The Hydrogen Standard

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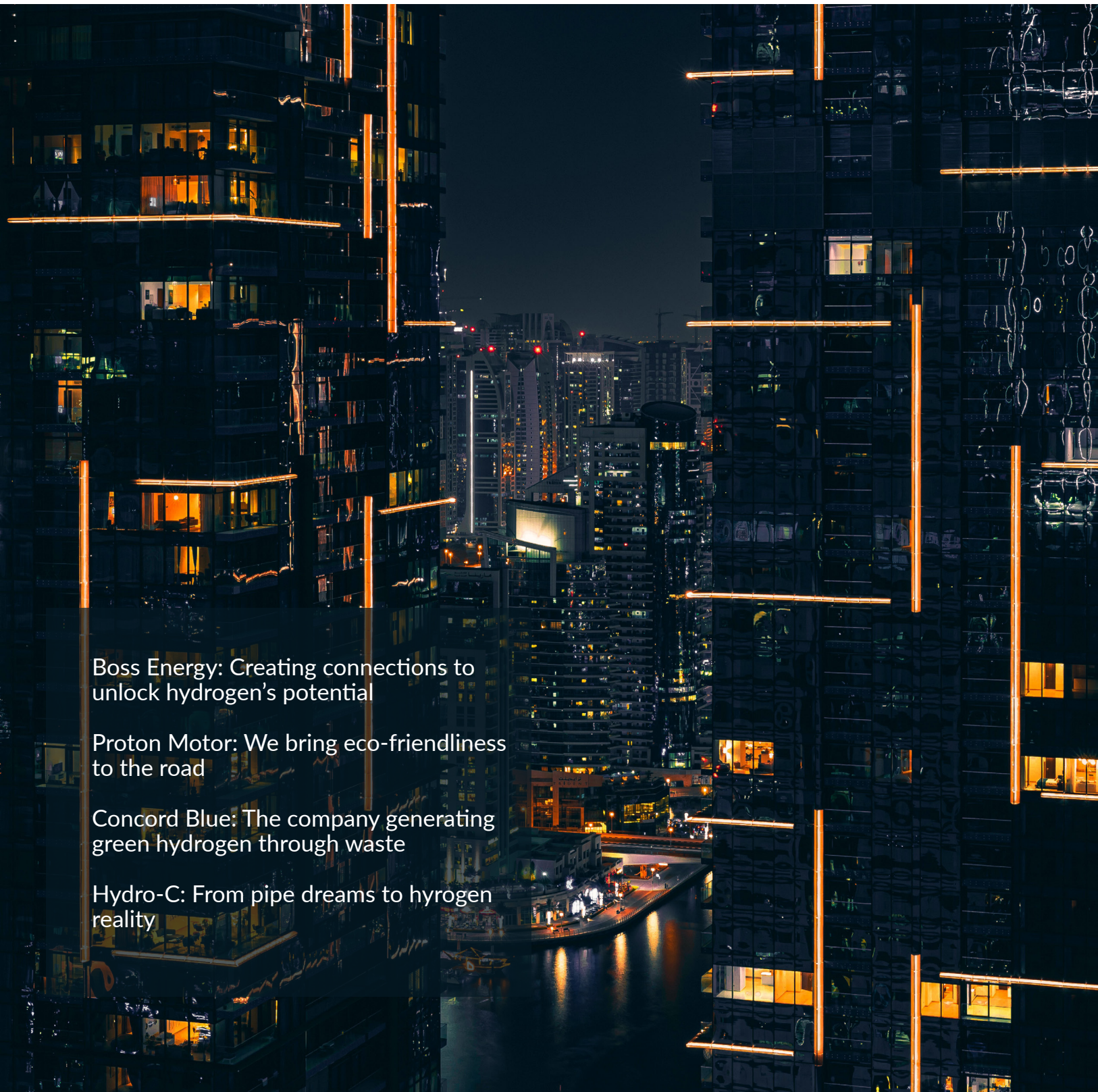
The Leading Magazine on Global Hydrogen Developements



Boss Energy: Creating connections to unlock hydrogen's potential

Proton Motor: We bring eco-friendliness to the road

Concord Blue: The company generating green hydrogen through waste

Hydro-C: From pipe dreams to hyrogen reality

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Company Profile

CEA Liten

Website

liten.cea.fr

The CEA's is one of Europe's leading institutios for Energy research.

