings | Mitigation measures rely largely on virtual operation of the project and its interactions with project stakeholders which have had lower efficiency  | <input type="checkbox"/> |

2. If the project received a **sub-optimal risk rating (H, S)** in the previous reporting period, please state the **actions taken** since then to mitigate the relevant risks and improve the related risk rating. Please also elaborate on reasons that may have impeded any of the sub-optimal risk ratings from improving in the current reporting cycle; please indicate actions planned for the next reporting cycle to remediate this.

N/A

3. Please indicate any implication of the **COVID-19** pandemic on the progress of the project.

The second highly disruptive wave of the COVID-19 pandemic hit the country in March 2021 and started to decline in June 2021. The magnitude of the spread and severity of the pandemic was so high that the overall public and industrial situation in the country recovered close to normalcy only from October 2021. Following the emergence of Omicron, India experienced a rapid yet less devastating third wave during January – March 2022. The techno-financial due diligence of the selected demonstration projects by their respective

banks was substantially delayed which also subsequently delayed their onsite construction and the installation and commissioning work.

The COVID-19 has further aggravated supply disruptions in the global supply chain of semiconductor which has not yet reached to its normalcy. Semiconductors are used in the control panels of the bio-methanation plant and its equipment. They are also widely used in other bigger and popular industries such as automobile, computer, home appliances. The semiconductors are being supplied to such industries on preference than the bio-methanation industry. This has severely impacted the ongoing implementation of the four innovation demonstration projects selected under the financial support scheme.

4. Please clarify if the project is facing delays and is expected to request an **extension**.

Upon CEO endorsement, the actual on the ground project execution commenced with two- and half-year delay to resolve the fund management requirements of the Government of India and subsequent conclusion of the execution agreement for the project between UNIDO and MNRE. In view of this and the recommendations from the project Mid Term Review (MTR) the first extension from 01 May 2020 to 31 Dec 2022 was endorsed and implemented.

The first nationwide lockdown was imposed by the central government on 25 March 2020 after the first COVID19 wave hit the country and thereafter series of lockdowns were imposed by the central and different state governments from time to time as measures to control the rapid spread of the pandemic. Hence, the major duration of the first extension till December 2022 severely impacted the project implementation and delayed its many activities.

The project activities related to the technical advisory services capacity building, knowledge dissemination and project management are delayed due to the instruction of the 4<sup>th</sup> PSAC to freeze capacity building activities under project and channelize additional project funding to technology demonstrations.

The financial support scheme of the project to demonstrate innovations in the biogas technology and its business models was launched amidst pandemic on 10 August 2021. The projects selected under the scheme could completed their financial closure by March 2022 and are presently under construction. At the end of the reporting period, it was foreseen that the four innovative demonstration projects could be commissioned by December 2023, subject to no further disruptions to construction and installation during July – December 2023.

The delay in their implementation was primarily due to long lead time for the supply of equipment because of the shortage of semiconductors and due to uncommon erratic and intermittent rainfalls. The impact of the climate change is continued in India this year as well as country has witnessed severe draughts and floods, unpredictable changes in the weather seasons with intense heat waves and torrential rainfalls. Such challenges of natural calamities which are beyond the control of mankind may further delay the completion of the four innovation demonstration projects.

Secondly, the delay in supply of the control panels and equipment required in the four demonstration projects may continue due to the ongoing Ukraine-Russia war crisis as both countries are major producers of two key materials used in semiconductor manufacturing: neon and palladium.<sup>6</sup>

In view of capturing the outcomes and learnings of the demonstration of 'innovations', assess its potential in the growth of waste-to-energy bio-methanation projects in India and GHG emission reduction their performance needs to be monitored for at least 9 months after their successful completion to cover impact of weather seasons on the supply of the feedstock, their operation and sale of bio-CNG and Fermented Organic Manure (FOM) as one complete business cycle.

Subject to comprehensive assessment of completion of construction, commissioning and start of operation of the demonstration projects during Q4, 2023, the project completion plan may need revision with potentially a relatively short (3-6 months) extension beyond the current completion date of 31 March 2024 to properly capture and disseminate the project's achievements and lessons learned.

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<sup>6</sup> Ukraine represents about 70 to 80 percent of the global supply of neon<sup>1</sup>, and Russia produces about 35 to 45 percent of the world's palladium supply - <https://kpmg.com/xx/en/home/insights/2022/08/semiconductor-considerations.html>

5. Please provide the **main findings and recommendations of completed MTR**, and elaborate on any actions taken towards the recommendations included in the report.

