

# What is flex fuel?

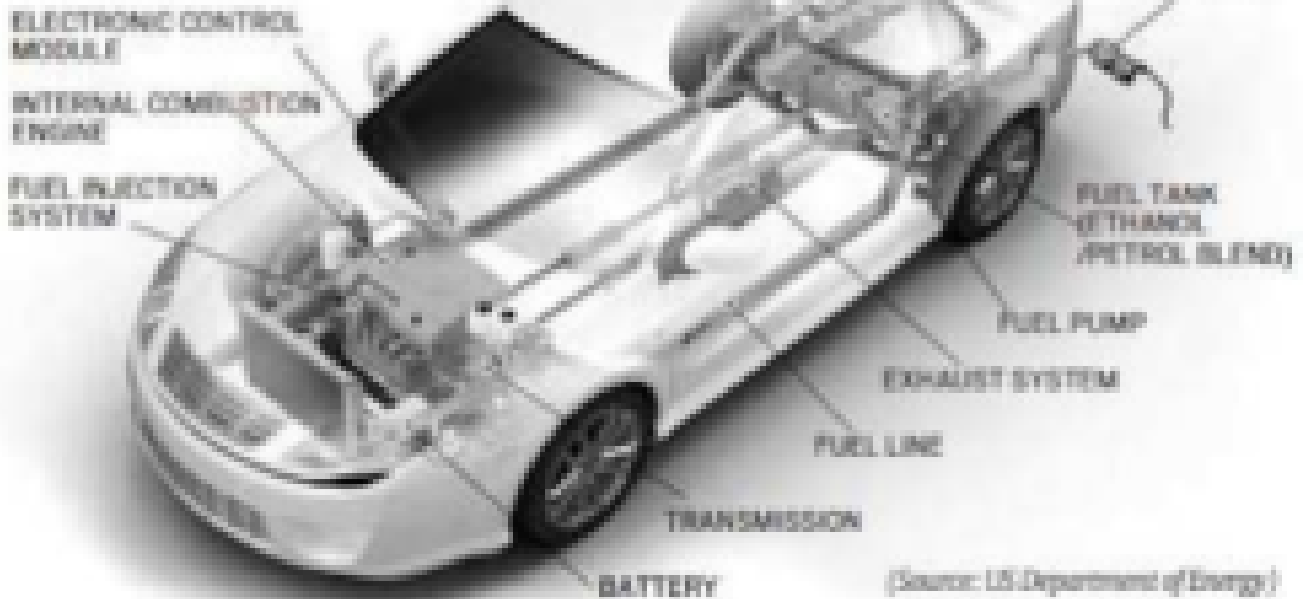
September 30, 2022

**In news-** India's first 'flex fuel' car, a Toyota sedan that can run on one or multiple fuel types and developed as part of a new pilot is set to be unveiled.

## **Toyota's Sedan-**

- It is learnt that Toyota will likely launch the flex fuel version of the sedan in September 2022, though the company has officially not said anything on this or disclosed technical details or any other specifications of the car.
- The pilot has been initiated as part of a government-led push to carmakers for adopting alternative fuels and the sedan, most likely a Camry, equipped with flex fuel tech will be part of a nationwide pilot that aims to replicate the commercial deployment of this particular technology in other markets such as Brazil, Canada and the US.

## KEY COMPONENTS OF A FLEX FUEL CAR



**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

### Flex fuel technology-

- 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 per cent 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.
- Flex fuel vehicles have one fuel system, and most components are the same as those found in a conventional petrol-only car.
- Some special ethanol-compatible components are required to adjust to the different chemical properties and energy content in ethanol or methanol, such as modifications to the fuel pump and fuel injection system.
- The ECM is also calibrated to accommodate the higher oxygen content of ethanol.
- According to IHS Markit, as of 2018, there were over 21 million flex fuel vehicles in the United States, but **Brazil is the biggest market and a leader in this segment**.
- Other than an ethanol-compatible fuel system and a different powertrain calibration, flex fuel vehicles are similar to their conventional petrol-only counterparts.

### **Pros and cons-**

- The most important benefit is that the use of ethanol blending **sharply lowers harmful pollutants such as carbon monoxide, sulphur, and carbon and nitrogen oxides**.
- Another obvious benefit is that blending will **help cutback on oil imports for fueling vehicles**.
- But there are problems: **a flex fuel car typically takes a small hit on fuel efficiency** when using ethanol for motive power, ranging from between 4 per cent and 8 per cent.

- So, while fuel economy is generally lower with increased levels of ethanol (engines are optimised for petrol), on the flip side, **many flex fuel vehicles have improved acceleration performance when operating on higher ethanol blends.**
- **A major problem with ethanol blending is that crops such as sugarcane** are usually very water-intensive.
- A NITI Aayog report suggested that in 2019-20, of the total ethanol produced in the country, over 90 per cent came from sugarcane alone.
- Currently, **around 9.5 per cent 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.
- **From a macro perspective, a big advantage being cited is that 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 like just after the Ukraine war.
- The precondition being that the vehicular fleet has been equipped to adjust to this fuel mix of varying degrees.
- **In Brazil, nearly all cars are required to be equipped to handle fuel blends with a minimum of 22 per cent ethanol,** with Brazil's state-owned oil company Petrobras being mandated to buy ethanol and dispense the mix at retail pumps.