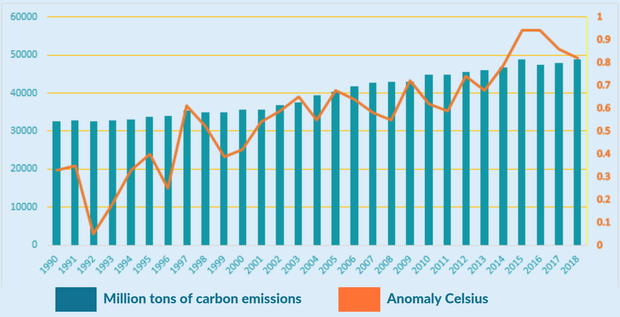
ARTIFICIAL PHOTOSYNTHESIS FOR WASTEWATER TREATMENT AND CARBON CAPTURE

An innovative photoreactor to convert greenhouse gas into sustainable fuels and chemicals, while oxidizing microplastics and organic pollutants in wastewater

Greenhouse gases (GHG) such as carbon dioxide, methane and nitrous oxide absorb infrared radiation, trapping heat in the atmosphere. The increasing concentration of GHG in the atmosphere as a result of anthropogenic activities is the main driver of climate change. Carbon Capture and Utilization (CCU) approaches reduce the net carbon emissions of otherwise carbon-intensive processes. The process of using sunlight for CCU, such as the one proposed in HySolChem, takes the name of Artificial Photosynthesis

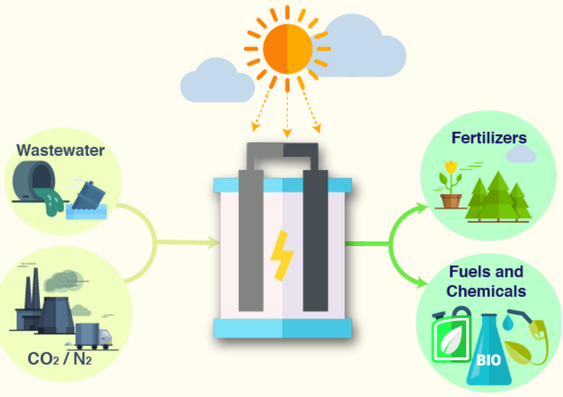
TOTAL GLOBAL CARBON EMISSIONS IN RELATION WITH ANOMALY TEMPERATURE



Data source: climatewatchdata.org and ncdc.noaa.gov

HOW DOES IT WORK ?

A photoreactor drives the photo(electro)catalytic reduction of gaseous CO_2 and N_2 and uses their oxidation potential to destroy microplastics and organic wastewater pollutants. The reduced CO_2 and N_2 are used to synthetize higher value chemical compounds, such as ethylene (C_2H_4), methane (CH_4), ammonia (NH_3) and urea ($CO(NH_2)_2$). The process is circular and entirely carbon neutral, since the degradation of wastewater pollutants supplies more carbon and nitrogen which are used as oxidants in the reaction.



HySolChem photoreactor is designed for municipal wastewater treatment plants, but it can be adapted for installation in carbon-intensive industries (chemicals, refinery, cement, fertilizers) and energy producers

INNOVATIVE TECHNOLOGIES

PHOTOCATODES

for the reduction CO_2 and N_2, at least 20 times more efficient than the state of the art, with at least 5% solar-to-chemical energy conversion efficiency and 1000 h duration

PHOTANODES

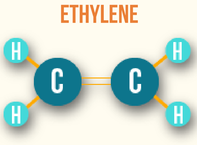
for the oxidation of wastewater pollutants, matching the efficiency of the state-of-the-art Boron Doped Diamond anodes, but at lower costs and with increased shelf-life.

PROTON EXCHANGE MEMBRANES

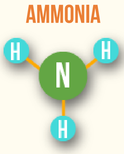
to drive the photo(electro)catalytic reaction, matching the efficiency of the state of the art per fluorinated membranes, but at lower costs, improved photo-stability and better fuel blockage.

OUTPUTS OF HYSOLCHEM PHOTOCATALYSIS

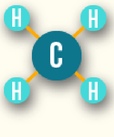
ETHYLENE



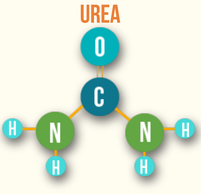
AMMONIA



METHANE



UREA



HYSOLCHEM

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