DEFENSIE
LA DÉFENSE

Royal Higher Institute for Defence

Defence-related Research Action - DEFRA

ACRONYM: HYDE

Title: HYdrogen technology for energy supply in DEfence applications

Duration of the project: 01/02/2023 - 31/01/2027

Budget: 1,708 M€

of which RHID contribution: 1,693 M€

Key words: Hydrogen, PV, electrolyser, fuel cell, CHP, microgrid

PROJECT DESCRIPTION

National and international disasters and conflicts have shown that the provision of basic needs, including electricity and potable water, is crucial for deploying and operating encampments in a global context. In this framework, the HYDE project investigates the benefits of renewable energies and hydrogen technology. The project develops and demonstrates a novel energy and water supply system (EWSS) for encampments, powered by solar energy, and supported by electrolysers and fuel-cells. Compared to the state of the art, the EWSS provides electricity, thermal energy and potable water with greater self-sufficiency at a smaller ecological footprint. Other design goals are modularity, robustness, and reliability with respect to NATO standards.

The EWSS main energy source is solar, converted by PV cells to electrical energy. Compared to other renewable energy sources, such as hydro- or wind energy, PV offers several advantages for an encampment: PV panels are easy to transport, simple to install and maintenance-free. They also have a less pronounced visual appearance and do not possess components with high kinetic energy such as wind turbine blades that could detach when damaged, and which pose a significant risk to the deployed assets.

The HYDE project strives for an EWSS with greatest autonomy that ideally renders the encampment independent from host nation support (HNS). This is achieved by local electricity production based on PV combined with hydrogen buffering. Potable water is harvested from the immediate surroundings, considering, for example, rain- and river-water. However, solar energy is neither continuously available (e.g. at night or during polar nights), nor constantly intense. Also, the size of the PV plant (the available peak-power) and the hydrogen buffering (the storable energy) is limited by logistics requirements. Therefore, HNS can be necessary. As the degree of HNS may be highly variable, the project aims at an EWSS that is able to bridge the gaps by storing the right amount of electric, chemical

(hydrogen) and thermal energy to keep the encampment self-sustainable during the absence of HNS. Nonetheless, if the available solar energy is adequate to provide self-sustainability, the encampment can be fully disconnected from external supplies. Built-in scalability (depending on the level of HNS), connectivity (interoperable with all types of NATO equipment) and survivability should allow for all types of operation at any level of intensity.

The HYDE project has four main objectives. The first objective encompasses research on the main building blocks of the EWSS. This comprises mainly literature studies and theoretical modelling. Also, the framework in which the building blocks must be operated, will be established. In the second objective, an optimum integration study on the EWSS building blocks is conducted. The third objective focusses on building a demonstrator unit, which is employed to validate the theoretical models, but also to test and assess the integration exercise. The fourth objective assures the dissemination of the results through journal and conference publications, workshops and networking events.

Defence will benefit from this project by gaining insight into the design of a fully autonomous and independent EWSS, its capabilities and limitations. The system will result in a reduced ecological and logistical burden associated with the delivery of energy and water, whilst it will diminish noise and vibration levels during operation. This improves noise comfort but also reduces the detectable vibroacoustic footprint. The EWSS possesses technology that can be used to produce hydrogen fuel for multiple applications. The modular EWSS design philosophy using hydrogen can be assessed, which includes redundancy and scalability with fail safe capabilities. Defence will get access to state-of-the-art hydrogen technology, which can be used to attract and train military staff. The project initiates a platform for future research with knowledge institutions and industry.

The outcome of the project will be:

- A design methodology of the EWSS
- Technology overview for the EWSS components
- A scaled EWSS demonstrator
- Dissemination of the acquired results in journal and conference papers
- Organisation of workshops and networking events with Defence and other relevant public services like civil security, fire brigades etc.

Valorisation is expected to start as from the second year of the project through dissemination of the project results. Long term valorisation is possible by further collaboration between Defence and public/private institutions, where the EWSS is upscaled and tested in live situations.

CONTACT INFORMATION

Coordinator
Frank, Buysschaert
KU Leuven/Mechanical Engineering
frank.buysschaert@kuleuven.be

Partners
Sam, Schotte
VIVES Zuid
sam.schotte@vives.be

Rob, De Roo
VIVES Noord
rob.deroo@vives.be

Sven, Duchatelet
Solenco Power
sven.duchatelet@solencopower.com

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