### **MTR was undertaken in Q4, 20219**

#### **Lessons learnt**

- Neither UNIDO nor MNRE were prepared for new rules in routing foreign funds through the mechanism known as the CAAA for all externally aided projects at the starting phase. An exemption was sought for this rule, given that the project was already under implementation prior to the rule being put in place. The process for granting of the exemption caused a delay of 2.5 years, upon which contract and cooperation modalities got in place and functioning which paved the way for several GEF UNIDO projects in India.
- It will not be possible to achieve major deliverables (as per project results framework) within the given timeframe. By December 2023, only the two smaller of the four innovative demonstration projects will have started to operate. All activities that substantively rely on outcomes from the innovative demonstration projects will therefore not be possible to complete within given time period.
- For OWtE CO<sub>2</sub> eq calculation is especially challenging. The impact on CO<sub>2</sub> eq of by-products (e.g. reduction by replacing 'chemical fertilizers') may not be taken fully into account. The full cycle of selected waste stream to energy including all by-products has to be monitored and evaluated. It is also needed to account for different end uses of the produced biogas.
- A full cycle for the pilot plant to test feasibility and to understand plant performance is needed. Therefore a 5-years project may by design already be inadequate to develop appropriate knowledge products to take innovation forward, as the development of knowledge products may need to undertake some research based upon the outcomes of the project, prior to publishing the products, and this may only be possible with at least one full year of the pilot projects running, if not more.
- Different business models (location, input material management and use/sales of product and by-products) have to be selected to showcase functionality in different scenarios and enable to develop appropriate roadmap and knowledge documents. Therefore, pilot projects will need to be selected carefully, taking into account these factors, as well as understanding project risks and ensuring that risks are addressed.
- Technologies for bio-methanation are available and proven in the country, but there is a lack in management of input materials and the plants itself, as well as standardizing and market development for the by-products which are critical for techno-economic feasibility. Hence, the focus of such project must reflect innovations in both upstream and downstream marketing, along with the reflection of these factors in project documentation and knowledge products.
- Existing scheme (given price for CBG) did not seem to be attractive for plant owners and developers. The price per kg is rather low and only granted for a 3 years period, therefore FIs were hesitant with loans and industries do not have a sustainable baseline to calculate their business models.
- Legal framework is not in favour of OWtE, e.g. feed in tariff in grid at state level is not regulated. Existing rules for testing, labelling and promoting digestate as fertilizers are not rated to be supportive. There is also a need for a supportive environment for cleaner energy sources – such as OWtE, over oil -based fuels. It needs a strong entrepreneur (managerial skills, financial background, strong network) to start a project without subsidies and legal support.
- Only if all potential by products can be marketed successfully OWtE projects become viable. In some cases, the gas may even be the by-product. It will therefore, also be important to review these aspects in the project and to consider them as a part of planned knowledge products.
- Legal framework for all by-products is needed. The project has its focus on organic wastes, but if mixed waste is used, different legal regime may come into play, and will also require to be considered. Given that is unlikely that any of the OWtE pilot projects will sustain completely on a single type of waste, this may be a concern to address within this project. Furthermore, as other waste streams come into play, there may be additional stakeholders that may need to be included. All these aspects will need to be identified in the next few months as pilot projects are selected.
- Selection of location is key to success, including sufficient feedstock-mix, space, buyer of products and by-products as incoming waste and also product are very sensitive to transport cost and logistic. Availability of local labour forces is important.

- Technology has to be designed to fit all these parameters, and also consider local climatic conditions. Envisaged roadmap and knowledge documents should support these aspects of the project and pilot projects
- The Exposure cum Study Tour (in 2019) was well received by and encouraged the participants. It was seen as a helpful learning, even though the visited plants operated in first instance for environmentally sound management of wastes, with biogas generation as a complementary benefit.

### **Best practices**

- Creation of multiple local pilot projects focusing on the business case to prove viability and functionality, as OWtE projects are complex, specific to their mix of feedstocks and final products, and can hence not easily standardized.
- Approach to quality standards to create performance guidelines and a standardization framework for biogas projects. This is key to bring more plants on stream and market their biogas and other products.
- Project has shown flexibility and ability to adapt to actual situation and changing policies. Production and marketing of by-products is given a stronger focus now.
- Existing biogas plant in Kheda has control over major logistics processes from raw material; waste, to delivery of gas to industries. It owns trailers, used by the farmers to procure cattle dung, and tankers, also belonging to the plant, are used to transport liquid waste from industries. This plant also has ensured enough space is available to produce fertilizer, which is dried on a sealed concrete floor to ensure that it does not mix with the soil. Finally, the plant uses its own caskets to transport CBG to industry clients and also owns the gas pressure control units at their client's sites, where they supply their gas to industries. Existing biogas plant in Kheda has assessed its full material flows, is designed for and is now utilizing the full (closed) loop. It is an almost perfect 'closed loop' or 'Circular economy' example. They are presently experiment on how to utilize the CO<sub>2</sub> that is generated from the plant, to close the 'loop' completely. Furthermore, the owner of the plant and his consultant, decided to undertake the development of the plant without funding support from the project, even though technical support had been extended by UNIDO experts.
- Close cooperation with MNRE has been developed, and IREDA has been appointed to manage the project's funding support for the innovative demonstration projects. This joint understanding project relevance between MNRE, IREDA and UNIDO is enabling project progress and result.
- GEF project is to contribute up to an existing funding scheme from MNRE by subsidising part of the loan for selected pilots, to foster 'Innovation'. This practice increases the impact and also allows to compare the outcome; if time for monitoring is given. This is also fully in line with GEF strategies.
- Definition of innovation has been well thought through and developed. It is giving a specific focus on 'management of raw material' including:
  - modification of properties of organic waste to optimize overall biogas generation process and digestate quality
  - New models of waste collection, transportation and storage facilitating optimized and sustainable supply of multiple wastes, including seasonal wastes

