IMPLEMENTATION OF THE "HYDROCAR" KIT AS A TEACHING MODEL FOR THE STUDY OF ELECTROCHEMISTRY IN SUSTAINABLE MOBILITY

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Introduction

In response to the global need to meet increasing energy demands without compromising environmental integrity, hydrogen emerges as a key energy vector in the transition toward next-generation transportation technologies. This work presents a proposed **experimental practice for Chemistry**, first-year students in **Engineering Schools**, based on the use of the **Hydrocar scientific kit**, designed to comprehensively illustrate the cycle of energy production, storage, and conversion from renewable sources as shown in Figure 1.

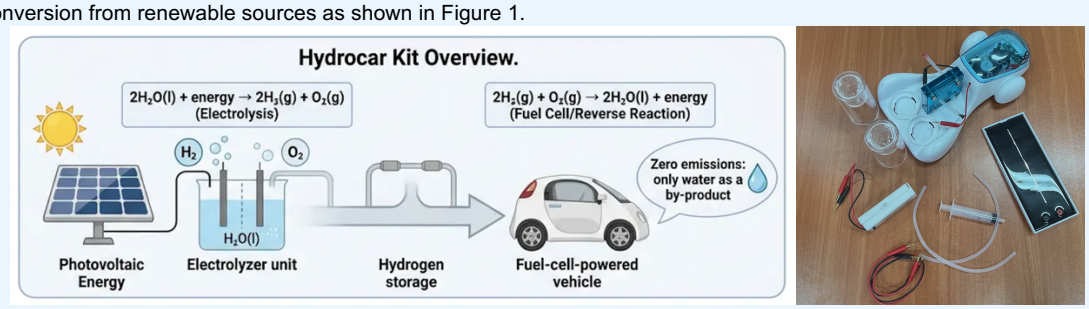

Fig 1. Hydrocar scientific kit (adapted from NotebookKLM).

Methodology

The system uses photovoltaic solar energy to power an electrolysis process, demonstrating how water can be transformed into a clean fuel. **Hydrogen production in this model is based on the electrolysis reaction**, where electrical energy (supplied by the solar panel) facilitates the decomposition of water molecules into their primary gaseous components as indicated by Equation 1:

$$2H_2O(l) + \text{energy} \rightarrow 2H_2(g) + O_2(g) \qquad \text{Eq. (1)}$$

Subsequently, the **hydrogen gas produced is directed to a fuel cell integrated into the vehicle**. In this device, the chemical energy of the fuel is converted into electrical energy for motion through the reaction that is the reverse of electrolysis as shown in Equation 2:

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(l) + \text{energy} \qquad \text{Eq. (2)}$$

This **reaction produces only liquid water as a byproduct**, positioning this technology as a **zero-emission solution**. The proposed laboratory practice includes advanced experiments to analyze the effect of solar panel inclination on efficiency, determine the maximum power point, and study the polarization curves of the fuel cell.

Conclusions

It is concluded that the use of this kit not only:
- **facilitates the understanding of complex electrochemical concepts** but also
- promotes a critical perspective on the future of **sustainable mobility** and
- the **use of renewable resources** such as sunlight and water to mitigate global environmental impact.

Acknowledgements
This study has been supported by mobility grants for teaching and research staff under the ERASMUS+ Action KA131 program (2024 and 2025 calls). In addition, X. Vecino and M.S. Álvarez would like to thank the Ministry of Science and Innovation and the European Union NextGenerationEU/PRTR for their Ramón y Cajal contracts (ref. RYC2021-030966-I and ref. RYC2023-044722-I, respectively).