Flex Fuel Prototype

Why in news?

India launched the world's first prototype of the BS 6 Stage II ‘Electrified Flex Fuel Vehicle’, developed by Toyota Kirloskar Motor.

What is flex fuel vehicle (FFV)?

> *FFV differ from bi-fuel vehicles by the fact that two fuels are stored in the separate tanks and engine runs on one fuel at a time in the latter.*

- **Flexible fuel**- It typically has an internal combustion engine (ICE), but unlike a regular petrol vehicle, it can *run on more than one type of fuel*, or a mixture of these fuels.
- The most common versions use a blend of *petrol and ethanol or methanol.*
- FFVs are also known as *dual-fuel vehicles*.
- They are capable of running on *100% petrol or 100% bio-ethanol or a combination of both.*
- **E20 fuel-** The original equipment manufacturers (OEMs) in India have already introduced vehicles that are compatible with E20 fuel (petrol blended with 20% ethanol).
    - The Government aims to achieve a complete *20% blending of ethanol by 2025*
- **Flex Fuel Strong Hybrid Electric Vehicles (FFSHEV)-** When FFV is integrated along with strong hybrid electric technology, it is referred as FFV-SHEVs.
- It essentially houses an *electric motor* which powers the vehicle alongside the traditional petrol engine.
- **Electrified Flex Fuel Vehicle–** It is a *100% ethanol-fuelled* variant.
- It is being seen as a broader push by the government for using alternative fuels like hydrogen, flex-fuel, biofuel etc.
- **Need for flex fuel-** To reduce carbon footprint and decrease the country’s dependency on traditional fuel sources.
- This car will be the world’s first BS-VI (Stage-II), which would also generate 40% electricity bringing the effective price of ethanol much lower.

Hybrid vehicles
• **Strong hybrid** – It is another term for full hybrid vehicles, which have the capability to run solely on either electric or petrol modes. • **Mild hybrid** – They cannot run purely on one of these modes and use the secondary mode merely as a supplement to the main mode of propulsion.

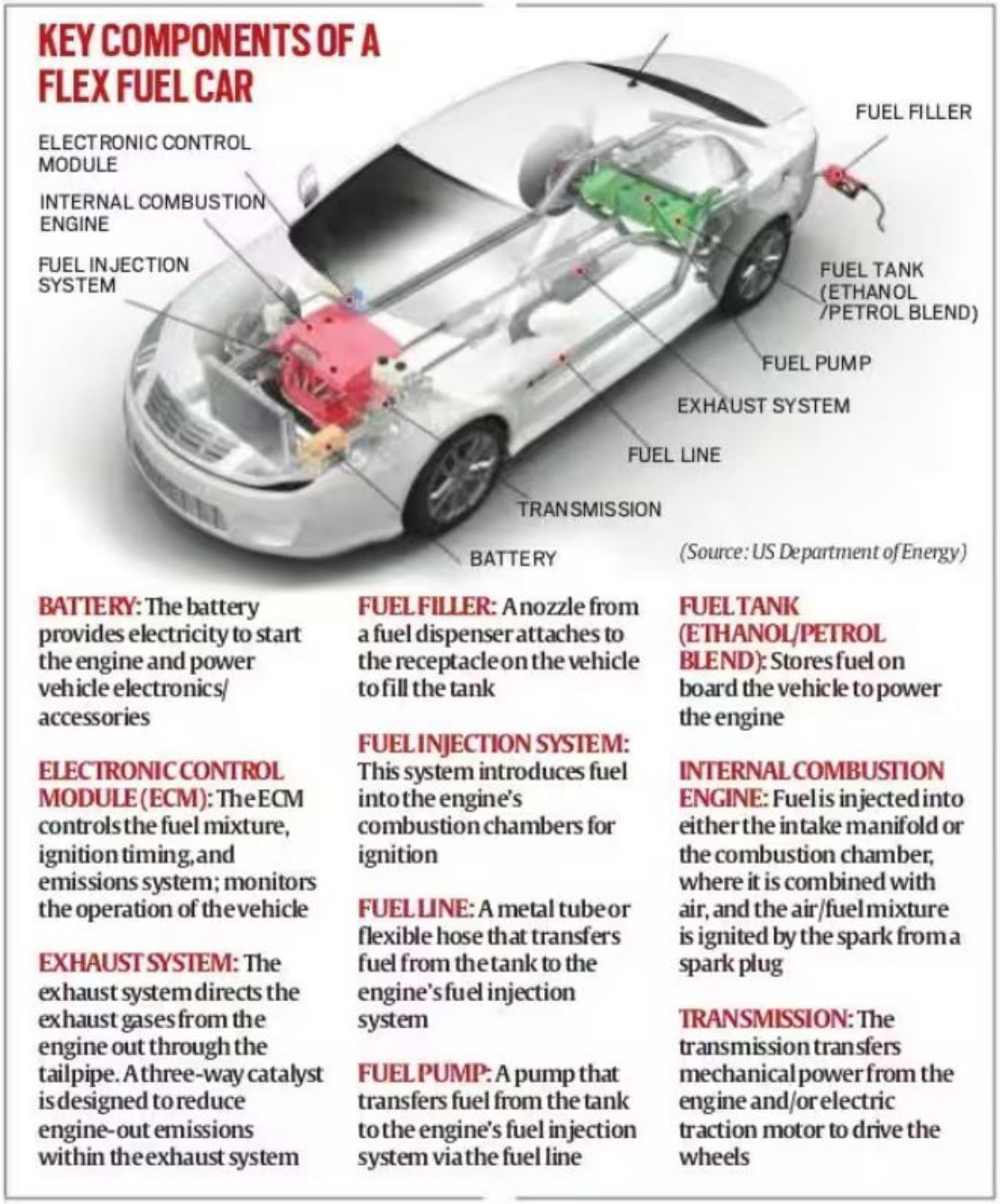
What is Hycross Prototype?

