Next Generation Electrochemical System for Sustainable Direct CO_2 Capture and Utilization/Storage as Clean Solar Fuel

NEXTCCUS Project

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https://www.nextccus.eu

#	Participant organization name	Country	Type
1 (**PCo**)	IRITALY Trading Company S.r.l	IT	SME
2	Consiglio Nazionale delle Ricerche, Institute of Structure of Matter	IT	RES
3	Hellenic Mediterranean University (HMU), Mechanical Engineering Department	EL	HE
4	University College London, Institute for Materials Discovery	UK	HE
5	Argonne National Lab & Indiana University–Purdue University Indianapolis	US	RES
6	IRCELYON, Institut de recherches sur la catalyse et l’environnement de Lyon	FR	RES
7	Institut de chimie physique, Université paris-Saclay	FR	HE

NEXTCCUS Objectives

Overarching Aim: Towards a sustainable energy technology with negative carbon footprint to produce methanol at SATP conditions by developing and scale-up an innovative electrochemical system in order to enable sustainable CO_2 capture, direct conversion and storage as liquid fuel.

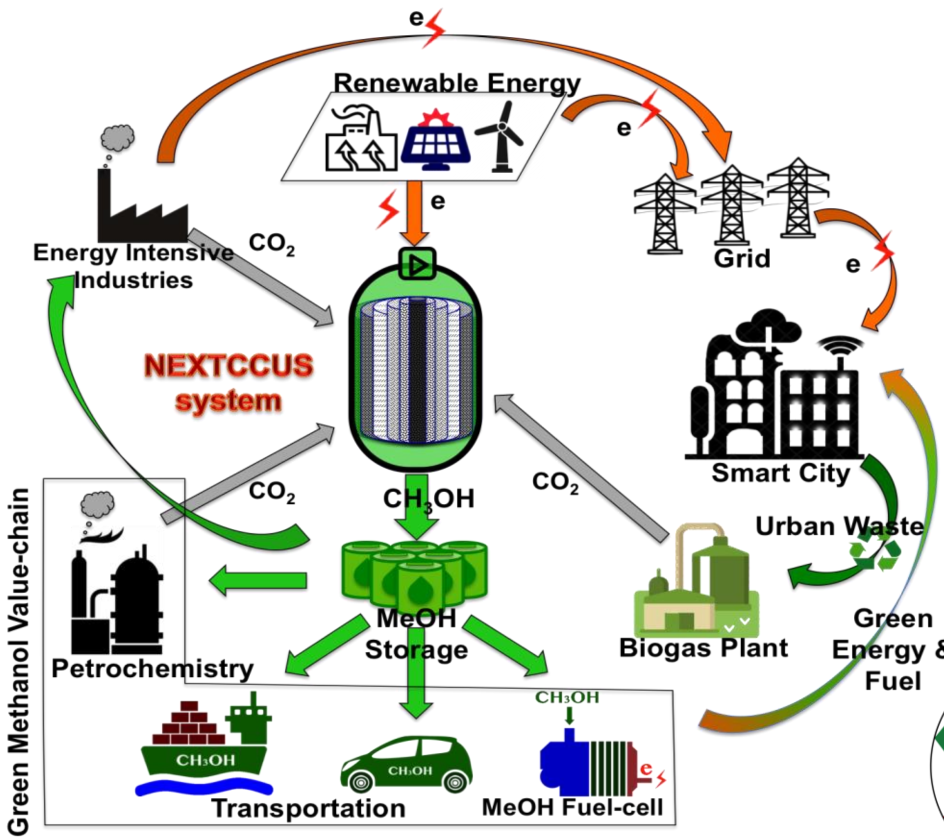
OBJECTIVE #1. Realization of a system for sustainable CO_2 capture and direct reduction to methanol working at SATP conditions.

OBJECTIVE #2. To demonstrate cost effectiveness of the technology by developing volume manufacturing.

OBJECTIVE #3. Reducing the emission of carbon intensive industries with a sustainable CO_2-based circular economy solution.

OBJECTIVE #4. Reducing the environmental and energy impacts of the system.

OBJECTIVE #5. To demonstrate a feasible road-map toward commercialization.



