How hydrogen can help support the economic recovery

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Chemical Industries Association

Working for chemical and pharmaceutical businesses

About us

CIA is the organisation that represents chemical and pharmaceutical companies located throughout the UK.

The UK chemical and pharmaceutical industries have a strong record as manufacturing's number one export earner (on a value-added basis) and a provider of essential inputs to UK value chains. This includes products and technologies which are key enablers of climate change solutions. We therefore have a strong contribution to make both to rebalancing and greening the economy.

However, the chemical industry is energy intensive, competes globally for market share and inward investment, and has already done much to improve the energy efficiency of our existing production assets. Our contribution is therefore critically dependent on secure and competitive energy supplies and carbon reduction schemes which do not leave us internationally exposed. Energy is our number one issue.

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Hydrogen and the chemical sector

Hydrogen could play a pivotal role in eliminating the carbon footprint of energy and feedstock in the chemical sector. A reliable and competitively priced hydrogen network in the UK would help to enhance the competitiveness of UK industry and would attract inward investment. However, the cost of hydrogen, as well as the energy-intensity of the industrial process and its exposure to international competition, will dictate whether UK industry is able to use hydrogen to reach net zero.

The challenges

The overall capital investment required to convert UK industrial sites and equipment is ~£3 billion.[1] Under normal circumstances, securing capital to invest in fuel-switching would be difficult for chemical firms based in the UK. But these are not normal circumstances. Our manufacturers are faced with a new and uncertain trading regime, a pandemic, a deep recession and an energy transition which is driving up the price of UK energy. The below outline the challenges facing the UK chemical industry: [2]

1. **Energy prices and policy cost:** UK energy and carbon costs are significantly higher than elsewhere, making the UK a less attractive investment location for manufacturers, including for upgrades to existing assets.
2. **Internal competition for resources and funding:** Our sector is typified by multi-national firms in which UK-based operations are competing for investment with more profitable projects around the world.
3. **Stringent return on investment requirements:** The industry standard return on investment is 1-2 years, which places many decarbonisation projects outside of the time horizon for business decision-making.
4. **Uncertainty in policy and regulation:** Legislating for net zero by 2050 gives industry certainty of the direction of travel, but significant investments in fuel-switching require supportive funding and policy frameworks.
5. **Access to capital and funding:** Current hydrogen funding is comprised of small, distributed pots of funding which are burdensome to apply for and insufficient for the transformation required.[3]
6. **Commercialisation of new and unproven technology:** The cost of being a first-mover cannot be mitigated by charging a higher price for our products, because we compete on price with cheaper production locations.
7. **Long lifetime of major equipment:** The equipment that would need to be replaced on site is long-lived (20-30 years), so any fuel-switch would need to coincide with a site's current assets' end-of-life.
8. **Operational cost:** Current hydrogen fuel costs are significantly higher than natural gas and switching to hydrogen would render UK manufacturers internationally uncompetitive.

In addition to cost, there are technical constraints relevant to hydrogen in our industry:

9. **Hydrogen as a fuel:** Use of natural gas in the chemical industry is highly process specific. Companies manufacturing similar products may use gas very differently, operating furnaces or other equipment with different tolerances, temperature and safety requirements. The advantages and disadvantages of blending hydrogen into our supply will depend on the stability of the gas composition, its calorific value and the volume of consumption required, as well as the equipment and process on site.
10. **Hydrogen as a feedstock:** Natural gas is not just a source of energy but an essential feedstock (raw

[1] https://static1.squarespace.com/static/5b8eae345cfd799896a803f4/t/5e287d78dc5c561cf1609b3d/1579711903964/WP6+Industrial+Heating+Equipment.pdf

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/416669/Chemicals_Report.pdf

[3] Low-carbon Hydrogen Fund, Industrial Fuel Switching Competition, Hydrogen Supply Programme, Industrial Energy Transformation Fund, and Industrial Strategy Challenge Fund

material) for chemical manufacturing, and so gas quality concerns are highly process specific. For example, hydrogen production is a step in the existing ammonia manufacturing process, and so mixing hydrogen into the gas supplying the plant would represent a costly duplication of effort. For ammonia production it would be better to continue to supply natural gas in its current form, whilst facilitating access to carbon capture and storage (CCS) for the CO_2 by-product.

11. **Security of supply:** The most effective way to run a chemical plant is to maintain a 100% production rate for as long as possible. Often plants run for 3-4 years without shutting down. If the UK moved to hydrogen before our neighbouring gas networks, storage would be fundamental to smoothing out demand requirements, allowing high utilisation rates whilst providing for the large seasonal swings in gas demand. The ability to store hydrogen in a similar way to natural gas, i.e. in salt caverns or depleted gas fields, means that hydrogen could be held in seasonal storage in the way natural gas is now.

Creating a hydrogen economy in the UK

Our sector is already a significant participant in the hydrogen economy, we are both a major producer and consumer of hydrogen, and these roles will only become more important as we transition to net zero. To establish a successful hydrogen economy, the UK needs a long-term and flexible strategy that establishes the conditions needed to invest. This strategy should have at its heart the objectives below:

1. **Cost reduction:** Significant and long-term financial support is required, for the development, deployment and operation of hydrogen technologies. The government must increase the funding available for "shovel-ready" projects, to demonstrate the safety and feasibility of hydrogen in an industrial context, and to allow the market to begin to drive cost and efficiency improvements. The government should consider grants or tax incentives, to encourage companies who are considering replacing existing assets, or installing new facilities, to invest in more expensive hydrogen-ready technology. Incentives for hydrogen production and consumption must guarantee UK industry an internationally competitive supply of energy.
2. **Reliability:** As an energy-intensive industry, with many sites whose operations are vulnerable to interruption, the chemical sector needs a reliable and predictable energy supply. Hydrogen technologies must be rigorously tested and proven to be reliable over the long-term.
3. **Competition:** Subsidy business models, to encourage new hydrogen production assets (green or blue) must maintain a level-playing field for existing production assets. Once the hydrogen economy starts to accelerate, the regulator must ensure that the hydrogen market is subject to effective competition, to help drive down prices.
4. **Infrastructure:** Strategic planning will be needed to store and transport hydrogen through our interconnectors, ports, transmission and distribution networks, safely and efficiently.
5. **Research and innovation:** Support is required to progress hydrogen technologies at low Technology Readiness Levels (TRLs), and to improve, upscale and lower the cost of existing technologies.
6. **Free trade:** In the current natural gas market, security of supply is ensured by interconnectors and liquified natural gas (LNG) shipments. Free trade of hydrogen must be guaranteed through adequate planning, policy and regulatory provisions.
7. **Certification:** The government must work with closely linked markets (e.g. the EU), on standards for certifying the carbon intensity of hydrogen production, and to establish "guarantee of origin" certificates.
8. **Demand-side measures:** Support for hydrogen in the home and for transport would help to boost demand for the fuel, allowing market forces to engage and bring down the cost of supply. The government should facilitate the amendment of the Gas Safety Management Regulations to allow for hydrogen injection into the domestic grid, and progress hydrogen and ammonia solutions for transport. Ammonia can provide an effective method to store and transport hydrogen, and as a clean, hydrogen-rich fuel, it can also be burnt in an engine or used to produce electricity in a fuel cell.