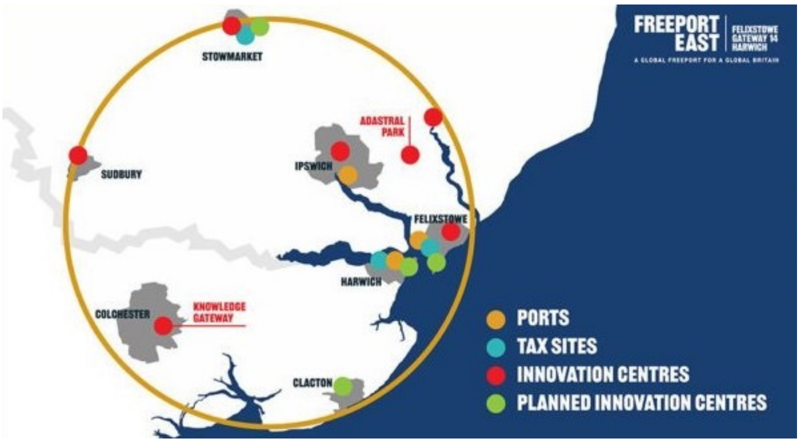
REA

FREEPORT EAST | FELIXSTOWE GATEWAY 14 HARWICH

A GLOBAL FREEPORT FOR A GLOBAL BRITAIN

GREEN TRANSPORT HUB STRATEGY



A report by the REA (The Association for Renewable Energy and Clean Technology)

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Dr Nina Skorupska CBE FEI, CEO, REA

REA's report is based on a case study of Freeport East, as a location that features international transport hubs across land and sea and could provide resources for international airports in the UK, as well as several significant energy generation assets for the region. The report makes clear that, across all of these modes of transport, Freeport East would be in strong position to accelerate the transition to Net Zero as a Green Transport Hub.

Across land, sea and air, many of the essential components of a net-zero transport system are shared. High-power grid connections with renewable energy and low carbon generation assets are required to deliver rapid electric vehicle charging, provide shore-to-ship electrical supplies, green fuels and to produce truly zero-emission hydrogen.

Infrastructure is required to produce, distribute and supply renewable transport fuels to rapidly reduce whole-life emissions in areas of the transport system that cannot easily be decarbonised using electricity or electrolytic fuels.

Considering how much of this infrastructure is cross-compatible between different modes of transport, it is clear that in the planning and delivery of a net-zero transport system the government and local stakeholders will need to enhance electricity resources; enable hydrogen production; enable finance solutions and ensure integrated resource planning and delivery for Freeport East to lead the way in green transport fuel supply and use.

Our thanks go to Maritime Transport, RWE and Sizewell C, for their generous support of this report, without which it would not be possible, to Robert Hull, the report author, and of course to the organisations and local businesses who have taken the time to engage with us. We hope this report can be used as a springboard for the positive and vital actions already planned locally and be the example for other Freeports to follow.

REA TRANSPORT

www.r-e-a.net

Freeport East

Green Transport Hub Strategy

Foreword

Steve Beel, CEO, Freeport East

Decarbonisation of our transport systems will require the action of multiple parties along extended green transportation corridors connecting key hubs of clean energy supply.

Freeport East sits at the heart of these decarbonisation efforts. It includes, at Felixstowe, the biggest container port in the UK and regularly hosts the world's largest ships connecting to over 700 destinations around the world. Other active ports at Ipswich and Harwich also contribute to a local economy that is home to hundreds of companies involved in the transportation sector as well as helping to transport goods and people throughout the UK and overseas. Our local renewable energy resources are plentiful, including a significant proportion of the UK's offshore wind resources right on our doorstop.

As Freeport East looks to help drive our regional economy towards net zero in a manner that delivers benefits across our communities, it is clear that decarbonisation of the transport sector and maximisation of our potential for renewable energy production is a key opportunity and priority, one that will bring benefits to local businesses, communities and investors.

The East of England is already a clean energy powerhouse of international significance, comprising a range of renewable generation, innovation and R&D assets but also the deep skills and experience to match. It is in our national interest that the region's capabilities are deployed to drive forward decarbonisation across the transport sector.

This work that we have undertaken, with the support of the REA and sponsorship from RWE, Maritime Transport and Sizewell C, highlights the implications that future transport decarbonisation will have on our local grid capacity.

None of the ambitions we have for Freeport East, whether it be decarbonising transport, our planned Green Hydrogen Hub, supporting new manufacturing facilities across our freeport sites, facilitating more local energy systems or maximising the solar potential of new building developments, is possible without the local grid network. Ensuring the grid keeps pace with these ambitions and acts as an enabler to net zero and the investment and employment opportunities that we see before us, is fundamentally important for the overall success of Freeport East. The recently published Freeports Delivery Roadmap itself emphasised the critical roles of DESNZ, Ofgem and the network companies in delivering grid solutions that enable freeports to maximise their potential.