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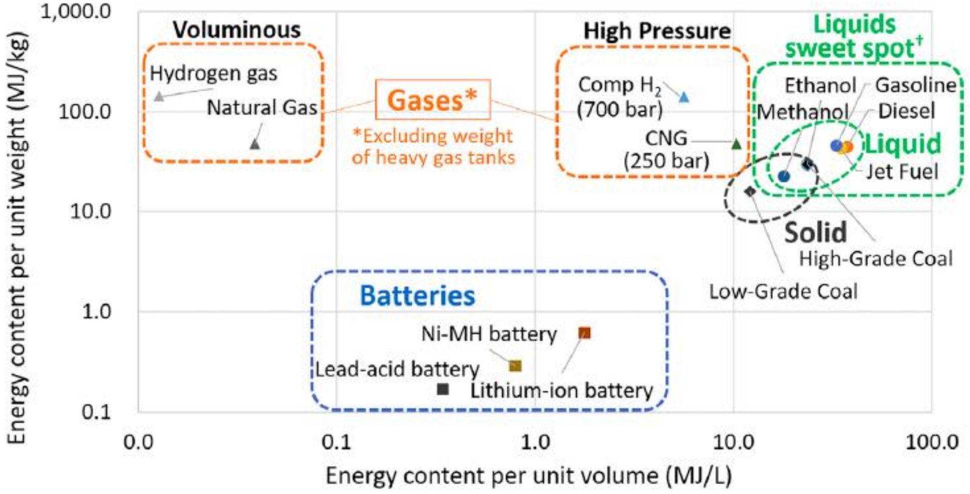
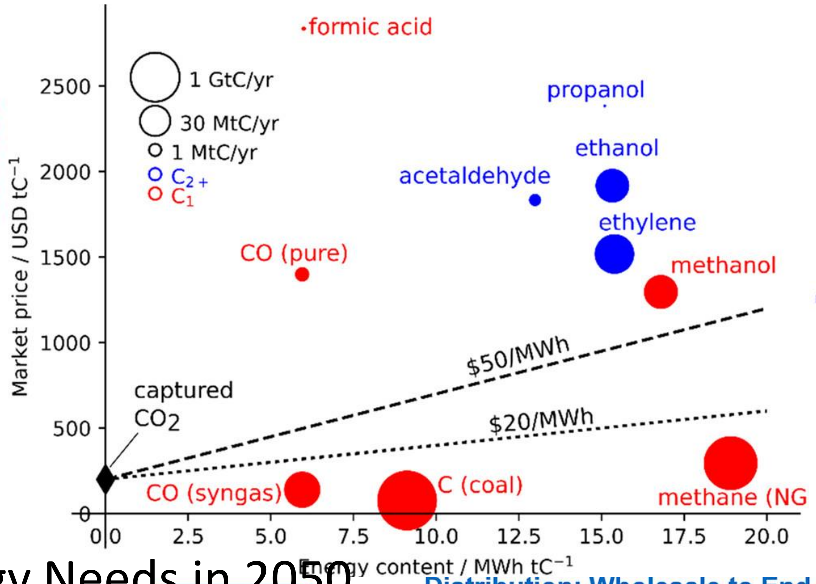
Why Alcohols

