

CONVERSION OF BIOMASS IN INDIA - NEW AGE TECHNOLOGIES AND POLICIES



Biomass generally refers to the renewable organic matter or residue generated by crop production or agro wastes, animal wastes, industrial waste effluents, urban wastes, aquatic wastes, etc.

The National Policy on Biofuels, 2018 defines the term 'biomass resources' as *the biodegradable fraction of products, wastes and residues from agriculture, forestry and related industries as well as the biodegradable fraction of industrial and municipal wastes*. A few instances of biomass include tiny wood chip, rice husk, arhar stalks, cotton stalks, barks, leaves, wastes from paper mills, food processing units, animal dung, food and kitchen waste, etc.

Biomass energy is a renewable source of energy that plays a vital role to produce heat and electricity, to be used as a transportation fuel, etc in an eco friendly manner. This would help to reduce dependence on fossil fuels and to combat climate change.

India is ranked as the second most attractive renewable energy market in the world.

According to the Ministry of New and Renewable Energy (MNRE), in the past few decades, there has been an increasing demand for biomass conversion to energy for the aforesaid purposes in a cost effective and efficient manner, and a number of technologies have been developed in India to convert biomass to bio-energy, bio-fuels, bio-gas, etc.

As per The National Policy on Biofuels 2018, **100% FDI through automatic approval route is allowed in biofuel technologies** and projects except plantations in India, provided biofuel is for domestic use only, and not for export purposes.

Following are various biomass conversion technologies being promoted and/or developed in India:

1) Thermo-chemical process technology

This process consists of the following three main sub-processes for conversion of biomass to bio-energy/bio-fuels:

i) Combustion-

In this process, biomass is burnt in air and it is used to convert the chemical energy stored in biomass into heat energy, mechanical power and electricity, by use of devices such as furnaces, stoves, steam turbines, boilers, etc.

ii) Gasification-

Herein, biomass is converted into a combustible gas mixture by the partial oxidation of biomass at high temperatures. The gas produced in this process can either be used as a fuel for gas engines and gas turbines which would, in turn, convert the gaseous fuel to electricity or be used to produce methanol and hydrogen which, in turn, can be used as transportation fuels.

MNRE is promoting biomass gasifier based power plants to be installed mainly in rural areas, where surplus biomass and agro-residues are available, to generate electricity for lighting, water pumping, etc.

iii) Pyrolysis-



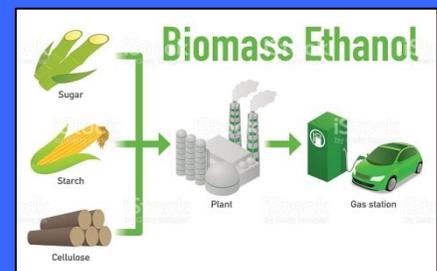
It is the conversion of biomass to liquid, (bio-oil or bio-crude), solid and gaseous state, by heating the biomass in the absence of air. This bio-oil can be used in engines and turbines.

2) Bio-chemical/biological process technology

This process consists of the following two main sub-processes for conversion of biomass to bio-chemicals:

i. Fermentation

The biomass generated from sugar and starch crops is grounded and the sugar so produced along with yeast is converted to ethanol. Ethanol can be used in fuel, solvents, and even hand sanitizers. The bagasse residue which is obtained from sugar cane can be used as a fuel for boilers.



ii. Anaerobic digestion

Herein, biomass is converted in anaerobic environment by bacteria, which produces a gas comprising of mainly methane and carbon dioxide with small quantities of other gases such as hydrogen sulphide. This gas is known as biogas which can be used directly in spark ignition gas engine and gas

turbines and can also be upgraded to higher quality by removing the carbon dioxide content.

3) Mechanical extraction (with esterification) process technology

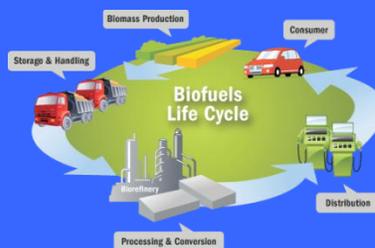
In this process oil is produced from the seeds of various biomass crops such as groundnuts, cotton, etc. This oil may be used as transportation fuel.



4) Second generation-ethanol technology

The Institute of Chemical Technology (ICT), Mumbai has recently in 2017 developed India's first home grown 2nd Generation-Ethanol Technology which would convert biomass to ethanol with speed and efficiency. It has been reported that the conversion using this Technology is four times faster than other technologies currently available in the international market.

