

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.

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"**.

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.
