Tomás Roncal[1], Estefania Estalayo[1], Laura Sánchez-Cupido[1], Yolanda Belaustegui[2]
Fundación Tecnalia Research & Innovation. Basque Research and Technology Alliance (BRTA)
[1] Paseo Mikeletegi 2, San Sebastián/ [2] Astondo bidea,700, Derio. España.
laura.sanchez@tecnalia.com

PHOTO2FUEL

Artificial photosynthesis to produce fuels and chemicals

Hybrid systems with microorganisms for improved light harvesting and CO_2 reduction

Towards a climate-neutral energy production

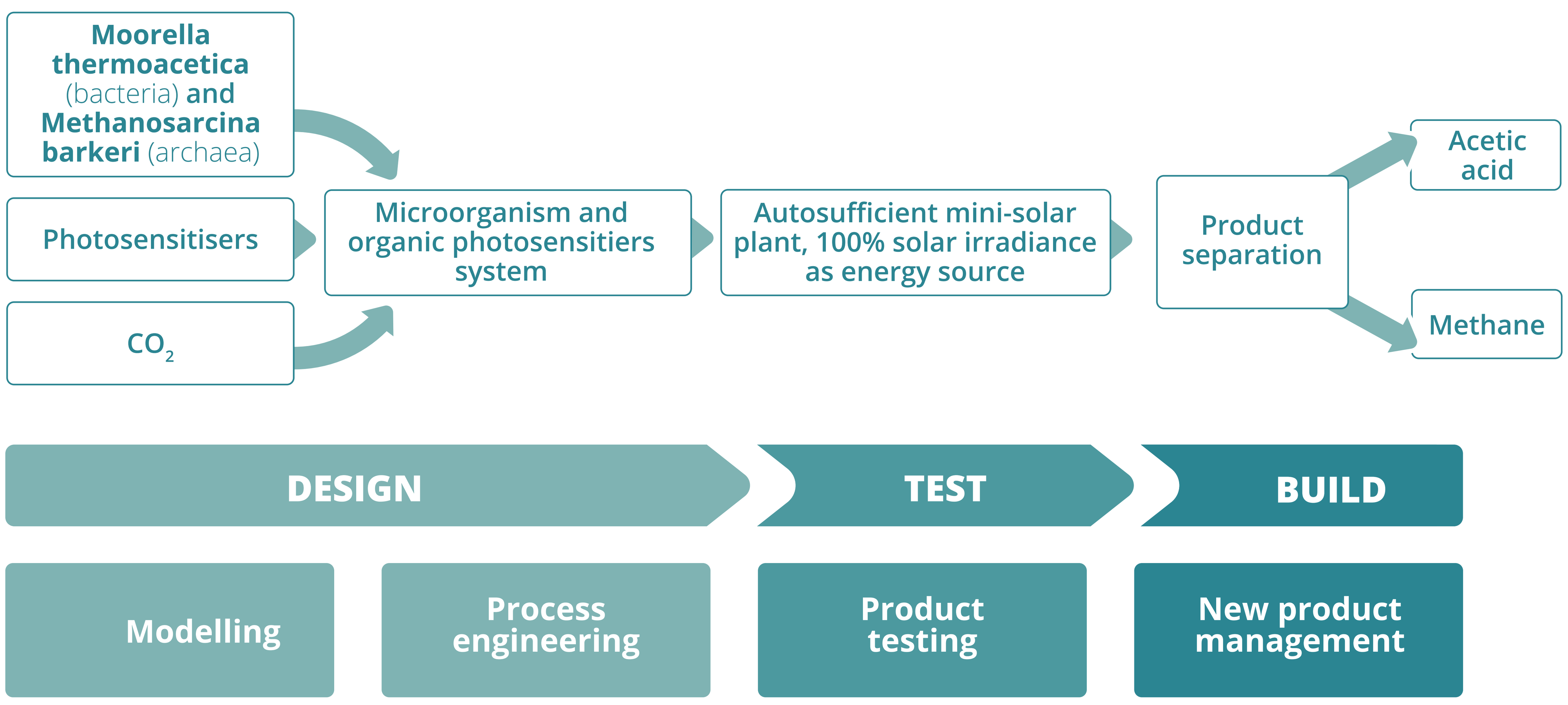
The European Union has set an ambitious objective for 2050: being the first climate-neutral continent. But first, we need to overcome several challenges: using sustainable feedstocks, implementing technologies which are not using rare materials and capturing, storing and converting CO_2 without extra energy source. To overcome these challenges, **Photo2Fuel** is advancing in the research of solar fuels.