We hope that the report will be of interest to all those involved in decarbonisation of transport in and beyond Freeport East including the policy makers, businesses and investors who will play a key role in driving forward the changes we need to see. We look forward to working with partners across Government and the private sector to build on the report. As well as the contributions of the REA, sponsors and other stakeholders who have contributed to the report, we would also like to thank the Department for Levelling Up, Housing and and Communities (DLUHC) for their ongoing support for the freeports programme.

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wwwfreeporteast.com


Felixstowe

Summary

The Freeport East region, based around the ports of Felixstowe and Harwich, is a major UK transport hub. Decarbonisation of transport can enhance the Freeport's future competitive position and attract new investment in green transport technologies and resources.

A Green Transport Hub Strategy will allow the Freeport to position itself as a UK and international leader in transport decarbonisation. Freeport East is already well placed to pursue this strategy through the UK Government's energy transition plans which:

- For energy supplies, targets investment and growth in nearby offshore wind, low carbon hydrogen and nuclear power.
- For transport, targets an acceleration to zero emission surface vehicles and green fuels for shipping and aircraft.

The global transition to green transport fuels means that current fuel supply chains for surface, sea and air transport will need to change. Freeport East can use its geographical advantage as a major transport hub to produce and supply green fuels for maritime, surface, and potentially also air transport at nearby Stansted airport.

In assessing future energy needs, this report has applied the Climate Change Committee's recommended decarbonisation scenario to the Freeport East region. By 2050, it shows electricity as the major energy source for the industrial & commercial, residential, and surface transport sectors. For shipping, energy growth is expected with hydrogen derivatives replacing fossil-fuels. There are two key implications for Freeport East from this scenario:

- Electricity consumption will need to increase significantly (estimated at six-fold from 2022) to supply electricity for transport and hydrogen electrolysers. This will require major new investment in electricity networks and associated infrastructure, and
- Major new hydrogen production and storage facilities will be required to supply green transport fuels, initially methanol and potentially ammonia in the 2030's

The Freeport East energy transition to Net Zero will need to be supported by significant new infrastructure investment. But there is a risk that this investment is not realised due to insufficient electricity capacity and from a lack of available finance. An integrated and robust plan is needed to justify investment in new electricity capacity and the transport/fuel infrastructure. This report recommends four strategic themes are pursued by Freeport East:

- **Enhance electricity resources** – identify investments needed in electricity networks, low carbon generation, customer electricity infrastructure and electric vehicles
- **Enable hydrogen production** – identify investment needed in electrolyser capacity and the supply chain for production, storage, and supply of green fuels
- **Enabling finance solutions** – identify priority investments and business cases to enable a mix of public and private finance solutions
- **Integrated resource planning and delivery** – Freeport East should lead the development of co-ordinated local energy plans to optimise the delivery of Net Zero targets across the whole energy system. Also, by preparing delivery plans which identify priority investment needs, delivery models and financing solutions.

Freeport East's evolution to a co-ordinated 'Green Transport Hub' will bring opportunities for investment and to innovate and exploit new technologies. These can bring significant economic benefits to the area and the wider UK economy.

Introduction

In 2019, following the recommendation of the Climate Change Committee (CCC), the Government committed to a 100% reduction in greenhouse gas emissions by 2050 as compared to a baseline of 1990. Progress so far has focused on decarbonisation of the electricity sector, but decarbonisation of heat and transport now needs to accelerate to achieve Net Zero targets.

Transport decarbonisation will have significant local impacts arising from the major changes expected to modes and volumes of transport. The Government's Net Zero strategy for decarbonising transport will drive a major social and business transition that will reach deep into all parts of the local and national economies.

For developers and operators of transport infrastructure these themes pose major opportunities and challenges over the coming decade. Technology advancements in smart charging, intelligent grid management, and financing models are all creating opportunities in the surface transport sector. Sustainable energy solutions are also becoming available for the marine, aviation, and rail sectors.

These overall transport policy targets, technology advances, economic impacts and societal change all need to be included into local integrated decarbonisation strategies and action plans.

Structure of report

This report considers the current transport decarbonisation landscape in Freeport East and the gap to expected future decarbonisation targets in 2050. It describes the opportunities, and the challenges, to address this gap, and outlines a potential roadmap to build a green transport hub and meet these decarbonisation targets.

The report has assessed both a 'top-down' approach of national decarbonisation strategies, and a 'bottom-up' approach as described by Freeport East's existing projects and internal research and analysis. The report is structured as follows:

• Introducing the Freeport East Green Transport Hub opportunities, drawing on analysis conducted by Freeport East and key regional stakeholders,

• Describing National and Regional policies and plans for transport decarbonisation,

• An assessment of the current 'whole energy system' in the region across power, heat and transport, and future demand in 2035 and 2050.

The assessment reviews the key barriers to Green Transport Hub development, namely electricity grid capacity and attracting finance, and

• The report conclusions describe a strategy for Freeport East to be a leading Green Transport hub and provide recommendations for delivery of this strategy. Suggestions are made for a potential local transport strategy and initiative roadmap to 2050, including delivery frameworks to enable the necessary investment.

3.Freeport East Green Transport Hub – the opportunity

As a major UK transport hub, Freeport East's evolution to a 'Green Transport Hub' will bring opportunities to innovate and exploit new technologies. These can bring significant economic benefits to the area and the wider UK economy.

