TOWARDS A MORE SUSTAINABLE INDUSTRY WITH GREEN HYDROGEN

KH Engineering

TOWARDS A CO_2-NEUTRAL INDUSTRY

More and more governments, partly through idealism and partly due to legal obligations, are proposing ambitious climate plans in which the words 'energy transition' and 'CO_2-neutral' are common and in which fossil fuels are to be replaced by renewable energy sources. Think, for example, of electricity from solar panels or wind turbines, green hydrogen or biofuels.

The industry in Europe is responsible for around 10% of CO_2 emissions, with in highly industrialised countries such as the Netherlands outliers up to 32%. Electrification plays a positive role in sustainability, but this is not enough. To actually reduce CO_2 emissions in the industry, a game changer like green hydrogen is needed.

The importance of hydrogen is also recognised at the policy level. *Fit for 55* is the proposal of the European Union to reduce greenhouse gases by 55% by 2030. This should be done in part by sustainably generating 35% of the hydrogen used by that time. Five years later, this increases up to already 50%.[1]

THE POWER OF GREEN HYDROGEN

Hydrogen can be produced in a sustainable way with green energy via electrolysis. This without emitting CO_2 into the atmosphere, making this process the basis for a carbon-neutral economy. As a result of the energy transition and further development of renewable energy, electrolysis and green hydrogen production are gaining importance.

The promises are big: for instance, a 1 GW water electrolyser can generate enough hydrogen in a year for 3 million households, as many as there are in Flanders, to have a whole year of heating.

ELECTROLYSIS IN THE INDUSTRY

Currently, hydrogen is mainly used for different types of products in the chemical industry. But in the future, it will also increasingly be used for high-temperature processes, such as steel production (currently, natural gas or coal is used for this purpose).

Using hydrogen in the industry effectively reverses the current cycle of making products. Now, long carbon molecules are 'cracked' in refineries into the desired end product. Instead, in the case of electrolysis, these products will be built from small molecules produced in a green way.

The potential of electrolysis as a sustainable source of hydrogen is thus very high, and much can be improved when it comes to electrolysis through further research. Enough reason to dive into this current topic! In this white paper, we answer the following questions:

- Why do we need new technology for the production of hydrogen?
- What is hydrogen production in 'island mode'?
- How do we tackle these challenges?

ELECTROLYSIS IN PRACTICE

In the field of electrolysis, there are two market-ready technologies, according to TNO and FME.[2] First, there are the alkaline systems that have been applied on a large scale (6-100 MW) for years, mainly in chlorine production. More recent are the Proton Exchange Membrane (PEM) systems. These have a smaller physical footprint, produce pressurised hydrogen and are suitable for coupling to a fluctuating energy source such as a wind farm. The largest PEM systems have a capacity of about 10 MW.

NEW TECHNOLOGY NEEDED FOR HYDROGEN PRODUCTION

Hydrogen production will be further developed by using renewable energy, from solar panels and wind turbines, for example. It is important that this is done as much as possible without adding energy from the public electricity grid, due to capacity problems in the public electricity grid. This also prevents energy from fleeing back into the grid. If too much energy is produced, the energy sources must therefore be slowed down or switched off.

Electrolysis is ideally suited for capturing the fluctuation between energy production and consumption. The development of new power electronics and new control systems to match the power supply of electrolysis with the availability of solar and wind energy and its fluctuations are of great importance for the future. By reacting quickly to fluctuations in the electricity grid and switching quickly between sources, the safety, quality and availability of electricity can be guaranteed. This is also known as ‘peak shaving’. A new alternative to ‘peak shaving’ is ‘island mode’ which brings further advantages.

EUROPEAN GRANT

To stimulate the development of innovative products and services with hydrogen technology, the European IPCEI 1 hydrogen has been launched. An IPCEI (Important Project of Common European Interest) is an integrated European project. It consists of multiple national projects of companies and/or research institutions from various EU member states that are complementary, have synergy and contribute to strategic European goals.

The second IPCEI wave, for which €785 million is available, focuses on decarbonisation of the industry, with a focus on: electrolysis capacity and technology; industrial end-uses such as steel, methanol, fertiliser and so on.

More information: https://www.rvo.nl/subsidies-financiering/ipcei-waterstof/waterstofproductie

WHAT IS ‘ISLAND MODE’?

The energy transition and hydrogen production require new forms of infrastructure and new solutions for the scale-up of hydrogen. These include large-scale hydrogen production capacities, which are directly supplied with sustainably generated energy. At times when more renewable energy is generated than can be absorbed by the electricity grid, energy sources can also be disconnected from the public grid and fully deployed for hydrogen production in an independent local electricity grid. This local grid, like an island, has no connection to the public grid. This is why it is called ‘island mode’.

Hydrogen production in ‘island mode’ is an innovative and ambitious solution for large-scale production of green hydrogen from renewable energy. Moreover, green hydrogen can be produced and exported to nearby countries through a European network of hydrogen pipelines. The technical challenge is to develop an installation that ensures that the energy flows remain balanced between generators and consumers of energy.

