BIO-FUEL, RENEWABLE ENERGY R&D AND POLICY IN INDIA

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RENEWABLE ENERGY SCENARIO IN INDIA

- Electricity sector in India has an Installed capacity of 288 GW as of 31st January 2016. Non Renewable Power Plants constitute 86.20% of the installed capacity, and Renewable Power Plants constitute the remaining 13.80% of total installed Capacity.

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TOTAL RENEWABLE ENERGY INSTALLED CAPACITY

Sector	Cumulative Achievements (as on 31.01.2016)
I. GRID-INTERACTIVE POWER (CAPACITIES IN MW)	
Wind Power	25188.39
Solar Power	5248.21
Small Hydro Power	4187.65
Bio-Power (Biomass & Gasification and Bagasse Cogeneration)	4760.55
Waste to Power	127.08
Total	**39511.88**
II. OFF-GRID/ CAPTIVE POWER (CAPACITIES IN MW_{EQ})	
Waste to Energy	146.51
Biomass(non-bagasse) Cogeneration	602.37
Biomass Gasifiers -Rural -Industrial	18.15 160.72
Aero-Genrators/Hybrid systems	2.67
SPV Systems	302.30
Water mills/micro hydel	17.21
Total	**1249.93**

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OTHER MAJOR ACTIVITIES OF CENTRE OF RURAL DEVELOPMENT AND TECHNOLOGY(CRDT), IIT DELHI

- Apart from being a part of SEE forum Indian Institute of Technology, Delhi is also a Biogas Development and Training Centre supported by Ministry of New and Renewable Energy, Government of India to train manpower and develop human resources.
- IIT Delhi with the support of Ministry of Human Resource Development(MHRD) has started **"Unnat Bharat Abhiyan (Glorious India Movement) "** focusing on overall holistic development of villages. The Mission of Unnat Bharat Abhiyan is to enable higher educational institutions to work with the people of rural India in identifying development challenges and evolving appropriate solutions for accelerating sustainable growth.

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THEMES OF UNNAT BHARAT ABHIYAN

- Alternate Energy Sources
- Organic Farming and Animal Husbandary
- Water Management
- Rural Artisans and Industries
- Basic amenities to rural areas

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RECENT ADVANCES IN POLICY SPACE IN THE AUTOMOTIVE BIOFUEL SECTOR IN INDIA

- **Bio-Ethanol:** The Ministry of Road Transport & Highways released a Notification for mass emission standards for flex-fuel ethanol E85 and ED95 in vehicles. The Ministry has notified the test requirements for Type Approval and extension for two, three and four-wheeled vehicles. It has also notified the technical specifications of reference fuel E85 and ED95 used for testing of such vehicles. This Notification will enable vehicle manufacturers to manufacture vehicles running on bio-ethanol E85 and ED95.

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- **Bio-CNG:** The Ministry has notified Rules for mass emission norms and testing standards of vehicles running on bio-CNG. This notification enables the vehicle manufacturers to manufacture, sell and get vehicles fueled by Bio-CNG in the country.
- **Bio-Diesel:** The draft notification has been formulated for Mass Emission Standards for vehicles compatible to run on diesel or on mixture of Bio-diesel of upto hundred percent Biodiesel (B100). Notably the oil marketing companies have started Bio-Diesel supplies to some retail outlets.

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NATIONAL SOLAR MISSION

The **National Solar Mission** is a major initiative of the Government of India and State Governments to promote ecologically sustainable growth while addressing India's enery security challenges with a target of 20GW by 2022 which was later increased to 100 GW in 2015. To meet the scaled up target of 100,000 MW, MNRE has proposed to achieve it through 40,000 MW through Rooftop Solar Projects and 60,000 MW through Large and Medium Scale solar projects.

Year-wise Targets (in MW)

Category	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Total
Rooftop Solar Project	200	4,800	5,000	6,000	7,000	8,000	9,000	40,000
Ground Mounted Solar Project	1,800	7,200	10,000	10,000	10,000	9,500	8,500	57,000
Total	2,000	12,000	15,000	16,000	17,000	17,500	17,500	97,000

R&D ON BIOFUELS IN INDIA

- **Bio-CNG:** IIT Delhi has developed an indigenous low cost small scale biogas upgrading and bottling plant based on water scrubbing technology to demonstrate the use of biomethane as a vehicular fuel. This enriched biomethane has more than 90% methane. A car has been run for more than 30,000 km on biomethane and tested for its engine performance and emissions. Its performance has been found to be at par with CNG in all aspects and a mileage of more than 24 km/kg was obtained during trials. A BIS standard has also been brought out laying the guidelines for biomethane as vehicular fuel. IIT Delhi is also working on a mobile unit for Biogas upgradation and bottling system which can move around and ca directly take the gas from the Biogas plants and upgrade it.

