नवीन और
नवीकरणीय ऊर्जा मंत्रालय
MINISTRY OF
NEW AND
RENEWABLE ENERGY
सत्यमेव जयते

SARDAR SWARAN SINGH
NATIONAL INSTITUTE OF BIO-ENERGY

(An autonomous institute of Ministry of New and Renewable Energy, GoI)

Quarterly Newsletter

Bio-ऊर्जा

April 2025

Issue 10

Word from the Director General, SSS-NIBE

The Tenth issue of SSS-NIBE's quarterly newsletter is scheduled for release as we complete the last quarter of the financial year 2024–25.

The last quarter was a period of consolidation of the R&D efforts in all the five R&D divisions at the institute. A major milestone being setting up of Solid Oxide Fuel Cell test facility at the institute in collaboration with National Aerospace Laboratories, Bangalore. This facility when fully functional will enable research in use of a variety of gaseous fuel for electricity production. I am also proud to share that the institute received NABL accreditation as Testing Centre– biogas/bio CNG and biomass – proximate and ultimate analysis (probably first institute in the country for biomass testing). This certification will go a long way in providing credible testing services and also paves way for applying for accreditation of other testing services.

The last quarter witnessed signing of MoU with two major institutions in Punjab. First MoU being with Punjab State Council for Science and Technology (PSCST), Chandigarh and the second MoU with Punjab Agricultural University, Ludhiana. These two strategic partnerships will enable collaboration in research, training, testing, creating awareness relating to bioenergy in the state of Punjab. The first evidence of partnership is the dissemination of clean biomass cook stoves among 20 rural households in Jalandhar district as part of Technology demonstration program, sponsored by PSCST.

Last but not the least, the institute is gearing up for conducting the 5th International conference ICRABR 2025 during October 2025. The call for abstracts has been announced and we are hoping for a successful event with large contingency of international participation.

Dr. G. Sridhar
(Director General)
SSS-NIBE

Research and Innovation

Biogas: A Sustainable Solution from Waste to Energy

Rakesh Godara, Dr. Vandit Vijay

Biogas and its Relevance: Biogas is emerging as a powerful and sustainable alternative to conventional fuels, offering a clean, renewable source of energy derived entirely from organic waste. It is already being used in homes, farms, and industries, quietly contributing to energy security while addressing the pressing problem of waste management. At its core, biogas is a mixture of gases, primarily methane (CH_4) and carbon dioxide (CO_2), produced when organic materials such as kitchen waste, cattle dung, crop residues, or poultry manure decompose in the absence of oxygen—a process known as anaerobic digestion. This biological process occurs in specially designed systems called digesters, where naturally occurring microbes break down the waste and release biogas as a byproduct.

Production process and optimization parameters: The production of biogas takes place through four main biological stages: hydrolysis, where complex organic compounds are broken into simpler molecules; acidogenesis, where these are converted into organic acids; acetogenesis, which forms acetic acid and hydrogen; and methanogenesis, the final stage where methane is generated. The resulting gas typically contains 50–70% methane, 30–40% carbon dioxide, and small traces of other gases like hydrogen sulfide (H_2S), ammonia (NH_3), and water vapor. Biogas systems operate most efficiently at controlled temperatures—typically 30–40°C (mesophilic range) or 50–60°C (thermophilic range)—and within a neutral pH range of 6.5 to 8. Maintaining these conditions ensures optimal microbial activity and consistent gas production.

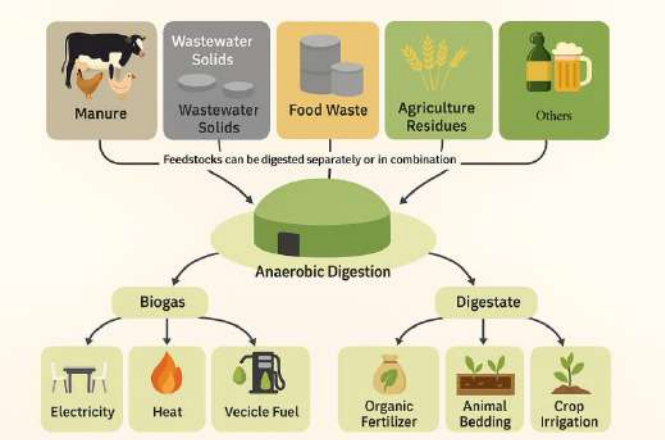
Feedstocks for Biogas Production: A variety of feedstocks can be used to produce biogas, making the process highly flexible and accessible. In rural areas, cattle dung remains a common input due to its availability and microbial richness. Kitchen waste, crop residues such as rice straw and bagasse, Napier grass, and municipal solid waste (MSW) also serve as excellent raw materials. These not only help generate energy but also reduce the burden on landfills and improve sanitation.

