

Report
on
The National Training Programme
Sustainable Development of Waste to Biogas/Biomethane
November 26–29, 2025

Programme Organisers and Sponsors

Organising Institution: Department of Biochemical Engineering, Harcourt Butler Technical University, Kanpur

Collaborator: Indian Biogas Association (IBA)

Supporting Partners: IFGE (Indian Federation of Green Energy) and GASKON

Resource persons

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3.	Rajesh Sani	SD Mines	Professor
4.	Prakash Chand Gupta	INDIAN OIL	General Manager (Alternate Energy)
5.	Nidhi Sahu	Indian Federation of Green Energy	Deputy General Manager
6.	Dr Sonal Garg	KC Carbons Pvt Ltd	Director
7.	Deepak Kumar Jha	Hindustan Petroleum Corporation Limited	Chief Manager - Technology Licensing
8.	Gaurav Kumar Kedia	Indian Biogas Association	Chairman

9.	Gaganpreet Kaur	Dr B R Ambedkar National Institute of Technology Jalandhar	Research Scholar
10.	Dr Vanita Prasad	REVY Environmental Solutions Pvt. Ltd.	Director, Founder & CTO
11.	Dr. Krishnendu Kundu	CSIR CMERI	Senior Principal Scientist
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16.	Ajay Kumar	Godfather Sustainable Solutions LLP	Partner
17.	P. Shanmugam	CSIR-CLRI	Chief Scientist
18.	Mahendra Thakur	Ruchiex Biofuel Pvt Ltd	Managing Director
19.	Mradul Srivas	Ecoveda Climate	Senior Manager
20.	Dr. Jitendra Bhaskar	HBTU	Dean Incubation
21.	Col. Rohit Dev	IFGE	Co-Chairperson
22.	Sh. Manish Dabkara	EKI Energy	CMD & CMO

Supporting Sponsors:

- REDA Chemicals India Pvt. Ltd.
- Jalon (Thailand) Co. Ltd.
- Norit
- Pi Green Innovations Pvt. Ltd.
- SYNO PCP Pumps Pvt. Ltd.
- Bapa Sitaram Jaiv Urja Praudhyogikee Pvt. Ltd.
- Urjika Consulting & Engineering Solutions Pvt. Ltd.

- Techmark Engineers & Consultants
- NS Energy Groups

Participants: CBG/ Biogas Project Developers, Implementers, EPCs, Consultants, Biogas Aspirants, Start-ups and SNDs/ SNAs/ BDTCs/ KVIC, Manufacturers of Biogas systems, Researchers and Scholars.

Executive Summary

The National Training Programme (NTP) on "Sustainable Development of Waste to Biogas/Biomethane" was successfully conducted by the Department of Biochemical Engineering, HBTU Kanpur, from November 26 to 29, 2025. This four-day intensive programme brought together leading industry professionals, academic researchers, and innovators to explore the latest advancements, technologies, and best practices in biogas production, biomethane conversion, and waste valorisation. A landmark strategic partnership was established through the signing of an MoU between the National Research Development Corporation (NRDC) and HBTU, paving the way for collaborative technology transfer, incubation support and renewable energy innovation. The programme culminated with an industry visit to Gati Vivaan Biomass Energia LLP on November 29, 2025, providing participants with hands-on exposure to commercial biogas plant operations.

Introduction

Anaerobic digestion (AD) and biogas production have emerged as critical pillars of India's sustainable energy transition, offering simultaneous benefits of waste management, greenhouse gas mitigation and renewable energy generation. The Department of Biochemical Engineering at HBTU Kanpur recognised this transformative opportunity and organised the NTP to equip professionals, researchers and entrepreneurs with technical knowledge, operational insights and industry connections necessary for advancing waste-to-biogas technologies across India.

The programme featured keynote lectures and technical sessions delivered by leading subject-matter experts from government bodies (Indian Oil, Hindustan Petroleum Corporation Limited, CHT, NRDC), research institutions (CSIR CMERI, CSIR-CLRI), industry pioneers and international academics. Industry partners including REDA Chemicals, Jalon (Thailand), Norit, Pi Green Innovations, SYNO PCP Pumps, Bapa Sitaram Jaiv Urja Praudhyogikee, Urjika Consulting, Techmark Engineers and NS Energy Groups provided sponsorship and technical insights.

Programme Structure and Daily Overview

Day 1: November 26, 2025 – Foundations and Advanced Bioprocessing

The programme opened with a plenary session by Prof. Rajesh Sani from South Dakota School of Mines and Technology, USA, who provided foundational insights into extremophile-based bioprocessing, BioGTL technologies for converting biogas into liquid fuels, and advanced biological pretreatment strategies. His presentation on novel metabolic pathways, biomanufacturing and sustainable PHA-based solutions established the intellectual framework for subsequent sessions.

