

# The UK Hydrogen Strategy, the New Anglia “Hydrogen Hub” and a Different Type of Cluster

Position Paper by Hydrogen East

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## Introduction

### The purpose of this paper is to:

- Provide a high-level summary of the recently published *Hydrogen Strategy* and the supporting documents
- Identify the main themes of stakeholder comment on it
- Identify key implications for the East of England
- Set out how this region can demonstrate leadership in development of an alternative type of cluster that is different to the industrial projects that currently dominate policy and media attention, and
- Demonstrate how the work of Hydrogen East is already preparing the ground for a targeted regional approach.

### National Framework

Another energy carrier will be required to deliver the *2050 Net Zero target* and enable a more flexible, resilient, and integrated energy system, and hydrogen is increasingly seen as playing a complementary but essential role beyond low-carbon electricity in decarbonising the economy. The Government had already set a target of 5GW of hydrogen capacity by 2030 in the Prime Minister's *Ten Point Plan* issued last November.

The long-awaited *Hydrogen Strategy*, as promised in the *Ten Point Plan*, issued on 17 August 2021 along with several significant supporting consultations. General reaction has been that the strategy – while a useful consolidation of official thinking at over 120 pages – doesn't add hugely to current thinking. But the supporting consultations and analysis do seem to show that the Government is joining up the dots, and they should allow a more holistic treatment of its approach to hydrogen development moving forward.

The Government had already agreed to boosting the formation of industrial clusters in "hard-to-abate" sectors and backing proposals to promote the use of hydrogen in heating, notably by sign-posting its intention of potentially permitting up to 20% hydrogen blending into gas networks. It has previously also set out high-level plans to establish a £240mn *Net Zero Hydrogen Fund*. The energy source was extensively name-checked in the *Energy White Paper* in December 2020 and the *Industrial Decarbonisation Strategy* in March 2021. Most recently, hydrogen also featured in the *Transport Decarbonisation Strategy* in July, and it is clearly being positioned to play a significant role in decarbonising heavy and long-distance transport.

The *Hydrogen Strategy* confirms all this and also provides some new insights into when or how, including how domestic supply chains can be supported. It is a difficult exercise for Government as so much has happened within the emergent hydrogen sector over the past two years, and in many ways the document is the Government's chance to pause for breath and take stock. It draws together the disparate strands that have been laid out since 2017's *Clean Growth* and *Industrial Strategies* and clearly places them within the context of the commitments first set out in the *Ten Point Plan* and then establishes a framework for articulation and development over the coming years based on a series of consultations and commitments.

Some of us in the energy industry had hoped that, given the continuing development and refinement of a wide range of development proposals, the level of ambition set out in the *Ten Point Plan* might be increased in the strategy paper. The last nine months since its publication has seen:

- A diverse range of investment plans for new projects internationally
- Advancement of work around the industrial clusters, the Teesside Multi Modal Hydrogen Transport Hub and a range of other initiatives around among other things Green Distilleries and Clean Maritime Transport, and
- The narrowing of the economics between green and blue hydrogen.

However, while the Government notes that “it is aware of a potential pipeline of over 15GW of projects”, recent calls by the All-Party Parliamentary Group on Hydrogen<sup>1</sup> and some industry groups to increase the 2030 target have been ignored.

The covering statement continues to place the same emphasis on “low-carbon hydrogen” as the *Ten Point Plan* and notes how the strategy sets out “our twin-track approach to supporting both electrolytic ‘green’ and carbon capture (CCUS)-enabled ‘blue’ hydrogen production, alongside other potential production routes.” It seems to be trying hard to avoid any explicit references to colour coding, but instead places much greater emphasis than previously on carbon intensity of hydrogen. The strategy is described as “outlining a comprehensive roadmap for the development of the wider hydrogen economy over the 2020s to deliver our 2030 5GW ambition”.

The main targets and aspirations are summarised in Box 1, and the *Hydrogen Economy 2020s and beyond Roadmap* from the document is reproduced at Figure 1 over the page.