Key Features

Focus: European Research Institute (CEA-Liten). Hydorgen and plitum use in fuel cells.
Interview with: Hermine Renon, Business Development and Industrial Partnerships Manager, Christine Nayoze-Coynel, PEMFC Fuel Cell Engineer Department of Electricity and Hydrogen for the Mobility.
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How is the CEA Involved in Fuel Cell Recycling?

The CEA, a French research centre established in 1945, had a strong nuclear focus until the early 2000s. But now the research carried out at CEA could be critical for another major energy source: hydrogen.

Over the past 20 years, it has become a European leader in alternative energy research, development, and innovation, with 20% of the budget funded by the French government, 40% from European projects, and the 40% left is linked to industrial partnerships and contracts.

The CEA's mission is to develop state-of-the-art technologies and make them ready to deploy them. As an example, the CEA developed batteries for the Japanese market before the European market became mature enough for alternative energies.

Today the CEA is active in nuclear technologies, Fundamental Research (materials and life science), defence and security, information technologies, and Technological Research.

LITEN, the energy-focused institute within CEA, focusses its research in 3 pillars:

- Low-Carbon Power Generation (solar and photovoltaic development)
- Management of Energy Grids (Smart Energy Grid, flexibility: H2 vector, storage: electrical and thermal)
- Improve Energy Efficiency (Material and energy efficiency, reducing environmental footprint, closing the carbon cycle).

And the latter is where the department's research could be important for hydrogen, as LITEN researchers work to safeguard platinum supplies for fuel cells.

"What is interesting to bear in mind is the impact recycling can have," says Hermine Renon, Business Development and Industrial Partnerships Manager. "To a very large extent, we can retrieve almost all the platinum used."

The CEA is working in partnership with Hensel Recycling on a project called BEST4Hy, to create efficient recycling technologies adapted for polymer electrolyte membrane (PEM) and solid oxide fuel cells.

The work aims to ensure the recycling of critical raw materials, including platinum group materials, rare earth elements, cobalt, and nickel. The CEA has two teams involved in the BEST4Hy project for the PEMFC part.

One of these teams focuses on new recovery techniques to create recycled materials and components usable either in MEA or in open loop. The recycling team develops novel technologies for MEA dismantling (based on a gaseous phase dismantling process) and Pt electrochemical recovery, from lab to pilot scale, aiming to achieve high levels of efficiency and reduce waste. The electrochemical process, without gas emissions and oxidants use, will provide an environmentally friendly way to recover Pt metal (>95% yield), spent membrane (100%) and GDL (100%) for open loop scenarios. At the end of the project, the developed process will be compared to traditional ones thanks to LCA/LCC studies.

The other team focuses on MEA and on characterising and validating the platinum salts processed by Hensel. The goal is to ensure the recycled materials have close characteristics to commercial ones.

