Hydrogen Trains Workshop 15.05.17

Conclusions

The purpose of this Shift2Rail and FCH-JU workshop, hosted by HyER, was to discuss the future of hydrogen trains in Europe.

State of the art and case studies:

Policy

- DG MOVE have been following the fuel cell debate and have published a new transport package at the end of May which includes hydrogen trains. For the European Commission it is important to know: how can they best help and what support is needed?
- For the FCH-JU it is important to know where to invest in the near future. Good project ideas are always welcome.
- Emission and energy reductions are necessary for the railway sector to comply with energy policies and environmental needs. Hydrogen comes as a complete solution as an alternative to fossil fuels.

Case studies

- Groningen have looked at the introduction of hydrogen trains on regional lines and believe that it could be half the cost of electrification.
- Alstom has prototypes of regional trains to be used in four German Lander (Lower Saxony, Hessen, Baden Wurttemberg), commercial services are expected in 2020 - 2021. These are based on a former diesel design.
- Two other planned deployments have been mentioned: in Latvia and in China (100km – refuelling every 3 or 4 trips).

Technology & business case

- Transport of hydrogen: trains can transport hydrogen very efficiently as they are not subject to SEVESO: create a pipeline network without building pipelines.
- In the future, stacks will shrink (space and weight) but still the space in the locomotive is very small → for now, hybridisation strategy is key, fuel cell and batteries are complementary.
- Hydrogen combined with batteries could also help maintain right voltage on catenary.
- Business case: in the Norway case, hydrogen is the cheapest option, followed closely by batteries. Overhead lines are by far the most expensive option, especially when traffic is low.
- For hydrogen trains the CAPEX is much higher than the OPEX: fixed fuel cost for the locomotive lifetime (30 years, hydrogen fuel cells will need to be replaced every 6-8 years). The cost of hydrogen is stable, independently from fossil fuels prices.
- The industry is first investing in regional trains and shunting locomotives. Freight and mainline will follow if there is a business case. An intermediate solution for freight and mainline could be hybridisation.

Identified challenges:

- Important to break the silo approach and combine funding sources.
- To implement hydrogen fuel cell in trains, railway standards and safety regulation need to be taken into account. More studies might be needed.
- Redesign of locomotives will have to be done, which will require 4-5 years of work. For freight cases, large fuel cells will be needed. Decarbonisation of the train sector will have to happen so redesign will be necessary regardless of the alternative fuel.
- There is a need for modular approach so hydrogen installations can be easily incorporated in the train, in various configurations.
- There are some concerns about range and refuelling infrastructure for larger trains (long refuelling time). Hydrogen infrastructure companies argue that they are ready to cope with this requirement.
- For regional trains, the challenge is to bring the total cost of ownership (TCO) closer to the one of diesel trains (infrastructure and rolling stock)

Next steps:

- **Train sector:**
  - More demonstrations: need for pilots on a variety of operation situations
  - Should demonstrations be co-funded by the JUs?
  - Simulation or calculation tool needed?
  - For shunting locomotives: development of concept, feasibility and development of first prototype
  - For mainline freight: studies to investigate the functional requirements and the various technology solutions would be the first step.
- **Hydrogen sector:**
  - Need for more research on fuel cells?
  - Refuelling infrastructure – need for an improvement of the refuelling protocol and to make it faster
  - Storage – need for increased efficiency
- **FCH-JU and Shift2Rail:**
  - A support programme for a large-scale deployment of fuel cell regional trains, including infrastructure with large scale storage of hydrogen (3 000t), compression and fuelling stations would help to bring their TCO down. See the example of the fuel cell buses deployment programme supported by the FCH-JU and how it could be applied to trains.
  - Need for more feasibility studies?
  - Address safety and regulation barriers? Link with HyLAW project looking at barriers in hydrogen sector
  - How to best combine funding?
  - Facilitate discussion between all interested stakeholders.