



IEA Bioenergy
Technology Collaboration Programme

Country Update – India

Gasification of Biomass and Waste

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IEA Bioenergy : Task 33 meeting

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Technology Collaboration Programme

by **iea**

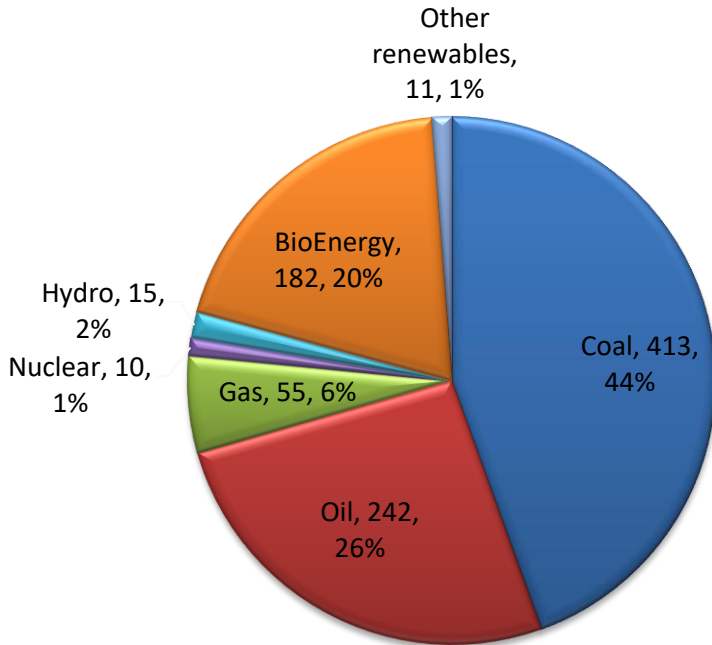
Outline

- India's energy basket - renewables, bio-energy
- Bioenergy potential
- Recent developments
- Biomass gasifier manufacturers details
- Research institutes
- Activities related to advanced biofuels



India's current energy basket

India TPED in 2019 – 929 (Mtoe)



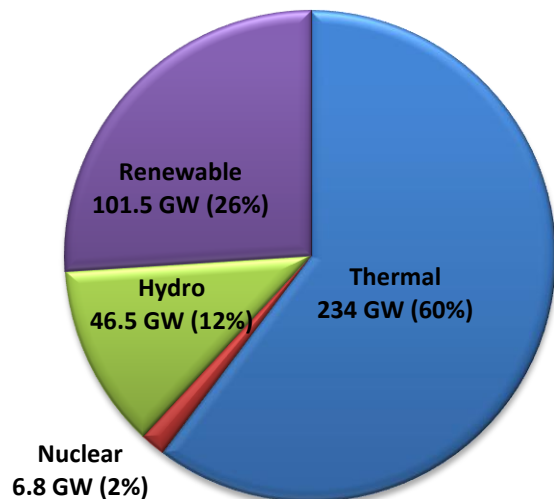
- Third largest energy consuming country in the world
- Coal a dominant share in energy mix
- Oil & gas second only to coal in the energy mix
- Share of oil and gas at 32% is way below the global average of 52%
- Share of bio-energy at 20% in the energy mix
- Third largest global emitter of CO₂ with 2.3 Gt emissions in 2020
- On a per capita basis, India's energy use and emissions are less than half the world average