Accelerating CCS Technologies

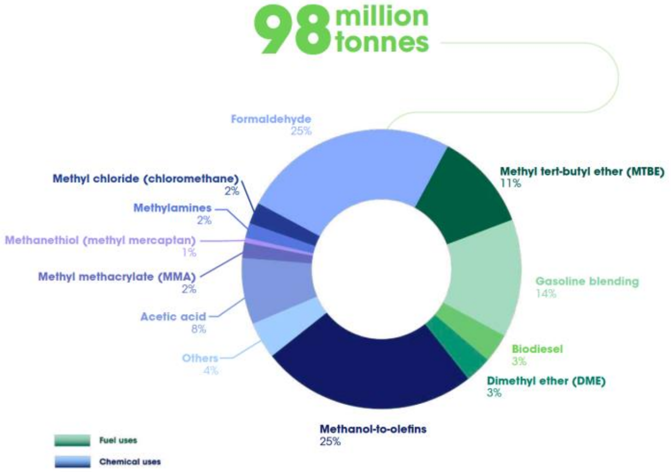
Energy Density



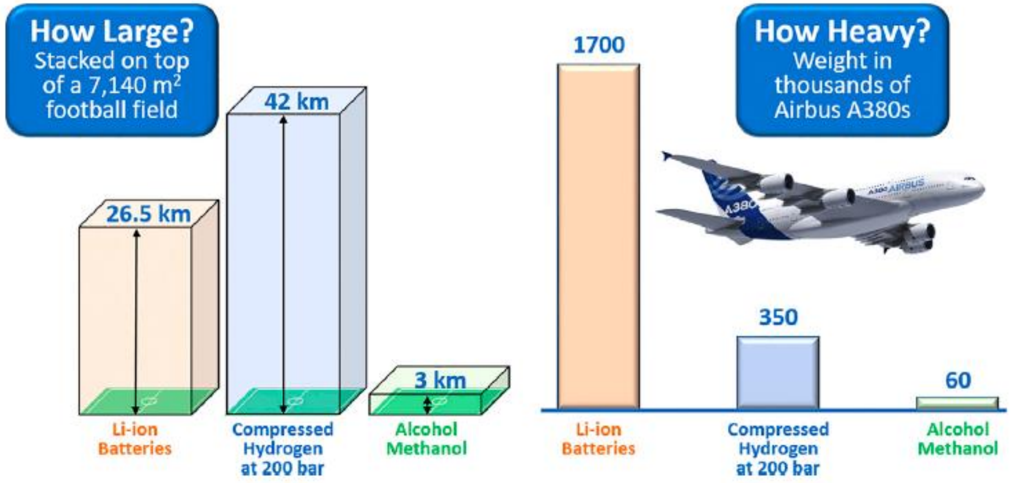
Market price



Global Demand



94 TWh Storage of Global Energy Needs in 2050



