Policy Briefing



Hydrogen as a sustainable energy storage

We are Unite! – a network of nine European universities that combine science and technology to jointly address the major challenges facing society.

One of these challenges is climate change. Rising temperatures, extreme weather events and dependence on fossil fuels require an environmentally sound, safe and affordable energy transition. To achieve this, existing finite fuels that are harmful to the climate must be replaced – for example, by solar, wind, or water energy.

The restructuring of the energy supply has now picked up speed: in 2024, renewable energy accounted for over 46 per cent of electricity generation in the EU. However, a fundamental dilemma of renewable energies is their volatility, i.e. the fact that demand and generation do not sufficiently match in terms of time and space. Even so, energy must be available where it is needed, reliably and independently of external factors. Therefore, it is essential to store energy, transport it and release it at another location. Hydrogen is one such storage medium. It offers a promising solution for storing excess renewable energy on large-scale and can thus mitigate the fluctuations of renewable energy sources such as wind and solar energy.



One disadvantage of hydrogen is its low energy efficiency, since a great deal of the energy used is lost again during processing, conversion and transport. However, research can increase energy efficiency, lowering the cost and increasing the technological maturity.

As part of 'Unite!Energy', a team of twelve doctoral students from the Unite! universities will work together with partners from industry to research hydrogen as a sustainable energy storage medium. The doctoral students will particularly benefit from the international network of the Unite! alliance, as they will each be assigned to a tandem of two researchers from two partners of the Unite! network and will thus conduct research at two universities.

The project, funded as a Marie Skłodowska-Curie Action (MSCA), brings together ten of Europe's most prestigious universities: the Unite! universities Aalto University, KTH Royal Institute of Technology, Wrocław University of Science and Technology, Technical University of Darmstadt, Graz University of Technology, Grenoble INP-UGA, Politecnico di Torino and Universitat Politècnica de Catalunya, as well as Friedrich-Alexander-Universität Erlangen-Nuremberg and the University of Lisbon, which is involved in this project as a Unite! university and as an associated partner. Eight companies (EOS Finland, ABB, Powercell Sweden, KIC InnoEnergy, Heraeus,

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Solaronix, Snam and eRoots Analytics) and two R&I organisations (CEA Grenoble and Barcelona Supercomputing Center) are also associated partners in Unite!Energy.

Research in this area is essential

1. The effects of climate change are becoming increasingly noticeable, extreme weather events are becoming more frequent and the global average temperature is rising.

2. Furthermore, fossil energy sources such as coal, gas and oil are not available in unlimited quantities; these resources are finite.

3. For economic reasons and resource independence, too, policymakers should therefore focus on sustainable energy systems.

The high production costs of catalytic materials, the low durability and energy efficiency of electrolysers and the challenges of safe hydrogen storage still limit the integration of this technology into society.

Unite!Energy has set itself the goal of addressing these issues and providing market-ready solutions: the hydrogen economy has great potential to support the energy transition towards a carbon-neutral society, offering a promising solution for storing excess renewable energy and thus mitigating the intermittency of renewable sources such as wind and solar power. However, to fully realise hydrogen's potential, advanced materials and technologies must be developed that increase efficiency, reduce costs throughout the supply chain and ensure safety.

This can be expected

The project is expected to yield significant advancements in the field of green hydrogen production and energy generation, leading to decreased costs, resource dependency and environmental impacts. Politicians can expect to see advancements in electrolyser-photoelectrolyser systems, fuel cell stacks and system designs, along with comprehensive sustainability assessments. These advancements are expected to contribute to the EU's energy and climate targets, including the integration of hydrogen into renewable energy power plants and the reduction of reliance on fossil fuels. The project also focuses on training and educating a new generation of researchers in the field, ensuring the availability of a skilled workforce for the future hydrogen market. Finally, the project is expected to improve public awareness and acceptance of hydrogen-based technologies through dissemination activities.

We invite you to visit us on our website: https://www.unite-energy-msca.eu/ Contact: unite-energy@tu-darmstadt.de or <u>unite.energy@upc.edu</u>

Unite!Energy Doctoral Network in Energy Storage is coordinated by Universitat Politècnica de Catalunya.

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