The global transition to green transport fuels means that current fuel supply chains for surface, sea and air transport will need to change. Freeport East can use its geographical advantage as a major transport hub to produce and supply green fuels for maritime, surface, and potentially air transport.

This section describes the potential opportunity for Freeport East to enable energy decarbonisation, focusing on the maritime and surface transport sectors.

Maritime decarbonisation

Ports can deliver decarbonisation by replacing fossil-fuel shore-side energy and shipping fuels with low carbon alternatives. For shore-side energy, this is likely to require renewable electricity and associated infrastructure, and for shipping, green fuel supplies will be needed.

Freeport East ports transit about 50% of the UK's container traffic and, during 2022, 4,400 vessels passed through the ports. Typically, these are Lift-On Lift-Off (Lo-Lo) or Roll-On Roll-Off (Ro-Ro) containers of 20,000-100,000 tonnes. Ro-Ro uses vehicles to roll the cargo on and off the vessel, and Lo-Lo uses cranes to lift the cargo on and off the vessel.

Many of the vessels originate from Singapore and China and stop on-route at the Port of Rotterdam where bunkering or refuelling takes place. Over half of the world's bunkering is provided by ten major port hubs, with the Port of Rotterdam being the second largest worldwide. There is currently no bunkering infrastructure at Freeport East.

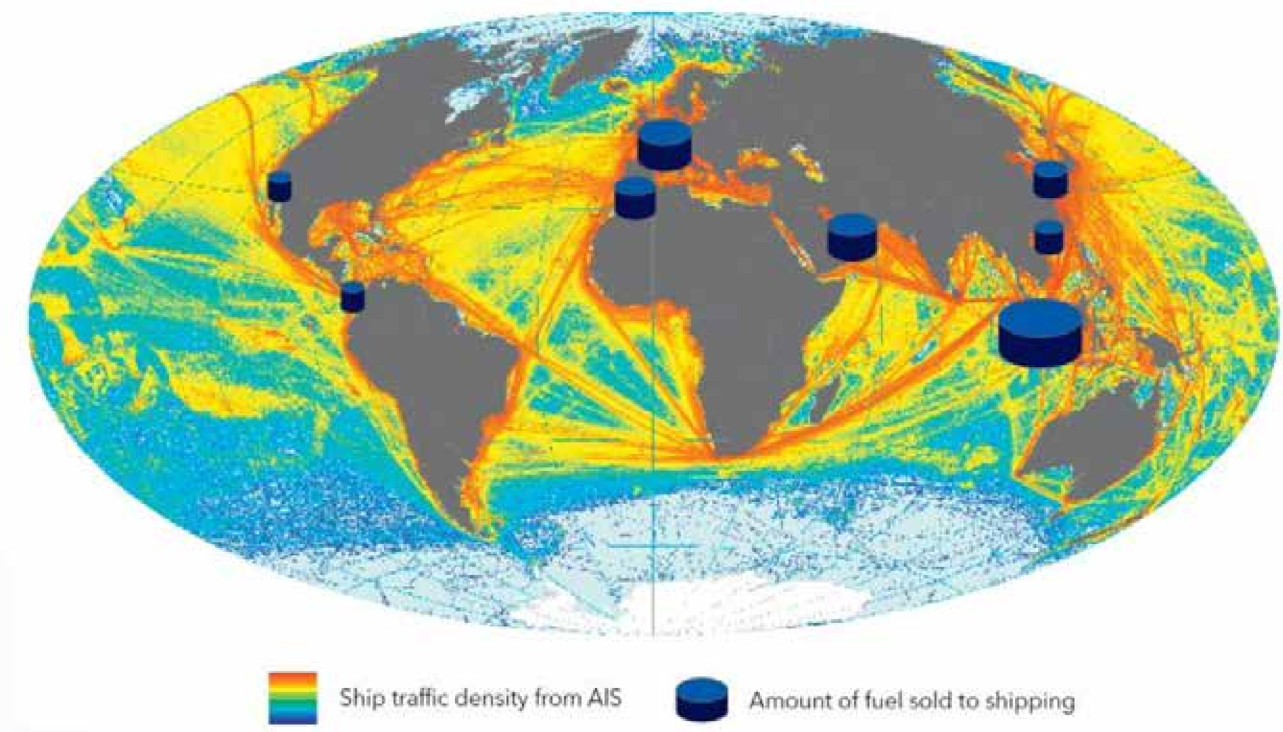
The following diagram illustrates the density of global shipping routes and the key bunkering ports. In Northern Europe, bunkering is mostly provided at Rotterdam and Antwerp.

The energy transition away from fossil fuels will disrupt the historic supply chains and open opportunities for new bunkering locations. With its large port traffic volumes, and proximity to low carbon electricity supplies, Freeport East is well positioned to additionally offer low carbon fuelling capacity to these customers, adding economic benefit to the region.

The pathway to shipping decarbonisation seems likely to prioritise e-methanol which is produced from green hydrogen (using renewable electricity). Growth in orders for methanol-fuelled vessels are increasing rapidly, with demand for methanol growing over the 2020's[1].

