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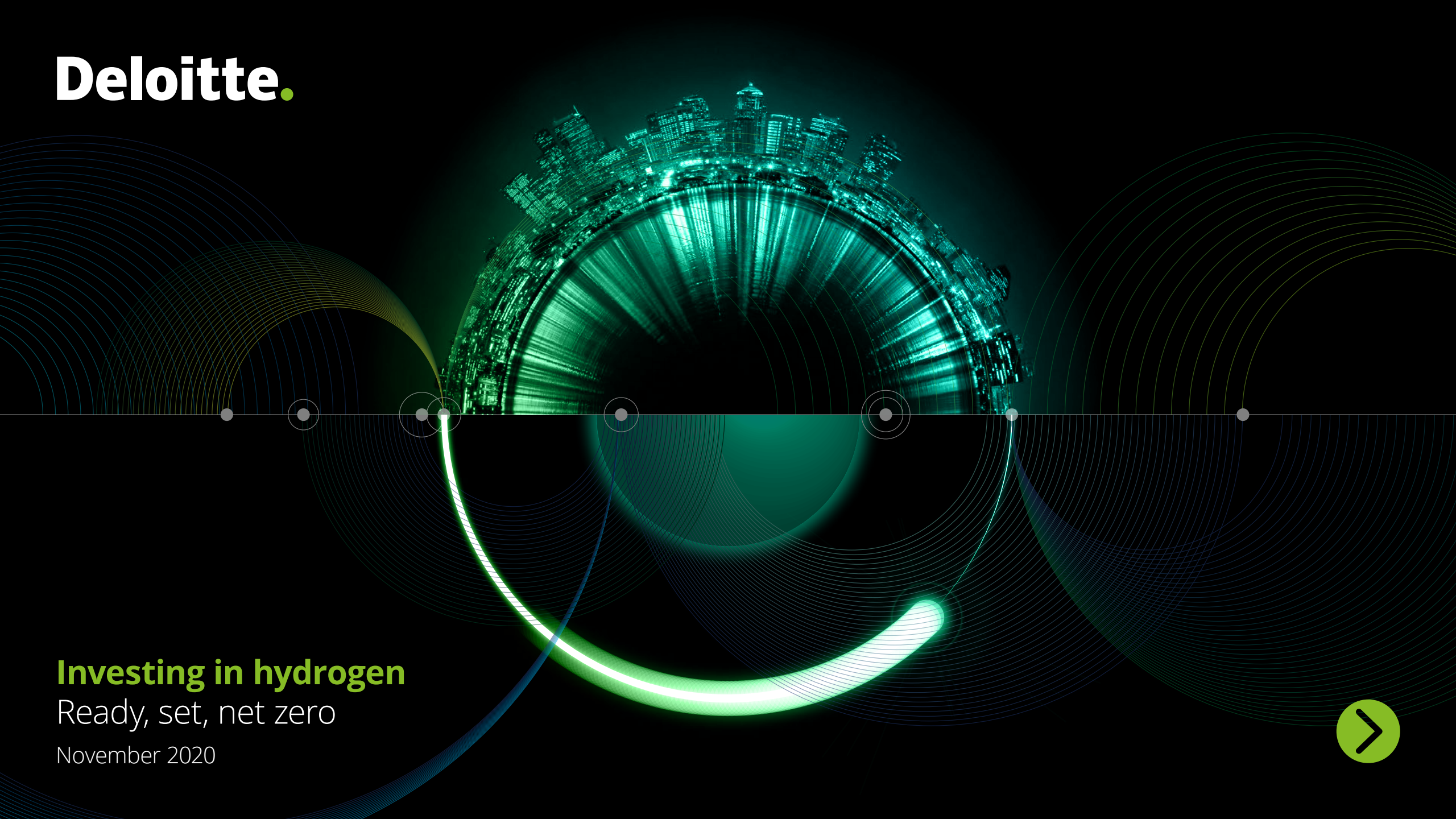


Investing in hydrogen

Ready, set, net zero

November 2020

Executive summary

Hydrogen will play a crucial role in the UK's efforts to reach its net zero target for 2050. It could help decarbonisation efforts in a number of sectors, but needs investment and policy support to establish demand, increase the scale of deployment and reduce costs. This report investigates the costs of hydrogen under different pathways to net zero and factors that could make it more attractive to investors.