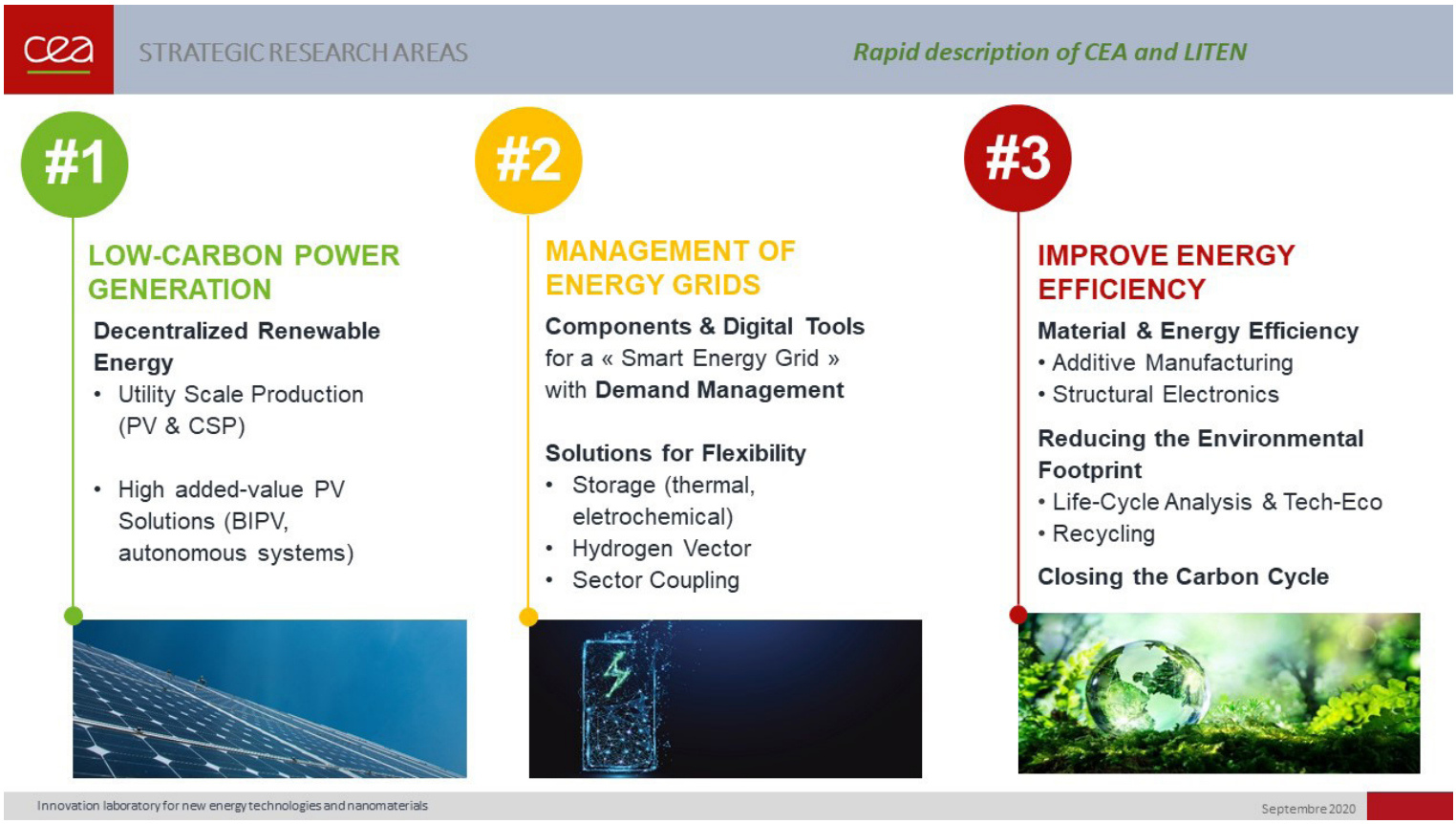

Image 14: Main Pillars of the CEA

The characterization of materials is an important part of the project because these recycled components will directly contribute to create a closed-loop production process, by being incorporated in the remanufacturing of new MEA.

The team works on developing this transformation process to manufacture electro-catalysts such as platinum that can be reintroduced in the closed-loop manufacturing process, as the recycled ionomer.

In other cases where the recycled output is unsuitable for MEA, it can be repurposed and contribute to an open loop.

Fuel Cell Engineer Christine Nayoze-Coynel says: "We have a critical role within the BEST4Hy project because we evaluate and characterise the recycled materials used for PEMFC. But also, we reintroduce them in the MEA process."

This is crucial, she says, “because while some impurities are acceptable, others can disturb synthesis."

Renon adds: "Currently, the technology readiness level is between three and five. It needs to be seven or more to be ready for industrialisation."

Nayoze-Coynel's team works on materials but also bi-polar plates, which are licensed and used on the market. The aspiration is to understand every step of the system in terms of degradation, performance, and durability.

Renon says: "That's one of the key added values of CEA; we don't stop at the materials but we are working on

all the value chain. We try to address all the different problems of the market and solve them."