Shih et al. Joule 2018

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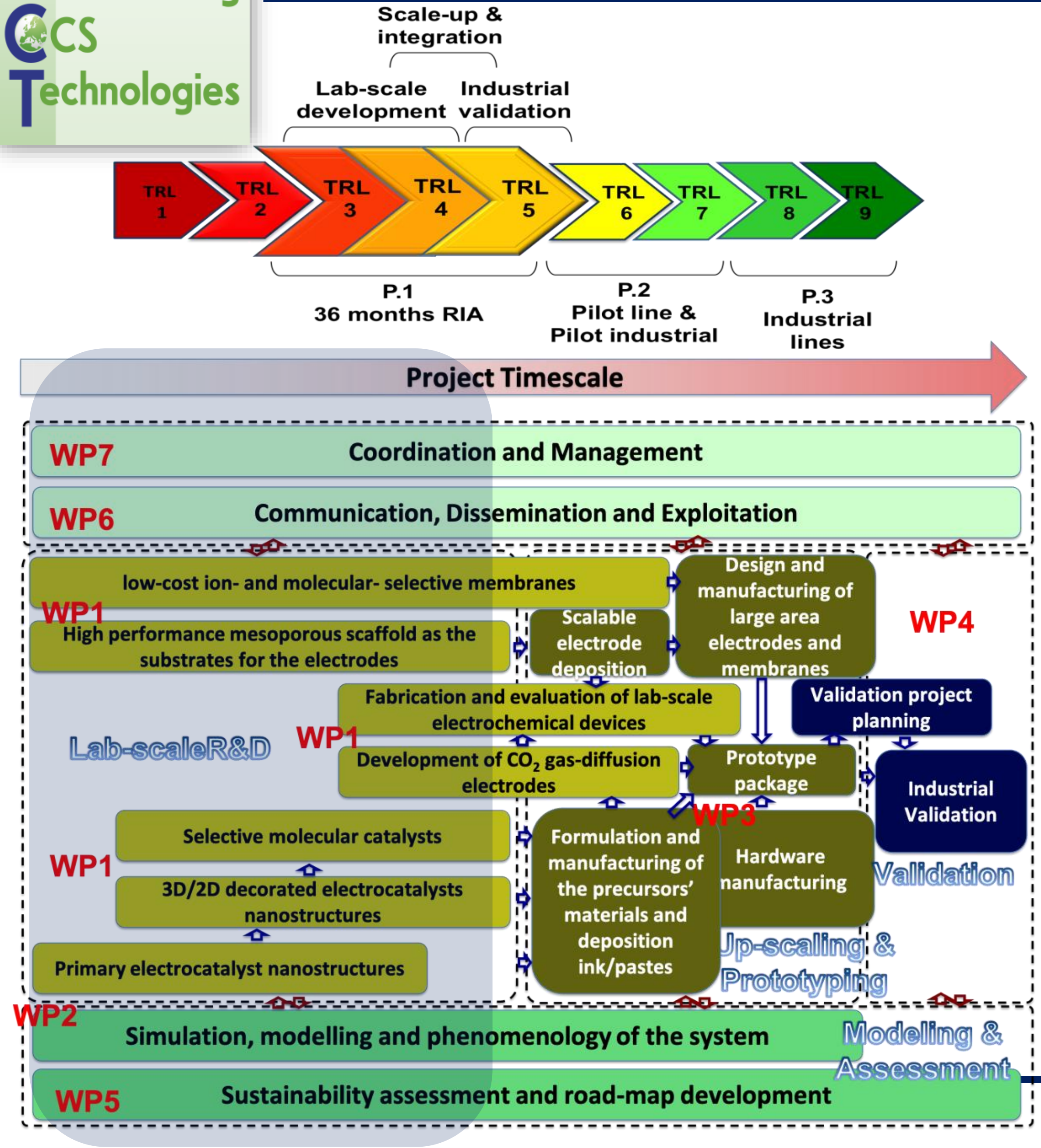
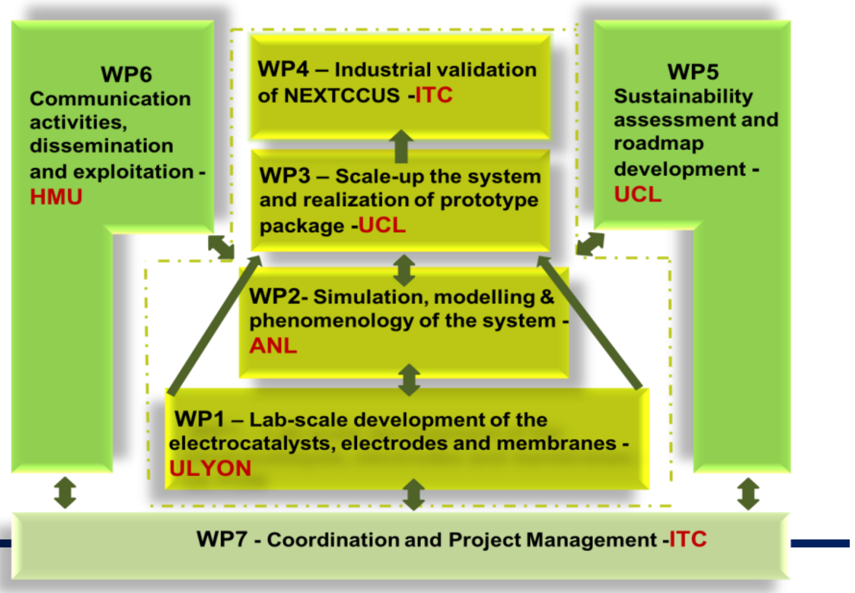
Roadmap and benefits of the technology

