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NEWSLETTER #3
From January to August 2025



Funded by the European Union, DECODE is a groundbreaking collaborative project. Our mission is to develop and showcase the first decentralised cloud-based platform that unites multiple laboratories in a shared effort to accelerate the design and integration of energy materials.

Latest DECODE project updates!

Consortium Meeting #3



In April, the DECODE partners held their third consortium meeting in Renningen, Germany, hosted by their esteemed partner BOSCH Hydrogen Energy. This meeting was a great opportunity for the consortium partners to share their latest progress and discuss the next steps for a smooth project implementation.

Official video of the DECODE project is out!

Euroquality, our dedicated partner leading the Work Package on Communication, Dissemination, and Exploitation, coordinated the production of the official video presenting the DECODE project.

If you're curious about what our project is all about, and wish to learn more about the technological innovations that we aim to achieve, this video is meant for you!

[Watch the project video to dive into DECODE!](#)

DECODE Platform user workshop - highlights

On April 4th, hte GmbH hosted the first DECODE Platform User Workshop in Heidelberg. The event focused on the DECODE Cloud Platform, offering insights into metadata, data sources, and workflows across the consortium.

Participants explored real-world examples from our data spaces and engaged with presentations on data infrastructure, cloud deployment, and agentic modules - providing valuable feedback to guide future use cases.

The workshop concluded with a tour of hte GmbH's testing facilities, showcasing upcoming experimental workflows and data integration efforts.



[See more](#)

Work in progress!

WP1 successfully completed

Work Package 1, led by CNRS, was successfully completed at the end of July 2025.

This foundational phase focused on collecting, refining and evaluating modelling and characterisation methods and tools that DECODE partners have at their disposal. The methods and tools are being assessed in terms of four attributes: maturity, resource requirements, interoperability, and integration complexity; furthermore, utility is considered as a context-dependent layer.

At its core, WP1 advanced experimental and theoretical approaches to better understand the local reaction environment (LRE) and the distribution of reaction conditions and rates (DRR) in electrochemical systems, from model interfaces to realistic electrodes. These insights enabled us to propose the next-generation descriptors to assess the activity and stability behaviours of next-generation materials and devices.

WP2: linking materials insights to device performance

Led by the Paul Scherrer Institute (Switzerland), WP2 aims to connect insights from WP1 on LRE, DRR, and electrode media properties with device-level metrics. This will enable correlation analysis and the identification of optimal multiparametric descriptors. WP2 also focuses on harmonising lab testing practices and applying multiscale, multimodal characterisation to explore the relationships between structure, properties, activity, and stability.

Since the beginning of 2025, significant progress has been achieved in WP2. The baseline membrane electrode assembly (MEA) has been prepared and distributed among partners and its characterization work has started to fully parameterize the MEA models. We are in the process of consolidating a correlative experimental workflow that connects different characterization techniques with properties and further with performance, stability and durability. On the modelling side, a seamless workflow has been strung together for the PEFC use case and DTU's dynamic workflow manager is being adapted to orchestrate the deployment of models. The development of the module for the assessment of the integration readiness level has been concluded, which is accessible as a Flask-based web application. In another activity, in situ and operando characterization tools are being collected that provide information about the operating cell. Preparations for the demonstration use case that entails variation of the ionomer-to-carbon (mass) ratio (I:C) in PEFCs have been concluded and we have started to collect data from partners on the repository created for this purpose.

WP3: building the DECODE cloud platform

Launched in December 2024 and led by Forschungszentrum Jülich (IET-3), WP3 focuses on developing the core modules of the DECODE platform. Running until February 2027, it includes the implementation of a central processing unit (CPU) and the development of advanced fine-tuning methods to retrain models embedded in the DECODE FOUNDRY.

Since the beginning of 2025, significant progress has been achieved, with a focus on designing and developing an advanced AI-enabled recommendation system. This intelligent system will execute tasks of suggesting the most relevant modeling and experimental methods for a given use-case. It will have to autonomously understand complex queries provided by users and return tailored toolchains of methods, along with the evaluation of how ready and suitable they are for integration, based on the Integration Readiness Level (IRL) framework developed in WP2. The first working version of this multi-agent recommendation system has already been built. The first agent, called DECODE FOUNDRY, plays the role of a virtual materials science researcher. It uses a knowledge graph to explore and identify relevant modeling and experimental methods for the use case at hand. Once relevant methods and tools have been selected, the Database agent (aka IRL Assistant) steps in. This agent accesses the IRL database to retrieve the relevant scores. Finally, the IRL Scoring agent calculates an overall IRL score for each method and for the toolchain.

Launch of WP4: demonstrating DECODE in real use cases

June 2025 saw the launch of WP4, which focuses on showcasing the DECODE platform through use-case studies. Led by Forschungszentrum Jülich, it includes a well-established baseline case (PEFC) with extensive data, used to demonstrate efficiency gains in technology optimisation. Insights from this case will be transferred to exploratory cases (PEWE, AEWE, AEFC), which are less mature and data-rich, to highlight DECODE's potential in accelerating technological development.

Stay connected to follow the progress of these tasks!

Breaking news highlights

Scientific & technological advances	Digitalisation & lab connectivity	Policy & regulatory updates
Breakthroughs in PEM electrolysis	Rise of autonomous, sustainable labs	New EU framework for low-carbon hydrogen
Recent developments in proton exchange membrane (PEM) electrolyzers have pushed efficiency targets to 72% (LHV) and extended lifetimes to 80,000 hours. Cost reduction strategies are also progressing, aiming for \$1/kg hydrogen production.	AI-enabled platforms are transforming materials research by: <ul style="list-style-type: none"> Automating molecular design and predicting their properties. Generating molecular structures and predicting their properties. Automating experimental workflows and optimizing formulations. Accelerating discovery in fields like batteries, solar cells, and carbon capture - with initiatives such as Microsoft's MatterGen and Google's GNOME. <p>These approaches reinforce the relevance of the "Future Lab" concept promoted by DECODE, and resonate with DECODE's AI-enabled CPU, which orchestrates modelling and characterisation contributions across partner labs.</p>	In July 2025, the EU adopted a methodology for assessing greenhouse gas emissions from low-carbon hydrogen. A 70% reduction threshold compared to fossil fuels has been set, complementing existing RFNBO regulations. This is aimed at securing investments and accelerating the scale-up of clean hydrogen production.
These advances align closely with DECODE's goals in validating and integrating cutting-edge technologies.		This policy shift supports DECODE's demonstration efforts and strengthens the clean hydrogen value chain.



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