With only 30 years to go to 2050, and although good progress has been made, the size of the UK's decarbonisation challenge is huge: how to reduce, eliminate and, if necessary, decarbonise fossil fuels at minimal cost and disruption, while maximising opportunities for all stakeholders.

"Hydrogen could support the UK's decarbonisation efforts in a number of applications."

What roles could hydrogen play in the UK?
Hydrogen could support the UK's decarbonisation efforts in a number of applications. Its contributions could be particularly important in sectors where greenhouse gas emissions are difficult to abate:

- **Heat** – by replacing natural gas and providing low or zero carbon heat for buildings and industrial use
- **Transport** – by replacing fossil fuels in segments where electrification is not possible or practical (heavy goods vehicles, buses, trains, ships and aeroplanes)
- **Industrials** – by possibly replacing fossil fuels as the reducing agent in steelmaking.

In the **power sector**, hydrogen could be used to store low-cost, excess renewable electricity. This in turn would increase short-term and seasonal system flexibility, and support the integration of a higher level of renewable generation in the energy system.

What does our analysis show?

We have created a bespoke cost model to understand the impact of each segment of the hydrogen value chain – from production through to storage and transport – on the final levelised cost of hydrogen.

Hydrogen production is likely to be the largest cost component of most hydrogen projects, according to the model. In production technology alone, somewhere between £3.5 billion to £11.4 billion would need to be invested by 2035. Further investments will be required in carbon capture, hydrogen conversion, storage and transport infrastructure.

Conversion treatments would most likely be the second largest cost component across the hydrogen value chain.

Storing hydrogen in large quantities over longer time periods is most cost effective in salt caverns and compressed gas containers. While salt caverns have geographical constraints, they would ideally serve the heat, industrial and potentially, power sectors, particularly those near industrial clusters where hydrogen demand from several sectors may be concentrated. Compressed gas containers can be placed closer to demand centres and could also serve multiple sectors, including transport and power.

Transporting hydrogen is most cost effective in pipelines in a gaseous state over long distances and in large quantities, according to the model. Trailers – gaseous and liquid hydrogen and ammonia as well as liquid organic hydrogen carriers – are more expensive than pipelines on a levelised cost basis. They are likely to serve sectors and customers where smaller-scale transport is needed on an ad hoc basis or for shorter distances.

Reducing the investment needed in hydrogen production, and conversion treatments in particular, could have a significant impact on the final levelised cost of any hydrogen project. In the transport sector, efforts will need to focus on reducing the costs associated with refuelling stations, which constitute another major component of the final levelised costs. Any reduction in operating costs will further improve the overall competitiveness of hydrogen projects.