Local supply of cleaned Biogas and new developments in production of organic fertilizers using digestate

### **Recommendations**

- The Project Result Framework and Workplan should be reviewed and adapted to the actual situation especially focusing on the timeframe for project work.

Action Taken: The detailed workplan was updated and presented before the 4<sup>th</sup> Project Steering-cum-Advisory Committee (PSAC) meeting held on 29 January 2020.

- Specific effort is needed to speed up with the pilot projects; programme to invite potential project developers to be started quickly. If projects cannot start by mid 2020, even the extension for 2,5 years will not be sufficient.

Action Taken: The UNIDO project team, supported by PRS, worked extensively to address successive concerns of IREDA in finalizing the contract to appoint it as the fund manager for the project's financial support scheme and finally obtained IREDA approval in June 2021, so that contract was finally signed on 29 July 2021 (draft had been issued to IREDA in April 2020). The financial support scheme was launched soon after on 10 August 2021.

- Some new objectives (including Indicators and means of verification) should be added (e.g. tons of fertilizers produced/capacity established and respective regulations for fertilizer in place)

Action Taken: In view of this relevant information included in the application of project financial support scheme launched for the demonstration of innovations.

- Review stakeholder map to enable creation of an inductive environment for OWtE projects. The learnings so far showcase, that additional stakeholders have to be included. An illustration of this is the applicable regulations in the project - some regulations are at state level, and therefore the state nodal agencies from selected states will be needed.

Action Taken: Following the regulations imposed by the central and state governments during the COVID19 pandemic, different stakeholders including the representatives of the State Nodal Agencies participated in the webinar conducted on the world biofuel day 10 August 2021.

- Allocate sufficient time and resources to select and monitor pilot projects.

Action Taken: Expert Appraisal Group (EAG) was selected to conduct the competitive assessment of the project applications received for the pilot demonstration. Virtual interaction between the EAG members and applicants was organised before the final evaluation. The UNIDO PMU is regularly monitoring the construction of the selected pilot projects

- Implement an efficient project management system in line with given indicators to ensure efficient project execution as timeliness of outcomes from different components is core to project success.

- Demonstrate and publish feasible OWtE projects that will foster uptake of these business models. As the project will add its funds to existing scheme from MRNE to bring more innovation to the ground, the outcome has to be carefully monitored

- Crosscheck if extra support from GEF project enhances performance, compared to 'standard projects' –

Action Taken: Pilot demonstration projects are under construction hence performance data are not yet available.

- Test the business model (full cycle) to understand operation costs and sales of products. As waste streams as well as sales of products and by-products have a seasonal dependency, a full year of M&V will be needed.

Action Taken: Pilot demonstration projects are yet to complete.

- Prepare a specific knowledge document for FIs on selection criteria and finance guidelines for not specialized banks to enable them to enhance their loan programmes.

Action Taken: A guideline document to conduct the techno financial due diligence of waste to energy bio-methanation projects is under consideration.

- Specific focus given to Gender Mainstreaming. PMU is advised to check the project documents and act accordingly.

Action Taken: The project document is being followed.

- Explore/develop an accounting system for cradle-to-cradle GHG reduction for OWtE, suitable for
  - fossil/non fossil fuel-based system
  - different OWtE approaches and technologies
  - different products and by-products

Action Taken: The accounting system for cradle-to-cradle GHG reduction for OWtE is planned.

- Ensure monitoring and validation protocol are an integral part to pilot projects (funding contract). In order to do this, there is a need to define and monitor all project relevant indicators, starting with waste management (including logistics), to plant operation and different products and the chain of actions and processes, such as marketing, sales and logistics.

- This will enable harvesting of results to be included in knowledge products

Action Taken: Pilot demonstration projects are yet to complete.