THE ROLE OF THE ENGINEERING COMPANY

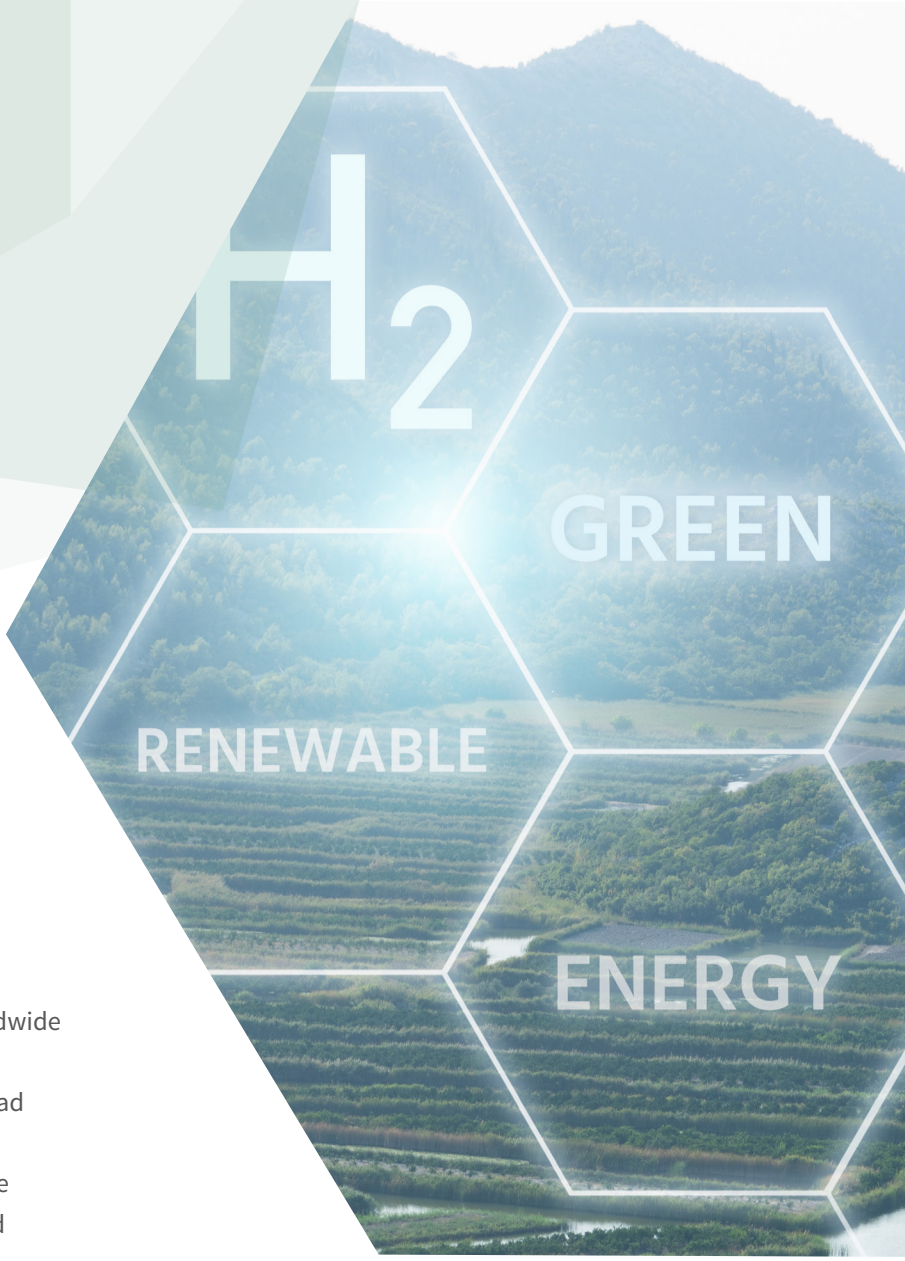
The potential of electrolysis is huge. Through further research, including in the form of pilot projects, much can be improved when it comes to electrolysis. Whether it involves participating in hydrogen production in ‘island mode’ or a new process at an industrial site, these kinds of projects can only succeed if the best people in their field work together.

From the earliest design to commissioning, the role of project management is crucial. The right project manager not only has substantive knowledge of innovative technologies, but also knows how to fit the new technology into existing processes. He or she is also the connecting link between all stakeholders.

That is quite a list of demands - and all while many organisations have had to downsize in recent years. Therefore, the choice often falls on an external expert who can devote himself or herself fully to his or her task.[3]

To contribute to the Climate Goals, our **New Energy & Infrastructure group** specifically deals with projects related to decarbonisation, energy transition, up- and recycling. In recent years, KH Engineering has already built up an impressive portfolio in energy transition projects. Think of CO_2 capture or heat decoupling from the industry to district heating.

Furthermore, through our activities, we have played an active role in resource and energy recovery from existing processes at various asset owners. We have in-depth knowledge of all required multidisciplinary fields to execute the project to perfection.



ABOUT KH ENGINEERING

As a multidisciplinary full-service engineering company, KH Engineering supports clients worldwide in the development of projects. We distinguish ourselves with our pragmatic approach, the broad technological knowledge of our colleagues and the realisation of complete projects. These range from front-end to engineering, procurement and construction management (EPCm) services for national and international clients.

KH Engineering aims to deliver innovative technological solutions by combining knowledge, capacity and experience. As a result, we create continuous developments and valuable solutions for the market. For us, safety and sustainability are the preconditions for a successful project. With a dynamic approach, our professionals ensure added value in every project. We provide our clients with a transparent and predictable project, in which 'thinking and doing' form the success of our services.

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FOOTNOTES

1 https://opwegmetwaterstof.nl/eu-raad-35-groene-waterstof-in-de-industrie-in-2030-50-in-2035/

2 Whitepaper 'Elektrolysers: Kansen voor de Nederlandse Maakindustrie', te downloaden via: https://www.tno.nl/nl/aandachtsgebieden/energietransitie/roadmaps/co2-neutrale-industrie/elektrolysers-kansen-voor-de-maakindustrie/

3 Want to know more about our approach to project management? Download this white paper.