#### **Box 1 – Targets**

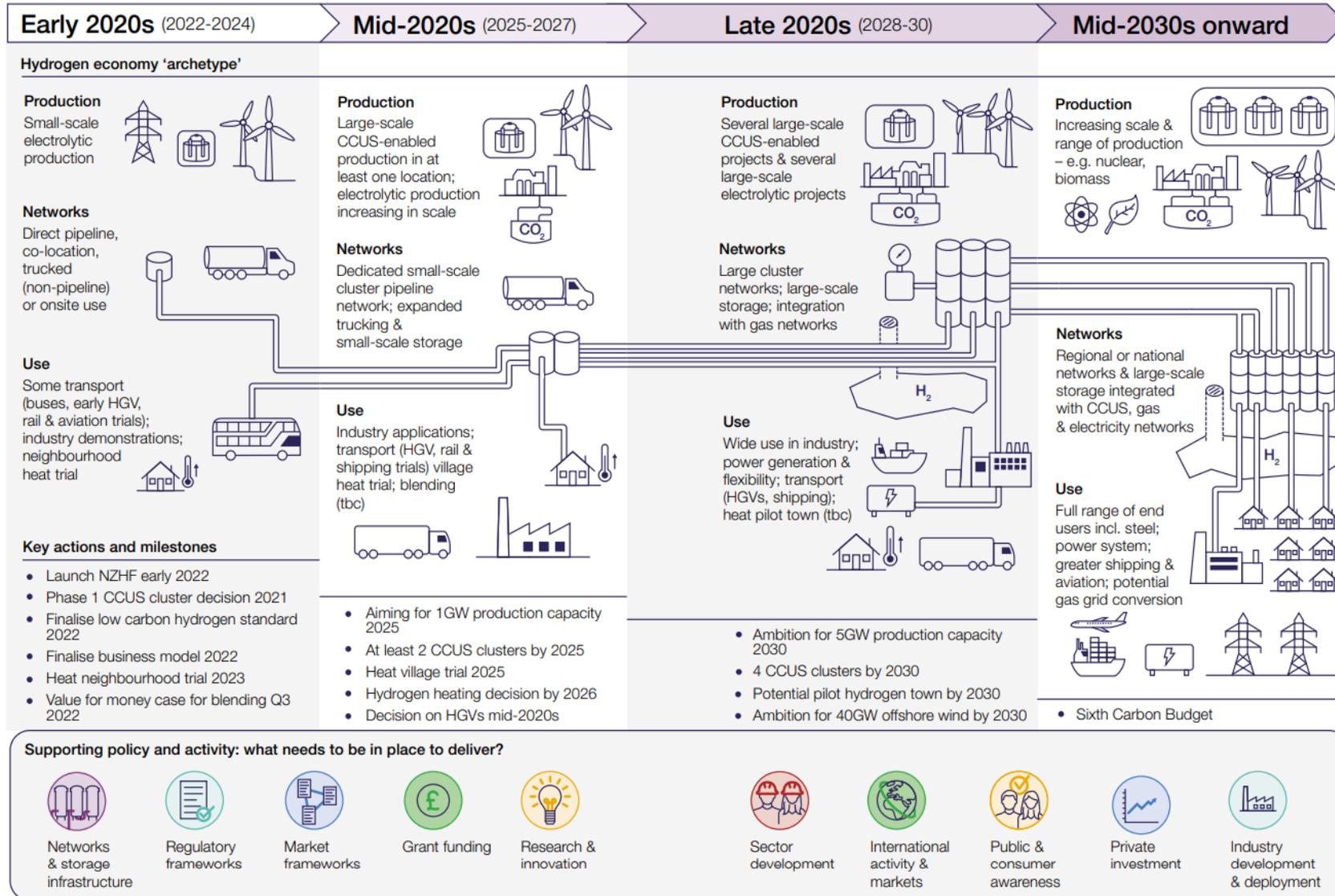
- Aspiration to see 1GW of production capacity by 2025
- “Twin-track approach” to both **blue and green hydrogen**
- Early deployment of CCUS to be in industrial clusters – **four industrial clusters targeted by 2030**
- **5GW of low-carbon hydrogen by 2030** target from Ten Point Plan reaffirmed
- **Up to 38TWh of hydrogen supply by 2030 (21TWh industry, 10TWh heat in buildings, 1TWh heat in buildings and 6TWh in transport) not including any blended gas, rising to 55-165TWh by 2035<sup>2</sup>**
- Hydrogen demand of **250-460TWh - that is, a 10- to 20-fold increase on targeted 2030 position by 2050, and**
- Supporting **9,000 jobs and £900mn GVA by 2030** (growing to 100,000 jobs and £13bn GVA by 2050).

