

# HYDROCULT: Traffic? A Resource!

De Santa, Tommaso (School: ITIS "Alessandro Volta")

Petralia, Francesco (School: ITIS "Alessandro Volta")

Ples, Paul (School: ITIS "Alessandro Volta")

**ABSTRACT:** The HYDROCULT project aims at transforming the kinetic energy generated by passing vehicles into usable energy for producing molecular hydrogen, eliminating the need for batteries and ensuring zero environmental impact. Through a system called "press bump," the motion energy of vehicles is converted into electrical energy, which powers an electrolytic system capable of splitting water into hydrogen (H<sub>2</sub>) and oxygen (O<sub>2</sub>). These gases are then stored in dedicated tanks: graphene-based for hydrogen and MOF-based for oxygen. The hydrogen produced in this way powers fuel cells ("Fuel Cell") to generate the electricity needed to recharge charging stations. The system is self-sufficient, sustainable, and completely eco-friendly, eliminating reliance on traditional batteries. In the future, HYDROCULT could evolve to provide not only electricity for vehicles but also direct hydrogen refueling, supporting the adoption of hydrogen-powered vehicles as a clean and sustainable alternative.

**CALCULATIONS:** From the electrolysis of 10 liters of H<sub>2</sub>O, we obtain 1.119 kg of H<sub>2</sub> and 8.88096 kg of O<sub>2</sub>

Efficiency of PEMFC:  $50\% \text{ mH}_2 = 30.36 \text{ mol} \times 2.026 \text{ g/mol} = 61.205 \text{ g}$   
 $\text{mO}_2 = 15.18 \text{ mol} \times 32 \text{ g/mol} = 485.76 \text{ g}$   
 $\text{mGraphene} = 61.205 \text{ g} / 0.077 = 0.79487 \text{ kg}$   
 $\text{VGraphene} = 0.3506 \text{ L}$   
 $\text{mZIF-8} = 485.76 \text{ g} / 0.150 = 3.2384 \text{ kg}$   
 $\text{VZIF-8} = 4.048 \text{ L}$

This innovative system enables the charging of small vehicles, producing approximately 3 kWh without the need of batteries.

**Awards Won:**