Renon and Nayoze-Coynel agree that the need for platinum in a fuel cell will gradually shrink, and recycling is a great way to fill the gap meanwhile. However, Nayoze-Coynel adds, "We won't be able to cancel it out completely. “

“We will likely reach a lower plateau, but smaller amounts will remain necessary for the performance and durability."

CEA is working on solid oxide electrolysers as part of a joint venture with Schlumberger named Genvia. "It's one of our big activities,” Renon says. “We have a team of about 70 people working on it. “

“We strongly believe in this technology, primarily because of its promising efficiency levels. Up to 90% with heat, a niche known to suffer fatal losses with most alternative energies."

Another area of research is anion exchange membrane (AEM) electrolysers, a technology with high efficiency potential, catalysts that are not rare but still low in maturity.

"As a research centre, we don't work on alkaline and we are slowly stopping working on PEM [polymer electrolyte membrane] electrolyzers because these are more or less mature technologies,” Renon explains. “We prefer to focus our time and energy on what we believe will be most relevant in the future."

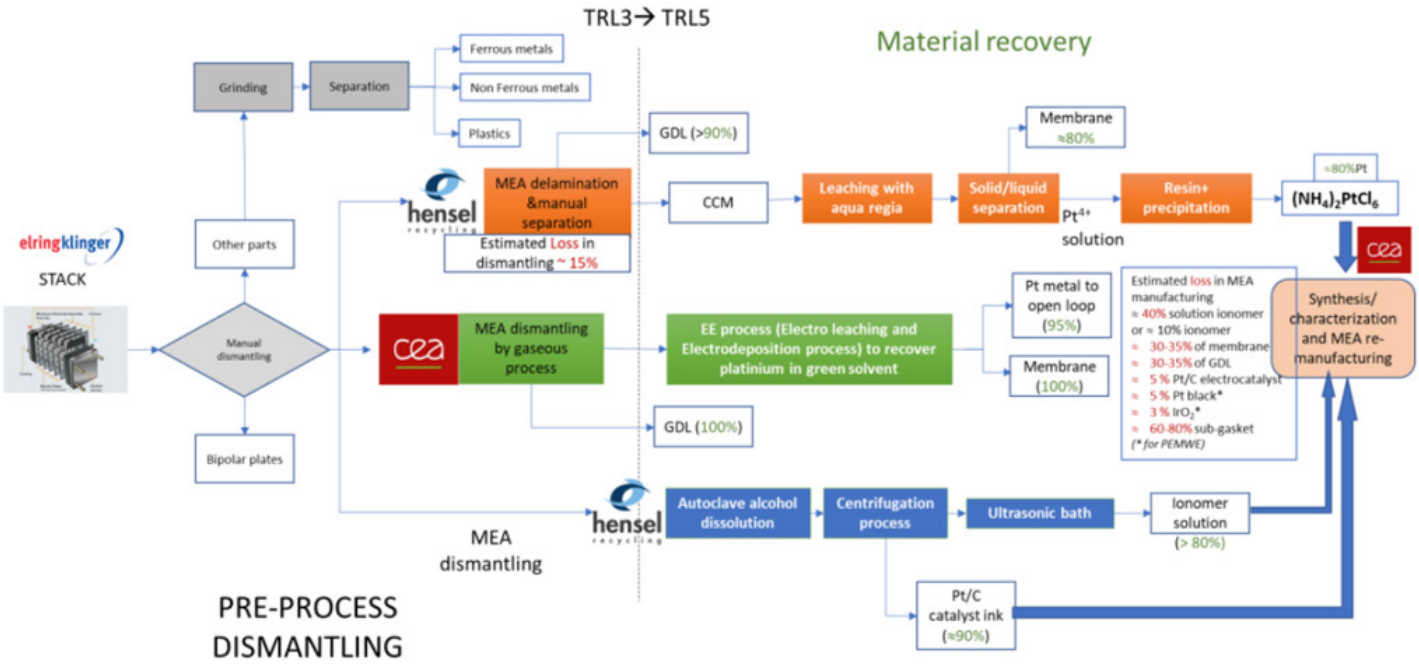

Image 15: Schematic Process for PEMFCs (reported % of recovery and losses) in Best4Hy Project

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