However, the strategy acknowledges the need for significant further work. It says it will pull together a *Hydrogen Sector Development Action Plan* by early 2022. It will also provide “further detail on our production strategy and twin track approach”, and “finalise design elements” of the low-carbon hydrogen standards at that time too. It confirms that the preferred business model will be finalised in 2022.

<sup>1</sup> <https://connectpa.co.uk/wp-content/uploads/2021/07/Hydrogen-APPG-Report-2021.pdf>

<sup>2</sup> In line with the 95TWh recommended for 2035 by the Climate Change Commission in its Balanced Net Zero Pathway.

**Figure 1: Hydrogen Economy 2020s Roadmap (Source: BEIS)**



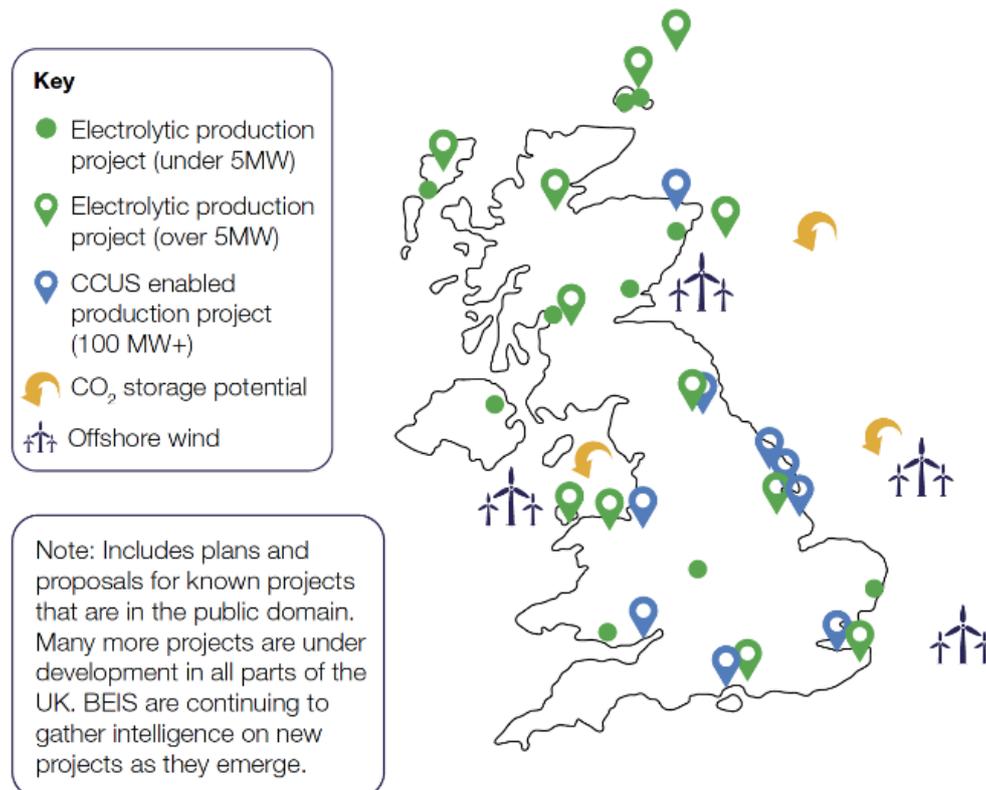
The strategy also makes additional commitments. These include:

- An imminent call for evidence on the future of the gas system
- A call for evidence on hydrogen-ready industrial equipment by the end of 2021
- A call for evidence on the phase-out of carbon-intensive hydrogen production in industry within a year
- Opening of Phase 2 of the £315mn Industrial Energy Transformation Fund, and
- A £55mn Industrial Fuel Switching Competition in 2021.

