



## **SEPARATIC Executive Summary**

### **Introduction:**

Fuel cells are poised to revolutionize the mobility sector by replacing traditional fossil fuel engines. However, one major challenge with fuel cells is the significant loss of hydrogen during the purge process, which not only reduces efficiency but also poses safety risks and environmental concerns. Our project, SEPARATIC, aims to develop a cutting-edge hydrogen recovery device that captures purged hydrogen, thereby enhancing the efficiency, safety, and sustainability of fuel cell systems.

### **Problem Statement:**

In fuel cells, hydrogen is oxidized with air to generate electricity. The presence of nitrogen in the air (78%) leads to hydrogen contamination, requiring frequent purging of nitrogen along with 50-70% of hydrogen. Over a fuel cell's operational lifetime, this results in a loss of more than 600 kg of hydrogen, translating to a financial loss of €7,800-15,000 per fuel cell and significant environmental impact equivalent to 0.6 tons of CO<sub>2</sub> emissions per 150-kW fuel cell engine per year.

### **Objectives**

1. Understand the hydrogen value chain in Asia, particularly in China.
2. Establish a connection with the hydrogen fuel cell industry. In particular with hydrogen fuel cell producers and users.
3. Securing a pilot agreement (at least on a verbal level) for performing pilot testing with one of the fuel cell producers.

### **Innovation and Solution:**

Our hydrogen recovery device leverages a novel graphene membrane technology that operates at room temperature, offering high permeability and selectivity. This innovative approach significantly reduces energy consumption and operational costs compared to traditional high-temperature methods. The device is designed for longevity, durability, and ease of integration into existing fuel cell systems, making it a cost-effective solution for enhancing fuel cell efficiency.

### **Market Potential and Economic Impact:**

The global fuel cell market is projected to grow from CHF 10 billion to CHF 42 billion by 2030. By recovering 90% of purge losses, our device can save approximately 540 kg of hydrogen per truck, resulting in significant cost savings and potential annual revenue of €76 million from projected sales of 20,000 systems annually. Our primary customers include major fuel cell manufacturers such as Plastic Omnium, Proton Motor Fuel Cell GmbH, and other significant players in the automotive and stationary fuel cell markets.

**Conclusion:**

SEPARATIC offers a transformative solution to the hydrogen loss problem in fuel cells, providing significant economic, environmental, and safety benefits. By enhancing the efficiency and sustainability of fuel cells, our project aligns with global efforts to achieve net-zero CO2 emissions by 2050 and supports the transition to clean energy. We seek Innosuisse funding to bring this innovative technology to market and make a substantial impact on the future of sustainable mobility.