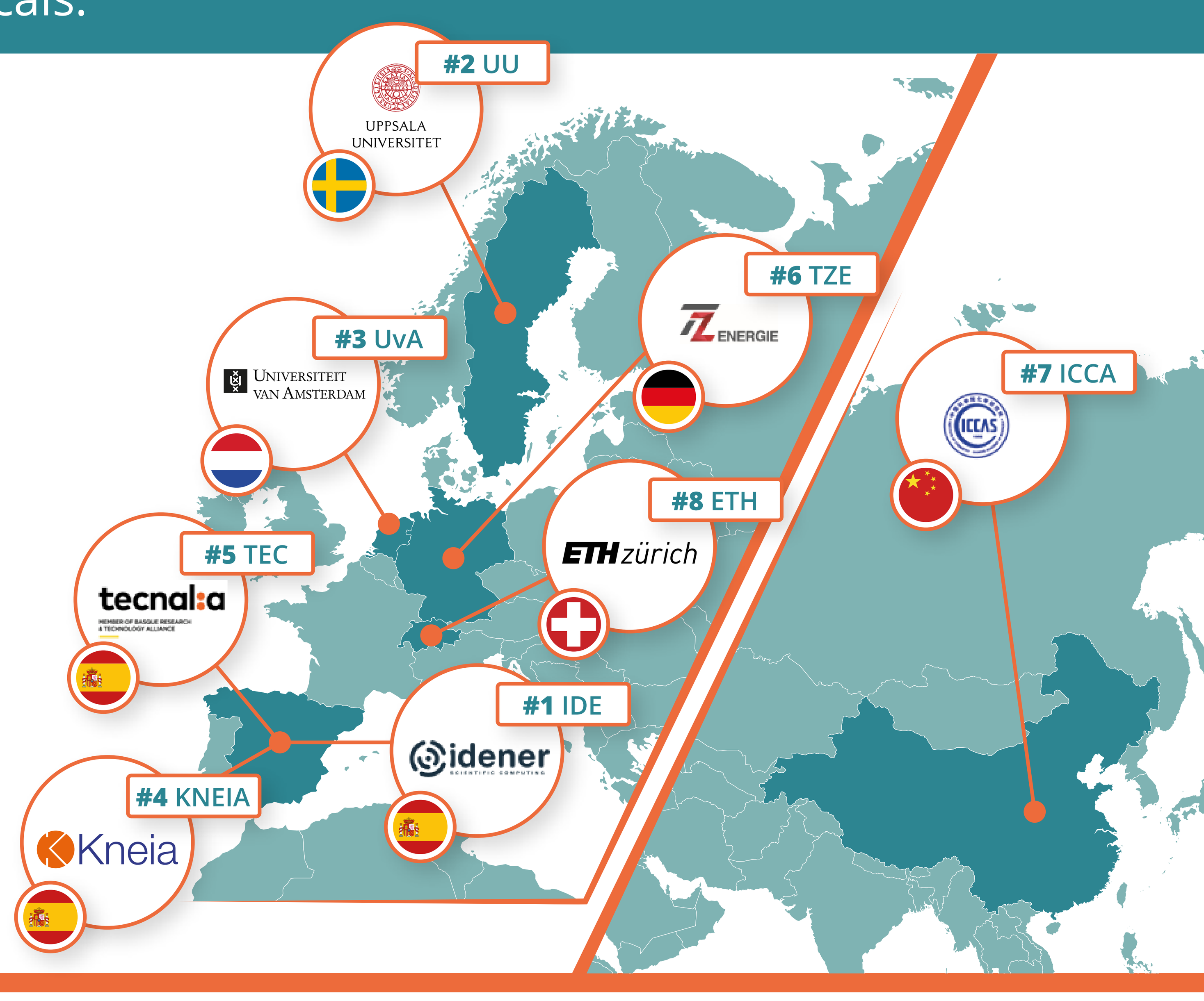
Photo2Fuel aims to develop a breakthrough technology that converts CO_2 into useful fuels and chemicals employing microorganisms and using only sunlight as an energy source.