It also fleshes out plans for hydrogen heating trials and a consultation on “hydrogen-ready” boilers by 2026. It will examine gas blending into the gas network by late 2022 and aim to make a final decision by late 2023.

But the timing and scale of hydrogen deployment in the UK energy system remains uncertain at this stage partly because we are starting at ground zero and partly because of the scale of the ambition. Existing projects are shown at Figure 2, reproduced from the document. The degree of development of these and other projects will depend on technology commercialisation pathways, cost reductions and policy support that has yet to be defined in detail. The consultations that were issued alongside the document in effect push this definitional process forward.

**Figure 2: Proposed UK electrolytic and CCUS-enabled hydrogen production projects (Source: BEIS)**



There are some key challenges that the UK will need to overcome to establish a hydrogen economy, and these are addressed in the document and shown in Box 2.

### Box 2 – Challenges to overcome

- **Cost of hydrogen** relative to existing high-carbon fuels
- **Technology uncertainty**, with many applications needing to be proved at scale
- **Policy and regulatory uncertainty** to provide direction and support
- **Enabling infrastructure** including transport, storage and integration of CCUS, gas and electricity networks
- **Supply and demand coordination** to overcome the “chicken and egg” dilemma, and
- Need for **support in first-of-a-kind (FOAK) and next-of-a-kind (NOAK) investment** and deployment.

Despite the references to the “twin-track” approach, the policy focus still concentrates on blue hydrogen and development of four industrial clusters deploying CCUS technology, and relatively less attention is being directed at security of demand and other use cases. Green hydrogen will be developed on a “learn by doing” approach. The strategy is clear that industry will be the “lead option” for early hydrogen use, starting in the mid-2020s. It also says it will “likely be important” for decarbonising transport, particularly heavy goods vehicles, shipping and aviation, and balancing a significantly higher share of renewables on the electricity system.

In respect of scaling up a hydrogen economy, Chapter 2 of the *Hydrogen Strategy* gave a breakdown of planned funding and policy support across key parts of the hydrogen value chain, including production, networks, storage, demand, creating a market and realising economic benefits in the UK; these are shown in Box 3.

### Box 3 – Scaling up the hydrogen economy

#### On hydrogen production:

- **Target:** 5GW of low-carbon hydrogen by 2030
- **Funding:** Net Zero Hydrogen Fund (£240mn | early-2022), Low Carbon Hydrogen Supply 2 Competition (£60mn | mid-2021)
- **Consultations and policy support:** UK standard for low-carbon hydrogen (early-2022), Hydrogen Business Model (2022 | first contracts Q1 2023), further detail on production strategy and twin-track approach (early-2022)

#### On hydrogen networks and storage:

- **Consultations and policy support:** Call for evidence on future of the gas system (2021), review of systematic hydrogen network and storage requirements (2020s)

#### On hydrogen demand:

- **Funding:** Industrial Energy Transformation Fund: Phase 2 (315mn), Industrial Fuel Switching 2 (£55mn | 2021), Red Diesel Replacement Competition (£40mn | late-2021), Zero Emission Bus Regional Areas (£120mn | mid-2021), Clean Maritime Demonstration Competition (£20mn | late-2021), Green Fuels Green Skies (£15mn | late-2021), Hydrogen Hub Development in Holyhead (£4.8mn | mid-2021), Hydrogen Transport Hub in Tees Valley (£3mn | mid-2021)
- **Consultations and policy support:** Call for evidence on ‘hydrogen-ready’ industrial equipment (end-2021), call for evidence on phase out of carbon intensive hydrogen production in industry (within 12 months), consultation on hydrogen-ready boilers (2021 | for mandating in 2026), continued support for transport decarbonisation (2020s), hydrogen neighbourhood (2023), hydrogen village (2025), hydrogen town (2030)

