- ✓ **Second Generation Biofuels** Different from the 1st generation the so called second or 'next' generation of future biofuels can be produced from wider range of feedstocks, which are represented mainly by non-food crops. For example, the whole plant biomass can be used or waste streams that are rich in lignin and cellulose, such as wheat straw, grass, or wood.

In order to breakdown this biomass, two main conversion pathways come into consideration:

- ✓ 1) **HYDROLYSIS** (can be done via chemical and biochemical pathways) of ligno-cellulose into sugars, which can then be fermented into alcohol - this technology is best known as 'cellulosic bioethanol' and is still in development
- ✓ 2) **THERMOCHEMICAL PROCESSES** (use of high temperatures to pyrolyse or gasify biomass) of lignocelluloses to a raw gas or oil. The resulting gas is then treated and conditioned into synthesis gas (syngas), consisting mainly of carbon monoxide and hydrogen. This gas can further be processed into different types of liquid and gaseous fuels via different fuel syntheses. Fuels from this route are then called 'synthetic biofuels'.

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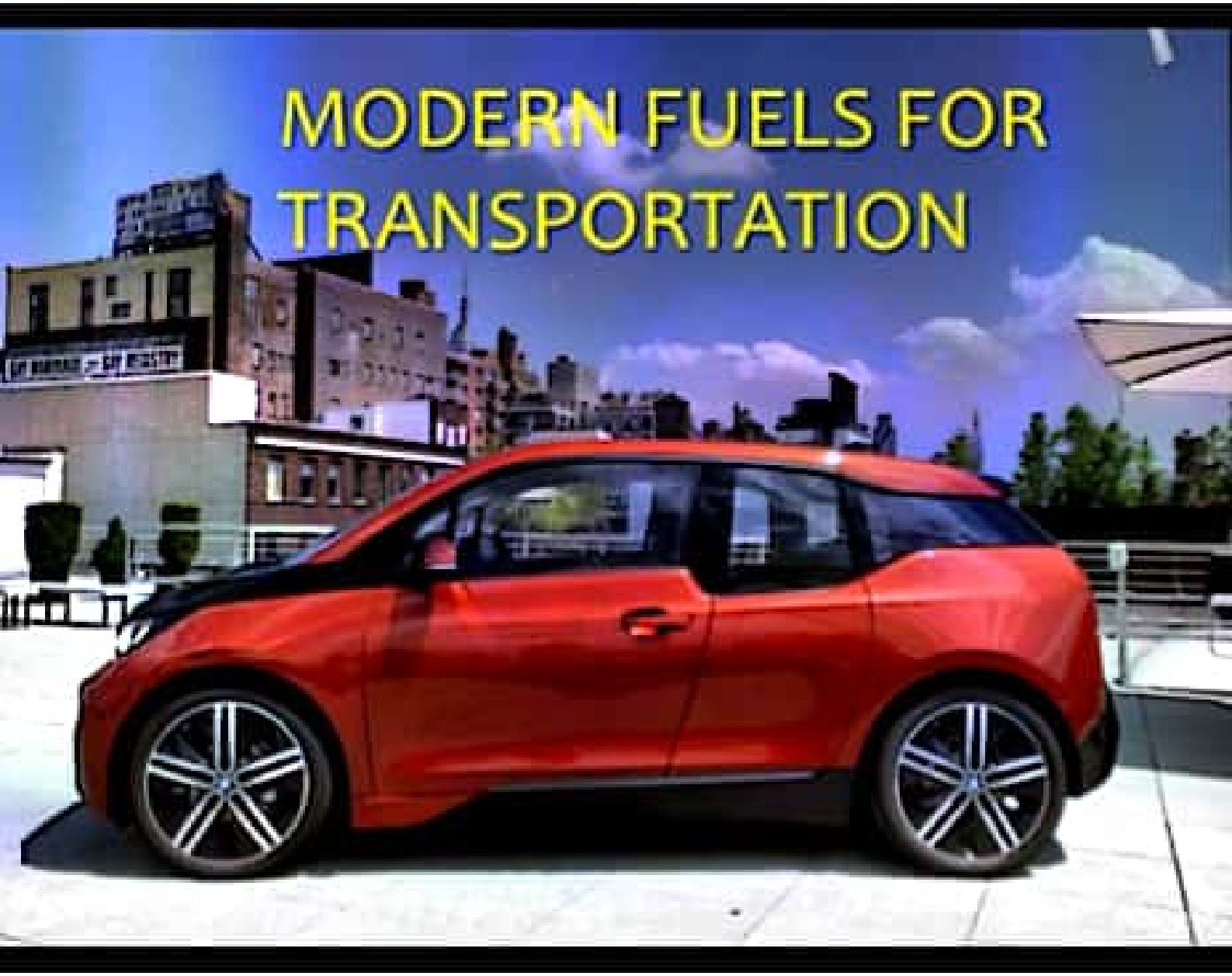
Overview of Biofuel Production Technologies

