

Successful Kick-off to the PRETZEL Project

On January 24th 2018, the Deutsches Zentrum fuer Luft – und Raumfahrt EV (DLR) hosted the official project kick-off of the project entitled: *Novel modular stack design for high PREssure PEM water electTro-lyZer tEchnoLogy with wide operation range and reduced cost (PRETZEL).*

The overall goal of project PRETZEL is to develop an innovative polymer electrolyte membrane electrolyzer (PEMEL) that provides significant increases in efficiency and operability to satisfy emerging market demands. Such electrolyzers are urgently needed in the context of the increased demands of the grid balancing market. PRETZEL is offering a break-through in becoming game changers in the field of water electrolyzers.

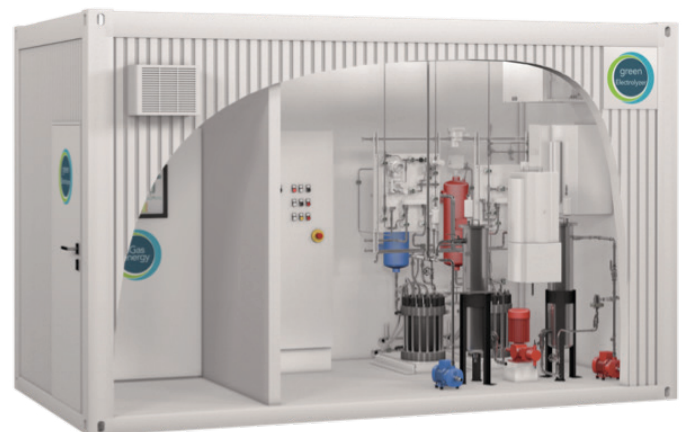
The project PRETZEL has the following objectives:

- 1) Develop and manufacture high pressure polymer electrolyte membrane electrolyzer (PEMEL) to operate at increased temperatures.
- 2) Develop and manufacture the high pressure PEMEL stack based on the novel principle of hydraulic compression.
- 3) Set-up and undertake continuous procedures to evaluate the development process through all phases against PRETZEL specifications.
- 4) Integrate the innovative PEMEL stack into a high pressure PEMEL test facility and validate the overall performance and operational criteria.

5) Disseminate and exploit the innovations in PRETZEL in order to prepare the market penetration of this new technology.

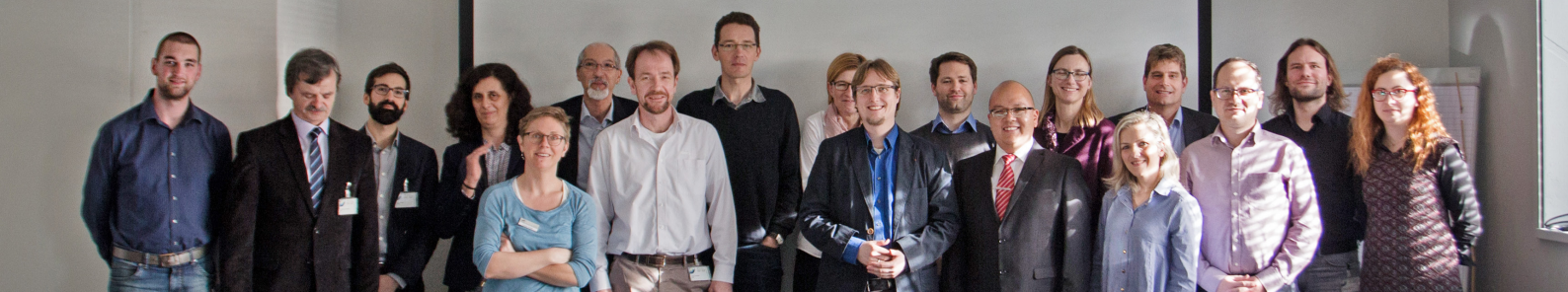
Each of these innovations have already proven in a small laboratory scale and can be considered being in the range of TRL 3. Hence, the overall goal of this project is to prove the functionality of these proven technologies in a realistic environment in order to advance them to TRL 5. In practice, this means integrating them into a fully functioning 25 kW, 100 bar electrolyzer system that reflects the realistic and highly dynamic conditions required by the market.

A central objective of this project is the development of a novel PEMEL system with a maximum 25 kW electrical power consumption that generates 4.5 m³H₂ per hour at rated power, at an output pressure of 100 bar and feed water temperature of maximum 90° C.



Schematic drawing of a PEMEL system as container solution by iGas energy.





At the system level, the specific energy demand at rated production rate will be below 25 kWh per kgH₂ referring to a system efficiency of above 70% on the basis of higher heating value (HHV). Furthermore, this system will be able to operate in overload mode referring to a production rate as high as 6.8 m³H₂ per hour (1.5 times overload). Rapid response of 1 second for a hot start and 10 seconds for a cold start are the operating targets of the system.

At the stack level, the project will implement a patented design approach based on hydraulic cell compression. This design allows for large planar cell components, which is required for future mass production, and effective cooling at very high production rates and temperature levels. Regarding sufficient stack conditioning, a cooling system will be developed for voltages of maximum 2.0 V per cell at rated power and of 2.3 V per cell in overload modus. Additionally, the target of PRETZEL is the development of a high pressure PEMEL stack, which opens a perspective for specific stack costs of below 500 €/kW. As for the production at 100 bar an additional compressor is omitted, for the targeted system specific systems costs are possible in the range of 750 €/kW.

This concept addresses the above aspects to realize the next generation electrolyzer technology, whilst meeting the needs of industrial scale hydrogen production in the near future.

Beyond these challenges, a significant increase of lifetime and improved operability will be achieved to cope with intermittent electricity supply from renewable energy sources.

This approach is encapsulated in the full title of the project: “Novel modular stack design for high PRESSure PEM water elecTrolyZER tEchnoLogY” with wide operation range and reduced cost. This is shorted to the acronym: “PRETZEL”.

Over the coming three years, the PRETZEL project will be carried out by an experienced and well-rounded consortium represented by the following partners:

- Deutsches Zentrum fuer Luft – und Raumfahrt EV (Lead Partner, Germany)
- Westfalische Hochschule Gelsenkirchen, Bocholt, Recklinghausen (Germany)
- Association pour la recherche et le développement des méthodes et processus industriels (ARMINES)
- Universitatea Politehnica Timisoara (Romania)
- Adamant Composites Ltd. (Greece)
- GKN Sinter Metals Filters GmbH Radevormwald (Germany)
- Centre for Research and Technology - Hellas (Greece)
- Soluciones Catalíticas Ibercat, S. L. (Spain)
- iGas Energy GmbH (Germany)

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