- Involved project stakeholders should plan PSC meeting soon to come up with a joint decision how to modify the project to achieve project deliverable
  - UNIDO – MNRE to prepare 2 versions of workplan (ext./non ext.) to be agreed upon by stakeholders in upcoming PSC
  - Request for no-cost project extension of 2.5 years
  - Adapt workplan according to new timeline including harvesting results and dissemination of learning
  - Discuss whether to include additional stakeholders to create an attractive business environment for OWtE
  - Ensure continuity with involved experts

Action Taken: The workplan with the project extension up to December 2022 was reviewed with MNRE and presented in the 4<sup>th</sup> PSAC meeting for approval. The members accepted the proposal and granted the no-cost project extension. The beginning of COVID19 pandemic in March 2020 and continued its progression in different waves until February 2022 severely impacted the adaption of the new workplan.

#### Action Update

- The workplan with the project extension up to March 2024 was reviewed with MNRE and presented in the 6<sup>th</sup> PSAC meeting held on 19<sup>th</sup> December 2022 for approval. The members accepted the proposal and granted the no-cost project extension till 30<sup>th</sup> March 2024.
- The UNIDO PMU and the Expert Appraisal Group (EAG) are jointly monitoring the progress of all four innovation demonstration project through conducting regular site visits and providing necessary assistance to them.

## IV. Environmental and Social Safeguards (ESS)

1. As part of the requirements for **projects from GEF-6 onwards**, and based on the screening as per the UNIDO Environmental and Social Safeguards Policies and Procedures (ESSPP), which category is the project?

☐ Category A project

☐ Category B project

☐ Category C project

(By selecting Category C, I confirm that the E&S risks of the project have not escalated to Category A or B).

Please expand the table as needed.

|   | E&S risk | Mitigation measures undertaken during the reporting period | Monitoring methods and procedures used in the reporting period |
|---|----------|--|--|
| (i) Risks identified in ESMP at time of CEO Endorsement   | NA       | NA   | NA   |
| (ii) New risks identified during project implementation (if not applicable, please insert 'NA' in each box) | NA       | NA   | NA   |

## V. Stakeholder Engagement

1. Using the previous reporting period as a basis, please provide information on **progress, challenges and outcomes** regarding engagement of stakeholders in the project (based on the Stakeholder Engagement Plan or equivalent document submitted at CEO Endorsement/Approval).

MNRE is proactive in the project execution to ensure that the activities on organic waste to energy are properly aligned with the other MNRE activities on Renewable Energy, including its “Energy from urban, industrial and agricultural waste program”. MNRE continues to convene and chair the Project Advisory and Steering Committee (PSAC) and Project Executive Committee (PEC). Successive PEC meetings monitored the project progress and provided timely support to extend the project required for the successful completion of the four demonstration projects selected under the financial support scheme.

GEF project and MNRE jointly organised a workshop ‘National Bioenergy Programme’ on 18 November 2022. In the event the waste-to-energy programme which supports the large scale bio-methanation projects. More than 250 participants representing financial institutions, development agencies, technology providers, potential project developers, state nodal agencies and other relevant stakeholders attended the workshop. From the event the participants gathered knowledge about the latest developments in waste-to-energy sector and its potential growth.

As mentioned above the four demonstration projects are incurring delays in construction, procurement and installation. The project developers may not be complete their project to full commercial operation before the respective deadlines issued to them in the 6<sup>th</sup> PSAC meeting and formally communicated through the PMU.

IREDA is the Fund Manager of the financial support scheme of the project. The frequent changes in their personnel appointed on the GEF-MNRE-UNIDO Project has resulted in the delay of UNIDO-IREDA contract amendment after it was approved in the 6<sup>th</sup> PSAC meeting held on 19 December 2022.

UNIDO and MNRE jointly organised workshop on ‘Bioenergy for Sustainable Development: Case Studies and Best Practices’ on 12<sup>th</sup> May 2023. The presentations and moderated discussions on ‘significance of innovation in growth of bio-methanation sector’ and the ‘Financing of waste-to-energy bio-methanation projects’ were arranged. The event also provided a platform to the project developers of the four selected demonstration projects to present potential innovations in them.

The Expert Appraisal Group (EAG) and UNIDO conducted two consecutive on site monitoring and inspection visits to the four demonstration projects during the reporting period to identify and address any bottlenecks that have arisen.

2. Please provide any feedback submitted by national counterparts, GEF OFP, co-financiers, and other partners/stakeholders of the project (e.g. private sector, CSOs, NGOs, etc.).

Feedback of national counterparts has been taking place in the main through the PSAC, which (as per the above in section V.2) has provided strong direction to the project execution with regard to scope and detail of waste mapping, appointment of fund manager and further support for technology demonstrations, as the expense of awareness, training and knowledge activities. Moreover, through separately convened roundtable and innovation consultation, industry and technology stakeholders have provided input to clarification of innovation areas to support through the project.