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	- Biodiesel from energy crops: methyl and ethyl esters of fatty acids - Biodiesel from waste	- Oil crops (e.g. rapeseed, oil palm, soy, canola, jatropha, castor, ...) - Waste cooking/frying oil	- 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

Third Generation Biofuels rely on biotechnological interventions in the feedstocks themselves. Plants are engineered in such a way that the structural building blocks of their cells (lignin, cellulose, hemicellulose), can be managed according to a specific task they are required to perform.

- ✓ For example, plant scientists are working on developing trees that grow normally, but that can be triggered to change the strength of the cell walls so that breaking them down to release sugars is easier.
- ✓ In third generation biofuels, a synergy between this kind of interventions and processing steps is then created: plants with special properties are broken down by functionally engineered enzymes. Notably, this latter generation of biofuels is only gradually being explored.



CAN I USE BIOFUEL FOR MY VEHICLE ????

- ✓ **Bio-fuels** have been introduced to decrease our dependence on fossil fuels, clean tailpipe emissions and lower our carbon footprint, these outcomes can be achieved when used in the right vehicle.
- ✓ Ethanol blended fuels should not be used in carburettor equipped vehicles.
- ✓ A list of vehicles that can use ethanol blended fuels is available on the FCAI website (http://www.fcai.com.au). As a general rule no vehicle built before 1986 should be run on an ethanol blended fuel, and vehicles built 1986 or after should only do so at the manufacturers recommendations.

NO PROBLEM AT ALL !!!!!

- ✓ The focus for development of **biofuels in India** will be to utilize waste and degraded forest and non-forest lands only for cultivation of shrubs and trees bearing non-edible oil seeds for production of bio-diesel.
- ✓ In India, bio-ethanol is produced mainly from molasses, a by-product of the sugar industry.
- ✓ In future too, it would be ensured that the next generation of technologies is based on non food feedstocks. Therefore, the issue of fuel vs. food security is not relevant in the Indian context.

✓ **Ethanol** is mainly being produced in the country at present from molasses, which is a by-product of the sugar industry. 5% blending of ethanol with gasoline has already been taken up by the **Oil Marketing Companies (OMCs)** in 20 States and 4 Union Territories.

✓ **10% mandatory blending** of ethanol with gasoline has become effective from October, 2008 in these States.

भारतीय मानक ब्यूरो
Bureau of Indian Standards
The National Standards Body of India

✓ The blending would have to follow a protocol and certification process, and conform to **The Bureau of Indian Standards(BIS)** specification and standards, for which the processing industry and OMCs would need to jointly set up an appropriate mechanism and the required facilities.

✓ **Section 52 of the Motor Vehicles Act** already allows conversion of an existing engine of a vehicle to use biofuels.

✓ Engine manufacturers would need to suitably modify the engines to ensure compatibility with biofuels, wherever necessary.

The development of automobiles with heat engines is one of the greatest achievements of modern technology. However, the highly developed automotive industry and the large number of automobiles in use around the world have caused and are still causing serious problems for society and human life. Deterioration in air quality, global warming, and a decrease in petroleum resources are becoming the major threats to human beings. More and more stringent emissions and fuel consumption regulations are stimulating an interest in the development of safe, clean, and high-efficiency transportation. It has been well recognized that electric, hybrid electric, and fuel cell-powered drive train technologies are the most promising solutions to the problem of land transportation in the future.