CALL FOR PROPOSALS FOR RDME PRODUCTION IN INDIA

1. Who are we – Futuria Fuels

Futuria Fuels is a dedicated business unit of SHV Energy with the mission to enable innovations that accelerate the development and availability of sustainable fuels. Through collaborations, partnerships, and investments, Futuria fuels aims to make this happen. To know more about Futuria fuels, please visit https://www.futuriafuels.com

2. Objective

Futuria Fuels would like to invite all interested parties to submit pre-feasibility study proposals for rDME (Renewable & Recycled Carbon Dimethyl Ether) production in India (for proposal scope see below figure 2) for a commercial plant of 50Kt/y rDME.

3. Background

India has taken the lead in ethanol production and usage, with an impressive consumption rate of around 4 billion liters (or 4 million tonnes), achieved in less than eight years. Since 2014, Ethanol blending has contributed to improving air quality, reducing carbon emissions, generating employment opportunities, and saving money for India. The E10 blend target was successfully achieved ahead of schedule, and now, Prime Minister Sri Narendra Modi has launched an E20 blend ambition.

Like ethanol blending, a 10% blend of locally produced renewable liquid gases such as rDME would represent a 3 million tonnes (of renewable liquid gases) to be produced in rural India. Thanks to a visionary government policy, India currently consumes approximately 30 million tonnes of LPG to reduce air pollution-related deaths. Over time, replacing imported fossil LPG with locally produced renewable gas would reduce imports, create jobs, clean up waste, improve air quality and lower carbon intensity.

India generates over 500 million metric tonnes of agricultural residues and 60 plus million metric tonnes of Municipal Solid Waste every year. If all this waste is converted to rDME, it would come close to supply a global volume of ~200 million metric tonnes of LPG and even more in future.

3.1 Current challenges in value chain:

- **Feedstock production and handling**: Feedstock, especially agricultural waste, which is distributed wet, cyclical/seasonal, is often available in small quantities at rural locations. Meanwhile, not all urban waste is collected or treated.

- **Converting waste/biomass to rDME:** Processing waste & agricultural residues is a complex process and often struggles with tar / slag formation. Scale and costs relevant to the operations need to be aligned as high lignin feedstock requires the right process to convert and treat.

3.2 Possible solutions:

- **Feedstock production and handling:** Take low-quality waste & biomass as a source and converts them into high energy intensity feedstocks. Hence, the product, e.g.; torrefied biomass, is homogenous and easy to transport (1/10th volume!) Also, it enables decentralized processing of various waste biomass sources.

- **Converting waste/biomass to rDME:** Gasification converts biomass into SynGas (building block for various chemicals and fuels). The more homogeneous, carbon rich and pre-treated feedstock, the more reliable and efficient gasification process. Torrefied or pelletized biomass enables the pathway for a more efficient gasification process for problematic biomass sources. Waste product is biochar with added value for agriculture (potential circular solution)

- **Biofuel such as rDME**: Blending with LPG, rDME is a clean and safe biofuel and can easily be utilized within the existing LPG infrastructure.

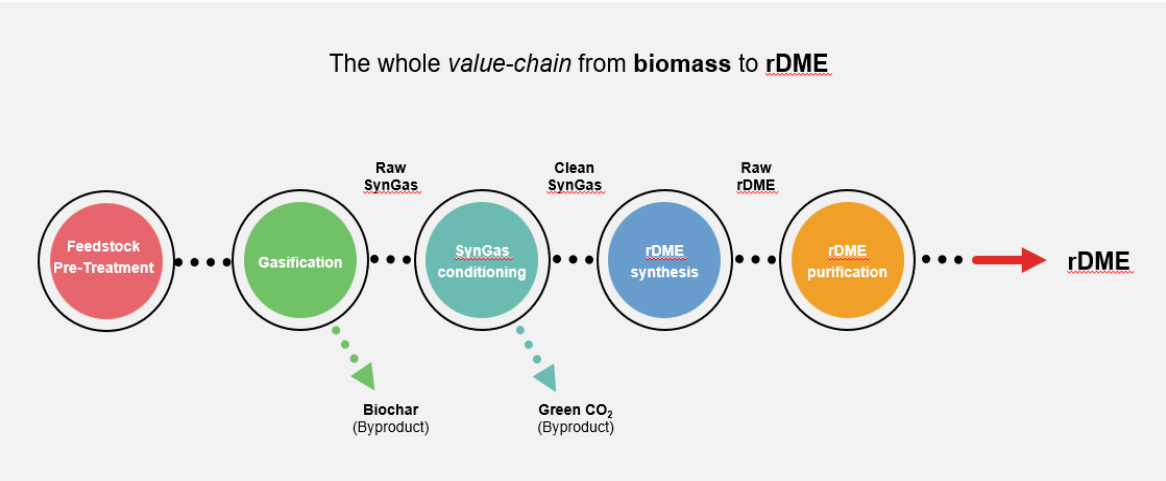

Figure 1 - Indicative Process Flow

4. Key requirements

- A successful proposal should provide sufficient confidence in the understanding of the individual process steps and technologies to achieve an integrated process.