Hybrid biofuel production systems employing microorganisms and CO_2

In **Photo2Fuel**, we are developing devices to convert CO_2 into fuels and chemicals using only microorganisms and sunlight. The main system of **Photo2Fuel** is composed of microorganisms, photosensitisers and CO_2. After testing and optimisation, this system will be scaled up into a photo-micro reactore, able to operate in variable weather conditions. After the reactions, methane and acetic acid will be recovered. An evaluation of the environmental, social and technological aspects of the system will lead to a roadmap for further research. **Photo2Fuel** is a project bringing together 8 partners from 6 countries that are working together to cover all the steps for the develpment of **Photo2Fuel** technology, which focuses on teh sustainable production of biofuels and biochemicals.

Project activities and partners

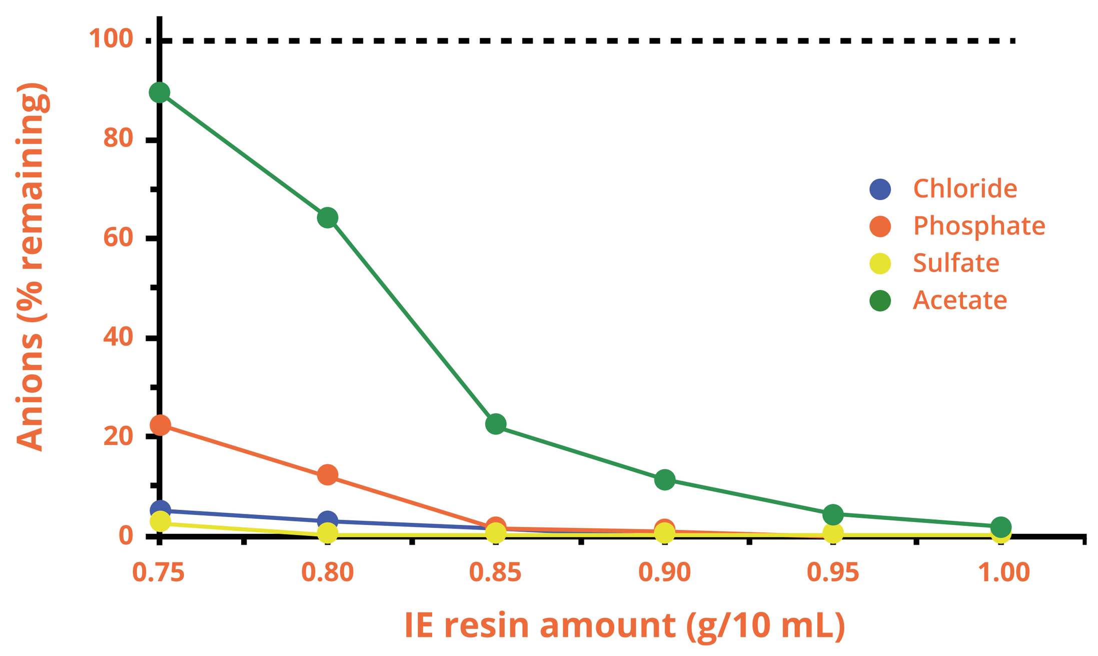




TECNALIA's role in Photo2Fuel:
Separation of acetic acid from the bacteria culture with different technologies

