HYMOTION - UNLOCKING LOW CARBON TRANSPORT OPPORTUNITIES IN THE NORTH WEST

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#h2nw
Unlocking low carbon transport opportunities in the North West
HyNet Project Summary

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
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</thead>
<tbody>
<tr>
<td>Hydrogen produced per year</td>
<td>7.0 TWh (180m kg)</td>
</tr>
<tr>
<td>Industrial users</td>
<td>10</td>
</tr>
<tr>
<td>Carbon captured per year</td>
<td>1.5m tonnes</td>
</tr>
<tr>
<td>New hydrogen pipeline</td>
<td>109km</td>
</tr>
<tr>
<td>Blending level</td>
<td>15-20%</td>
</tr>
<tr>
<td>Blend customers</td>
<td>c.2m</td>
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</table>
HyMotion Summary
Secure local political support for wider HyNet project

Goals of HyMotion

Goals

- Build upon existing cost and emissions evidence base
- Model scenarios for future deployment of vehicles and HRSs
- Highlight market opps and roadmaps to mass deployment
- Identify and support early deployment projects

Outcomes

- Influence Govt to put in place appropriate policy support
- Secure local political support for wider HyNet project
- Demonstrate solutions to enable network-delivered H₂
Hydrogen supplied by HyNet network delivers mobility-grade hydrogen at **40-70% lower cost than electrolysis**

Hydrogen supplied by HyNet network can be **6 times cheaper than hydrogen delivered by tube trailer**

Both BEVs and FCEVs needed to meet CO2 targets: different strengths: long range / short range
Hydrogen cars, buses, trains and ships are ready for deployment. Challenge to bring Hydrogen HGVs to UK

Cost of FCEVs will be similar to BEVs when production volumes reach parity

Under our medium scenario, FCEVs could reduce mobility-related CO$_2$ emissions by around 350 ktpa in the North West by 2030

Networked-hydrogen delivers mobility energy more easily, and with lower environmental impacts and costs than electricity on its own
Hydrogen Distribution Costs

Hydrogen distribution cost comparison (in £/kg) for different delivery options

Key Assumptions:
- HRS is 100 km from point of production (200 km round trip for tube trailers)
- Each tube trailer delivers 750 kg $H_2$
- 1km dedicated pipeline required for network delivery (as a ‘spur’ to planned HyNet pipeline)
Hydrogen Production and Distribution Costs

Effective current costs of production (sales margin not included) to meet a demand of 2,000 kg/day

- Onsite electrolysis (grid electricity): £7.4/Kg
  - Electricity @14p/kWh: £1.4/Kg
  - Production Capex: £0.9/Kg
- Offsite electrolysis (renewable electricity): £6.4/Kg
  - Electricity @5p/kWh: £2.8/Kg
  - Production Capex: £1.0/Kg
  - Other production Opex: £0.1/Kg
  - Purification cost: £0.9/Kg
- HyNet (grid gas, CCS, pipeline): £3.6/Kg
  - Production cost (includes Capex and Opex): £1.6/Kg
  - Pipeline distribution cost: £0.4/Kg
Potential Refuelling Network in 2030

- 8-15 filling stations in North West can provide good coverage of region.
- Focus on strategic locations close to major roads for cars and at return to base depots for HGVs
- Hydrogen distribution costs optimised by locating stations close to HyNet dedicated hydrogen pipeline

Source: Google My Maps
## Resulting Sector Roadmaps

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<thead>
<tr>
<th></th>
<th>2020</th>
<th>2025</th>
<th>2030</th>
<th>2040</th>
<th>2050</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cars</strong></td>
<td>Limited cars on market</td>
<td>Hyundai, Toyota, FAW move to mass market production</td>
<td>Large range of vehicles available</td>
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<tr>
<td><strong>HGVs</strong></td>
<td>Demonstrations in US, Norway, China</td>
<td>Commercial vehicles launched in key markets</td>
<td>Large range of vehicles available</td>
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<tr>
<td><strong>Trains</strong></td>
<td>First fleet operations in Germany, UK and Austria</td>
<td>Rolling stock commercially available in key markets</td>
<td>Large range of vehicles available</td>
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<tr>
<td><strong>HRSs</strong></td>
<td>Subsidised HRSs in strategic locations</td>
<td>Hydrogen demand sufficiently high to support unsubsidised HRSs</td>
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<tr>
<td><strong>Hydrogen Supply</strong></td>
<td>Electrolytic Hydrogen</td>
<td>HyNet ATR + CCS in NW</td>
<td>Further large scale production from ATR/SMR, followed by gasification and offshore wind</td>
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<tr>
<td><strong>Hydrogen Distribution</strong></td>
<td>By road</td>
<td>Low cost HyNet pipeline in NW</td>
<td>Hydrogen networks extended across UK</td>
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Download the full report

www.hynet.co.uk/transport