SOLAR ENERGY FOR A CIRCULAR ECONOMY

SUNRISE relies on artificial photosynthesis as a sustainable alternative to the fossil-based, energy-intensive production of fuels and base chemicals. The energy required will be provided by sunlight and the raw materials will be molecules abundantly available in the atmosphere, such as water, carbon dioxide, oxygen and nitrogen (H_2O, CO_2, O_2 and N_2).

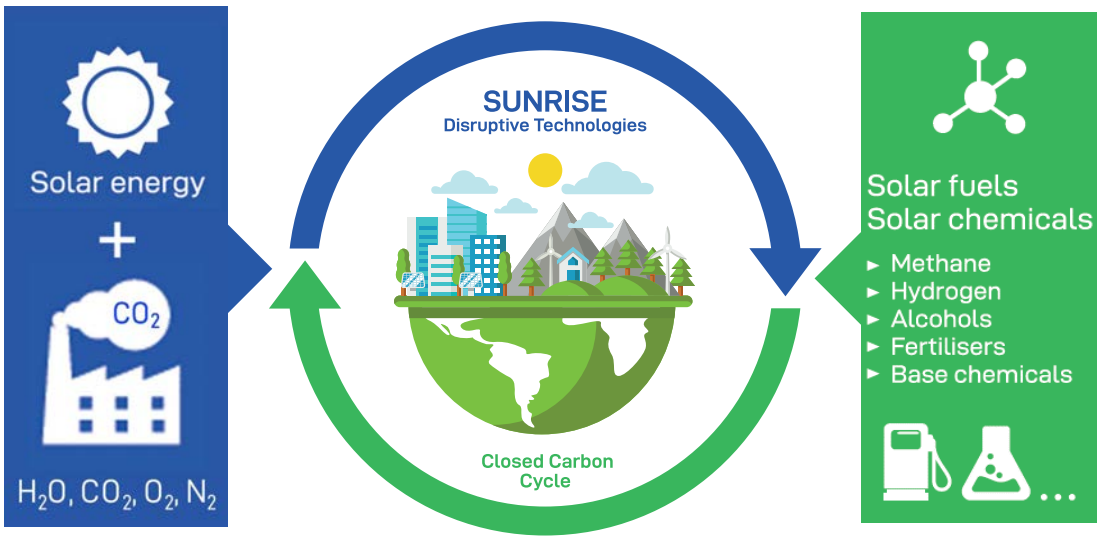
Recent IPCC (Intergovernmental Panel on Climate Change) reports point out the necessity to reduce carbon dioxide emissions to achieve negative emissions in the second half of the 21st century. Technologies allowing the transition to a low- and negative-emission society are not available yet and significant research and development efforts are crucially needed.

Storing surplus electric energy efficiently and reliably remains one of **today's** top challenges. Storage processes converting electricity and solar energy into fuel and chemicals, much more efficient than biomass production, are highly desirable.

For the transport and heating sector, fossil fuels are an unmatched energy source, coming along with a huge, existing infrastructure. Also the chemical industry, supplying a variety of indispensable bulk chemicals for every day life, is completely dependent on fossil-based raw materials such as crude oil.

Generating alternative fuels and chemical raw materials from renewable energy sources represents a real game changer.

A replacement of fossil-based raw materials and a modernisation of the production processes are crucial for **Europe's** vision of a zero-emission society and the global competitiveness of its industry.



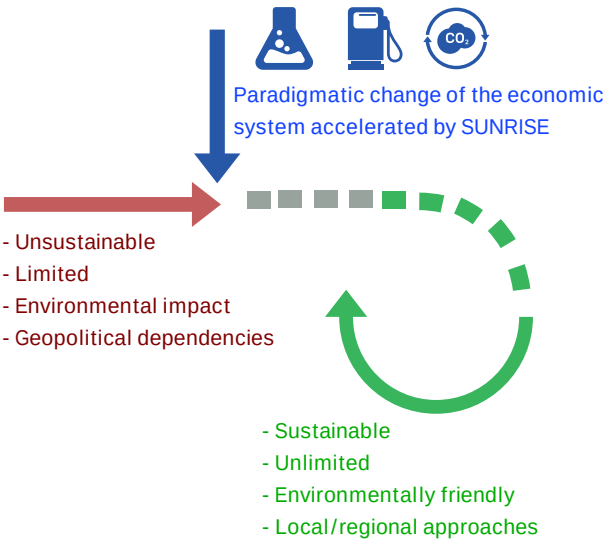
SUNRISE will facilitate the transition to a circular economy and a carbon neutral society. Artificial photosynthesis technologies will be developed as part of a large research initiative. Electrochemical conversion using renewable power in combination with electrolysers will be complemented with photoelectrochemical systems and biohybrid approaches for the direct conversion of sunlight into chemical compounds.

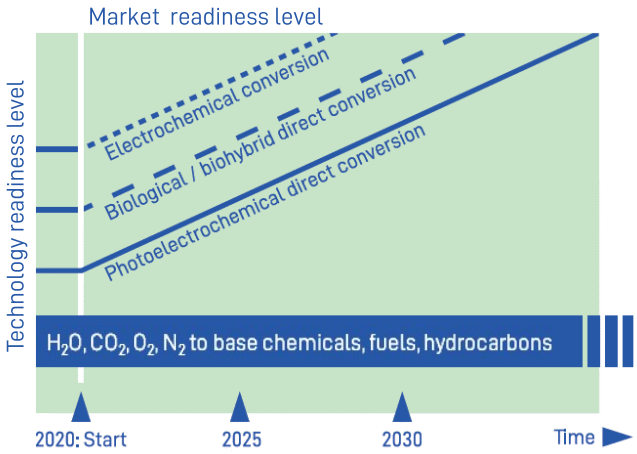
FUTURE RESEARCH INITIATIVE:
SUSTAINABLE FUELS & CHEMICALS VIA A CIRCULAR APPROACH

IN THE SHORT TERM. SUNRISE aims at providing value chemicals using renewable electricity sources and waste CO_2 from industrial processes as raw material for the circular production of chemicals and fuels.

IN THE LONG TERM. Final targets are sustainable high-value products produced by technologies going beyond the natural photosynthesis process, with higher efficiency and a wider selection of target molecules.

THE KEY ENABLERS. Information technology and bottom-up engineering of new advanced materials will enhance this ambitious paradigm shift. Information technology will enable optimized production processes, with savings of energy and feedstocks. New advanced materials will allow cost-competitive, efficient and durable solutions across a number of renewable energy technologies.





Solar fuels and chemicals: timescale

We target a sustainable CO_2 cycle, where the concentration in the atmosphere is decreased and then maintained at a level compatible with climate stability, with sustainable use of natural resources and land. The research and innovation programme will allow European economies to convert up to 1000-2500 ton atmospheric CO_2 per hectare per year, depending on the latitude. We will deliver disruptive technologies, absorbing 90% of light and storing 80% into products. The technology development will take into account key constraints such as the EROI (Energy Return On Investment) and availability and durability of critical materials.

www.sunriseaction.eu

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