Axel Seifert, Dr. Daniel Wothe

THE FUTURE MOVES WITH COMPETITIVE SYSTEM COSTS FOR FUEL CELL VEHICLES (FCEVs)!

With the TAHYA project funded by FCH JU, detailed cost pictures have been generated.

THE CHANCE FOR THE EUROPEAN AUTOMOTIVE INDUSTRY TO REMAIN IN POLE POSITION –The 20th: The DECADE OF HYDROGENIUM RISE

" The fuel cell must not remain in the niche and has great potential to outstrip conventional electric vehicles (BEV). In addition, it fits better into the actual automotive industry infrastructure and could bring the German automotive industry back into the technological leadership," says Elmar Degenhardt (Chairman of the Executive Board of Continental).

Today, the reliable figures of the evolution of costs for fuel cell technologies and hydrogen storage have been provided by the US Department of Energy (DOE). As part of a 5-year program (ending September 2021) the most recent up-date of "2019 DOE Hydrogen and Fuel Cells Program Review, Hydrogen Storage Cost Analysis (ST100)" was contracted to Strategic Analyses Inc., a consulting firm specialized on the feasibility of cutting-edge technology for the Federal Government.

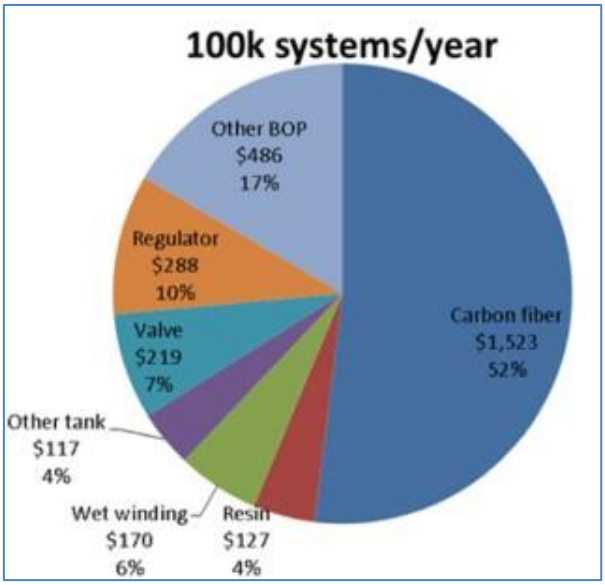

Figure 1: Cost breakdown for 70MPa hydrogen storage (DOE)

As part of the FCH JU funded TAHYA project[1], a new cost calculation model was introduced to provide a precise bottom-up approach considering possible effects of the industry of scale. Besides a detailed bill of material (BOM), all processing steps are being described and analyzed. As a result, the major cost drivers are being detected and leveraging effects quantified.

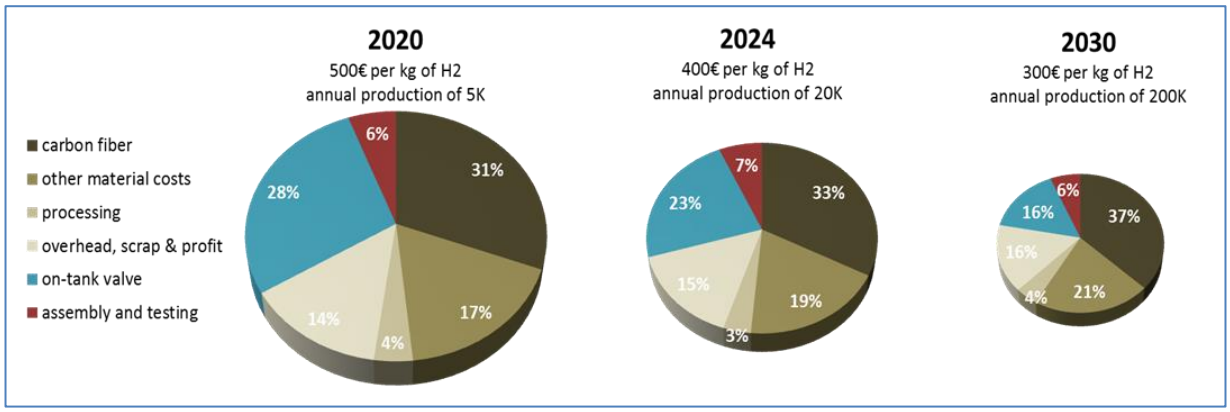

Figure 2: TAHYA cost structure for Hydrogen Storage (single tank system for 5.3 kg of hydrogen at 70MPa)

A significant difference in the cost modelling occurs when looking at the amount of carbon fiber required to store 1 kg of hydrogen at 70 MPa. According to the DOE study, a total composite reinforcement of 91 kg is needed for 5.6 kg of hydrogen. With a fiber fraction of 60 % by volume (70 % by weight), the required mass of carbon fiber is 11.4 kg per kg of H2. Furthermore, the cost of carbon fiber ("T700" grade) is estimated at more than 22 €/kg, which is more than 35 % higher than the current pricing.

The TAHYA calculation is based on a validated tank designs with less than 10 kg of carbon fiber per kg of H2. This amount will be further reduced with the up-date of the new certification standard by 2022, allowing a minimum safety factor from 2.00 instead of 2.25. Also, the trend is towards fibers with increased tensile properties ("T720" grade) to reduce the composite mass of the reinforcement. In times where the TCO (Total cost of ownership) of FCEVs (fuel cell electric vehicles) is crucial, a difference of more than 100 € per kg of hydrogen stored indicates the significant gap between the two approaches.

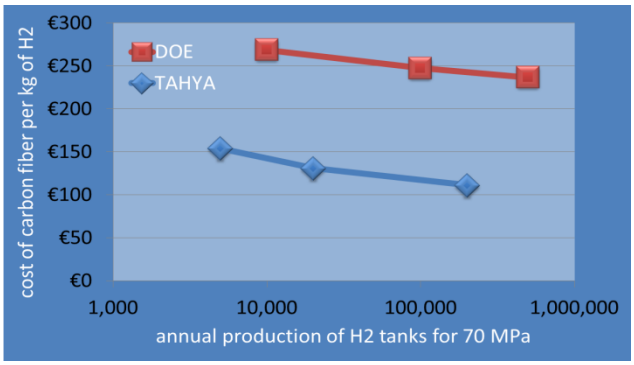

Figure 3: Cost of carbon fiber in H2 tank

[1] Fuel Cells and Hydrogen 2 Joint Undertaking under grant agreement No 779644

OUTLOOK

Europe should be confident that the cost targets set by the (automotive) industry can be achieved. The Fuel Cell can become a price competitive alternative to the battery, not only for heavy duty vehicles but for passenger cars.

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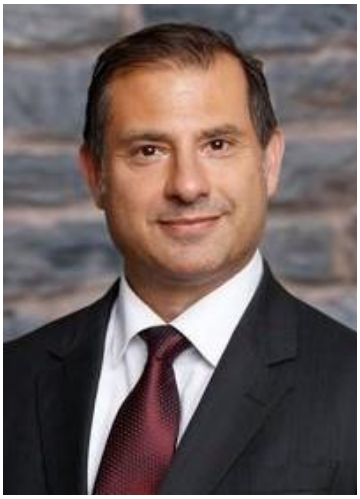

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