Share of bio-energy is 20% in the energy mix

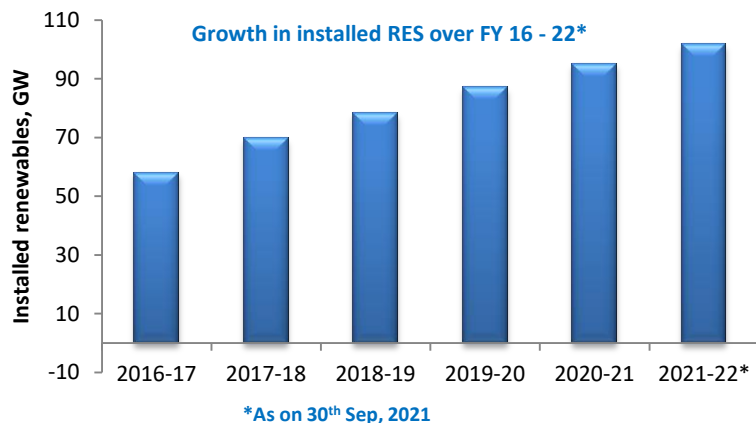
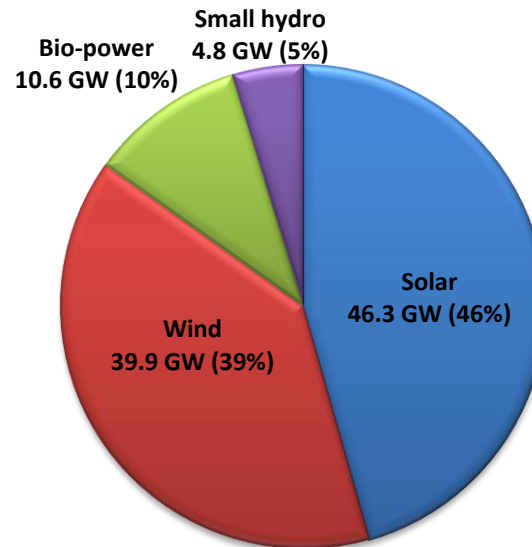


India's power sector – installed capacity

India's installed power capacity as on 30th Sep'21, 389 GW



Break up of Renewables as on 30th Sep'21



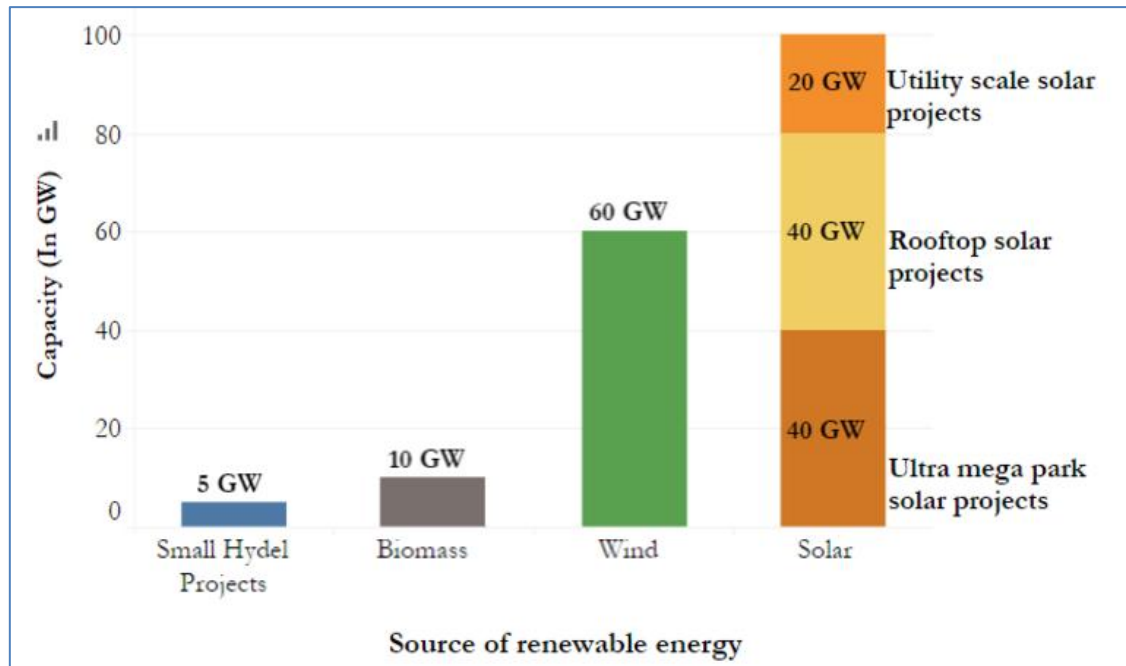
- Indian electricity sector is on the cusp of solar powered revolution
- Installed RES increased at a fast pace over the past few years, posting a CAGR of 15.4% between 2016-21
- India set a target of adding 175 GW of RES by 2022
- Announced an ambitious target of 450 GW RES capacity by 2030, & revised to 500 GW at the COP26 Summit in Glasgow

