Concept Paper for the *Study on use of fuel cells and hydrogen in railway environment*

This *Study on use of fuel cells and hydrogen in railway environment* performed by Roland Berger on behalf of the Fuel Cells and Hydrogen 2 Joint Undertaking (FCH 2 JU) and the Shift2Rail Joint Undertaking (S2R JU) is organised in four reports. The first covers the state of the art, business case and market potential for potential hydrogen rail applications. The second consists of ten specific case studies that cover the three main applications identified (multiple units, shunter locomotives and freight locomotives). The third analyses the technical and non-technical barriers facing these technologies. The fourth and final report synthesises the main conclusions and outcomes of the study.

To carry out the study Roland Berger set-up an Advisory Board composed of the most active stakeholders covering both the European railway industry and the fuel cells and hydrogen sector.

The main conclusions drawn point out a good potential for fuel cells in the railway environment for the replacement of diesel rolling stock. Some of the cases evaluated already show a positive Total Cost of Ownership (TCO) for fuel cells while in others this technology is recognised as the most adequate zero-emission alternative:

- Multiple units are seen as the application closest to the market but projects involving few trains or low daily millage will have problems to reach appropriate TCO due to the infrastructure costs.
- Shunter locomotives need further technological development but there are circumstances where they could be already competitive with diesel.
- Freight locomotives have a more difficult economic justification although if catenary electrification is not an option, fuel cells would be the only zero-emission option.

Whilst some barriers have been identified, no show-stoppers were found. To ease the most relevant barriers, three actions were suggested: a large-scale demonstration for multiple units and two research/design projects dealing with various aspects for both shunter and freight locomotives.

As part of the official presentation of the study, that will take place in Brussels on the 17th of May 2019, this workshop intends to gather the most relevant technology providers, members of the rail sector community and policy makers for a discussion on the next steps on the use of fuel cells and hydrogen in the railway environment.

The workshop will be structured in three panels, where we will discuss the technology status, the three most promising rail applications, and the political appetite and policy landscape for the introduction of fuel cells in the railway environment.