

## Hydrogen PEM – Fuel cells for mobile and stationary applications

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*„Electricity and Hydrogen are energy carriers that are particularly applicable for electric-/fuel cell vehicles class L in city- respectively suburban congested areas and accordingly other high density areas where they can contribute in improving air quality and noise reduction. Electric mobility can provide significant support in order to achieve the Union’s 2020 ambitious climate protection - and energy targets. So stated in directive 2009/28/EG - which was implemented until December 5<sup>th</sup> 2010 by the member states – were mandatory targets for all member states for the energy share from renewable energy sources – whereas until 2020 a Union target of a minimum of 20% energy from renewable energy sources and of 10% share in renewable energy carriers especially in the sector of traffic shall be achieved.” (Preamble of directive 2014/94/EU)*

Especially in the field of duty vehicles, trucks and city buses exists great potential saving of pollutant emission. Nowadays the operator’s requirements regarding range and mission time can be complied by combination of battery- and fuel cell technology. Proton Motor develops and produces PEM fuel cell stacks and the appropriate systems that are particularly designed for this purpose. For e.g. the HyRange® 25 fuel cell system is developed for this field of application. It fits into every already electrically propelled duty vehicle or city bus. Thanks to energy stored in Hydrogen the user’s range requirements can be met without additional battery capacity. Due to higher power density compared to today’s batteries – users are enabled to transport higher payload compared to a sole battery solution. This of course is still emission free.

Proton Motor (PM) develops and produces modular scalable fuel cell systems in mobile as well as stationary fields of application on base of PEM technology. The scope of solutions provided by PM covers a broad spectrum ranging from specially developed and produced stack to turnkey applications. Based on competence in integration of fuel cell technology into complete systems the performance of PM goes clearly far beyond the interfaces. PM supports the customers as a project partner in planning- as well as in implementation phase in design, testing and initial operation and maintenance and also approval and third party certification in order to safeguard optimized system integration. A result of many years of PM’s experience is the serviceability of the products which improves availability and reduces service cost.

Hydrogen as the most important option to store energy in the future. If we want to be realistic with our targets to reach the climate control, it is essential to continue with the Energy Change. This means more use of Wind, Solar and Hydroelectric Power. But

what does this mean? Especially Wind and Solar Power are very much volatile what leads to the consequence of the use of a good and efficient Energy Storage. This role can be taken over from Hydrogen at it's best. With Hydrogen a very high amount of energy can be stored and it can be stored for a long period of time. The stored Hydrogen can be re-energized through Fuel Cells in electrical and thermal energy again, at any time at any place. This can happen in stationary applications like EPS systems like FC-Gen-Sets or Hydrogen Power Plants. We call it seasonal energy shifting to use produced hydrogen at another time, produce it during summer time with over production of solar panels and use it in the winter, when it is needed.

Proton Motor had designed, together with a manufacturer of Electrolyzers an entire system of a compact energy storage in a container, based on hydrogen and Fuel Cells. This container contains an Electrolyzer which is producing hydrogen when energy is remaining and is stored in pressured gas, in Liquid Organic Hydrogen Carrier (LOHC) or a Metal Hydride storage. This hydrogen can be re-energized on demand with Proton Motor Fuel Cell systems in electrical and thermals energy. The efficiency can be higher than 80% then, if electrical and thermal will be used at the same time. The storage can be inside the container or located outside and can be scaled up to any order.

PM offers with this system an optimal solution for Energy Park Operator, Energy Supplier and Municipal Energy Supplier. An intelligent energy management shows also solutions for Smart Grid applications. Especially for Public Utility Companies the benefit can be double. On the one hand it is electrical (and thermal) energy on the other hand it can be fuel (Hydrogen) for the city bus fleet.