3. Please provide any **relevant stakeholder consultation** documents.

- 1\_5087\_EAG Inspection Report of the demonstration project sites
- 2\_5087\_6th PEC approved minutes
- 3\_5087\_Agenda and Background of NBP
- 4\_5087\_National Bioenergy Programme-Guideline document
- 5\_5087\_6th PSAC approved minutes
- 6\_5087\_GEF- MNRE- UNIDO Project extension

7\_5087\_BTOMR\_Delhi-Fatehgar Sahib-Yamunanagar-Delhi-14FEB2023  
8\_5087\_BTOMR\_Delhi-Meerut-Delhi-16FEB2023  
9\_5087\_BTOMR\_Delhi-Hissar-Delhi-17FEB2023  
10\_5087\_Agenda - Workshop Bioenergy for Sustainable Development  
11\_5087\_Project Activity Work Plan

## VI. Gender Mainstreaming

1. Using the previous reporting period as a basis, please report on the **progress** achieved **on implementing gender-responsive measures** and **using gender-sensitive indicators**, as documented at CEO Endorsement/Approval (in the project results framework, gender action plan or equivalent),.

The project endorsement document states several gender related activities (e.g., involvement of gender expert to monitor the gender-specific dimension) and gender strategies. Some documents include gender figures (female participation in events and training), these numbers are yet not monitored and only one specific target is given in PRF. The industrial sector has low female labour force participation (only one in five manufacturing jobs in India is done by women, and most of these are concentrated in garment making and food processing sectors only) and during project meetings only three women have been met. Participation from gender focal points from respective ministries and specific gender-related activities (e.g., selecting industries with women entrepreneurs on priority base) is not visible yet.

The project continues to aim for gender mainstreaming, and where possible, identify more activities where gender can be addressed as a part of project activities.

## VII. Knowledge Management

1. Using the previous reporting period as a basis, please elaborate on any **knowledge management activities / products**, as documented at CEO Endorsement / Approval.

The project has so far generated technical reports of successive stages of the organic waste inventory and mapping in India, particularly:

1. Report - Identification of Organic Waste Streams in India
2. Report - Identification of Potential States for Energy Generation using Organic Waste from Sugar, Poultry, Cattle farm and Fruit, Food and Vegetable Processing Industries
3. Report – Primary survey for collection of data on availability, utilization pattern and price for selected categories of industrial organic waste in the selected states
4. Report – Collection and characterization of various samples of industrial organic wastes across the selected states.
5. Report - District Wise Assessment of Waste Availability and Energy Generation Potential in four sectors sugar, poultry, cattle farm and fruit, food and vegetable processing industry across India
6. Report - District Wise Assessment of Waste Availability and Energy Generation Potential for Five Selected Sectors Across India
7. Report - GIS Based Inventory Tool of Organic Waste Streams

These and further waste survey data are being made accessible to project developers, industries and financiers through online inventory tool, accessible through: <https://bio-energy.isid4india.org/>.

2. Please list any **relevant knowledge management mechanisms / tools** that the project has generated.

An online GIS based and searchable knowledge tool has been created that shows available volumes of nine key organic waste streams at district level across India along with estimated energy generation potential. The GIS tool has been launched on 10 August 2021 and is accessible through: <https://bio-energy.isid4india.org/>.



## VIII. Implementation progress

1. Using the previous reporting period as a basis, please provide information on **progress, challenges and outcomes achieved/observed** with regards to project implementation.

### Progress

The start of the actual on the ground execution of the project incurred two years delay to resolve the fund management requirements of the Government of India and subsequent conclusion of the execution agreement for the project between UNIDO and MNRE (national execution agency).

Since then, MNRE has taken an active lead in the project execution. Upon refinement and confirmation of project planning, a knowledge partner had been competitively selected and contracted to conduct the surveying and mapping of organic waste generation in India and estimate its bio-methanation energy generation potential. The findings have been integrated into a web based organic waste resource map (launched in August 2021) for India, covering nine key organic waste streams across all districts of India. With inputs from technology experts and industry partners a set of innovation areas has been defined that will be promoted through the project's technology demonstration activities. Moreover, a project specific financial support mechanism was developed with IREDA as its assigned fund manager. The four projects have been selected through competitive evaluation under the project's financial support scheme to demonstrate different types of innovation in biomethanation technology, feedstock and applications.

UNIDO and MNRE jointly organized workshop and seminar under the GEF project to promulgate latest development in the waste-to-energy sectors including latest government policies and schemes and strengthened the engagement of stakeholders such as financial institutions, development agencies, technology providers, potential project developers, state nodal agencies into the waste-to-energy sector.

