HYLIGHTS

Hydrogen for Transport in Europe

The GAPS analysis – minimal user requirements for hydrogen vehicles

Where in Europe and who is willing to bridge the gap between lighthouse projects and early commercialization phase?

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Disclaimer

This document is the result of a collaborative work between HyLights Industry and Institute partners. The results of the research were subsequently elaborated and presented in a coherent manner, which involved extensive stakeholder consultation in locations around the world as well as feedback from the “HyLights” Industry Partners.

The ideas presented in this document were reviewed by certain "HyLights" project partners to ensure broad general agreement with its principal findings and perspectives. However, while a commendable level of consensus has been achieved, this does not mean that every consulted stakeholder or "HyLights" Industry Partner necessarily endorses or agrees with every finding in the document. The producer of this document is the sole responsible for its content and recommendations.

Executive Summary

This study is one deliverable within the HyLights project that addresses various issues in preparation of large-scale demonstration projects in hydrogen transport in Europe. The aim of the study was to gain insights about customer opinions and perspectives on the adoption of hydrogen vehicles in the transition phase from large-demonstration to early commercialization. It has become clear in principle which markets would be most adequate and receptive to deploy a number of hydrogen vehicles and which locations in Europe provide more favourable conditions than others. Nevertheless it also became clear that some of the attractive markets are difficult to address in the ramp-up phase and thus would require further more in depth attention.

Research approach

The study has been carried out based on a number of interviews with fleet operators in ten European focus regions. The interviews were conducted based on a questionnaire with a twofold aim. First, to find out general opinions and motivations of fleet operators to introduce hydrogen vehicles in their fleet. Secondly, a quantitative part focused on technical performance requirements on the current vehicles to identify the future demand level for vehicles. Different fleet operators also utilize their vehicles in different ways. Therefore a separate part of the questionnaire was seeking information on daily utilization, routines and practices. In each of the focus regions interviewees were identified from a wide cross-section of potentially interesting users from the public and private sector. Vehicles categories taken into account for the study are mainly road certified passenger cars, delivery vans, buses and specialty vehicles such as scooters and four-wheelers. In total, 63 interviews were conducted with selected individuals which play major roles in the strategy, vehicle or purchase department of their organizations. The outcomes cannot be regarded as statistical significant sample, but were intended to provide a broader outlook about the possibilities of hydrogen vehicle adoption by fleet operators.

Motivations for hydrogen

As yet, a number of fleet operators have introduced corporate policies that can drive hydrogen deployment faster than elsewhere. E.g. these are policies on low-emission fleet vehicles, fossil free energy plans or technological leadership. Public transport companies have been identified as the main group for an intrinsic motivation to switch to zero emission vehicles. Reason for this are that hydrogen buses are perceived as necessary next technological step and alternatives such as hybrid diesel buses would not be cost-effective on the long-term. Some small and innovative operators such as the public transport in Soria (Spain) as well as RVK and the Vestische Strassenbahn in North Rhine-Westphalia (Germany) have signalled high interest on purchasing hydrogen vehicles. However this business case assumes the availability of reasonably priced hydrogen and only slightly higher priced hydrogen buses.

Commercial fleet operators tend to purely focus on cost effectiveness of vehicles if no other internal policy on alternative transport choices or lowering fleet emissions exists within the company. Those operators carefully watch the political developments and prefer to choose second-best alternative sources of energy (biofuels, other low-

emission vehicles) before considering hydrogen. In general, large commercial operators tend to be hesitant towards hydrogen due to perceived higher vehicle cost. Partly it is also caused by the need for very high vehicle reliability in the business process. Another reason is often their dependence on leasing companies and their respective vehicle portfolio. Despite some pioneering operators, massive adoption of hydrogen vehicles will not occur unless the necessary investment level compared to conventional vehicles is equalised and hydrogen as a fuel is competitively priced.

The by far two largest customer groups identified in the HyLights interview activities are municipal services and public bus operators. In the municipal services group some 13 operators mainly using vans and cars are considered and in the public bus operator group some 12 bus operators are included. All other groups consist of 6 or less users.

It seems to be misunderstood by the operators that lowering fleet CO_2 emissions cannot be done by forcing vehicle use meeting a higher emission standard. CO_2 emissions are not part of the emission standards and are currently only subject of voluntarily agreements between the EU and car manufacturers. In fact, the carbon footprint is not reduced by switching to a higher emission standard (e.g. from Euro III to IV to Euro V or VI)

A further driver for the implementation of clean hydrogen propulsion technologies are the *increasing requirements for conventional pollution abatement measures* reflected in the EURO IV, V and VI emission standards which lead to significant increases in fuel consumption. Already for the switch from EURO III to EURO IV these increases in fuel consumption can lie between 12% and 18% (reported by EMT-Madrid and RVK Cologne respectively) and thus increase the carbon footprint at the same rate. The continuously growing requirements in reducing pollutants will lead to rising invest costs and complexity of technology and sooner or later might force a technology switch anyhow to intrinsically cleaner propulsion concepts.