India's installed biomass power capacity – 10.6 GW



India's 2022 renewable energy target

Renewable energy capacity target by 2022 – 175 GW



- India achieved the target of 10 GW biomass power before 2022 with the present installed capacity of 10.6 GW
- Nearly achieved the 5 GW target from small hydropower projects with present installed capacity of around 4.8 GW

Bioenergy potential in India

- As per a recent study sponsored by MNRE, the current availability of biomass in India - ~750 million metric tons per year
- Estimated surplus biomass availability at about 230 million metric tons per annum covering agricultural residues
- Biomass power potential from surplus biomass resources - 28 GW
- Around 14 GW additional power could be generated through bagasse based cogeneration in India's 550 Sugar mills
- Further, nearly 5.7 GW power can be generated by waste to energy projects
- As per MNRE website, central financial assistance for biomass energy project available till 31st March, 2021

India's National Hydrogen Mission

- National Hydrogen energy Mission (NHM) announced in the union budget for 2021-22
- Honorable prime minister launched NHM on India's 75th Independence Day
- Aims to make India a green hydrogen hub as well as export of green hydrogen
- Green H₂ spearhead India's transition to clean energy and aid in meeting India's climate targets
- India's total hydrogen demand expected to be nearly double from current 6.7 Mt to 11.7 Mt by 2030
- Govt. has plans to bring down cost of green hydrogen to Rs 160 per kg by 2029-30
- Aims to extend PLI scheme for manufacturing electrolyzers



COP26 climate summit – India's commitment

- Increase India's share of non-fossil energy capacity to 500 GW by 2030
- Meet 50% of India's electricity requirements from renewable energy by 2030
- Reduce one billion tonnes (1 Gt) of carbon emissions from the projected emissions by 2030
- Reduce carbon emissions intensity of its economy by 45% by 2030 compared to 2005 levels - 28% already achieved
- By 2070, set to achieve the target of Net Zero emissions



Biomass gasification implementation in India

- Development and dissemination of biomass gasifiers in India was commenced in the early 1980s
- **Indian Institute of Science (IISc)** : Initiated research on biomass gasification based systems in 1981
- **Jyoti Solar Energy Research Institute (JSERI)** : Developed a 5 hp biomass gasifier in 1980s. In 1984, JSERI changed its name to Sardar Patel Renewable Energy Research Institute (SPRERI).
- **The Energy and Resources Institute (TERI)** : constructed a 5 hp gasifier by 1984
- Department of Non-conventional Energy Sources (DNES, now MNRE) launched first major national initiative under biomass gasifier programme in 1987
- Initial work centred on development of small wood based gasifiers that would be useful for applications such as powering irrigation pump sets



Biomass gasification implementation in India cond.