- **Engine** - Toyota's Innova Hycross flex-fuel prototype comes with the 2-litre Atkinson Cycle petrol engine coupled with an electric motor.
- The Company claims the prototype can run on petrol with *more than 20% ethanol blending* that is currently mandated in India.
- **Performance-** It would be at par with the standard Hycross hybrid, even with ethanol-blended petrol.
- **Low carbon emission**- This will be achieved "on a comprehensive well-to-wheel basis".
- **Energy storage**- It would run 60% of the time in the electric vehicle mode using energy stored in the battery pack, same as standard strong hybrid variant.
- **Ethanol belnding**- Flex-fuel vehicles such as the prototype Hycross can run on blends of ethanol that are far higher than the current standard 20% mix (E20).
- **Fuel ratio**- 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.

Air fuel ratio is defined as the ratio of air and fuel of a mixture prepared for combustion

How do flex fuel cars work?

- **Components-** Most components are the same as those in petrol-only cars.
- **Ethanol compatibility** - Special *ethanol-compatible components* are required to adjust to the different chemical properties and energy content in ethanol/ methanol, such as modifications to the fuel pump and fuel injection system.
- **Accommodate oxygen-** It is also calibrated to accommodate the higher oxygen content of ethanol.
- **Corrosion resistant-** The hybrid engine of the type used in the Hycross would have separate spark plugs, piston ring tops, and valves to render them more corrosion-resistant.
- **Catalyst-** A modified catalyst in the exhaust system is used to lower hydrocarbon emissions.
- The vehicle's fuel filter and fuel lines have also been tweaked.



What are the advantages of flex fuel vehicle?

- **Cheaper** - Ethanol is actually cheaper than petrol and diesel, and a higher blend of ethanol in petrol can help the government keep fuel prices in check.
- **Reduce import bill-** The program is the part of the broader strategy to cut dependence on imported crude in the *medium-to-long run.*
    - The expected implementation of E20 by April 2025 is estimated to result in annual savings of Rs 35,000 crore in India's oil import bill.
- **Reduce harmful emissions**- The use of ethanol blending lowers harmful pollutants such as carbon monoxide, sulphur, and carbon and nitrogen oxides.
- **Sustainability** - Ethanol is a natural byproduct of plant fermentation, which makes it much more sustainable as compared to petrol or diesel.
- **Improved performance**- Fuel economy is generally lower with increased levels of ethanol, many flex fuel vehicles have improved acceleration performance when

operating on higher ethanol blends.
- **Easier to adopt** - Flex-fuel vehicles are easier to adopt as compared to a fully battery-powered electric vehicle.
- A host of vehicles in India, including mass-market two-wheelers and cars are already E20 fuel compliant.

The National Biofuel Policy 2018 envisages a 2025 target of 20% blending.

BRAZIL MODEL

- **Varying fuel mix**- Countries such as Brazil can be flexible on the degree of the mix depending on crude prices, varying it when energy prices rise like they did after the Ukraine war.
- **Fuel blend**- In Brazil, nearly all cars are required to be able to handle fuel blends with a minimum of 22% ethanol.
- **Subsidy-** Brazil provides government subsidy to narrow the price gap of higher ethanol blends, in order to make the proposition viable.

What are the issues with flex fuel vehicle?

- **Fuel efficiency**- Fuel efficiency takes a hit when ethanol is used as motive power.
- **Water intensive**- The source crops required for ethanol blending such as sugarcane are usually water guzzling crops.
    - According to a NITI Aayog report, in 2019-20, more than 90% of the ethanol produced in the country came from sugarcane, which is a politically important crop in states such as Maharashtra and Uttar Pradesh.
- **Manufacturing** - Higher blending of ethanol will mean higher manufacturing costs which translates to pricier vehicles.
- Certain auto parts, especially those that come in contact with higher ethanol content, will have to be replaced with a compatible product to avoid corrosion.
- **Tax benefits** - As of now, flex-fuel vehicles carry a 28% GST, as against the 5% GST rate applicable on EVs. Tax benefits would result in the faster adoption of flex-fuel vehicles.

References

1. Indian Express- Toyota’s flex fuel prototype
2. India Today- World’s first electrified flex fuel prototype vehicle
3. PIB- BS 6 Stage II Electrified flex fuel vehicle

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