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Modeling and technical-economic analysis of a hydrogen transport network for France

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INTRODUCTION

This work aims to study the technical and economical feasibility of a new hydrogen transport network by 2035 in France. The goal is to furnish the charging stations for fuel cell electrical vehicles with a hydrogen produced by electrolysis of water using low carbon energy. What is new compared to previous research work on hydrogen transport (see André et al [1] or Reuß et al [2]) is the use of low-carbon electricity to produce green hydrogen.

EXPERIMENTAL/THEORETICAL STUDY

On the demand side, we assume that all drivers driving more than 20,000 km per year will switch to fuel cell electrical vehicles. This corresponds to a total demand of 100TWh of electricity for the production of hydrogen by electrolysis. To meet this demand, we primarily use surplus electricity production from wind power. This surplus will satisfy approximately 10% of demand. We assume that the rest of the demand will be produced using the surplus from nuclear power plants. We assume decentralized production, namely that 100 MW electrolyzers will be placed near the electricity production plants. Using an optimization model, we define the transport network for this hydrogen between the points of supply and the points of demand (the regions of France).

RESULTS AND DISCUSSION

Given the short distances between supply and demand, the model established that all hydrogen will be delivered by truck. The total annual cost of this network was estimated at 502 638 644€, which corresponds to €0.31€/kgH2.

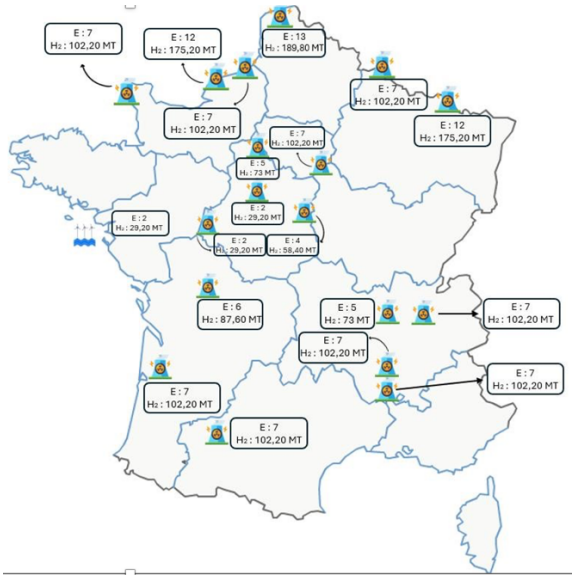

Fig. 1 Decentralized production of low carbon hydrogen

CONCLUSION

The comparison with more centralized production envisaged in Germany makes shows a reduction of a factor of 2 in this distribution cost with a decentralized production.

REFERENCES

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