

What are modern fuels ?

- ✓ **Modern Fuels are renewable fuels synthesized from renewable energy sources, such as wind and solar.**
- ✓ **Renewable fuels have gained in popularity due to their sustainability, low contributions to the carbon cycle, and in some cases lower amounts of greenhouse gases.**

OTHER MODERN FUELS ?

-Perhaps the most recent change to modern fuels has been the introduction of bio-fuels."

Biofuel is any fuel that is derived from biomass, recently living organisms or their metabolic by-products, such as manure from cows.

It is a renewable energy source, unlike other natural resources such as petroleum, coal and nuclear fuels.



LETS CLASSIFY IT !!!!!

✓ **First Generation Biofuels-** First generation biofuels are biofuels which are produced from food crops (sugar or oil crops) and other food based feedstock (e.g. food waste).

✓ These biofuels are on the market in considerable amounts today and their production technologies are well established. The most important biofuels of the 1st-generation are **bioethanol, biodiesel, and biogas.**



- ✓ **Bioethanol** is produced by fermenting sugars from starch and sugar biomass (e.g. cereal crops such as corn or maize and sugarcane). It can be used in pure form in specially adapted vehicles or blended with gasoline in any proportion up to 10% (US), provided that fuel specifications are met.
- ✓ **Ethyl-tertiary-butyl-ether (ETBE)** is synthesized from bioethanol and isobutylene. It can be blended with gasoline in any proportion up to 15%. It is currently the biggest biofuel contributor in Europe.
- ✓ **Biodiesel (FAME)** is made from vegetable oils of rapeseed, soya, palm fruits or other oil crops via the reaction of triglycerides with methanol and alkali or acid (transesterification process). It can be used in pure form in specially adapted vehicles or be blended with automotive diesel in any proportion up to 5% (up to 30% for captive fleets).
- ✓ **Biogas** typically refers to a mixture of different gases produced by the breakdown of organic matter in the absence of oxygen. Biogas can be produced from raw materials such as agricultural waste, manure, municipal waste, plant material, sewage, green waste or food waste. Biogas is a renewable energy source. Biogas can be produced by anaerobic digestion with methanogen or anaerobic organisms, which digest material inside a closed system, or fermentation of biodegradable materials

Overview of Biofuel Production Technologies

First Generation of Biofuels

Biofuel type	Specific name	Feedstock	Conversion Technologies
Pure vegetable oil	Pure plant oil (PPO), Straight vegetable oil (SVO)	Oil crops (e.g. rapeseed, oil palm, soy, canola, jatropha, castor, ...)	Cold pressing extraction
Biodiesel	<ul style="list-style-type: none"> - Biodiesel from energy crops: methyl and ethyl esters of fatty acids - Biodiesel from waste 	<ul style="list-style-type: none"> - Oil crops (e.g. rapeseed, oil palm, soy, canola, jatropha, castor, ...) - Waste cooking/frying oil 	<ul style="list-style-type: none"> - Cold and warm pressing extraction, purification, and transesterification - Hydrogenation
Bioethanol	Conventional bio-ethanol	Sugar beet, sugar cane, grain	Hydrolysis and fermentation
Biogas	Upgraded biogas	Biomass (wet)	Anaerobic digestion
Bio-ETBE		Bioethanol	Chemical Synthesis

Food vs. Fuel crisis

Using crops that can be used for food, to produce bio-fuels

Government support of biofuels with tax breaks, mandated use, and subsidies.

land that was also formerly used to grow crops for food is now used to grow crops for biofuels

placing energy markets in competition with food markets

unintended consequence of diverting resources from food production and leading to surging food prices and the potential destruction of natural habitats.