Vehicle performance and daily operational characteristics

Technical performance requirements of fleet operators do not represent a barrier for hydrogen vehicle deployment. In the relevant vehicle categories (small and medium sized passenger cars, delivery vans and Buses) the average requirements for standard indicators (speed, driving distance etc.) are lower than the maximum capacity of a conventional reference. Next generation hydrogen vehicles will achieve performance levels very similar to today’s conventional vehicles as far as public information is available and are therefore perfectly suitable for daily use. Generally there are no vehicle performance related reasons to refrain from the deployment of next generation hydrogen vehicles. However few constraints might remain concerning specific requirements (space, load) depending on the vehicle type (in particular vans and buses) and need to be checked on a case-by-case basis.

Research into the driving pattern and refuelling behaviour found out that not all fleet vehicles return every day back to their home base or use only a small amount of refuelling stations in their vicinity. It needs to be distinguished between company cars, vehicles for sales personnel and maintenance vehicles. In particular commercial operators maintain increasingly ‘dynamic’ fleets that do not return every day to their home base. E.g. drivers of maintenance vehicles in the telecom and energy sector receive their daily tasks by means of wireless communication and start directly from their home. In this case a wide refuelling network is utilized on a national or regional scale and does only experience restrictions by the choice of the fuel card. Yet, still a number of vehicles will pass by certain base points on their daily route.

Not all operators refuel their vehicles every day at the same station or return every day to their base: public transport operators and municipalities in the first place. On the other hand company cars handed out to the employees often travel the same route every day to their workplace and back so that installation of infrastructure in proximity of the company could supply those vehicles with hydrogen. In addition, drivers of company cars today have to fill their cars at filling stations in the company (depends on the company) or at a restricted number of public filling stations. As in the early stages hydrogen infrastructure will be only available in the major cities and along major highways, the driving characteristics has implications for the first users. A trend to open refuelling stations in the near future (2009/2010) could be detected in Germany, Scandinavia and Spain.

Policy

The lack of financial support is one of the most frequently mentioned obstacles by organizations for further procurement of vehicles for demonstration and first use. Hydrogen vehicles will not be anywhere close to cost parity with conventional vehicles unless a number of vehicles are produced on mass-scale and a lowering of cost comes into effect. Hydrogen vehicle funding opportunities provided by governments thus play a vital role for technology deployment. Germany is the only country that offers national level funding for demonstration projects in the study, but other countries are in preparation such as Norway and small funding possibilities in Spain. Regional funding is provided in NRW, Aragon and Rhône-Alpes. Indirect funding schemes through vehicle tax exemptions are applied in Norway, Denmark and will be likely introduced soon in Germany.

Conclusions

Fleet operators will be one major entry point for the early deployment of hydrogen vehicles. These seem to be a good opportunity to access a large vehicle pool that can be relatively easy supplied with a limited infrastructure for hydrogen distribution. *Mass-manufacturing and economies of scale* will bring down the cost of hydrogen vehicles over time. However, until this stage is reached a number of vehicles need to be deployed first that will still be substantially more expensive. Vehicles in large numbers are supposed to be absorbed by commercial fleet operators that maintain a larger fleet than their public counterparts, depending on national and regional preferences. But those deployment opportunities should not be seen as too 'simplistic'. Changing business processes have a large impact on the way vehicles are operated that in turn influences their refuelling needs. A growing number of operators do not use only one filling station anymore. This needs be taken into account.

The expected high investment costs for hydrogen vehicles are of major concern for the fleet operators. Equal or only marginal higher procurement costs should therefore be the target. Also the operating costs need to be equal or less (due to expected higher efficiency of the fuel cell) compared to conventional fuels. It should be mentioned that most operators are not 'prepared' to adopt vehicles since announcements about the timeline for availability of vehicles connected to a price indication remain virtually absent up to now. A repeatedly stated request by practically all respondents was the need for the *availability of a hydrogen refuelling infrastructure*.

To absorb the expected additional costs a *two component policy support* might be necessary to lead to a successful introduction in this segment: support programs for vehicle purchase subsidies and for infrastructure build-up respectively medium to long-term preferential pricing of hydrogen as vehicular fuel.

Deployment focus for volume vehicles (passenger cars, vans) should be on city/regional logistics and mail & courier collection/delivery in larger cities and urban agglomerations. These operator groups typically return daily to their home depot and/or distribution centers.

As each region has its own specific characteristics concerning the fleet adoption potential, more research on the opportunities offered by regional fleet operators might be worthwhile to be preformed. As a next step, regional actors should become engaged in *business plan activities* to elaborate on feasible vehicle numbers that could be absorbed and how the additional costs of hydrogen could be covered.

Currently it is mainly the major cities in *Norway, Sweden and Denmark as well as Germany that are increasingly becoming active in the hydrogen field*, the procurement of vehicles and the opening of refuelling stations due to availability of national or regional funding. Those regions will greatly benefit from the existence of refuelling infrastructure and are expected to absorb much quicker a number of vehicles in the early stages. In Southern Europe besides two to three metropolitan areas, it is also the small and medium-sized cities that want to achieve a pioneering position in new technologies but often lack funding.