E-ammonia, produced from green hydrogen (again using renewable electricity) offers lower costs of production but the technical maturity and safety case is lagging that of methanol. As such, roll-out of ammonia at scale is expected to take place from the 2030's[2].

Figure 1: Map of current global bunkering hubs and density of shipping routes



1 https://www.dnv.com/expert-story/maritime-impact/Methanol-as-fuel-heads-for-the-mainstream-in-shipping.html

2 https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2021/Oct/IRENA_Decarbonising_Shipping_2021.pdf

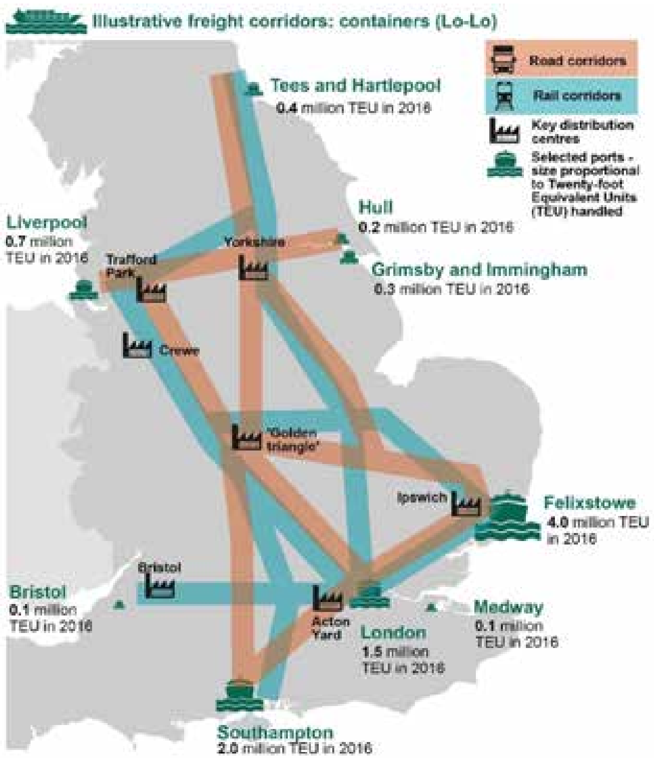
Surface transport decarbonisation

Surface transport is expected to decarbonise through replacement of fossil fuels with electricity and green fuels e.g., hydrogen. Freeport East ports provide a focal point for several road and rail corridors serving much of the UK. These are illustrated overleaf.

(293 tpd of methanol and 736 tpd of ammonia), requiring c2.3GW of electrolyser capacity.

The PA study assumes that 50% of ammonia supplied will be 'blue' ammonia using hydrogen produced from methane. This is because sufficient electrolyser capacity is not expected to be available. The above electrolyser capacity has been halved to reflect this assumption.

Figure 2: Illustrative UK rail and road connectivity corridors: containers (Lo-Lo)



Potential hydrogen demand

Their analysis concluded: Maritime hydrogen demand:

Freeport East commissioned PA Consulting to map the potential hydrogen demand sources across the Freeport East economic zone and surrounding areas[3].

The Port of Rotterdam handles 20 times the tonnage of Felixstowe and is building import terminals for green fuels due to a lack of clean energy capacity. If Freeport East, with its access to clean energy, could capture 5% of the Port of Rotterdam's bunkering volumes, then the following amounts for hydrogen could be required for methanol and ammonia production:

• Up to 187 tonnes per day (tpd) of potential Hydrogen could be needed by 2035 (65 tpd of methanol and 122 tpd of ammonia), requiring c450MW of electrolyser capacity.

• By 2050 this could scale to over 1,000 tpd

Surface transport hydrogen demand:

The analysis recognised that hydrogen demand (or derivatives thereof) for surface transport applications may be displaced by electrification and biofuels (or fossil fuels). Electrification is expected to dominate for light road vehicles, but hydrogen may become a viable alternative to replace diesel used by heavy goods vehicles (HGV's), buses, rail, and port tractors/machinery.

The decarbonisation opportunity for Freeport East

Given the competitive international trade landscape, Freeport East will need to ensure that it can optimise its future competitive position if it is not to lose existing economic benefits and create new ones. In future, port customers are increasingly likely to seek the benefits of using a green, affordable energy hub.

There is a growing international trend for Green Shipping Corridors to be developed, where ports and shipping fleets seek to co-ordinate green fuel bunkering with green-fuelled vessels. However, there are challenges in delivering green fuels and mobilising shipping demand. In order to exploit this trend, Freeport East could seek to participate in Green Shipping Corridors, possibly in collaboration with the ports of Rotterdam and Antwerp.

The decarbonisation of Freeport East transport requires replacement of fossil fuels for ports, shipping, and surface transport. Significant increases in renewable electricity and green fuels such as e-methanol and e-ammonia will be required. Both e-methanol and e-ammonia production require green hydrogen as a feedstock, and in turn electrolysers need renewable electricity as a feedstock.

HGV hydrogen demand has significant potential, but the scale and timing of growth is uncertain. Initial demand for hydrogen may arise from specific applications such as port operations and local buses, including for Sizewell C construction.

