



BIOFUELS

- **Biofuels** are renewable energy sources made from organic materials such as plants, algae, and animal waste.
- They can be converted into liquid fuels like ethanol, biodiesel, and biogas for use in transportation, heating, and electricity generation.
- Biofuels are considered eco-friendly alternatives to fossil fuels, reducing greenhouse gas emissions.

Types of Biofuels

- **Ethanol:** A type of alcohol made from fermented plant sugars, commonly used as a gasoline substitute or additive.
- **Biodiesel:** Derived from vegetable oils, animal fats, or algae, biodiesel can replace or blend with conventional diesel fuel.
- **Biogas:** Produced from the anaerobic digestion of organic materials, such as agricultural waste and landfill trash, used for heating or electricity generation.
- **Bioethanol:** Similar to ethanol, made from crops like corn or sugarcane, often used as a renewable fuel for vehicles.
- **Algal Biofuels:** Derived from algae, they have high energy yields and are seen as a promising alternative for transportation fuels.
- **Biobutanol:** A higher-energy biofuel produced from plant sugars and biomass, considered a potential substitute for gasoline.
- **Wood and Pellet Fuels:** Solid biofuels made from wood, agricultural residues, or compressed sawdust, commonly used for heating and cooking.

Categories of Biofuels

First Generation Biofuels

- These are made from food sources such as sugar, starch, vegetable oil, or animal fats using conventional technology.
- First-generation biofuels include Biodiesel, Vegetable oil, Biogas etc.

Second Generation Biofuels

- These are produced from non-food crops or non-edible crops and are considered as wastes, e.g. stems, husks, wood chips, and fruit skins and peeling.
- Examples include cellulose ethanol, biodiesel.

Third Generation Biofuels

- These are produced from micro-organisms like algae. For example – Butanol

Fourth Generation Biofuels

- Genetic engineered crops that can have high capacity of carbon are taken in production of these biofuels.