- Capital subsidy based scheme was quite successful in setting up large number of biomass gasification systems for irrigation water pumping
- Biomass gasifier system configuration - Fixed bed down draft
- Efforts towards development of reliable industrial package for both power generation and thermal application initiated around 2000
- Between 1990-2010, several research institutions, industries and implementing agencies actively involved in development and deployment
- Quite a large no of biomass gasifiers set up to cater thermal and power requirements
- Since 2010, focus reduced except few institutions which has continued their ongoing research activities
- Currently 10 - 12 biomass gasifier manufacturers available



Biomass gasifiers technology providers/ manufacturers

S No	Name of the organization	Technology details
1	Ankur Scientific Energy Technologies Pvt. Ltd. Ankur', Near Navrachana School, Sama, Vadodara - 390 024, Gujarat, India Website : www.ankurscientific.com	Technology : Downdraft with closed top End use : Electrical and thermal applications Product range : 10 kW - 1500 kW WBG series : Process wood pieces, coconut shells, corn cob FBG series : Process fine biomass such as rice husk and straw COMBO series : Process both fine and woody biomass
2	Combustion, Gasification and Propulsion Laboratory (CGPL), Indian Institute of Science (IISc), Bangalore - 560 012, Karnataka, India Website : http://cgpl.iisc.ac.in/site/	Technology : Open top re-burn throat-less downdraft End use : Electrical and thermal applications Product range : 10 kW - 1200 kW Licensing mechanism with 8 licensed holders
3	The Energy Resources Institute (TERI) Darbari Seth Block, IHC Complex, Lodhi Road, New Delhi - 110 003, INDIA Website : https://www.teriin.org/	Technology : Closed top down-draft throat less/ two stage gasifeir End use : Electrical and thermal applications Product range : 50 kWe -2000 kWe for electrical application 25 kW _{th} to 5 MW _{th} for thermal application Licensing mechanism with 9 licensed holders
4	Husk Power Systems 2nd Floor, Sai Tower, New Dak Bunglow Road, Patna - 800001, Bihar, India Website : https://huskpowersystems.com/	Technology : Modified proprietary downdraft gasifier to process 100% rice husk End use : Electrical applications Product range : 25 kW to 100 kW
5	Infinite Energy Pvt. Ltd. Plot No. 25/2, Opp. Peer Baba, Dabua Pali Road, Faridabad, Haryana- 121001, India Website: http://www.infiniteenergyindia.com/ index.html	Technology : Gasifiers with updraft, downdraft with closed top, stratified downdraft and entrained configuration End use : Thermal and power applications Product range : 30 kW _{th} to 2000 kW _{th} and



Biomass gasifiers technology providers/ manufacturers

S No	Name of the organization	Technology details
6	GP Green Energy Systems Pvt. Ltd. Bengal Eco Intelligent Park Tower 1 Module 21 14th Floor EM Block Salt Lake City Sector V, Kolkata 700091 Website : http://gpenergy.net/	Technology : Updraft gasification End use : Thermal and power application Product range : 10 kW to 1 MW
7	Urja Gasifiers Pvt. Ltd. M.G College Road, Gorakhpur, Uttar Pradesh – 273001 Website : https://www.urjagen.in/index.php	Technology : Updraft and downdraft gasifiers End use : Thermal and electrical applications Product range : 10 kW – 500 kW
8	Radhe Renewable Energy Development Pvt. Ltd. Plot No. 2621/22, Road D-2 Gate No. 1(Kranti Gate), Lodhika GIDC Metoda, Kalawad Road, Rajkot – 360021 Website : http://radhegroup.com/	Technology : Updraft gasification End use : Thermal and power application Product range : 250 kW – 5 MW
9	E. B. Mechanism Pvt. Ltd. Manglam Biomass Gasifier 154, Road No. 5, Industrial Area Shalimar Chauraha, Jaipur-302012, Rajasthan, Website : https://www.manglamgasifier.com/	Technology : Up-draft and down-draft biomass gasifier End use : Electrical and thermal applications Product range : 110 kW _{th} – 2300 kW _{th}
10	Cosmo Powertech Pvt. Ltd. Near Jain Public School Devpuri, Dhamtari Road, Raipur – 492 015, Chhattisgarh, India Website : http://www.cosmo-energy.in/index.html	Technology : Up-draft gasifier to process fuels like biomass, coal and waste End use : Thermal applications Product range : 300 kW _{th} to 10,000 kW _{th} in single modules
11	Chanderpur Works Pvt. Ltd. Jorian, Delhi Road Yamunanagar - 135001, Haryana, India Website : https://www.chanderpur.com/	Technology : Up-draft and downdraft gasifiers End use : Thermal and power application Product range : 20 kWe to 1200 kWe gasifiers