The PA study suggested that the hydrogen demand for these surface transport applications could range from some 20 tonnes per day around the end of this decade to some 130 tonnes per day by 2050. The most significant use cases were expected to be for HGVs and port applications, including industrial tractors, other mobile machinery, and port vessels.

Combining the projected hydrogen demand for both shipping and surface transport gives:

• By 2030, a total hydrogen demand of 207 tonnes per day (tpd), and c500MW of electrolyser capacity

• By 2050, a total hydrogen demand of 1,130 tonnes per day (tpd) and c2.5GW of electrolyser capacity

Any aviation or industrial demand for hydrogen would be additional to this total.

Applying this 50% load factor to the above electricity capacity forecasts results in:

2035 – electrolyser electricity consumption of 2.2 TWh per annum, and

2050 – electrolyser electricity consumption of 11 TWh per annum.

Potential electricity demand

Electricity supply: Freeport East is located near some 5GW of offshore wind farms that are in operation or various stages of development. All these projects are intended to be operational over the next ten years. Also, the nearby 3GW Sizewell C nuclear power plant is expected to be operational by the mid 2030's. These projects could provide the Freeport East area with access to plentiful renewable and low-carbon electricity.

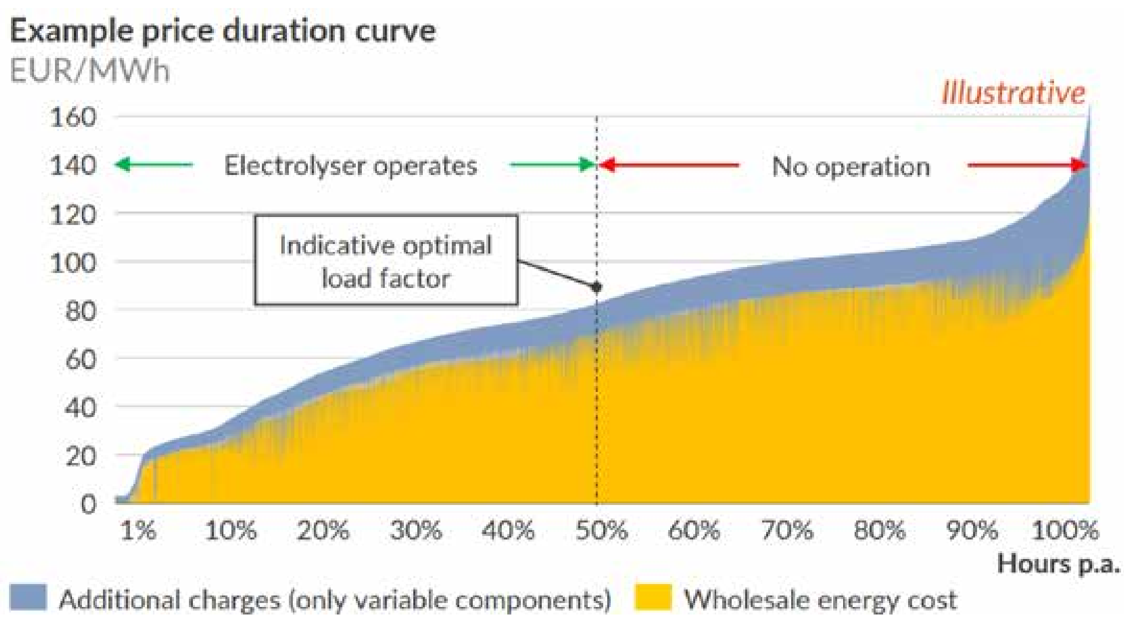
Electricity demand: As highlighted above, potential hydrogen demand could add an additional 2-3GW of electricity demand by 2050. Already, a 100MW electrolyser project at Felixstowe has been announced, aiming to supply some 40 tpd of hydrogen by the mid- 2020's.

Flexible demand: A report by energy market analyst, Aurora[4] on the future of UK hydrogen production highlights that electrolysers will need flexibility to produce hydrogen during periods of low energy prices. These periods are expected when there is high renewable output, including when excess renewables may otherwise be curtailed. As illustrated in the chart below, Aurora analysis suggests that the optimal load factor for stand-alone grid connected electrolysers may be around 50%.

3 https://freeporteast.com/wp-content/uploads/2023/11/Freeport-East-Hydrogen-Commission-Work-Final-Report-External-Version-Aug-2023.pdf

4 https://auroraer.com/wp-content/uploads/2022/02/Aurora_Jan22_EU_hydrogen_ShadesOfGreen-part2_publicReport.pdf?fbclid=IwAR3sUbajNjdBLmyAUNWQQhodgIdsIUYoTmZQxd6II56OU-R_hWSSCxfDezs

Figure 3: Illustrative price duration curve (EUR/MWh)



4. International Case Studies

Example 1 - Port of Rotterdam

The Port of Rotterdam[5] (PoR) is the largest port in Europe. The port area comprises 12.500 hectares, including 6,000 hectares of industrial sites. Cargo throughput is around 460 million tonnes of freight per year, alongside 30,000 seagoing vessels and 100,000 inland vessels annually. The PoR claims to generate over 500,000 jobs and provide added value of over 60 billion Euro to the Netherlands.

