

## Conclusions:

A journey across all the North Sea Region countries can be partly completed with the current network of refuelling stations. The HyTrEc partnership has proven that it is possible to travel across Belgium, Germany and Denmark in a fuel cell vehicle.

The car performed very well in challenging weather conditions including heavy snow and below freezing temperatures, however there are some considerations to take note of including:

- at present the journey is likely to require more refuelling stops than a conventional vehicle - due to the available refuelling pressure and locations of stations (off the optimum route);
- forward planning is essential due to the accessibility of some stations (not all stations are publicly available and some require appointments in advance);
- operating systems differ between stations which can make a long distance journey more challenging. Preparation in advance is required.



## Recommendations:

- Ensure all new stations are publicly accessible and built in convenient locations on main transport routes;
- Operators should guarantee high availability rates;
- An online map should be developed showing real time availability of all stations;
- Standardise the refuelling and payment system to ensure long distance journeys are feasible and can be done without the need for planning in advance;

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# HyTrEc

Hydrogen Transport Economy  
for the North Sea Region

## A Hydrogen Journey through the North Sea Region Putting theory into practice



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The Hydrogen Transport Economy (HyTrEc) project aims to improve access to and advance the adoption of hydrogen as an alternative energy vector across the North Sea Region. The project works to identify and address structural impediments constraining development of and access to refuelling infrastructure and adoption of this alternative fuel in urban and rural settings.

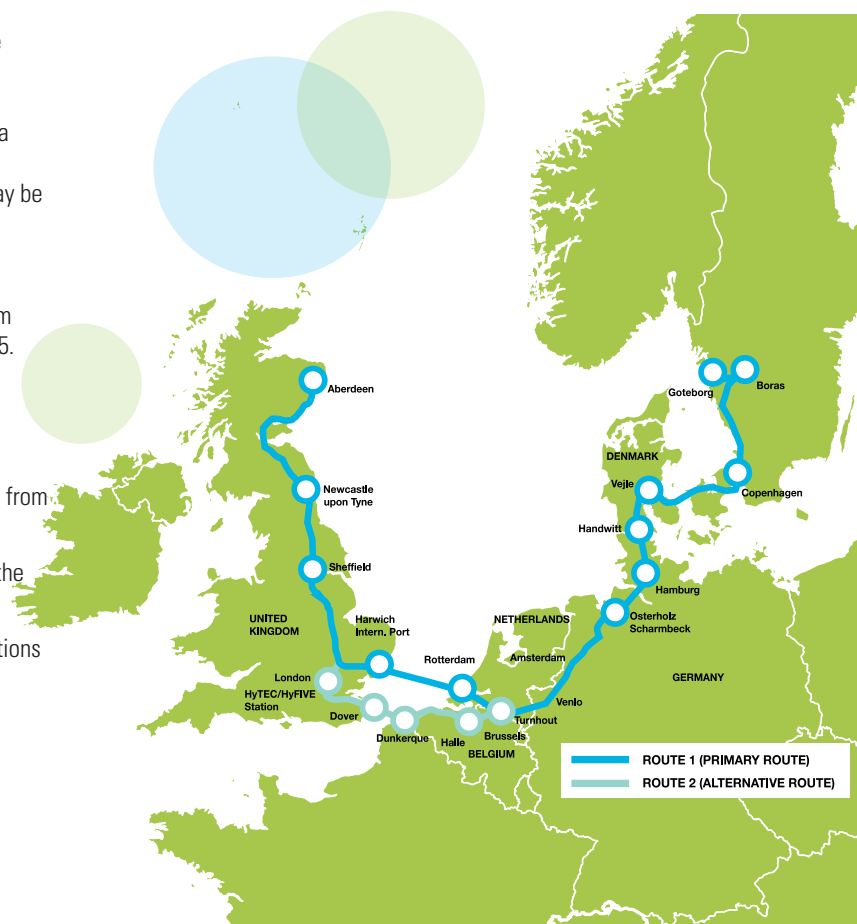
As part of the project a desk based study was undertaken to model a cross border journey in a fuel cell car from Aberdeen, Scotland to Gothenburg, Sweden. The route through the UK, Belgium, the Netherlands, Germany, Denmark and Sweden demonstrated what might occur when travelling through Northern Europe (the North Sea Region) in a Hyundai IX35 fuel cell vehicle taking into consideration regulations, restrictions or issues that may be encountered along the way.

In order to test the concept model and put theory into practice, part of the journey was travelled (from Belgium through Germany to Denmark and back) in January 2015.

### What we found in theory:

- The model journey covers approximately 2,500km, crossing 7 countries and 6 borders a one way route from Scotland to Sweden;
- The one way trip required 6 refuelling stops along the way  
(the optimum is 4 refuels but due to location of stations more stops are required);
- It was necessary to plan the route based on the refuelling station network rather than the shortest route;
- Average fuel consumption: 0.95 kg per 100km;
- Total fuel consumption: 22.77 kg hydrogen;

- EU guidelines and regulations for the use of hydrogen transport are in place. However, most North Sea Region countries do not have cohesive rules and provisions as yet and they tend to vary greatly between member countries;
- The Channel tunnel prohibits any vehicle that is capable of running on flammable gas within the tunnel;
- Service infrastructure is not yet in place to deal with a breakdown.



### What we found in practice:

In practice, only part of the theoretical route was driven from Halle, near Brussels to Vejle, Denmark and back covering approximately 1,865 km. This meant crossing four countries, three borders and eight provinces.

- The round trip required 9 refueling stops along the way (8x700 bar, 1 x350 bar);

The vehicle was refuelled at:

- the Colruyt station in Halle, Belgium (operated by WaterstofNet);
- the Automotive Campus Helmond station in Helmond, Netherlands (operated by WaterstofNet);
- the public Air Liquide Höherweg station in Düsseldorf, Germany;
- the public Vattenfall Hafencity station in Hamburg, Germany; and
- the H2 Logic public station in Vejle, Denmark.
- Average fuel consumption: 1.21 kg per 100 km or 83 km per kg of hydrogen;
- Total fuel consumption: 26.3 kg hydrogen;
- Each station required a different refuelling card (Radio-frequency Identification tags) which needed to be acquired in advance of the journey;
- Station availability is essential, particularly when relying on a small network of stations to complete the journey.