Research institutions working on gasification

Institute name	Research group details
Indian Institute of Science, Bangalore	Dr. S. Dasappa Professor, Centre for Sustainable Technologies, Combustion, Gasification and Propulsion Laboratory http://cgpl.iisc.ernet.in/dasappa/
Indian Institute of Technology, Bombay	Sanjay M Mahajani Professor, Dept. of Chemical Engineering https://www.che.iitb.ac.in/web/faculty/sm/index.htm
	Srinivas Seethamraju Assistant Professor, Dept. of Energy Science and Engineering https://www.es.e.iitb.ac.in/faculty/srinivas-seethamraju
	Sandeep Kumar Assistant Professor, Dept. of Energy Science and Engineering https://www.es.e.iitb.ac.in/faculty/sandeep-kumar
Indian Institute of Technology, Guwahati	Prabu Vairakannu Associate Professor, Dept. of Chemical Engineering https://www.iitg.ac.in/chemeng/faculty_profile.php?name=pv
	Vijay S Maholkar Professor, Dept. of Chemical Engineering https://www.iitg.ac.in/chemeng/faculty_profile.php?name=vsm
	Pinakeswar Mahanta Professor, Dept. of Chemical Engineering https://www.iitg.ac.in/mech/faculty/pinak/

Research institutions working on gasification

Institute name	Research group details
Indian Institute of Technology, Roorkee	Sonal K Thengene Assistant Professor, Dept. of Hydro and Renewable Energy https://bwrl.iitr.ac.in/
	N Siva Mohan Reddy Associate Professor, Dept. of Chemical Engineering https://www.iitr.ac.in/~CH/N_Siva_Mohan_Reddy
Indian School of Mines, Dhanbad	I M Mishra Professor, Dept. of Chemical Engineering https://iitism.irins.org/profile/97595#personal_information_panel
	Shalini Gautam Associate Professor, Department of Fuel, Minerals and Metallurgical Engineering https://www.iitism.ac.in/index.php/Departments/faculties_detail_fme
BITS Pilani, Pilani Campus	Pratik N Sheth Associate Professor, Dept. of Chemical Engineering https://www.bits-pilani.ac.in/pilani/pratik/Profile
Tezpur University	Sadhan Mahapatra Associate Professor, Department of Energy http://www.tezu.ernet.in/dener/people/SM_index.htm
University of Petroleum and Energy Studies(UPES), Dehradun	Pankaj Kumar Sharma Professor, Dept. of Mechanical Engineering https://www.upes.ac.in/schools-faculty/engineering/mechanical/dr-pankaj-kumar-sharma

Recent developments related to advanced biofuels

- IISc and IOCL jointly working on development and demonstration of biomass gasification based hydrogen generation technology for producing fuel cell-grade hydrogen
- Oxy-steam biomass gasification process adapted for generation of hydrogen rich syngas
- Vacuum Pressure Swing Adsorption (VPSA) considered for production of fuel cell grade hydrogen
- Developed technology demonstrated at 2 kg/h hydrogen production
- Optimization of operating conditions and generation of scale up data is under progress

Recent developments related to advanced biofuels

- Mangalore Refinery and Petrochemicals Limited (MRPL) awarded LanzaTech a contract in **September, 2020** to commence the basic engineering for an integrated processing facility to convert agricultural residues to ~16 ktons/year of FG ethanol
- LanzaTech deploy gasification technology of M/s Ankur Scientific
- Use LanzaTech's gas fermentation technology for conversion of syngas to ethanol
- LanzaTech & Spray Engineering Devices Ltd. (SED) announced bagasse-to-ethanol project in India in **October, 2021**



Thank You