- It should be noted that the cost of production must be in line with the LPG equivalent in India.
- Feedstocks need to be biogenic wastes, residues, or recycled carbon and be indigenous to India. To achieve the low-cost targets, they would be expected to have relatively low value. However, please note that the use of primary fossil fuels (e.g., coal) is specifically out of scope.
- The proposal should include funding requests for trials that meet the anticipated Technology Readiness Levels (TRLs) outlined below. Funding requests for trials that fall significantly below these TRLs are likely to be unsuccessful.

4.1 TRL (Technology Readiness Levels) & CRL (Commercial Readiness Levels)

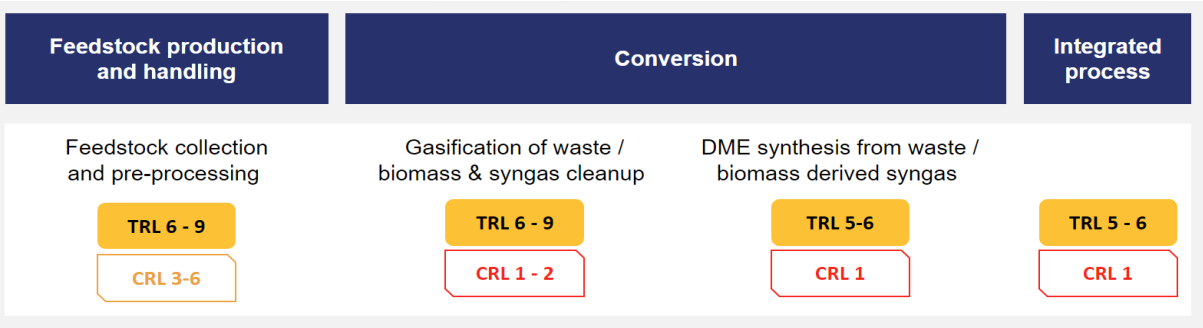

Figure 2 - rDME production pathway – Solid feedstocks -> Gasification + Catalytic synthesis

5. Deliverables

The Pre-Feasibility study will include the minimum aspects as below:

- Preliminary Basis of Design (minimum required information)
- Plant capacity
- Feedstock and product specification
- Operating cases for different feed cases
- Utilities (what are needed)
- Battery Limit Conditions
- Emissions & Environment (Noise, Authority requirements)
- ISBL and OSBL definition
- Feedstock, utility, and chemical prices
- Financial calculation basis

4.1 Main Deliverables

	Deliverable	Description
1	Plant Budgetary +/- 50% Cost Estimate Report	Summarizes the works developed during conceptual design study by reporting essential information, such as product and intermediate product yields, etc. including CAPEX and OPEX budgetary cost estimation (+/- 50% accuracy).
2	Preliminary Process Basis of Design	Summary of process design data (unit capacity, turndown requirements, feedstock characteristics, product specification), battery limit conditions for feed, product, and utilities.
4	Simplified Process Flow Diagram	Diagrams showing all major equipment items. Lines have reference for stream identification in the Heat & Material balance.
5	Simplified Heat and Material Balance	Listing of all identified streams on the process flow diagram showing the general composition, flow rate and operation conditions.
6	Process Description	Summary describing the main process characteristics and chemistry.
7	Preliminary Main Equipment List	Summary of main equipment items, including high level sizing: capacity, flows, operating pressure and temperature and material of construction.
8	Preliminary Utility and Chemical Consumption Summary	Summary of all utilities and consumables of the plant, including power, steam, cooling water, instrument air, nitrogen, process water and chemicals.
9	Preliminary Plot Plan	Preliminary plot plan with required area indication and location of main equipment.
10	Preliminary Effluent Summary	Specification and quantity of effluents, both continuous and intermittent.

Note: It is anticipated that a successful applicant would have the capability to deliver the full, integrated process as detailed in the proposal, or include in a proposal a commitment from a partner to take on that responsibility. However, expressions of interest covering part of the rDME production processes, and consortia of multiple parties are also welcome. Further steps would include the development of Pre-FEED/ FEED and demonstration/production plants in India.

6. Budget & Timeline

The winning proposal will receive funding not to exceed INR 2 crores to perform the proposed pre-feasibility study.

Submission dates:

Proposals are to be submitted to Bindu Lathwal (b.lathwal@futuriafuels.com) with the following timeline.

- Deadline for submission: 15th May 2024
- Notification of semi-finalists: 31st May 2024
- Semi-finalists to present (virtually/digitally) to Futuria Fuels Panel: First two weeks of June 2024
- Finalists announcement date: After two weeks of semifinal presentations

For any query, please reach out to Bindu Lathwal (b.lathwal@futuriafuels.com)