#### On creating a market:

- **Consultations and policy support:** Detail on revenue mechanism (2021), Hydrogen Regulators Forum (2021), assessment of market frameworks to drive investment (early-2022), assessment of regulatory barriers facing hydrogen projects (early-2022), indicative assessment on value for money case for 20% hydrogen gas network blends (late-2022 | final policy decision late-2023)

#### On realising economic benefits for the UK"

- **Consultations and policy support:** Hydrogen Sector Development Action Plan (early-2022), Early Career Professionals Forum, Hydrogen Technology R&I Roadmap

In all, some £900mn of public funding is confirmed in the strategy, with BEIS expecting that the sector is likely to crystallise over £4bn in private capital in the next decade.

There are important supporting documents alongside the Strategy, which in effect kick start some of these roadmap processes. They are:

- *Consultation on a Hydrogen Business Model* to stimulate private investment in new low carbon hydrogen projects
- *Consultation on the design of the £240mn Net Zero Hydrogen Fund (NZHF)* confirmed out to 2025 to support new hydrogen production projects
- *Consultation on a UK Low Carbon Hydrogen Standard* that will define what is meant by low carbon hydrogen, allowing us to incentivise and support low carbon hydrogen for supply across the energy system<sup>3</sup>
- *An annex setting out the analysis and evidence* underpinning the *Hydrogen Strategy* and consultations, and
- Another annex setting out *Hydrogen Production Costs 2021*, with a supporting detailed appendix on assumptions.

The strategy and twin-track approach are due to be updated in early 2022. This will provide more detail on the regulatory framework, which will also be informed by industry, the Hydrogen Advisory Council and the newly-formed Hydrogen Regulation Forum. But in the first instance, it will focus on loosening regulation around first-of-a-kind projects for low-carbon hydrogen and address any barriers to investment across the value chain.

#### Stakeholder responses

**Five dominating themes have emerged out of the various stakeholder and media responses. They are:**

- Support for the strategy and a general recognition that there is now a clearer framework that can guide further policy development
- Recognition that many of the decisions that are still needed on the form of developmental support and incentives, and that investment at scale is not likely to materialise until after these decisions have been taken
- A resurfacing of the tensions between the proponents of blue (fossil-fuel derived but in combination with CCUS) vs green (renewables derived) hydrogen
- Following on from this, despite the proposed "twin-track" approach, suggestions that insufficient focus is being placed on the early-stage development of green hydrogen, which seems not to be the preferred development route until into the next decade, and

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<sup>3</sup> There is also an accompanying report on *Options for a UK Low-carbon Hydrogen Standard* by E4tech (UK) Ltd and Ludwig-Bölkow-Systemtechnik GmbH.

- As a consequence, the early focus on blue hydrogen at scale could contribute to the foreclosure of future markets for green hydrogen.

**A summary schedule of comments and responses is attached.**

### **Regional opportunities overlooked**

Here at Hydrogen East, we believe hydrogen development will typically grow out of local conditions and lead to the formation of clusters with strong regional characteristics reflecting place-based opportunities and other decarbonisation measures adopted locally. These are likely to see development of hybrid technology groupings and cut across vectors depending upon the regional attributes and local demand. And, although the *Hydrogen Strategy* contains the useful map showing high-profile projects under development or being mooted (reproduced as Figure 2), it does not do justice to the diversity of thinking and interest that is now burgeoning around local opportunities or address whole-systems developments that will arise from local flexibility markets, including the value these could deliver to local networks and energy supply bottlenecks.

The East of England is a case in point. It already has strong foundations to support early deployment of a different type of hydrogen cluster through continuing development of the gas terminal at Bacton and the transformation of it into a diversified energy hub. Recent reports<sup>4,5</sup> have borne out the potential for early deployment of both blue and green hydrogen close to the site and more generally within the region.

