# MOBILITY & PRODUCTION

Fields of Expertise TU Graz

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Source: Lunghammer – TU Graz

**The FoE Mobility & Production is more than ever confronted with new technologies for the production, storage and use of green hydrogen.** In its recently published *Global Hydrogen Review 2021*, the International Energy Agency (IEA) discusses the role of hydrogen on the path to net zero $CO_2$ emissions from the global energy sector by 2050. Currently, the consumption of grey fossil hydrogen amounts to almost 90 million tonnes, making it one of the important global sources of $CO_2$ emissions. The scenario foresees the production of (green) hydrogen increasing to over 500 million tonnes by 2050 (approx. 60 kg hydrogen per capita and year worldwide), with hydrogen and hydrogen-based fuels such as ammonia, methanol and power-to-liquid, being used in production and transport, including shipping and aviation. Hydrogen production is mainly based on electrolysis using wind and solar energy. Biomass and biogas will also contribute to hydrogen production and can be used in combination with carbon capture and storage as negative emission technologies to remove carbon dioxide from the atmosphere. To achieve the competitive cost of green hydrogen of three euros per kilogram of hydrogen, electricity from renewable sources must be available at a price of around 2 cents per kWh. The broad expansion of electricity generation from renewable sources leads directly to the second challenge, the storage of surplus energy in large quantities and the management of seasonal fluctuations of sun and wind. The storage medium green hydrogen can be converted back into electricity with efficient technologies such as the fuel cell or used industrially via sector coupling and will thus make a significant contribution to decarbonisation by 2050.

In May 2021, Merit Bodner was appointed to the tenure-track assistant professorship in the area of Mobility and Production and assigned to the Institute of Chemical Engineering and Environmental Technology. Bodner is continuing her scientific career at TU Graz with a habilitation in the field of hydrogen fuel cells after several years of research work with European fuel-cell developers.

**Merit Bodner**

# Moving towards 80,000 Hours of Fuel Cell Operation and Beyond

Hydrogen and fuel cell technologies as viable and sustainable approaches to a renewable energy supply chain are experiencing unprecedented attention. As the industry is growing, its view is becoming increasingly holistic. Novel and innovative ways of maximising product utilisation and minimising product footprint are crucial in establishing a true alternative to conventional solutions.

Hydrogen-fuelled low temperature polymer electrolyte fuel cells have throughout the years been regarded as a viable and sustainable option in the transition to a green energy supply chain from a technological point of view, yet a lack of pressure in often purely economically driven trade-offs have for a long time hindered a large scale roll-out. As the impact and the accompanying challenges posed by climate change are becoming increasingly pressing and a threat to life as we know it, hydrogen as an energy carrier and fuel cells as a highly efficient converter thereof, are experiencing unprecedented attention.

As a price tag is more and more often put on the emission of pollutants and greenhouse gases, economic viability shifts too. However, this abruptly increased interest in the technology has put an industry, which is in the critical phase of the transition from a small scale and research-driven mind-set to mass manufacturing and the holistic >