ASAPFuels

Acronym and title	ASAPFuels Solar redox flow cell: all-in-one device for efficient conversion and storage of sunlight energy into electrochemical fuels
Project number	PTDC/EQU-EQU/30760/2017
Start and conclusion date	01/01/2022 to 01/01/2025
VG CoLAB total budget	€ 44 574.23
Main goal	Produce liquid electrochemical fuels, an emerging energy vector, through direct and efficient solar energy conversion and storage using a solar redox flow cell (SRFC).
Partners	FEUP
Expected results	ASAPFuels will develop a SRFC resulting in: a solar-to-fuel efficiency of 20%, a stability >1000h, and an electrochemical energy density of 150Wh/L, easily converted to electricity with an efficiency of > 90%. The SRFC overall efficiency will be 50%, which includes ca. 30% of solar-to-thermal efficiency, making this technology potentially 20% cheaper when compared with PV alone.
Summary	The world needs a disruptive technology to quickly decarbonise the energy sector; the success of this technology critically depends on its social acceptance, sustainability, low-cost and fast implementation. ASAPFuels proposes to produce liquid electrochemical fuels, an emerging energy vector, through direct and efficient solar energy conversion and storage using a solar redox flow cell (SRFC). The stored chemical energy can be converted into electricity at a redox flow battery (RFB), a competitive battery technology for stationary applications, with a forecasted Levelized Cost Of Storage of 0.03 €/kWh per charging cycle by 2050. SRFC displays the following advantages compared with other Photoelectrochemical (PEC) devices (H_2O splitting and CO_2 reduction): i) the redox energy levels of the electrolytes can be tuned to fit the energy levels of the photoabsorber, rendering the system more efficient; ii) non-aqueous based electrolytes can be used to improve the stability and the stored energy density; iii) allows the simultaneous conversion of sunlight to an electrochemical fuel and to thermal energy, with the potential for covering the daily cycle and inter-seasons energy needs; and iv) the electrochemical fuel-to-electricity efficiency is much higher when compared e.g. with H_2 at a proton-exchange membrane fuel cell (PEMFC). The ASAPFuels's team is firmly convinced that these ambitious goals can be achieved by introducing new and unconventional inorganic redox pairs, such as polyoxometalates, and non-aqueous based electrolytes, such as dialkylsufones and triarylamines, which display four times the storage capacity of conventional all vanadium RFB. Due to the simplicity of the proposed system and the low cost of the raw materials considered, which are earth-abundant, it is expected that the SRFC devices become very flexible and cost-competitive (in the range of the production cost of two times a perovskite solar panel).