Applications and Energy Potential of Biogas: One of the greatest advantages of biogas is its

versatility. It can be used directly for cooking, replacing fuels like LPG and firewood, with 1 m^3 of biogas roughly equivalent to 0.43 kg of LPG. It can generate electricity, with 1 m^3 yielding about 1.2 kWh of power, or it can be purified into Compressed Biogas (CBG), a clean and efficient fuel alternative for vehicles.

Circular Economy in Agriculture: the process creates a valuable byproduct: the digested slurry, which serves as an excellent organic fertilizer rich in nutrients. This promotes a circular economy, especially in farming communities, where waste from livestock and crops can be converted into energy and returned to the soil as fertilizer, reducing dependence on chemical inputs and enhancing soil health.

Types and Scales of Biogas Plants: Biogas plants come in various sizes to suit different needs. Household-scale systems (1–25 m^3) like fixed dome or floating drum types are ideal for families and small farms. Medium-scale plants (up to 100 m^3) include models such as KVIC and Deenbandhu, while large-scale digesters use advanced technologies like CSTR (Continuous Stirred Tank Reactors) for industrial or community-level operations.



Biogas production from different feedstocks

Government Support and the Future of Biogas: Recognizing the potential of biogas, the Indian government offers financial incentives and subsidies. Household plants of 1–6 m^3 can receive between ₹9,800 and ₹52,800, while large CBG projects may qualify for support of up to ₹10 crore, depending on their scale and region. Biogas presents a practical, eco-friendly solution that turns everyday waste into valuable energy, fosters cleaner communities, and supports sustainable agriculture. Its adoption can empower rural livelihoods, reduce fossil fuel dependency, and pave the way toward a greener future.

Bioenergy a green alternative for sustainable future

Rifat Azam, Dig Vijay Singh, A. Senthil Nagappan

Algal-based bioenergy is regarded as a third-generation biofuel concept, which is a more sophisticated and environmentally friendly

a. Wang, M., Ye, X., Bi, H., & Shen, Z. (2024), *Biotechnology Biofuels and Bioproducts*, 17(1), 10.
b. Mignogna, D., Szabo, M., Ceci, P., & Avino, P. (2024), *Sustainability*, 16 (16), 7036.

method for producing bioenergy than earlier generations. Algae are very effective in producing biomass from carbon dioxide, sunlight, and nutrients. As the world races to combat climate change and shift away from fossil fuels, bioenergy is emerging as a key player in the renewable energy revolution. It is derived from organic resources such as wood, algae, animal dung, agricultural waste, and byproducts, which provide a sustainable and environmentally beneficial power source. It is considered a key component of emission reduction in nations like Sweden and Brazil. About 35% of Sweden's energy comes from biofuels, yet Brazil still leads the world in ethanol produced from sugarcane[a]. Nearer to home, American farms and landfills are converting food waste and cow dung into biogas, a clean, methane-rich fuel that powers companies, automobiles, and even houses. Bioenergy is not without difficulties, despite its potential. Concerns have been raised by discussions about fuel vs food, land use, and water consumption. However, these problems are being addressed in part by next-generation solutions such sophisticated anaerobic digesters and biofuels derived from algae. Biogas, biodiesel, and biofuel are some of the several kinds of bioenergy. Bioenergy offers several benefits for waste management, economic growth, and the reduction of greenhouse gas emissions[b]. It has a wide range of uses in waste management, transportation, heating, and energy. By using renewable biological resources, its adoption improves energy security, boosts rural economies, and helps mitigate climate change. Although bioenergy has great potential to replace fossil fuels in a sustainable manner, it confronts a number of intricate and interconnected obstacles.