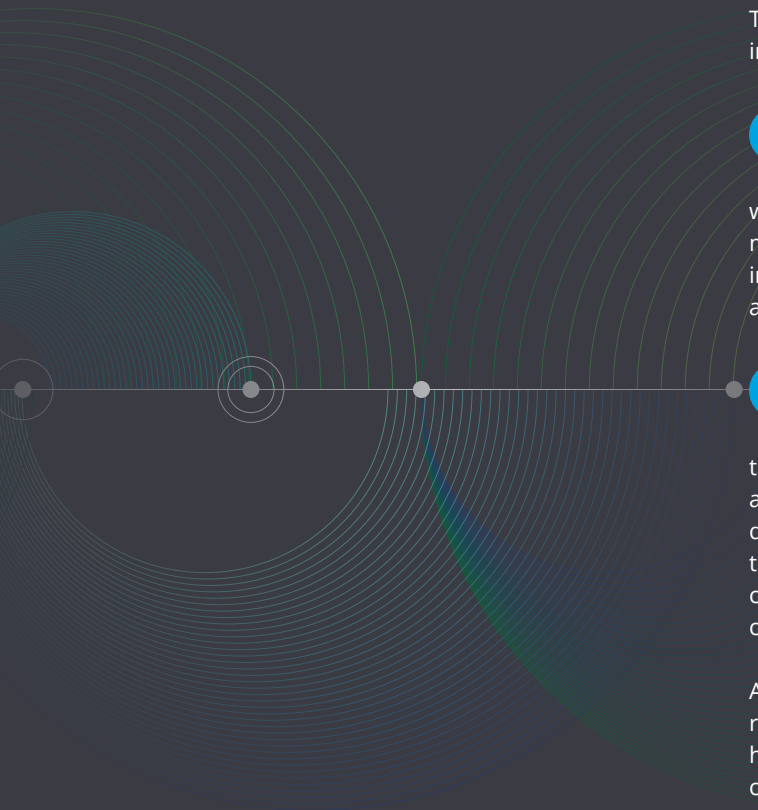
"Hydrogen seems to offer abundant opportunities for future investment."

How can hydrogen be made more attractive to investors?

Hydrogen seems to offer abundant opportunities for future investment, but demand for the commodity is far from certain. While a number of hydrogen pathways are plausible, the volume of demand projected by pathways and applications varies widely, making it challenging for investors to understand the scale of the opportunity.

Time is also of the essence. The majority of financial decisions need to be made in this decade to support the UK's net zero ambitions. In the absence of a nationally coordinated effort at the moment, hydrogen development might be fragmented and limit cost reduction opportunities in future years.

While investors are used to dealing with some uncertainty, given the size of the challenge and the speed with which decisions need to be made, they need to be confident that there will be demand for low carbon or carbon-free hydrogen and that they will see a return on their investments.



Therefore, there is an urgent need for targeted policy interventions in a number of areas, including:

A national strategy and roadmap

A national strategy would show investors a strong UK commitment to hydrogen, while a roadmap would be helpful in developing the regulatory and support mechanisms to deliver the strategy. This should also boost interdependencies between sectors that use hydrogen to achieve the best overall outcomes.

Short- to medium-term funding to reduce risk and stimulate innovation

Producing hydrogen is currently more expensive than other low carbon fuel sources. Investments may also carry higher risk associated with technologies, the deployment of which is limited on a large scale, and technology obsolescence. There is also a lack of clarity on risk allocations between investors and consumers/taxpayers.

At least in the early stages of development, hydrogen will require additional policy support or funding to help cover higher costs, reduce risk and create long-term revenue certainty. Similar support will be needed to encourage innovation to reduce technology costs and to understand hydrogen's role in cross-sector integration better.

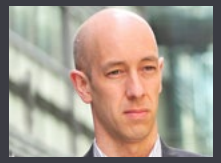
Successful support mechanisms already exist in the UK – such as Regulated Asset Base models for economic regulation of monopoly infrastructure assets or Contracts for Difference for stimulating investment in renewable energy generation. Work is already underway to identify the appropriate mechanism. The chosen mechanism will need to ensure compatibility with existing policies through a detailed market design and provide investors with more certainty to enable deployment on a commercial scale.

Sectoral coordination

Greater coordination will be needed between the sectors using hydrogen in the future. Such coordination would be easier based around industrial hubs or clusters where opportunities are more immediately visible and stakeholder objectives are more aligned. It will be more challenging on a regional or national level, although the government could play an active role in helping to align the interests of various stakeholders in opening up more opportunities for investment.

Regulation

Work is already underway to establish the changes necessary in regulatory regimes and standards for the safe use of hydrogen across the national infrastructure and in people's homes and businesses. This work needs to continue and be adopted as soon as possible to 'future-proof' the energy system.



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Looking to invest in hydrogen?

Please request a briefing session if you would like to discuss this analysis – or the broader topic of energy transition – in more detail with our team.

Request a briefing meeting

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