Electrified Flex fuel vehicle

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Why is in news? Toyota's flex-fuel prototype: How it will work, what advantages it offers

Toyota last week unveiled a prototype of the Innova Hycross with a flex-fuel hybrid powertrain, its first car in India with this option, and one that the Japanese carmaker claims is the **world's first BS6 Stage II-compliant flex-fuel vehicle.**

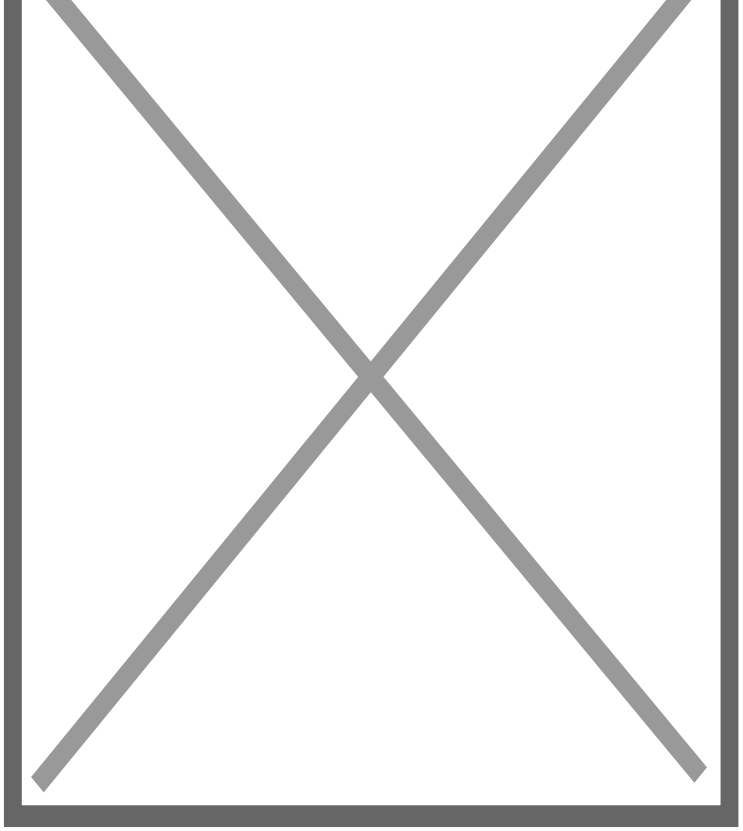
Toyota had displayed an **imported Corolla flex-fuel hybrid sedan** as a pilot project late last year.

The **pilot was initiated as part of a government-led push to commercially deploy this technology**, which is already in use in markets such as Brazil, Canada, and the United States.

Flex fuel:

A flex fuel, or flexible fuel, vehicle has an **internal combustion engine** (ICE), but **unlike a regular petrol or diesel vehicle, this can run on more than one type of fuel, or even a mixture of fuels**.

The most common versions **use a blend of petrol and ethanol or methanol**, but these engines are also equipped to run on 100 percent petrol or ethanol as well.



This is made possible by equipping the engine with a fuel mix sensor and an engine control module (ECM) programming that senses and automatically adjusts for any ratio of designated fuels.

How Do Flexible Fuel Cars Work Using Ethanol?

Flexible fuel vehicles (FFVs) have an internal combustion engine and are capable of operating on gasoline and any blend of gasoline and ethanol up to 83%.

In flex fuels, the **ratio of ethanol to petrol can be adjusted**, but the most commonly used flex fuel **uses 85 per cent ethanol and 15 per cent petrol.**

Bio-ethanol contains less energy per litre than petrol, but the calorific value (energy contained in the fuel) of bio-ethanol will become on par with petrol with the use of advanced technology.

Since an FFV is capable of running on either petrol or ethanol, it will be the first of its kind 100 per cent dual fuel vehicle to be running on Indian roads.

Flex fuel engines are already popular in Brazil, the United States, the European Union and China, among many others.

Benefit:

The **use of ethanol blending** sharply **lowers harmful pollutants** such as carbon monoxide, sulphur, and carbon and nitrogen oxides.

The blending will help cutback on oil imports for fueling vehicles.

Countries such as Brazil have the ability to be flexible on the degree of the mix depending on the crude prices, varying it when energy prices surge.

The precondition being that the vehicular fleet has been equipped to adjust to this fuel mix of varying degrees.

Challenges:

A flex fuel car typically takes a small hit on fuel efficiency when using ethanol for motive power, ranging from between 4 percent and 8 percent.

Crops such as sugarcane are usually very water-intensiveA NITI Aayog report suggested that in 2019-20, of the total ethanol produced in the country, over 90 percent came from sugarcane alone.

BS6 (Stage II) Norms:

The Bharat Stage (BS) norms are **emission standards** instituted by the Government of India to **regulate the output of air pollutants from motor vehicles.**

The BS regulations are **based on the European emission standards** and the Central Pollution Control Board implements these standards.

Presently, **every newly sold and registered vehicle in India is required to adhere to the BS-VI version** of emission regulations.