The UNIDO PMU is continuously monitoring the progress of all four projects by conducting actual site visits and collecting monthly progress reports from the project owners. As a result of which, out of four, two are in their advanced stage to achieve successful commercialization.

### Challenges

Project execution has incurred unfortunate and successive delays, firstly, at project start (for signature of execution agreements), secondly, with launch of the financial support package (due to delayed contracting of the PSAC assigned fund manager), thirdly (an part concurrently) during COVID19 pandemic and fourthly with the actual construction, procurement, installation and commissioning of the innovative pilot projects (due to adverse weather conditions and supply shortages). Despite the project execution negatively impacted by the COVID-19 pandemic the project financial support scheme was launched and the pilot demonstration projects were selected on basis of innovations incorporated and techno-economic viability. The two smaller demonstration projects are expected to be fully operational by December 2023, with the other two larger demonstrations expected to have started commissioning by then. It may therefore not be achievable to complete in full the monitoring and evaluation of demonstration projects and undertake the critical dissemination and outreach activities by the current completion date (31 March 2024).

### Outcomes

The project has created a first for India detailed organic waste inventory with bio-energy generation potential at the level of districts, covering nine large scale industrial and urban organic waste streams (poultry, cattle dung, fruit & vegetables, sugar, slaughterhouse, distilleries, paper, municipal solid waste and municipal sewerage) – which has been converted in an interactive and searchable web-based tool (launched in August 2021). The project has clearly articulated innovation areas to improve technology, efficiency and biogas and by-product yields for organic waste to energy projects. The project's financial support mechanism was launched and the pilot projects are selected to demonstrate the innovations.

2. Please briefly elaborate on any **minor amendments**<sup>7</sup> to the approved project that may have been introduced during the implementation period or indicate as not applicable (NA).

<sup>7</sup> As described in Annex 9 of the *GEF Project and Program Cycle Policy Guidelines*, **minor amendments** are changes to the project design or implementation that do not have significant impact on the project objectives or scope, or an increase of the GEF project financing up to 5%.

Please tick each category for which a change has occurred and provide a description of the change in the related textbox. You may attach supporting documentation, as appropriate.

|                                     |   |  |
|-------------------------------------|---|--|
| <input checked="" type="checkbox"/> | Results Framework                             | Preparation of National Master Plan (NMP) and strategic action plans and continued capacity building, training and awareness have been de-prioritized by MNRE (as endorsed by PSAC), in favor of further technical and financial support to innovative demonstration projects  |
| <input type="checkbox"/>            | Components and Cost                           | N/A  |
| <input type="checkbox"/>            | Institutional and Implementation Arrangements | N/a  |
| <input type="checkbox"/>            | Financial Management                          | N/a  |
| <input checked="" type="checkbox"/> | Implementation Schedule                       | A 2.5 year no cost extension was granted in 2020, to accommodate for delayed start of project activities as a result of need to clarify the fund management procedures with the Government of India. Further, 1.25 years no cost extension was granted in December 2022 by PSAC in view of achieving successful commercialization of all four demonstration projects selected under the OWtE financial scheme and release of applicable loan subvention fund in their loan account by fund manager i.e. IREDA. |
| <input type="checkbox"/>            | Executing Entity                              | N/a  |
| <input type="checkbox"/>            | Executing Entity Category                     | N/a  |
| <input type="checkbox"/>            | Minor Project Objective Change                | N/a  |
| <input type="checkbox"/>            | Safeguards                                    | N/a  |
| <input type="checkbox"/>            | Risk Analysis                                 | N/a  |
| <input type="checkbox"/>            | Increase of GEF Project Financing Up to 5%    | N/a  |
| <input type="checkbox"/>            | Co-Financing                                  | N/a  |
| <input checked="" type="checkbox"/> | Location of Project Activities                | Locations for the innovative demonstration projects followed the call for applications for project's financial support.  |
| <input type="checkbox"/>            | Others  | N/A  |

### 3. Please provide progress related to the **financial implementation** of the project.

|                 |                            | Total Budget | Obligation | Payments   | Expenditure | Funds Available |
|-----------------|----------------------------|--------------|------------|------------|-------------|-----------------|
| Sponsored Class |                            | USD          | USD        | USD        | USD         | USD             |
| 1100            | Staff & Intern Consultants | 35,732.71    | 0.00       | 15,721.13  | 15,721.13   | 20,011.58       |
| 1500            | Local Travel               | 36,529.87    | 21.09      | 18,405.98  | 18,427.07   | 18,102.80       |
| 1600            | Staff Travel               | 671.19       | 0.00       | 775.74     | 775.74      | -104.55         |
| 1700            | Nat.Consult./Staff         | 683,343.04   | 27,264.75  | 582,855.14 | 610,119.89  | 73,223.15       |