5 https://www.portofrotterdam.com/en

The PoR sustainability strategy aims to reduce CO2 emissions by 55% by 2030, and to become CO2 neutral by 2050.They aim to do this through four main strategies:

• **Efficiency and infrastructure** – increasing the efficiency of the existing and building new infrastructure for heat networks, CO2 capture and storage, electricity and hydrogen.

• **A new energy system** – renewing the port energy system by switching from fossil fuels to green electricity and hydrogen. The PoR first introduced methanol bunkering operations in 2015.

• **A new raw material and fuel system** – moving towards a CO2 neutral port and a circular economy where only sustainable resources are used and waste is reduced.

• **Sustainable transport** – moving to shore-based power, inland shipping using batteries, and green shipping corridors.

The PoR claims that ongoing projects and the production of hydrogen and biofuels provide a CO2 reduction of 23 million tonnes, which is 35% of the Netherlands target for 2030 (65 million tonnes). Some of the initiatives being pursued are:

Shore power: the municipality of Rotterdam and the Port of Rotterdam Authority are conducting a joint strategy and development programme to accelerate and scale up shore-based power for sea-going vessels, with the aim of having a high percentage of sea-going vessels plugged in at the quay by 2030.

Hydrogen: the PoR ambition is to produce 1.2 million tonnes of hydrogen per annum in the port area by 2030, comprising 0.8 million tonnes of blue hydrogen with carbon capture and storage, and 0.4 million tonnes of green hydrogen produced from 2GW of electrolyser capacity. 500MW is targeted for operation by 2025. In addition, PoR plans to import large volumes of hydrogen to establish a position as a hydrogen hub for Northwest Europe.

This hydrogen (and its derivatives) is expected to be used as a transport fuel, for international and inland shipping vessels, for heavy goods vehicles and for aviation. It will also supply a wide range of industries to support decarbonisation.

Green Shipping Corridors: the PoR and the Port of Singapore have formed an alliance, seeking to establish the world's longest green corridor. The PoR also has established a green corridor initiative with the Port of Gothenburg

Example 2: Green Hydrogen production and electrolyser demand

The HH2E Lubmin project, located on the German Baltic coast in the state of Mecklenburg-Vorpommern, is a large-scale green hydrogen production plant that encompasses high-capacity battery and heat storage to maximise green hydrogen production.

The project is expected to become operational by the middle of 2025 and will be capable of producing approximately 6,000 tonnes (over 200,000 MWh) of green hydrogen (using electricity from renewables) per annum during the first 100 MW phase. By 2030, it is expected to increase capacity to over 1 GW, with annual production exceeding 60,000 tonnes of green hydrogen.

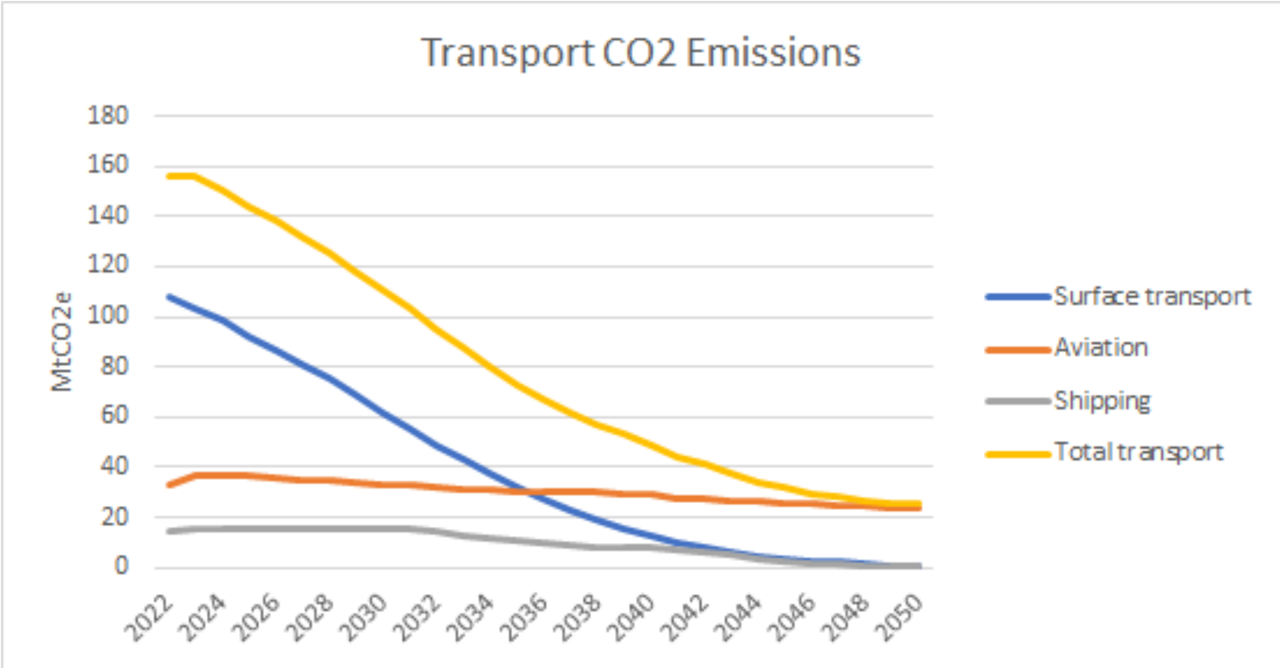
The plant will serve green hydrogen customers and offtakers, including large-scale energy and industrial consumers such as the chemical industry and commercial air and road transport operators. A collaboration is in place with MET Group, an integrated European energy company, with activities in natural gas and power, to facilitate the sale of green hydrogen produced by HH2E Lubmin.