Technical Sessions – Day 1:

Dr. Sachin Kumar delivered the opening lecture on the basics of biogas technology and biofertiliser processes, covering the fundamentals of anaerobic digestion and recent advancements in biogas production. This was followed by Ms. Gaganpreet Kaur's session on anaerobic digestion using Napier grass, which highlighted India's bioenergy potential as one of the fastest-growing sectors globally. She underscored ambitious national targets to boost bioenergy demand, reduce fossil fuel dependence, improve waste management efficiency and develop thermophilic microbial consortia.

Dr. Nidhi Sahu shared expertise on digester stability maintenance, focusing on critical stress parameters including ammonia toxicity, C/N/P imbalance, volatile fatty acid (VFA) buildup, micronutrient deficiency and organic loading rate optimisation. Dr. Krishnendu Kundu (CSIR CMERI) then highlighted innovations in the biofuel and biomass sectors, emphasising the utilisation of de-oiled cake for biogas generation and the development of decentralised kitchen waste-to-biogas plants.



Day 2: November 27–28, 2025 – Feedstocks, Operations and Emerging Technologies

Shri Deepak Kumar Jha (Hindustan Petroleum) presented lignocellulosic biomass as a high-potential feedstock, discussing HP ramp technology and efficient acidification processes, concluding with the inspirational assertion: "Biofuel is surely the fuel of the future."

Dr. Srinivas Kasulla (ARKA Brenstech) guided participants through biogas plant planning, operation and maintenance, addressing project development, feasibility analysis and operational requirements. An online lecture by Shri Ashish Kumar, Managing Director of Verbio, highlighted paddy residue management applications, air quality implications and

India's first Compressed Biogas (CBG) unit, detailing upstream straw management and nationwide scalability potential.

Shri Gaurav Kedia (Indian Biogas Association) delivered a critical safety-focused session covering workplace injury prevention, identification of thermal hazards and occupational health risk mitigation for biogas plant personnel. Colonel Rohit Dev (online session) addressed rising energy demands, energy transition pathways and challenges, offering recommendations for biomass industry awareness, quantifying social and financial benefits and exploring integrated logistics and educational strategies.

Shri Mahendra Thakur (Ruchiex Biofuel) presented Napier grass as a dedicated energy crop, discussing feedstock availability patterns and regional/seasonal variations. Dr. Vanita Prasad (REVY Environmental Solutions) highlighted the strategic importance of real-time monitoring for maintaining anaerobic digestion stability, presenting REVY's portfolio of products designed for reactor recovery and gas yield improvement.

Shri Vipin Malhotra (Green Power International) explained EPC-based carbon capture solutions, clean-energy initiatives and biogas purification-to-CBG plant upgradation processes. Shri Vishwanath Bhandarkar (Pi Green Innovations) concluded Day 2 with an illuminating session on advanced emission control technologies, focusing on filterless systems and sustainable particulate matter abatement solutions.



Day 3: November 29, 2025 – Circular Economy, Carbon Credits and Strategic Partnerships

The final day began with Shri M. L. Dhiman's (GASKON Engineers) comprehensive lecture on carbon capture, utilisation and storage (CCUS) and carbon credit opportunities within the biogas sector. Dr. Sonal Garg (KC Carbons) explained biogenic carbon storage,

CO₂ capture technologies and global trends in CO₂ capture based on international project case studies.

Shri Mohammad Adib delivered an impactful online session on the broader systemic benefits of biogas systems: fossil fuel displacement, methane capture, greenhouse gas reduction and robust carbon credit income streams. He emphasised environmental and socio-economic co-benefits including waste reduction, improved sanitation, organic fertiliser production and diversified revenue generation.

Sessions by REDA Chemicals, EcoVeda Climate and Godfather Sustainable Solutions underscored the expanding carbon market and the substantial revenue potential of carbon credit monetisation in the biogas sector.

Shri Luv Kumar (CHT) presented a policy-focused lecture on long-term and targeted regulatory frameworks for biogas sector growth.

Shri N. G. Lakshminarayan (NRDC) delivered a pivotal session on the Programme for Inspiring Inventors & Innovators (PIII) and Technology Development, Validation & Commercialisation (TDVC), detailing Technology Readiness Level (TRL) assessment, phased funding mechanisms and seed support for nascent technologies.

Dr. Jitendra Bhaskar (HBTU, Dean Incubation) presented the startup ecosystem landscape, including the role of Technology Business Incubators (TBIs), emerging job opportunities and the expanding intersection of AI/ML with health informatics and biotech entrepreneurship.

Shri Prakash Chandra Gupta (Indian Oil, General Manager – Alternate Energy) concluded the academic sessions with a forward-looking perspective on community-led biomass models, examining the underlying economic drivers of crop burning by farmers and exploring CBG plant deployment as a solution pathway.