|              |                      |                     |                     |                     |                     |                   |
|--------------|----------------------|---------------------|---------------------|---------------------|---------------------|-------------------|
| 2100         | Contractual Services | 2,263,451.69        | 1,360,074.15        | 550,092.45          | 1,910,166.60        | 353,285.09        |
| 3000         | Train/Fellowship/Stu | 104,112.76          | 10,417.85           | 26,134.13           | 36,551.98           | 67,491.20         |
| 4300         | Premises             | 164,997.13          | 186.59              | 150,341.41          | 150,528.00          | 14,469.14         |
| 4500         | Equipment            | 9,173.03            | -0.01               | 9,128.99            | 9,128.98            | 44.05             |
| 5100         | Other Direct Costs   | 34,988.58           | 2,400.86            | 25,972.20           | 28,373.06           | 6,615.52          |
| <b>Total</b> |                      | <b>3,333,000.00</b> | <b>1,400,365.28</b> | <b>1,379,427.17</b> | <b>2,779,792.45</b> | <b>553,137.98</b> |

|                             |                | Total Budget        | Obligation          | Payments            | Expenditure         | Funds Available   |
|-----------------------------|----------------|---------------------|---------------------|---------------------|---------------------|-------------------|
| Component                   | Project WBS    | USD                 | USD                 | USD                 | USD                 | USD               |
| 1. Policy & Strategy        | 120095-1-01-01 | 180,147.29          | 19,115.70           | 64,068.40           | 83,184.10           | 96,963.20         |
| 2. Technology Demonstration | 120095-1-01-02 | 2,330,221.62        | 1,362,158.47        | 944,254.46          | 2,306,412.93        | 23,808.69         |
| 3. Scale Up                 | 120095-1-01-03 | 284,533.66          | 4,606.55            | 39,034.39           | 43,640.94           | 240,892.72        |
| 4. Capacity Building        | 120095-1-01-04 | 315,096.66          | 14,484.59           | 145,196.50          | 159,681.09          | 155,345.99        |
| Project Management          | 120095-1-51-01 | 163,000.77          | -0.03               | 159,460.52          | 159,460.49          | 3,540.28          |
| Independent Evaluation      | 120095-1-53-01 | 60,000.00           | 0.00                | 27,412.90           | 27,412.90           | 32,587.10         |
| <b>Result</b>               |                | <b>3,333,000.00</b> | <b>1,400,365.28</b> | <b>1,379,427.17</b> | <b>2,779,792.45</b> | <b>553,137.98</b> |

## IX. Work Plan and Budget

1. Please provide **an updated project work plan and budget** for the remaining duration of the project, as per last approved project extension. Please expand/modify the table as needed.

Please, kindly note that this budget plan corresponds to three-quarters of the Jul 23 - Jun 24 monitoring year applicable to the remaining project duration at present, whereas the work plan provided in the zip folder is the latest activity plan approved by the Project Steering-cum-Advisory Committee (PSAC) in its last meeting and it corresponds to the complete project extension period from 1 Jan 2023 to 31 Mar 2024.

| Outputs by Project Component           | 2023/24 |    |    |    | Year 2 |    |    |    | Year 3 |    |    |    | GEF Grant Budget Available (US\$) |             |
|--|---------|----|----|----|--------|----|----|----|--------|----|----|----|-----------------------------------|-------------|
|  | Q1      | Q2 | Q3 | Q4 | Q1     | Q2 | Q3 | Q4 | Q1     | Q2 | Q3 | Q4 |                                   |             |
| Component 1 – Policy and Strategy      |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Outcome 1:                             |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Output 1.1:                            |         |    |    |    |        |    |    |    |        |    |    |    |                                   | 96,963.20   |
| Component 2 – Technology Demonstration |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Outcome 2:                             |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Output 2.1:                            |         |    |    |    |        |    |    |    |        |    |    |    |                                   | 23,808.69   |
| Component 3 – Scale-up                 |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Outcome 3:                             |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Output 3.1:                            |         |    |    |    |        |    |    |    |        |    |    |    |                                   | 2,40,892.72 |
| Component 4 – Capacity Building        |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Outcome 4:                             |         |    |    |    |        |    |    |    |        |    |    |    |                                   |             |
| Output 4.1:                            |         |    |    |    |        |    |    |    |        |    |    |    |                                   | 1,55,345.99 |



Please provide any further geo-referenced information and map where the project interventions is taking place as appropriate.