The HH2E Lubmin plant is in a highly congested area of the German electricity grid, where capacity is being fully utilised by imports from large offshore windfarms in the Baltic Sea. Due to its electricity import requirements, the plant was able to obtain an early grid connection and has the potential to provide important grid flexibility services and gain associated revenues in the future.

5. The National Policy and Regulatory landscape

The transport sector, covering surface transport, aviation, and shipping, currently accounts for about one third of the UKs overall greenhouse gas emissions. Rapid progress will need to be made in this sector if the 2050 Net Zero decarbonisation target is to be achieved. This section outlines the relevant national policy and regulatory landscapes, together with regional initiatives and plans for the transport sector.

Figure 4: Transport CO2 Emissions – CCC 2050 Balanced Net Zero Pathway



Climate Change Committee Net Zero recommendations

The UK Climate Change Committee (CCC) is established by legislation to independently review government net zero policies. The CCC quantified the challenge for the UK in its 6th Carbon Budget (for the years 2033-37) report[6] to Government in 2020. Their recommended pathway requires a 78% reduction in UK territorial emissions between 1990 and 2035 to reach Net Zero by 2050. Meeting the budget requires average annual reductions in UK emissions[7] of 21 MtCO2e, similar to the profile achieved in the UK since 2012.

The CCC scenario analysis includes detailed assumptions about technological, economic and behavioural factors, and associated policy measures, needed to achieve Net Zero. The CCC recommended that a 'Balanced Net Zero Pathway' scenario be applied such that the UK take a global leadership role to limit global warming below 1.5oC.

They recommend four key actions:

- Reducing demand for carbon intensive activities e.g., from improved vehicle efficiency, and reduced travel demand
- Take up of low carbon solutions e.g., electric vehicles
- Expanding low carbon energy supplies including renewable electricity and low carbon hydrogen
- Land use transformation, included low carbon farming practices, and bioenergy
- Turning to implications for transport, the CCC Balanced Pathway scenario estimates that the transport sector was responsible for 32% of all UK emissions, The CCC's recommended emissions reduction profiles for the three transport sectors are shown in the above chart and key features of each are described below.

6. https://www.theccc.org.uk/publication/sixth-carbon-budget/

7 This includes emissions from international aviation and shipping. The CCC estimates that emissions from international aviation and shipping totalled 45MtCO2e in 2019.

Surface transport

In 2022, the CCC estimates surface transport emissions to be 108 $MtCO_2e$ or 22% of total UK emissions. The CCC scenario assumes that surface transport (road and rail) emissions decrease by about 70% by 2035 before falling to just 1$MtCO_2e$ by 2050.

The key assumptions are that there is a rapid take up of electric vehicles over the next decade, associated with a reduction in the overall volume of car travel (about 17% of total miles travelled by cars by 2050). There should also be a transition to zero carbon trains, buses, and heavy goods vehicles. The scenario assumes that electric vehicles and charge-points will be available, together with economic or policy incentives to encourage behavioural change.

The CCC estimates that the overall domestic investment for decarbonisation of surface transport would reach about £10 billion per annum by 2025 and continue at that level until 2050, totalling over £250 billion. This includes both public investments e.g., public charging infrastructure and private investment e.g., for the purchase of vehicles.

Shipping

In 2022, the CCC estimates shipping emissions to be 15$MtCO_2e$ or 3% of total UK emissions. The CCC scenario assumes the shipping sector emissions hold flat until 2030, then decline to near zero by 2050.

The scenario assumes that the emissions reductions from 2030 are mainly (87%) derived from a switch to low carbon fuels such as ammonia and the remainder from an increase in electricity used for shore power and propulsion, and efficiency improvements.

The CCC estimate for investment in the shipping sector to achieve Net Zero targets is around £150m a year from 2032 and around £600m per year from 2032, totalling some £12 billion. About two thirds of this expenditure or £8 billion is expected to be domestic electrification and ammonia production, and the remainder mainly from international ammonia production.

Aviation

In 2022, the CCC estimates aviation emissions to be 33$MtCO_2e$ or 7% of total UK emissions. The CCC scenario assumes the aviation sector returns to pre-pandemic levels by 2024. Thereafter emissions decline over time to reach 23$MtCO_2e$/year by 2050. These residual emissions are expected to be offset by initiatives for removal of greenhouse gases.