Utilization of algae for renewable energy, health supplements and soil enrichments

It is important to pay close attention to issues including feedstock availability and quality, environmental sustainability, land use competition with food production, high production costs, and technical constraints[c]. To ensure that bioenergy can significantly

c. Saleh, H. M., & Hassan, A. I. (2024), Applied Chemical Engineering, 7 (2), 2084.

contribute to a sustainable energy future, these obstacles must be overcome by integrated policies, technological innovation, and a balanced approach that takes into account social, environmental, and economic factors. Bioenergy offers India the prospect of a cleaner, more sustainable energy future with sustained investment and innovation.

Bioenergy can be a key component in the country's shift to renewable energy sources by resolving issues and maximizing resource utilization. By addressing challenges and optimizing resource use, bioenergy can play a pivotal role in the nation's transition to renewable energy.

News and Events

Pravasiya Bhartiya Event

The 18th Pravasi Bharatiya Divas Convention was organized during 8th to 10th January, 2025, at Bhubaneswar, Odisha, which was inaugurated by the hon'ble Prime Minister, Narendra Modi. During this, the institute participated in the exhibition alongside IREDA, SECI, NIWE, and NISE, under the umbrella of the Ministry of New and Renewable Energy (MNRE), GoI. Dr. Ashish Bohre (Scientist-D) and Dr. Sanjeev Mishra (Scientist-D) represented SSS-NIBE at convention.

CPR and First Aid Training

On 15th January, 2025, SSS-NIBE organized a Cardiopulmonary Resuscitation (CPR) and basic First Aid training session for all students and staff members. The session was conducted by a medical expert from Civil Hospital, Kapurthala, with the objective of enhancing awareness and preparedness in handling medical emergencies. Participants were trained in essential life-saving techniques, ensuring they are better equipped to respond effectively in critical situations.

Students Visit at SSS-NIBE stall at Pravasiya Bhartiya Event

Guest Lectures at SSS-NIBE

On 22nd January, 2025, SSS-NIBE hosted two

insightful guest lectures by distinguished speakers from renowned institutions, Prof. Pratham Arora, IIT Roorkee, delivered a lecture on Biomass Supply Chain Management and Green Hydrogen, offering valuable perspectives on sustainable energy solutions and Prof. Anuj K. Chandel, University of São Paulo (USP), Brazil, presented on Lignin: An Untapped Reservoir of Renewable Carbon from Biorefineries, highlighting the potential of lignin in the bioeconomy.

The sessions provided students and faculty with a deeper understanding of emerging technologies and innovations in renewable energy and biorefinery systems.

CPR and First Aid Training

SSS-NIBE Signs MoU with PSCST

In a significant move to advance sustainable energy initiatives and strengthen scientific collaboration, Sardar Swaran Singh National Institute of Bio-Energy (SSS-NIBE), Kapurthala, signed a Memorandum of Understanding (MoU) with the Punjab State Council for Science & Technology (PSCST), Chandigarh. The MoU signing ceremony was held on 23rd January, 2025, at SSS-NIBE. This partnership aims to promote joint research, knowledge exchange, and the development of innovative solutions in the field of bio-energy and environmental sustainability.

Republic Day celebration

Republic Day Celebration at SSS-NIBE

The Republic Day celebration was held on 26th January, 2025, marking the 76th anniversary of India's Republic Day. The event was organized with great enthusiasm followed by flag hoisting by DG, SSS-NIBE. A brief cultural program was conducted by researchers, staff and their families.

NABL Accreditation for Testing Services

SSS-NIBE has achieved NABL accreditation for

testing services in accordance with ISO/IEC 17025:2017. The accreditation covers biogas/bioCNG and solid biomass testing, including proximate and ultimate analysis.

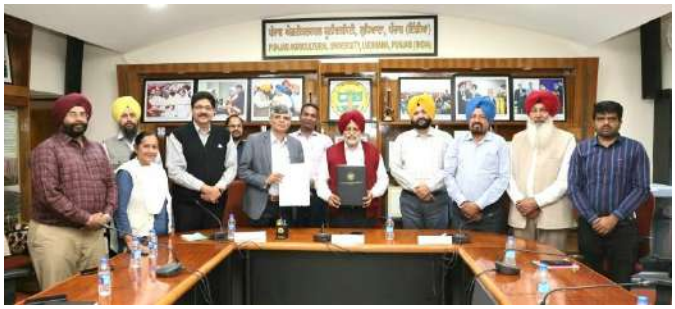
This marks a significant milestone for the institute, setting new benchmarks in quality and reliability within the bioenergy sector and further strengthening its role as a leader in renewable energy research and innovation.