Strategic Partnership: MoU Signed Between NRDC and HBTU



A landmark Memorandum of Understanding was formally executed between the National Research Development Corporation (NRDC) and HBTU Kanpur during the NTP. Shri N. G. Lakshminarayan, Scientist & Regional Representative of NRDC, signed the agreement on behalf of NRDC.

This strategic partnership is designed to deepen collaboration in technology transfer, incubation support, innovation promotion and capacity building across renewable energy and sustainable technology domains. The MoU will catalyse the translation of laboratory-scale innovations into real-world commercial solutions and strengthen India's national ecosystem for green technologies.

Key Focus Areas of the Partnership:

- Promotion of biogas and biomethane technology development
- Entrepreneurship and start-up support programmes
- Joint technology commercialisation initiatives
- Robust industry–academia linkages
- Accelerated innovation-to-market pathways

Industry Visit: Gati Vivaan Biomass Energia LLP (November 29, 2025)



As the culminating event of the NTP, all participants undertook a structured visit to Gati Vivaan Biomass Energia LLP on November 29, 2025, providing direct exposure to operational biogas and biomethane plant systems at commercial scale.

The industry visit offered practical insights into:

- Full-scale anaerobic digestion reactor design and operation
- Feedstock processing and pre-treatment workflows
- Biogas capture, compression and purification systems
- Biomethane (Bio-CNG/CBG) production and quality assurance
- Environmental monitoring and compliance frameworks
- Economic model validation and carbon credit realisation

This hands-on exposure bridged the gap between academic theory and industrial practice, enabling participants to appreciate the engineering challenges, operational realities and commercial viability of waste-to-biogas conversion systems.

Key Takeaways and Learning Outcomes

Participants of the NTP acquired knowledge and competencies across multiple domains:

1. **Feedstock Characterisation:** Understanding the biogas potential of diverse waste streams—agricultural residues, food waste, lignocellulosic biomass, de-oiled cake and the role of pre-treatment technologies in enhancing substrate digestibility.
2. **Process Engineering:** Mastery of anaerobic digestion fundamentals, digester stability management, process optimisation and the emerging role of AI/machine learning in predictive biogas modelling.
3. **Technology Pathway:** Familiarity with biogas-to-liquid (BioGTL), biogas-to-power (electricity) and biogas-to-CBG (compressed biomethane) conversion routes and their comparative economics.
4. **Regulatory and Economic Frameworks:** Exposure to India's renewable energy policy landscape, carbon credit monetisation mechanisms, and the business case for distributed and centralised biogas infrastructure.
5. **Safety and Operations:** Practical knowledge of occupational health and safety protocols, emissions management and environmental compliance in biogas facilities.
6. **Innovation and Entrepreneurship:** Understanding of incubation pathways, technology commercialisation frameworks and start-up ecosystem support mechanisms through partnerships with NRDC and institutional TBIs.

Impact and Future Directions

The NTP successfully positioned biogas and biomethane technologies as central to India's renewable energy transition and circular economy objectives. By convening leading industry practitioners, policymakers and innovators under one platform, the programme fostered knowledge exchange, network formation and identification of collaborative opportunities.

The NRDC–HBTU MoU exemplifies how academic institutions, government R&D corporations and industry partners can jointly accelerate technology maturation and entrepreneurial venture creation. The industry visit to Gati Vivaan reinforced the economic and environmental viability of waste-to-biogas systems at scale.

Going forward, there is tremendous scope for:

- Expansion of distributed biogas networks in agricultural regions
- Integration of AI-driven optimisation in real-time plant operation
- Development of modular, scalable systems for small and medium enterprises
- Community engagement models that align farmer incentives with feedstock supply
- Cross-sector partnerships spanning energy, agriculture, food processing and waste management

Conclusion

The National Training Programme on "Sustainable Development of Waste to Biogas/Biomethane" (November 26–29, 2025) represents a significant milestone in catalysing India's transition towards circular, low-carbon bioenergy systems. Through expert-led instruction, industry partnerships and strategic institutional alignment, the programme equipped participants with the technical knowledge, business acumen and innovation mindset necessary to advance waste-to-biogas technologies across diverse operating contexts.

The successful signing of the NRDC–HBTU MoU signals renewed institutional commitment to translating research discoveries into scalable, commercially viable solutions. The industry visits to Gati Vivaan Biomass Energia LLP provided tangible validation of the technical and economic feasibility of the waste-to-biogas value chain.

As India pursues net-zero carbon objectives whilst managing rapidly growing waste streams, biogas and biomethane technologies supported by continuous innovation, adaptive policy and collaborative governance will play an essential role in achieving energy security, circular resource utilisation and environmental sustainability.