BS6 Stage II:

BS6 (Stage II) has **even stricter emission limits** compared to the initial BS6 norms.

BS6 (Stage II) **incorporates Real Driving Emissions (RDE) and Corporate Average Fuel Economy** (CAFE 2) and On-Board Diagnostics.

The new RDE test figures will provide a more realistic estimation of the amount of emissions likely to be produced by vehicles in real traffic conditions with frequent changes in speed, acceleration, and deceleration.

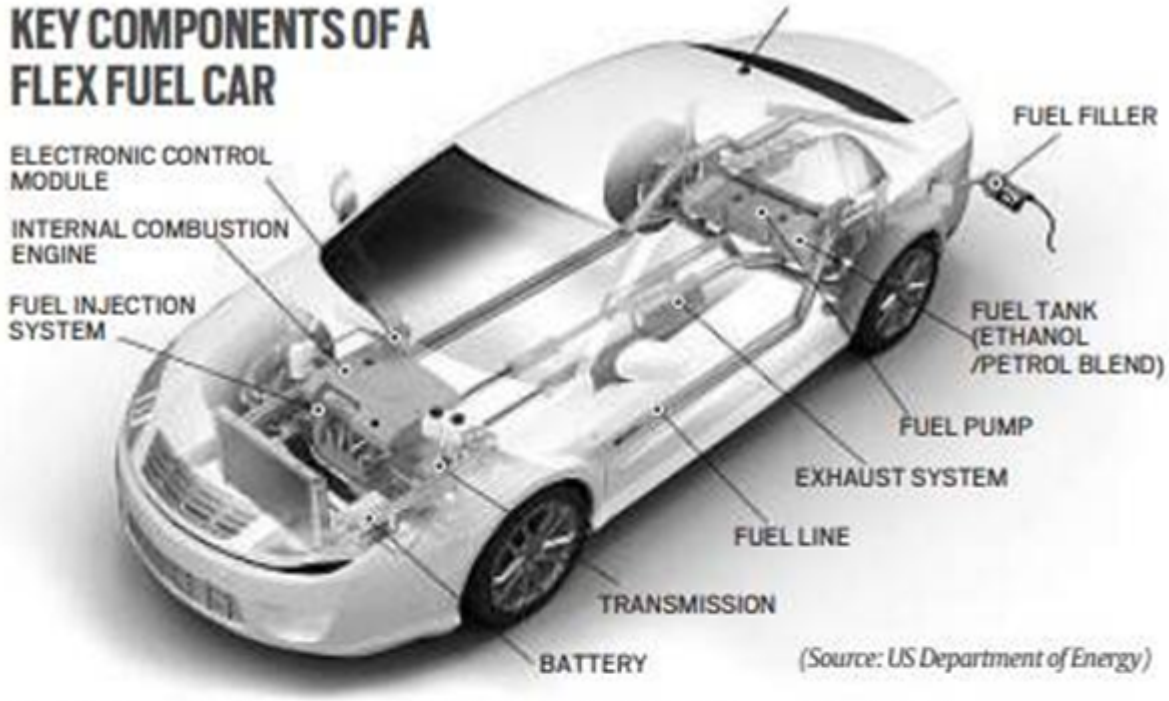
Onboard diagnostic (OBD) systems monitor and report the status and performance of various vehicle subsystems and sensors.

About ethanol production in India:

Currently, **around 9.5% ethanol blending with petrol has been achieved** in fuel dispensed in pumps in most metros and it is likely that the targeted 10 per cent ethanol blending will be achieved by November 2022.

But this is slated for a major bump up, with the government's **2025 target of 20 per cent blending of ethanol** in petrol envisaged in its **National Biofuel Policy 2018**.

KEY COMPONENTS OF A FLEX FUEL CAR



(Source: US Department of Energy)

BATTERY: The battery provides electricity to start the engine and power vehicle electronics/ accessories

ELECTRONIC CONTROL MODULE (ECM): The ECM controls the fuel mixture, ignition timing, and emissions system; monitors the operation of the vehicle

EXHAUST SYSTEM: The exhaust system directs the exhaust gases from the engine out through the tailpipe. A three-way catalyst is designed to reduce engine-out emissions within the exhaust system

FUEL FILLER: A nozzle from a fuel dispenser attaches to the receptacle on the vehicle to fill the tank

FUEL INJECTION SYSTEM: This system introduces fuel into the engine's combustion chambers for ignition

FUEL LINE: A metal tube or flexible hose that transfers fuel from the tank to the engine's fuel injection system

FUEL PUMP: A pump that transfers fuel from the tank to the engine's fuel injection system via the fuel line

FUEL TANK (ETHANOL/PETROL BLEND): Stores fuel on board the vehicle to power the engine

INTERNAL COMBUSTION ENGINE: Fuel is injected into either the intake manifold or the combustion chamber, where it is combined with air, and the air/fuel mixture is ignited by the spark from a spark plug

TRANSMISSION: The transmission transfers mechanical power from the engine and/or electric traction motor to drive the wheels