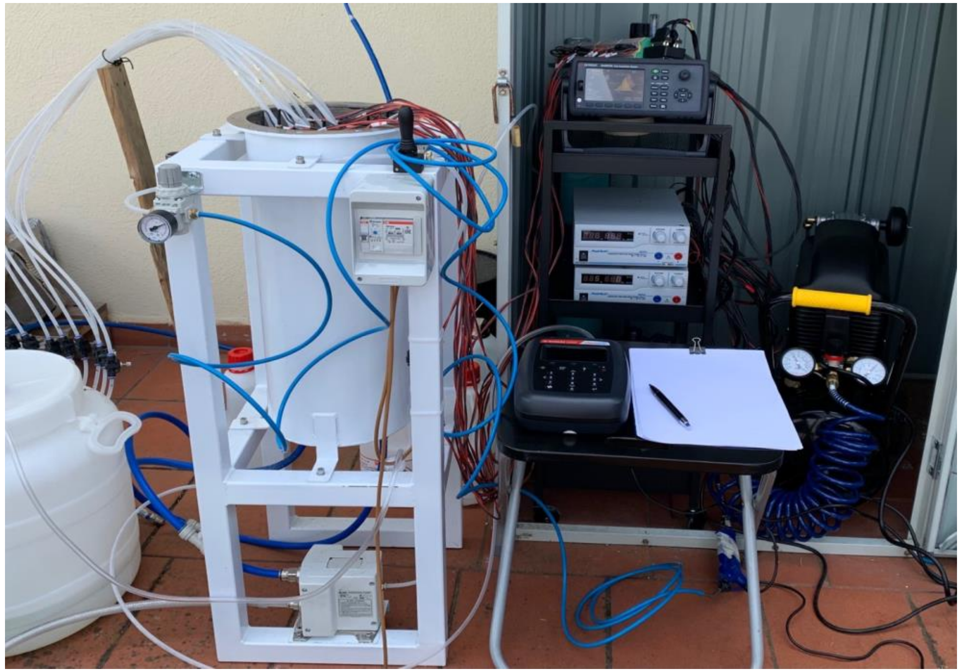


- Low CAPEX/OPEX and easy scale-up
- Integration of the CO_2 capture and conversion in one instrument
- Low energy consumption and low EPBT
- Flexibility to various feedstocks
- Highly durable electrodes and catalysts
- Flexibility to supply the energy from various sources of power
- Easy integration with carbon and/or energy intensive industries



NEXTCCUS Acheivements till now

- High current density at low over potential;
- Using fully earth abundant elements in the electrocatalysts;
- High stability in high currents;
- High Faradaic efficiency;
- >90% CO_2 reduction selectivity;
- Developed GDE setup for CO_2 reduction;
- Powerful computational models for simulation of HER, OER and CO_2RR activity of various novel electrocatalysts such as Mxenes and molecular catalysts;
- Scalable and low-cost design of the large area electrodes with easy and fast installation and revamping process;
- Various scalable and low-cost deposition methods have been invented and/or optimized for large area deposition of the electrocatalysts on GDEs;
- Scalable method has been developed for fabrication of low-cost MXene membranes;
- Semi-industrial prototype with Methanol production rate: **500 g/h**



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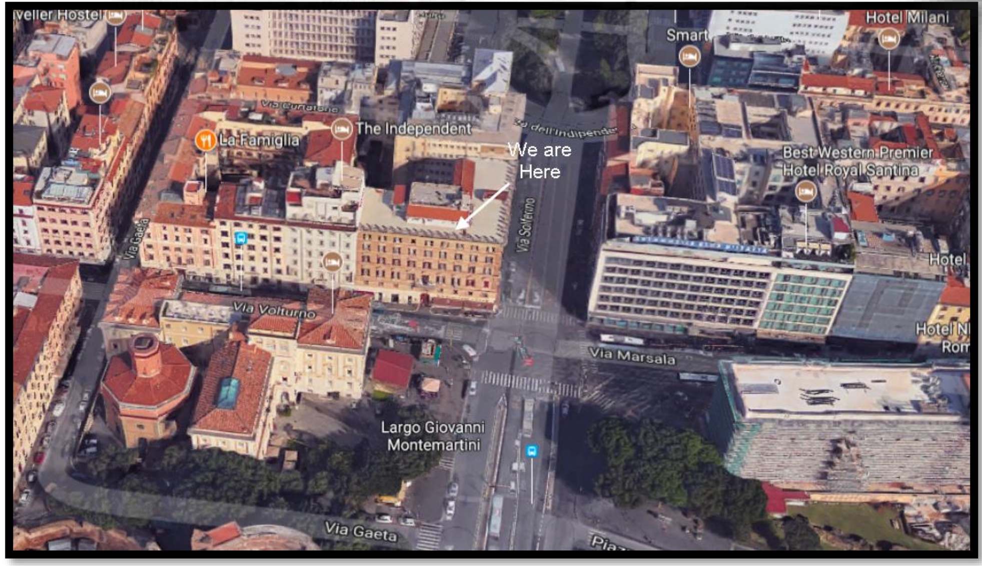
Acknowledgment

Accelerating CCS Technologies



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UCL

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IRCELYON

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