This Technology involves three steps:



(i) Chemical fractionation-

According to Institute of Chemical Technology, in this process *lignocelluloses are broken down to cellulose, lignin and C5 sugars by means of acid fractionation. A mixture of cellulose and lignin through alkali fractionation then separates to cellulose and lignin streams.*



(ii) Enzymatic hydrolysis

As per ICT, in this process *cellulose through enzymatic hydrolysis breaks down to C6 sugars. The non-sugar organic components can be simply converted into energy by direct burning while inorganic silica can be recovered and sold as by-product.*

(iii) Fermentation

Fermentation of C6 and C5 sugars yields ethanol.

INDIAN LAWS AND POLICIES GOVERNING THE RENEWABLE ENERGY SECTOR



1. **Ministry of New and Renewable Energy (MNRE)** is the key Ministry responsible for supporting research and development, and the promotion and coordination of renewable energy sources, including bioenergy. The MNRE has a non-banking financial company, viz., the Indian Renewable Energy Development Agency (IREDA), which provides loans for setting up biomass power and bagasse cogeneration projects.

The MNRE has implemented the following key programs:

- **Biomass Power/Cogeneration Program** - for financial and fiscal incentives to manufacture and install gasifier systems.
- **Biomass Gasifier Program** - for installations of power plants and power systems in rural areas.
- **National Biomass Resource Assessment Program (NBRAP)**- for developing biomass assessments.
- **National Biogas and Manure Management Program (NBMMP)**- for setting up family-type biogas plants for providing biogas as clean cooking fuel and a source of lighting.

2. **Energy Conservation Act, 2001 as amended in 2010**

This Act provides for a legal framework, institutional arrangements and a regulatory mechanism at the Central and state levels to promote energy efficiency drive in the country.

3. **Electricity Act, 2003 as amended in 2014**

The Electricity Act 2003 is proposed to be amended vide Electricity (Amendment) Bill, 2014 to give an impetus to the development of electricity generation and consumption from renewable energy sources.

4. National Renewable Energy Act, 2015 (the Act)

The National Renewable Energy Act, 2015 is a draft legislation that governs the development and deployment of renewable energy, including biomass, biofuel and biogas, and also enjoins upon both the Central and the state governments to take appropriate measures and formulate necessary policies. The Act has the following beneficial provisions:



- a. Integrated Energy Resource Planning (IERP)- IERP refers to a strategic plan for securing reliable and cost-effective energy resources. The plan is an exhaustive, research-based examination of potential risks and opportunities in procuring future energy supplies.
- b. Establishment of National Renewable Energy Committee and National Renewable Energy Advisory Group-This is for ensuring inter-ministerial coordination and expert assistance.
- c. Manufacturing and skill development- This is for setting up national renewable energy manufacturing zones, encouraging entrepreneurs and start-ups to come up with innovative renewable energy technologies, to provide low cost debt and financing to renewable energy projects, etc.

5. National Policy on Biofuels, 2018

This Policy has been published by MNRE and approved on 16.05.2018, in order to promote the use of indigenous biomass matter for production of biofuels in the country.

- i) As per the Policy, the Central and state governments will provide fiscal incentives and concessions to businesses in the new and renewable energy sector. Furthermore, bio-ethanol already enjoys concessional excise duty of 16% and bio-diesel is exempted from excise duty.
- ii) No other central taxes and duties have been proposed to be levied on bio-diesel and bio-ethanol. In the event that plant and machinery for production of bio-diesel or bio-ethanol, as well as for the engines that are run on biofuels for transport, and other applications, are not manufactured indigenously, custom and excise duty concessions would be provided.

6. Goods and services tax (GST) laws

As per the report of MNRE in 2016, there may be an increase in the goods and services tax (GST) rate on biofuels and biomass from the current rate of 20% Central GST.



The ICT has signed a Memorandum of Understanding (MoU) with Bharat Petroleum Corporation Limited (BPCL) and Hindustan Petroleum Corporation Limited (HPCL) to transfer the Technology and to build commercial scale biomass ethanol plants based on the Technology by 2018. Reportedly, BPCL is in the process of setting up 2G Biomass Ethanol Bio-refinery in Madhya Pradesh to process 400 tonnes/day of biomass to produce ethanol. The production of such bio fuels is expected to cut down the country's oil imports and also reduce carbon dioxide emissions into the air.

Furthermore, Indian Oil Corporation (IOC), BPCL and HPCL have planned to invest INR 10,000 Crore to set up bio-CNG (compressed natural gas) plants across India to promote clean fuel and reduce the country's fuel imports. Bio-CNG is a renewable form of energy produced from agricultural and food waste, and is a purified form of biogas with over 95% pure methane.

For further information please contact:

Mrs. Sushila Ram (Varma)

Chief Legal Consultant

Ph: +91 98111 91142, +91 99492 78548

Email: sushilaram@theindianlawyer.in , sushilaram@gmail.com