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PRESS RELEASE

THUNDER Project Launches to Advance Carbon-neutral e-Methanol Production in Europe

New EU-funded project unveils website and communication materials alongside its official launch

Hürth, 30 April 2026: The European research project THUNDER – Innovation in e-MeOH Production by One-Pot Tandem Process has officially launched, bringing together leading research and industry partners to accelerate the development of sustainable fuel technologies. Alongside the project start, the official website (<https://thunder-project.eu>) and the first communication materials, available via the publications and media section (<https://thunder-project.eu/publications-media/>), have now been published, providing accessible information about the project's objectives, approach and expected impact.

Running from October 2025 until September 2029, THUNDER is funded by the European Union's Horizon Europe programme with a total grant of €3.99 million, under the Climate, Energy and Mobility cluster. The project is coordinated by Fundació Eurecat (Spain) and unites scientific and industrial expertise from multiple European countries to address the challenges of decarbonising chemical production and energy systems.

THUNDER aims to develop an innovative, modular and integrated solution for electro-methanol (e-MeOH) production, addressing the high costs, energy demand and inefficiencies of current benchmark technologies. Using a one-pot tandem process, the project combines three key reactions in a single, optimised system: the capture of CO₂ and H₂O vapour, the co-electrolysis to generate carbon monoxide (CO) and green hydrogen (H₂), and the hydrogenation of CO₂ and CO to synthesise e-MeOH. This process integration enables significant efficiency gains and reductions in both operational and investment costs.

At the technological core of THUNDER are multifunctional membranes for CO₂ capture, advanced electrocatalysts for CO and H₂ production, and thermochemical catalysts for methanol synthesis. The system will operate using renewable electricity and recover surplus heat, resulting in markedly lower energy consumption compared with conventional processes. Its modular design minimises the use of critical raw materials, reduces infrastructure needs and allows flexible deployment across industrial sectors.

The expected impact of THUNDER is substantial, including up to a 75% reduction in greenhouse gas emissions, a 50–60% decrease in capital expenditure (CAPEX), and an 8–16% decrease in operational expenditure (OPEX). By recycling CO₂ and H₂O vapour and reusing residual heat from fuel cells, the technology will close the carbon loop, making e-MeOH production more sustainable and suitable for use in fuel cells for both mobility and electricity generation.

Throughout the project, THUNDER will deliver several key innovations: advanced materials such as catalysts, membranes and 3D-printed reactors made from recycled titanium; process intensification through the integration of all steps into a unified system; technology optimisation from TRL 3 to TRL 4 under real and simulated flue gas conditions; and validation of e-MeOH in fuel cell systems. Together, these developments will advance the European Union's goals for a climate-neutral and circular economy, providing a robust pathway towards carbon-free fuels.

Tackling CO₂ emissions through innovative technology

CO₂ emissions remain a major challenge for climate and industry. THUNDER addresses this by developing a modular and integrated system for the production of carbon-neutral electro-methanol (e-MeOH) using renewable electricity and captured CO₂.

At the heart of the project is a one-pot tandem process, which combines three key steps into a single, optimised system:

- CO₂ and H₂O vapour capture
- Co-electrolysis to produce carbon monoxide and green hydrogen
- Catalytic synthesis of e-methanol

By integrating these processes, THUNDER aims to significantly improve efficiency while reducing system complexity and costs.

Driving efficiency, sustainability and industrial impact

The THUNDER approach is designed to overcome the limitations of current e-methanol production technologies, which are often energy-intensive and costly. The project aims to:

- Reduce greenhouse gas emissions by up to 75%
- Lower capital expenditure by 50–60% and operational costs by up to 16%
- Minimise reliance on critical raw materials through advanced design and materials innovation

The technology will be validated under realistic conditions and advanced from Technology Readiness Level (TRL) 3 to TRL 4, laying the groundwork for future industrial deployment.

Enabling the transition to a circular carbon economy

THUNDER contributes directly to Europe's climate and energy objectives by promoting carbon capture and utilisation (CCU) and enabling the production of sustainable fuels for energy and mobility applications. By recycling CO₂ and integrating renewable energy sources, the project supports the transition towards a circular, low-carbon economy.

In addition to technological development, THUNDER will engage stakeholders across industry, research and policy to support market uptake and future commercialisation pathways.

Consortium Partners & Responsibilities

- **Fundació Eurecat (EUT)** – Coordinator
 - Overall project coordination and management (WP6)
 - Leads WP2: e-MeOH process optimisation in prototype reactors
 - Responsible for development of innovative CO₂ electroreduction catalysts, as well as reactor development, system integration and scale-up activities
- **Politecnico di Torino (POL)**
 - Leads WP1: Development of innovative membranes and catalysts
 - Focus on advanced membranes for CO₂ capture and anodic catalysts for water oxidation reaction.
- **JORCAR 2009 SL (JORCAR)**
 - Leads WP3: e-MeOH production and its validation in fuel cells

- Responsible for the fabrication of reactor components from recycled metals using 3D printing, as well as reactor development and multiphysics simulations (mechanical, fluid dynamics, and electromagnetic)
- **ICODOS GmbH**
 - Leads WP4: Process engineering, environmental and technology assessment
 - Conducts techno-economic analysis (TEA), life cycle assessment (LCA) and process modelling
- **nova-Institut GmbH (NOVA)**
 - Leads WP5: Communication, dissemination and exploitation
 - Responsible for stakeholder engagement, market analysis and pre-business case development
- **Centre National de la Recherche Scientifique (CNRS)**
 - Contributes across technical work packages (WP1–WP3)
 - Responsible for the development of thermochemical catalysts for CO₂/CO hydrogenation to methanol, and provides expertise in catalysis, materials science and reaction processes
- **Methanol Reformer SL (MREF)**
 - Involved mainly in WP2 and WP3, focusing on the development of fuel cell systems for mobile and stationary applications and the validation of e-MeOH use in fuel cells
 - Provides CO₂/H₂O streams and surplus heat from the energy generation process

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Since the mid-1990s, the nova-Institute has been dedicated to sustainability and today focuses primarily on renewable carbon cycles. As an independent research institute, it supports companies – particularly from the chemical, plastics, and materials industries – in the use of renewable carbon derived from biomass, direct CO₂ utilisation (CCU), and recycling.

With a multidisciplinary team of scientists, the nova-Institute participates in international innovation projects and provides science-based management consulting. The institute follows a holistic approach: its experts analyse which technologies and raw materials are suitable for specific products, in which markets their application is feasible, which regulatory frameworks apply, how sustainable the solutions are, and how they can be successfully positioned in the market.

Based on these analyses, the team develops tailored strategies to support the transformation from fossil to renewable carbon. Around 50 experts from various disciplines work together to drive the defossilisation of industry – for a climate-neutral future.

More information: www.nova-institute.eu – www.renewable-carbon.eu

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