Important regional differentiators are:

- Likely early availability of blue hydrogen at scale from legacy Southern North Sea (SNS) gas assets produced in combination with CCUS that can be landed through existing pipes
- Excellent potential storage facilities offshore for CO<sub>2</sub> storage and possibly hydrogen
- Good existing connections at the Bacton site with the onshore gas transportation system providing access to repurposed and new markets in London and the South East, but also major gas interconnectors connecting with mainland Europe, which could form part of the *European Hydrogen Backbone*
- Multiple opportunities for the early green hydrogen production from an array of renewable and low-carbon regional resources, notably the continuing aggressive build-out of wind generation off the East Anglian coast, but also solar power deployment onshore and possibly new nuclear development, including the use of waste heat
- These are all likely to make a major contribution in a rapidly changing but presently constrained electricity system at distribution level in some areas, and there will also be real opportunities to use increasingly frequent clean generation surpluses for conversion through use of electrolysers that could also have a local flexibility value supporting resilience of the electricity system
- Proximity of hydrogen availability to many parts of the gas system, which could see early development of “hydrogen neighbourhoods” on a place-specific basis, in a region that has relatively low dual-fuel penetration, easing the mass electrification of heat
- While the region does not have significant industrial load like many of the other clusters currently under discussion and in development elsewhere in Britain, it does have significant potential other markets in, among other things, heavy transport in various forms

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<sup>4</sup> <https://hydrogeneast.uk/bacton-energy-hub/>

<sup>5</sup> <https://www.ogauthority.co.uk/news-publications/publications/2021/bacton-energy-hub/>

(trucks, rail and shipping), agriculture and food processing, all of which could offer security of demand and pull through the necessary infrastructure, and

- This is supplemented by a predominantly rural economy in which typical distances travelled and journey times are above average but where there are real issues about transport electrification in some areas.

Looked at together, these could provide a fertile base for a different type of clustering linking up small, diverse projects, including electrolyzers that could be progressively scaled, and underpinning it with aggregated demand for a variety of emergent regional use cases.

Technology cost reductions are already surpassing expectations, with the gap between blue and green hydrogen set to narrow rapidly. (In this context, NEL Hydrogen are projecting aggressive cost reductions in electrolyser costs, especially as systems are scaled, as early as mid-decade, and the *Hydrogen Strategy* does acknowledge that electrolyzers “could become cost competitive with CCUS-enabled methane reformation as early as 2025”.) The economic opportunity is therefore significant, especially if development can be targeted and aligned with regional strengths. The East of England offers early-mover benefits given the existing supply chain and skills already established from the oil, gas and renewables sectors, and which can be redeployed as we “build back better” as part of the green recovery.

The Hydrogen East study referenced above has already highlighted that there could be over 10TWh of demand in the New Anglia area alone as early as 2030 provided there is active regional development, coordinated action and appropriate policy support. This approach should allow local communities and businesses - who are likely to be adversely impacted by the loss of jobs associated with the wind-down of the traditional oil and gas sectors - to benefit directly through investment and job creation in a variety of clean growth sectors.