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Biogas Cycle

Solar energy

Photosynthesis

Biomethane production

Animal husbandry

Crop harvesting

Industrial processing

Human consumption

CO_2

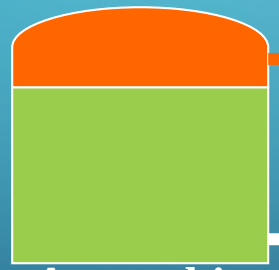
H_2O

Electrical and/or thermal energy

Energy crops

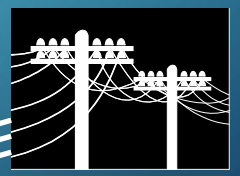
Biofertilizer

Organic wastes



Anaerobic digestion

Biogas



Natural gas pipeline

Energy crops

CO_2

Cleaning & Upgrading

Biogas Purification and Bottling plant Bhilwara, Rajasthan


BIOGAS ENRICHMENT AND BOTTLING PLANT - IIT DELHI
Biogas vehicle
DL 12 CC 2290

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- **Bio-Ethanol:** IITD has been carrying out active research on both sirst and second generation ethanol. India is the second largest producer of sugarcane in the world. juice. According to Ministry of Petroleum and Natural Gas, 5% ethanol blends on an all-India basis would require 500 million liters. The current availability of molasses and alcohol would be adequate to meet this requirement after fully meeting the requirement of the chemical industry and potable sectors.

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- **Bio-Diesel:** IIT Delhi have been working on utilization of biodiesel. Experimental results have shown that biodiesel blends can be utilized in IC Engine without significant hardware modifications. The biodiesel is Sulphur free fuel unlike diesel. Utilization of biodiesel has shown performance improvement along with emission reduction with significantly lower HC,CO, and PM emission. The NOx emission can also be controlled by various strategies. In IITD diesel vehicle was converted for biodiesel operation has successfully covered over one lakh.

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PROPOSAL FOR
INTERNATIONAL CONFERENCE ON ENERGY ACCESS TO RURAL AREAS AND SEE FORUM MEETING
15-17 SEPTEMBER, 2016

AT
INDIAN INSTITUTE OF TECHNOLOGY DELHI

Energy from wastes

THANK YOU

THANK YOU

ABOUT SEE FORUM INDIA

- SEE Forum India, is working on promotion of renewable energy by actively participations of young researchers and graduate students in research and development.
- At regular time interval technology dissemination activities are performed by means of workshops, conferences, field visits, by publishing articles in progressive news papers and energy magazines.
- In 2013 an International Dissemination Workshop on Biogas Upgradation, Bottling and Vehicular application was conducted which was attended by large number of academicians, businessmen and researchers from India, Finland, England, Kenya and Nepal.

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- Short term exchange programs wherein post graduate and PhD students from SEE Forum countries can visit each other and have field and lab visits to identify and understand the problems being faced due to energy scarcity in various regions and formulate academic content based on learnings.
- Through institutional collaboration there can be PhD scholar exchange programs between the institutes for enhancement of knowledge and R & D cooperation.

Since many members of SEE Forum countries have similar climatic and bio-geographic conditions and the challenges faced are not very different from each other we can have cross country exchange of ideas and technologies which will of significant benefit to all. Integrated Energy Systems may be one area of research collaboration.

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CURRENT ACTIVITIES OF NATIONAL/YOUNG SEE FORUM

- As a part of Young SEE Forum, for knowledge enhancement towards renewable energy, every year 10-12 students of Bachelor's and Master's degree opt minor projects on Biogas technologies and clean cook stoves.
- Two bachelor's students and a PhD scholar are working on designing and development of mobile biogas enrichment unit which is sponsored by Ministry of New and Renewable Energy, Government of India.
- Students and young researchers are working on other projects such as developing field scale biomethanation system for agri-residue and valorisation of biogas slurry.

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- A group consisting two PhD scholars, two research assistant and four bachelor degree students are working on designing of clean cook stove and implementation of thermoelectric generator in it.
- To further enhance the quality of research and its dissemination Rural Energy Group includes professor's from Department of Mechanical Engineering, Department of Biological Science and Bioengineering and Department of Chemical Engineering

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EXPECTATION FROM THE SEE FORUM ORGANISATION AND FUNCTION

- For the promotion of environmental friendly practices and green energy there is a need to build a platform for promotion, development and strengthening of consultancy and technology dissemination between SEE forum member countries by enhancement of export of consultancy, professional services and technologies.
- Feasibility Studies can be taken up on integrated system of Renewable Energy Technologies, which would be able to meet the energy requirements of rural areas, to continuously and consistently provide energy for consumption in an environment friendly way.
- Organisation of workshops for capacity building and promotion of technologies developed, to enhance its dissemination across the region.

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