How engines in internal combustion engines (ICE) work

Engines work by using pistons moving up and down to rotate a rod (crankshaft) to turn a set of wheels via gearing. The pistons move up and down using mini explosions. In a four-stroke engine, the piston moves down in the first stroke to allow the chamber to fill with fuel via a valve, then, in the second stroke, the piston moves up to compress the fuel making it unstable. A spark then is ignited from a spark plug creating an explosion sending down the piston in the third stroke. This stroke is called the power stroke, and is when the engine generates power. Then, in the fourth stroke, the piston moves up to send the gas through the second valve and out the exhaust. The process of the valve opening and closing is controlled by the camshaft which has cams (an egg shaped shape with a pointy top) along a shaft (it's in the name) to push the valves open and close. The camshaft rotates in sync with the crankshaft with the help of a timing belt. If the timing belt is misaligned it can permanently destroy the engine. The crankshaft, which is rotated using the pistons up and down movement, is connected to a (typically heavy) geared flywheel, which helps keep the engine running by helping the pistons in their first two strokes, starts moving the pistons which causes the engine to start running when its turned with an electric ignition, and connects to the gearbox which allows the car to move faster than the engines maximum rpm (rotations per minute). The gases emitted in the fourth stroke are sent out through the exhaust after going through a muffler (to lower the volume) and a catalytic converter (to filter most harmful gases). Even though a catalytic converter gets rid of most majorly harmful gases, greenhouse gases such as Carbon Monoxide (CO). This is then released into the atmosphere causing too much heat from the sun to be trapped in the atmosphere causing global warming.

Eco-friendly Alternatives

Solution	Pros	Cons	Examples
Electric	Better for environment long-term Reduces noise pollution Acceleration (quick) Can use brakes to save on fuel	Low range If the battery is bigger, than you need to have it for longer to actually benefit the environment (Teslas) Unsafe	-Teslas -Rimac -Honda E
Turbine engines	Can run on anything that burns	Loud (22,000 rpm) Not much research done for it Not fuel efficient Bad for stop-and-go driving Slow-acceleration	-Chrysler turbine car
Hydrogen fuel-cells	Emits only water vapour Acts like an electric car Hydrogen is common Takes five-minutes to refuel Can use brakes to save on fuel Safe thanks to modern tech	Lots of energy needed to separate hydrogen Not used a lot meaning not a lot of refuel stations Stations can only fuel 2-5 cars before needing 30 minutes to repressurize Rain	2024 Hyundai Nexo 2025 Honda Clarity 2024 Toyota Mirai Hyundai n vision 74

How electric cars (EV’s) work

Electric cars are quite simple, almost like a RC car. You have a battery, and the battery powers the motors which in turn spin the wheels. The amount of motors is up to you. You could have one motor connected to a differential that spins two wheels, or you could have motors for each wheel and use some code to simulate a differential. Obviously, a motor connected to a differential would generate far less power than a motor for each wheel, meaning car manufacturers such as Tesla and Rimac opt to use a motor for each wheel. Because it uses motors and batteries, it has a faster acceleration, makes less noise, and although it uses more fossil fuels when being made, it saves on fossil fuels in the long term meaning by the end of its life, it should have used less fossil fuels. It can also use the brakes to produce more energy. It does have cons though. EV’s take longer to refuel/charge, and even then, it won’t go far without needing to recharge again using current technology, and we don’t have time to develop better batteries. If we did use bigger batteries, the EV would need more time to make up for the fossil fuels used to produce it. And to top it off, they’re unsafe. Unlike ICE cars, (which need their fuel tank to be low on fuel and to be compressed quickly in order to burst into flames, and even then, it's relatively easy to put out) EV’s just need one short circuit to burst into an unstoppable fire, only stopping when the energy runs out.

How turbine cars work

The Chrysler Turbine car, made in 1963, uses a two-part turbine engine. There's the compressor section, which runs all the time and is responsible for the whistling noise. It blows hot air to the power turbine, which is in turn connected to a 3-speed automatic gearbox which moves the wheel, making it similar to an ICE car. It can run on anything that burns, which makes it seem like it would be great, but that's where the advantages end. It's loud, idling at about 20,000 RPM but it can easily go up to 44,000 RPM and sounds like an airplane. There's also not much research done for it, making it difficult to revive the project. It's definitely NOT fuel efficient, having a mpg of 17-18, while V8's of the time had mpg's of 30-40. The turbine was also not ideal for daily driving such as stopping and accelerating again and again, and it had a slow-acceleration.

How hydrogen cars work

A hydrogen fuel-cell vehicle (HFCV) also uses electric motors like EVs, but instead of powering the motors using a battery, it uses dihydrogen and dioxygen to create an electrochemical reaction that generates electricity, heat and water vapour. The electricity is used to power the motor while the water vapour and heat are let out through a tube. Thanks to this, they have all the perks of a electric car in terms of performance, but also generates less fossil fuels during production thanks to a smaller battery, emits only water vapour during its life, takes only five minutes to refuel, and is much safer thanks to modern technology. To top it off, hydrogen is also quite common so we probably won't run out. Sadly, everything comes at a price, and hydrogen fuel cells do have their disadvantages. At the moment, it's quite expensive to get pure hydrogen, hydrogen cars are also not too common meaning they aren't well researched, and hydrogen fuel stations can only refuel 2-5 cars before needing to repressurise for 30 minutes. Also, The water vapour generated might cause more rain which can lead to possible flooding.

Conclusion

In conclusion, if we want to save our planet right now while keeping arguably one of the most important pieces of tech, cars, our best bet is to use hydrogen fuel cells because they generate the least amount of fossil fuels and could possibly buy us time to find more efficient and environmentally friendly forms of engines.

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