### **Building on the momentum**

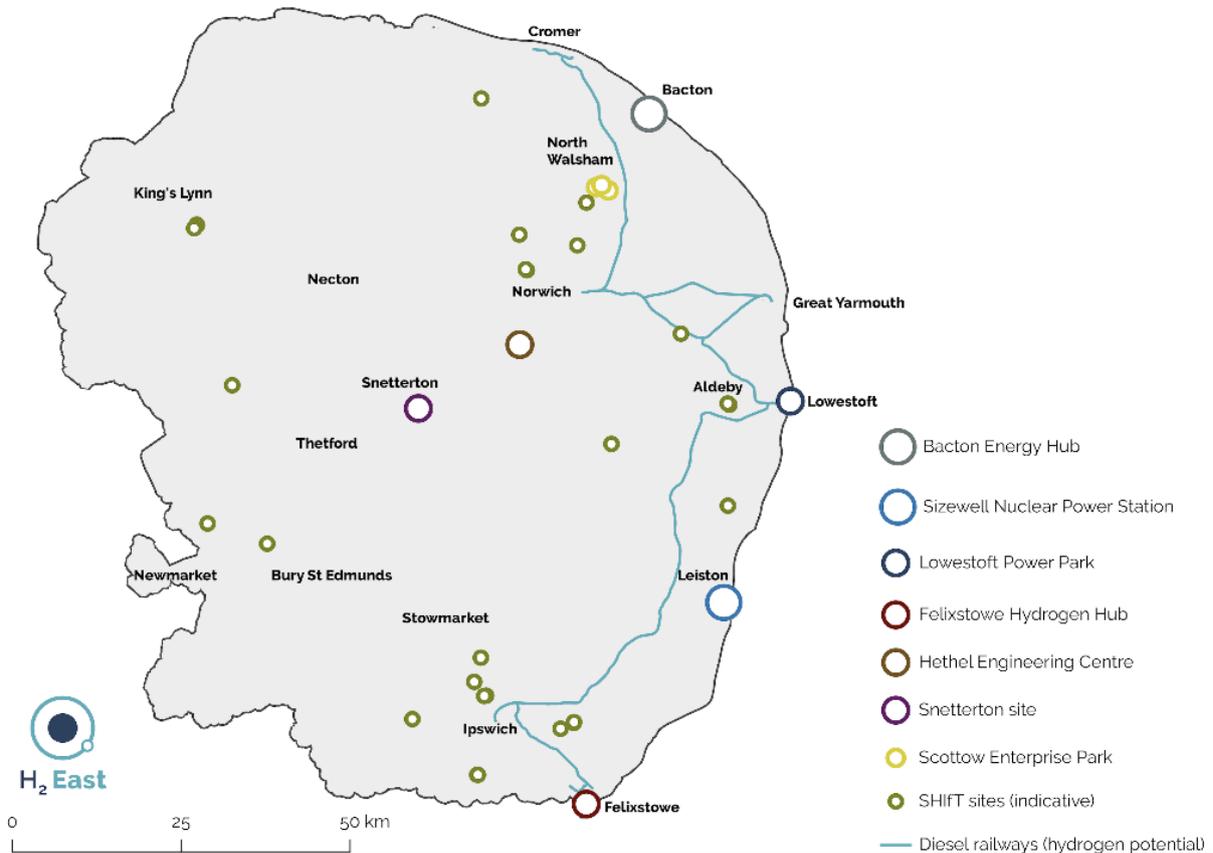
Several analytical projects and assessments are already underway in the region, many involving Hydrogen East, including:

- The **Bacton Energy Hub** project, which might readily expand into a wider sub-regional hub combining both blue and green hydrogen but also integration with solar and other renewable technologies locally
- The development of electrolysis capacity in conjunction with nuclear energy and heat to support development at **Sizewell**
- The Freeports East project centred on **Felixstowe and Harwich**, which could see early adoption of hydrogen in port-side operations and eventually shipping
- The **Lowestoft Power Park** project, which is looking at refurbishment of aging wind turbines and their pairing with electrolyzers for use by municipal buses and refuse fleets
- The SHIfT programme – **Solar and Hydrogen Infrastructure for Transport** – which is examining co-location of solar and hydrogen production for heavy transport use at several municipal waste and landfill sites, and for which we are already undertaking detailed geospatial mapping
- The development of the **Hethel Engineering Centre** and also the **Scottow Enterprise Park** into centres of excellence for clean transport
- Investigation of **Snetterton** as the focus for development of a Clean Transport Hub including the use of hydrogen refuellers supporting the Cambridge-Norwich Tech Corridor and other local business development opportunities, and

- The conversion of the **Bittern and Wherry** branch railway lines to hydrogen.

These projects and potential sites are shown at Figure 3.

**Figure 3: Hydrogen East and possible hydrogen projects**



Today, hydrogen is poised to be a deployable technology to integrate power and transport decarbonisation especially in a region with its own unique opportunities and challenges. **We are convinced that the East of England can make a significant contribution to realising hydrogen's potential regionally and support delivery of the *Hydrogen Strategy*.**

The region aspires to be the UK's Clean Growth Region. *The Norfolk and Suffolk Economic Renewal Plan* has started to set out the vision. The issue is how big that contribution for hydrogen could be. To do this, **the Government's focus needs to give due weight to early deployment of green as well as blue hydrogen and not be over-focused on the industrial clusters. It should also place more focus on a whole-systems approach but through a regional lens.**

**Greater focus should be given to allowing thinking around different choices and pathways in a range of diverse regional economic sectors,** in addition to supporting emergence of industrial clusters elsewhere in GB and in neighbouring European markets. In doing this, the Government can build on the excellent foundations of its first *Hydrogen Strategy* and create opportunity and growth across unique and disparate regions of the UK such as the East of England, allowing them to be a significant and important contributor to a Net Zero Britain.