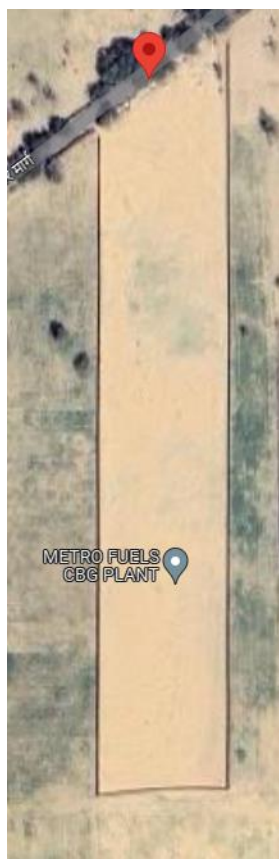
**1. M/s Cities Innovative**



**2. M/s SPS Bio Chem**



### 3. M/s Metro Fuels



### 4. M/s Circle CBG





## EXPLANATORY NOTE

1. **Timing & duration:** Each report covers a twelve-month period, i.e. 1 July 2022 – 30 June 2023.
2. **Responsibility:** The responsibility for preparing the report lies with the project manager in consultation with the Division Chief and Director.
3. **Evaluation:** For the report to be used effectively as a tool for annual self-evaluation, project counterparts need to be fully involved. The (main) counterpart can provide any additional information considered essential, including a simple rating of project progress.
4. **Results-based management:** The annual project/programme progress reports are required by the RBM programme component focal points to obtain information on outcomes observed.

| Global Environmental Objectives (GEOs) / Development Objectives (DOs) ratings |   |
|---|---|
| <b>Highly Satisfactory (HS)</b>   | Project is expected to achieve or exceed <u>all</u> its major global environmental objectives, and yield substantial global environmental benefits, without major shortcomings. The project can be presented as "good practice".  |
| <b>Satisfactory (S)</b>   | Project is expected to <u>achieve most</u> of its <u>major</u> global environmental objectives, and yields satisfactory global environmental benefits, with only minor shortcomings.  |
| <b>Moderately Satisfactory (MS)</b>   | Project is expected to <u>achieve most</u> of its major <u>relevant</u> objectives but with either significant shortcomings or modes overall relevance. Project is expected not to achieve some of its major global environmental objectives or yield some of the expected global environmental benefits. |
| <b>Moderately Unsatisfactory (MU)</b>   | Project is expected to achieve <u>some</u> of its major global environmental objectives with major shortcomings or is expected to <u>achieve only some</u> of its major global environmental objectives.  |
| <b>Unsatisfactory (U)</b>   | Project is expected <u>not</u> to achieve <u>most</u> of its major global environmental objectives or to yield any satisfactory global environmental benefits.  |
| <b>Highly Unsatisfactory (HU)</b>   | The project has failed to achieve, and is not expected to achieve, <u>any</u> of its major global environmental objectives with no worthwhile benefits.   |

| Implementation Progress (IP)          |   |
|---------------------------------------|---|
| <b>Highly Satisfactory (HS)</b>       | Implementation of <u>all</u> components is in substantial compliance with the original/formally revised implementation plan for the project. The project can be presented as "good practice". |
| <b>Satisfactory (S)</b>               | Implementation of <u>most</u> components is in substantial compliance with the original/formally revised plan except for only few that are subject to remedial action.                        |
| <b>Moderately Satisfactory (MS)</b>   | Implementation of <u>some</u> components is in substantial compliance with the original/formally revised plan with some components requiring remedial action.                                 |
| <b>Moderately Unsatisfactory (MU)</b> | Implementation of <u>some</u> components is <u>not</u> in substantial compliance with the original/formally revised plan with most components requiring remedial action.                      |
| <b>Unsatisfactory (U)</b>             | Implementation of <u>most</u> components in <u>not</u> in substantial compliance with the original/formally revised plan.   |
| <b>Highly Unsatisfactory (HU)</b>     | Implementation of <u>none</u> of the components is in substantial compliance with the original/formally revised plan.   |

| Risk ratings   |   |
|--|---|
| Risk ratings will assess the overall risk of factors internal or external to the project which may affect implementation or prospects for achieving project objectives. Risk of projects should be rated on the following scale: |   |
| <b>High Risk (H)</b>   | There is a probability of greater than <b>75%</b> that assumptions may fail to hold or materialize, and/or the project may face high risks.                   |
| <b>Substantial Risk (S)</b>  | There is a probability of between <b>51%</b> and <b>75%</b> that assumptions may fail to hold or materialize, and/or the project may face substantial risks.  |
| <b>Moderate Risk (M)</b>   | There is a probability of between <b>26%</b> and <b>50%</b> that assumptions may fail to hold or materialize, and/or the project may face only moderate risk. |
| <b>Low Risk (L)</b>  | There is a probability of up to <b>25%</b> that assumptions may fail to hold or materialize, and/or the project may face only low risks.                      |