

Study Guide: Electricity- Hydrogen-Synthetic Fuel-What's The Future

Here is a study guide based on the provided sources, focusing on hydrogen and synthetic fuels:

This guide summarizes key information about two potential "fuels of the future": Hydrogen and Synthetic Fuel, as discussed by Professor Horace and others.

I. Hydrogen

A. The Science of Hydrogen Fuel

- **Process:** Hydrogen (H₂) mixes with oxygen (O₂) from the atmosphere.
- **Conversion:** Through a complex exchange of protons and electrons, this mixture produces **electricity**.
- **By-product:** The only thing that comes out of the exhaust is **H₂O (water)**.
- **Carbon Neutrality:** The entire process is **carbon neutral** if the hydrogen is extracted using **green electricity**.
- **Energy Output:** Hydrogen "packs a punch" and produces a **bigger "bang" than petrol** when compared gram for gram.

B. Vehicle Application & Practicality

- **Vehicle Type:** Cars like the **Toyota Mirai** are examples of hydrogen cars.
- **Functionality:** A hydrogen car drives essentially **like an electric car**, but it stores its energy differently.
 - **Electric Car:** Conventionally uses a battery.
 - **Hydrogen Car:** Stores hydrogen in a tank and uses a **fuel cell to convert it to electricity**.
- **Refueling:**
 - Similar to petrol cars, you fill it up.
 - It's a liquid, and refueling takes only **a couple of minutes**.
 - A full tank can provide a range of **400 miles**.
- **Downsides:**
 - **Limited Infrastructure:** There are very few hydrogen fuel stations – only **12** in the country. This is a significant challenge compared to the widespread availability of petrol stations.
- **Upsides:**
 - **Weight:** It avoids the need for a "great big battery," which is **"really, really heavy"**.
 - **Environmental Impact (Metals):** There's no need to dig up "nasty metals from the ground" associated with battery production.

- **Existing Network Potential:** It could potentially use the **existing petrol network**; for example, BP stations that offer LPG could also offer hydrogen.
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II. Synthetic Fuel

A. The Concept & Science

- **Goal:** Offers a way to **"go green without giving up on the combustion engine"** and preserve the "noise, drama, and soul" of traditional engines.
- **Creation:** Developed by engineers like Formula One engineer Paddy Lowe.
 - It's a **petrol made not from oil**, but from:
 - **Carbon dioxide captured from the air.**
 - **Hydrogen extracted from water.**
- **Carbon Neutrality:** When burned, it emits **only the CO2 that was extracted to make it**. This makes it **"completely carbon neutral"** as long as **"green electricity"** is used for its production.
- **Compatibility:**
 - It will **work in any petrol car**, regardless of age.
 - It can even be **mixed with regular fuel**.

B. Benefits & Drawbacks

- **Benefits:**
 - **Preserves Classic Cars:** It could "save some of these old dinosaurs from extinction," referring to high-performance cars with traditional combustion engines like the Lamborghini Aventador or Porsche GT3.
 - Allows for the continuation of high horsepower, flat-six, normally aspirated engines that rev to high RPMs.
 - **Drawbacks:**
 - **Availability:** You cannot buy it at a local petrol station; it is **"experimental" and "extremely rare"**.
 - **Cost:** Currently, it is **"expensive"**, costing about **"ten quid a litre"**.
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III. Future Outlook

- While there are challenges, especially with cost and infrastructure, the sources suggest that with fossil fuels declining, the "new dawn is starting to look very bright indeed" for alternative fuels like hydrogen and synthetic fuels.
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