Organisation Name	Key messages
<b>New Anglia LEP</b>	New Anglia LEP chief executive Chris Starkie announced that the planned increased use of hydrogen present huge opportunities for the region, especially with the transformation of Bacton gas terminal into a diversified energy hub and planned Freeport East Hydrogen Hub
<b>ScottishPower</b>	ScottishPower predicts that its green hydrogen projects will demonstrate how critical green hydrogen is in tackling the climate emergency. They are stated that the scale of the Strategy's industry support scheme shows that UK has real ambition to deliver hydrogen at pace.
<b>ITM Power</b>	Graham Cooley, CEO of ITM Power says that the <i>Hydrogen Strategy</i> will help British companies become world leaders in decarbonisation. Kwasi Kwarteng also officially opens the Bessemer Park Gigafactory at the strategy launch event.
<b>Regen</b>	Regen describes the <i>Hydrogen Strategy</i> as high in ambition but light on clear strategic direction; there is lack of mention of development of demand markets and new hydrogen applications.
<b>RenewableUK</b>	RenewableUK's CEO Dan McGrail said that he welcomes the steps such as the new Net Zero Hydrogen Fund but points out the overall the strategy doesn't focus on developing UK's world-leading green hydrogen industry. He also said: We're urging the Government to set a target of 5GW of renewable hydrogen electrolyser capacity by 2030 as well as setting out a roadmap to get us there, to show greater leadership on tackling climate change".
<b>ENA</b>	David Smith, Chief Executive at Energy Networks Association, urges:  "We need further recognition that for hydrogen to play its part in Net Zero producing 5GW of hydrogen by 2030 will not be enough. We must set our sights higher, towards a figure twice that amount."
<b>S&amp;P Global</b>	The strategy "will definitely improve market confidence", UK Hydrogen and Fuel Cell Association (UK HFCA) CEO Celia Greaves told S&P Global Platts. "But whether a project is feasible will depend on the detailed numbers. So we do need those as soon as possible."  Equinor states that the strategy is a step forward but is not enough to make final investment decisions.

<b>Cadent</b>	Cadent Chief Strategy and Regulation Officer Dr Tony Balance is supportive of plans to introduce hydrogen blending into the wider gas network. He adds that this should be aligned with a mandate to introduce 'hydrogen-ready' boilers from 2025.
<b>North West Hydrogen Alliance</b>	Professor Joe Howe, Chair of the North West Hydrogen Alliance, welcomes the commitment to develop a Hydrogen Sector Development Action Plan to ensure that economic benefits from hydrogen are kept in the UK. He also states that now's the time to start raising public awareness of hydrogen to engage people in the hydrogen revolution.
<b>UKHFCA</b>	UKHFCA states that the Government needs to introduce business models that are attractive and workable for both green and blue hydrogen and reflect their different characteristics. Its chairman Chris Jackson also stepped down citing blue hydrogen concerns.
<b>The Conversation</b>	The Conversation is critical of the governments "twin track approach", where both blue and green hydrogen would be used to phase out fossil fuels, as the research suggests that blue hydrogen might be worse than burning natural gas due to methane emissions throughout the supply chain.
<b>Labour Party</b>	<p>Alan Whitehead MP, Labour's shadow minister for energy and the green new deal, said: "It is regrettable that the Conservatives have failed to match the investment shown by other countries and key decisions have been delayed, such as mandating that all boilers must be hydrogen-ready."</p> <p>Environmental campaigners criticise the strategy as having too much focus on blue hydrogen.</p>