I) Ion Exchange resins

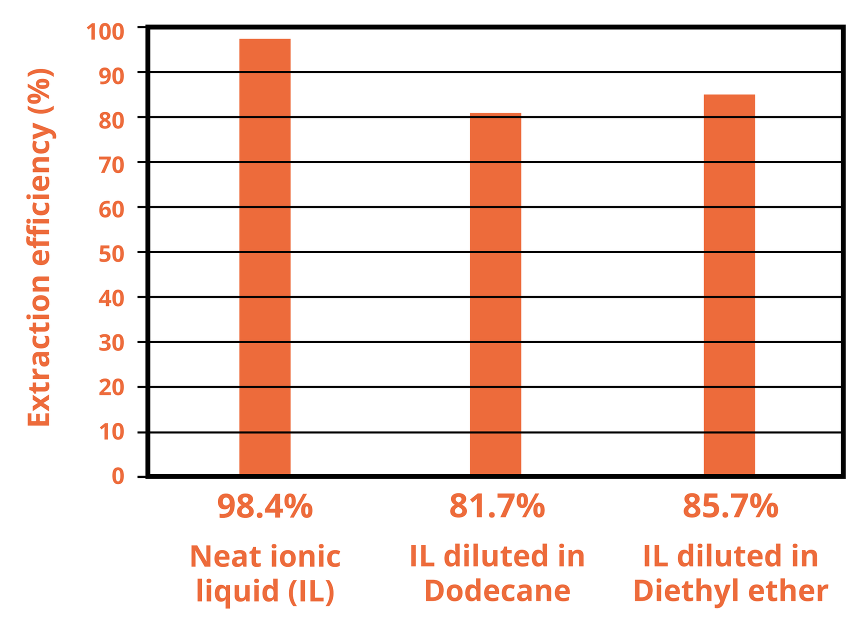
Demineralisation of DPM medium with Amberlite MB20 mixed resin at pH 2.5



Demineralisation of DPM medium to remove most of salts that would interfere with acetic acid purification methods was carried out by ion exchange using the Amberlite MB20 mixed resin.

II) Liquid- liquid extraction using ionic liquids (ILs)

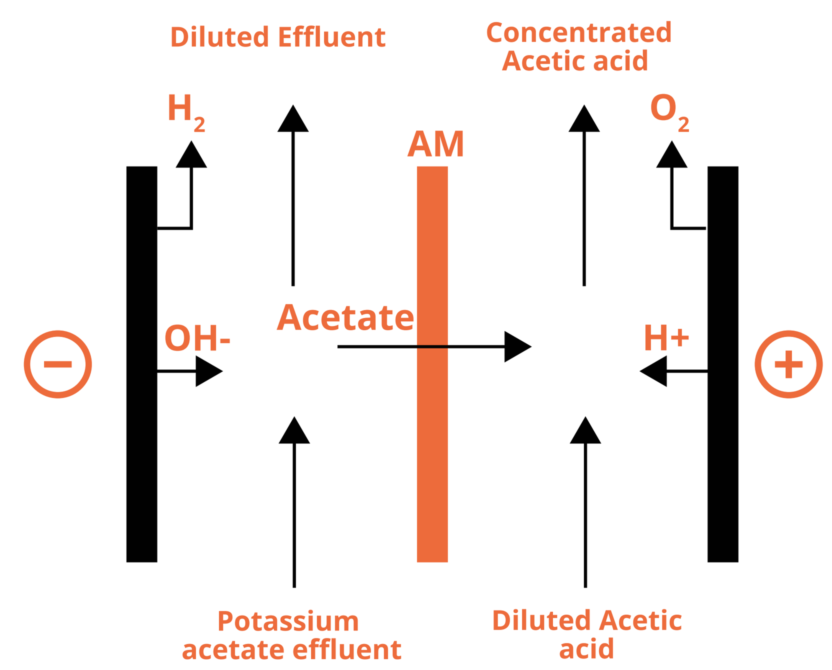
Acetic acid (HAc) extraction from 5 g /L HAc aqueous solution using Trihexyl(tetradecyl)phosphonium bis(2,4,4-trimethylpentyl)phosphinate IL. Aqueous/Organic v/v ratio 1/5. Room T. Contact time 30 min



Preliminary liquid-liquid extraction experiments showed that ILs can extract acetic acid with high efficiencies. The figure above shows examples of extraction efficiencies achieved using neat and diluted Trihexyl(tetradecyl)phosphonium bis(2,4,4-trimethylpentyl)phosphinate IL.

III) Electrodialysis

Two compartments configuration cell, anionic membrane: AMX Neosepta and DC=250 A/m²



Preliminary results using this configuration showed that it is possible to remove 33% of acetic acid from Thermoacetica culture with 10% current efficiency.
Thermoacetica culture contains Cl^-, SO_4^{2-} and PO_4^{3-} anions which compete with CH_3COO^- for passage through anionic membrane.

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OVERALL PROJECT BUDGET: € 2.493.171
START DATE: 1 September 2022
END DATE: 31 August 2025
TOTAL MONTHS: 36