

Benchmarking of European and U.S. hydrogen roadmapping efforts: the HyWays-IPHE project

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Many regions of the world have developed hydrogen roadmaps, among them Europe and the USA. The activities of both countries include different models as well as interactions with stakeholders. The HyWays-IPHE project funded by the European Commission and the US DOE compares the hydrogen roadmaps with a view to improving the understanding of the ongoing activities and thereby supporting further roadmapping processes in IPHE countries, particularly in Asia. A multi-national group of institutes compared, in the first phase, models and approaches applied to hydrogen roadmaps in Europe and the US. In a second phase stakeholder involvement, analyses of regional infrastructure build-up, energy system modelling and energy price assumptions, modelling of economic impacts and vehicle cost analyses were assessed quantitatively and qualitatively. The third phase of the project currently under way involves a broader analysis of the roadmapping activities being undertaken by countries of the IPHE. The results of all three phases are scheduled to be disseminated at various international workshops.

In the first phase of the comparison of methodologies adopted in the EU and the US, nine hydrogen energy pathways covering production, delivery and distribution were assessed with regard to costs, energy use and well-to-wheel emissions. Both regions use a similar methodology to estimate the technical potential of hydrogen pathways but modelling philosophies and terminology sometimes differed. In the US, three models were used. They were connected to form pathways that could be compared to pathway results generated by European analysts in a single tool. Because the methodologies were similar, parameters in the various tools could be compared. The US focused on business cases and required a greater rate-of-return than Europe. European analysts assumed a smaller vehicle size in the calculations and a greater fuel efficiency than those used by analysts in the US. European energy-price projections are significantly higher than those projected by the US. Both groups also used similar methodologies for uncertainty analysis.

The second phase of the analysis shows that in both regions, stakeholders have strong but different inputs into the programs. Existing models used to analyze regional infrastructure build-up scenarios were examined with respect to objectives, spatial detail, spatial extent and data handling. An extensive toolbox is available, however lacking models with good foresight and detailed global interactions. Energy system models were similar but the prices assumed exogenously for fossil energy sources (oil, natural gas, coal) were much higher in the European model than the endogenous US price estimates. In addition, the European model was constrained in choice of primary energy according to stakeholder input leading to high diversity, while the US model was not constrained. Employment effects were modelled similarly in both regions. Also vehicle costs are comparable, however based on different assumptions on components and cost reduction.

These results, together with an analysis of a survey of roadmaps in IPHE countries will be disseminated to interested parties at international workshops and using electronic media.