Parliamentary Hindi Inspection

On 27th February, 2025, the Parliamentary Committee of Official Language conducted an inspection of SSS-NIBE at Hotel Hyatt, Chandigarh. The committee assessed the implementation and use of official language Hindi at the institute and found it to be satisfactory. Following the inspection, MNRE Rajbhasha officials visited SSS-NIBE on 28th February, 2025, for a Hindi work review to further ensure the proper usage of the language in official functions.

MoU Signed Between SSS-NIBE and PAU

On 17th March, 2025, SSS-NIBE and Punjab Agricultural University (PAU), Ludhiana signed a MoU to collaborate on bio-energy research, academic programs, and capacity building. This partnership aims to promote the sustainable use of agricultural residues for energy production and soil nutrient amendment, contributing to environmental sustainability and agricultural innovation.



MoU Signed Between SSS-NIBE and PAU

Expert Talk delivered at Jawahar Navodaya Vidyalaya, Dhilwan

On 13th March, 2025, Dr. Ashish Bohre and Dr. Sanjeev Mishra delivered an expert talk on Renewable Energy at Jawahar Navodaya Vidyalaya, Dhilwan. Dr. Bohre discussed "Waste Management", while Dr. Mishra focused on "Renewable Energy for a Sustainable Future". The talk provided students with a deeper understanding of key environmental topics and how they can contribute to a sustainable future.

Cookstove Dissemination Program

On 19th March, 2025, SSS-NIBE with collaboration with PSCST, organized a Cookstove Dissemination Program for the rural community of Punjab. The event, held at SSS-

NIBE, distribute the improved cookstoves to twenty households from Fateh Jalal and Khaira Majha villages in Jalandhar District.

Dr. G. Sridhar, DG, SSS-NIBE, and Shri Pritpal Singh, Executive Director, PSCST, highlighted the importance of clean cooking and the harmful effects of traditional stoves. The improved cookstoves, utilizing biomass efficiently, aim to reduce emissions and offer a sustainable alternative to rising LPG costs. The event also included a demonstration on the proper use of the cookstoves.

This initiative supports rural communities by improving health, reducing environmental impact, and promoting sustainable energy solutions.

Cookstove Dissemination

Visit to CSIR IIP, Dehradun

On a recent visit to the Indian Institute of Petroleum (IIP), of DG SSS-NIBE, along with a team of scientists, engaged in discussions with IIP Scientists to explore collaboration opportunities in various areas of mutual interest. This visit aimed to strengthen the research partnership between SSS-NIBE and IIP, focusing on advancing cutting-edge solutions in the field of sustainable energy. This collaboration is expected to drive forward research on sustainable bioenergy solutions, contributing to both national and global environmental goals. The visit marks an important milestone in fostering partnerships that combine scientific expertise and innovation to address pressing energy and environmental challenges.


Visit to CSIR IIP, Dehradun

ICRABR-2025: 5th International Conference on Recent Advances in Bio-energy Research

We're excited to announce the 5th International Conference on Recent Advances in Bio-energy Research (ICRABR-2025), organized by SSSNIBE, taking place from 6th to 8th October, 2025. With a growing global focus on renewable energy, the conference will highlight cutting-edge research in

biomass and bio-energy—including biohydrogen, biomethanation, bioethanol, biomass gasification, carbon materials, value added chemical and more. Building on the success of previous editions, ICRABR-2025 will bring together global experts to explore sustainable solutions for energy and environmental challenges. For more details please visit: www.icrabr.com

Important Dates

Abstract Submission Opens:	20/03/2025
Abstract Submission Closes:	30/06/2025
Early Bird Registration Deadline:	31/07/2025
Final Registration Deadline:	31/08/2025

******For suggestion please contact at sss.nibe@nibe.res.in******

Published by:
Director General,
Sardar Swaran Singh National Institute of Bio-Energy,
Kapurthala, Punjab,
Pincode-144603

Website: http://nibe.res.in
Email: sss.nibe@nibe.res.in
Twitter@SssNibe
Telephone: (+91)1822507406
Facebook: https//www.facebook.com/SSS.NIBE

Publication Team: Editor: Dr. Sandeep Kumar Assistance: Mr. Hitesh Sharma