The scenario assumes that demand growth is constrained through policy measures to 25% growth from 2018 levels compared to an unconstrained growth of 65%. It is assumed that fuel efficiency is improved, and there is greater use of sustainable aviation fuels (split between biofuels and synthetic jet fuel).

The CCC estimate for investment in the aviation sector to realise Net Zero is around £12 billion

but only around 5% of these are expected to be domestic investments, with the remainder being international sustainable fuel investments.

Since producing its report on the 6th Carbon Budget in 2020, the CCC has continued to analyse Government's progress in achieving Net Zero targets. In its latest progress report to Parliament in June 2023[8], the CCC stated that the UK had reduced greenhouse gas emissions (including international aviation and shipping) by 46% relative to 1990 levels. The CCC's had increased confidence that targets for the fourth carbon budget (2023-27) would be met but its confidence that medium to longer term targets would be met had decreased, citing a lack of urgency in delivering priority actions and policies.

UK Government Net Zero Plans

In October 2021, the UK Government published its Net Zero Strategy[9] and policies to achieve Net Zero targets for each emissions sector. This was updated in March 2023 with a Net Zero Growth Plan[10] and an accompanying Carbon Budget Delivery Plan[11] setting out policies, timescales and delivery risks to enable carbon budgets four to six to be met.

Further policies[12] were announced in autumn 2023, delaying the ban on new petrol/diesel cars by 5 years to 2035, and delaying the ban on new oil/gas boilers from 2026 to 2035.

Turning to transport, the Government's key policies include:

- Road transport: a ban on the sale of new petrol/diesel cars by 2035, and for all HGV's by 2040 and HGVs of less than 26 tonnes by 2035. Incentives to encourage the uptake of zero emission vehicles, and incentives to encourage bus travel.
- Charging infrastructure: funding (£470m over three years) to help scale up local charge point rollout. Regulate to support payment roaming and pricing transparency.
- Cycling and walking: funding and governance established to help enable half of journeys in towns and cities to be cycled or walked by 2030.
- Aviation: setting a 2040 net zero target for domestic aviation. Funding for sustainable aircraft fuel development, and the development of ultra-efficient, zero carbon aircraft.
- Maritime: championing a 2050 net zero target for international shipping and zero emission shipping corridors. Launch of Green Maritime

Alongside the overall Net Zero transport strategy, many detailed policy initiatives are also set out in the Government's 2021 Decarbonising Transport Plan[13] applying to each of the transport sectors. These are summarised below:

Surface transport

Surface transport is currently the largest emitting sector of the UK economy but emissions from this sector have been broadly flat over the past decade. They need to fall dramatically by 2050 to meet the economy-wide Net Zero target.

The Government vision is for a fundamental change, with transport use reduced through greater walking and cycling and greater use of public transport, especially buses. All non-zero emission road vehicles, including cars, vans, buses, and heavy goods vehicles, should be phased out by 2040. Railways will be decarbonised through further electrification together with the use of battery and hydrogen trains.

This vision is highly ambitious and will be difficult to realise at a national scale. Huge behavioural changes will be required together with investment in alternative transport solutions. It will require co-ordinated action across Government together with major new funding commitments.

Furthermore, this scale of change will be challenging to achieve in the widespread Freeport East region, where the connectivity provided by surface transport is critical for trade and the local economy.

8 https://www.theccc.org.uk/publication/2023-progress-report-to-parliament/

9 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1033990/net-zero-strategy-beis.pdf

10 https://assets.publishing.service.gov.uk/media/642556c560a35e000c0cb167/powering-up-britain-net-zero-growth-plan.pdf

11 https://www.gov.uk/government/publications/carbon-budget-delivery-plan

12 https://www.gov.uk/government/speeches/pm-speech-on-net-zero-20-september-2023

13 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1009448/decarbonising-transport-a-better-greener-britain.pdf

Aviation

In the aviation sector, aircraft themselves represent one of the most challenging technologies to decarbonise. However, airport ground operation, including transport and ancillary services offer greater potential for other low carbon technologies to be deployed.

The Government vision is to accelerate aviation decarbonisation in a way that preserves the benefits of air travel and maximises the opportunities from decarbonisation. While aviation only contributes about 2-3% of current emissions, it is forecast to become the second highest emitter by 2050 if petroleum continues to be the main fuel used for aviation.

The 2022 'Jet Zero Strategy' sets a target for domestic flights and airport operations to reach net zero by 2040, together with initiatives to support the commercialisation of sustainable aircraft fuels. A sustainable aviation fuel mandate of at least 10% is set for 2030 with targets to 2040 expected to be confirmed in 2024.

Shipping

The maritime sector faces a major decarbonisation challenge from the need to transition the forms of vessel propulsion.

However, similar to aviation, there is a significant opportunity to decarbonise the shore-based equipment, including for example, electrification of shore power, cranes, and other ancillary equipment.

The Government's vision is for the UK to play an important role in developing zero emission maritime technology, such as alternative fuel powered vessels using ammonia or methanol produced from low carbon hydrogen, or highly efficient batteries, and maximising the opportunities from these developments.

In its 2019 Clean Maritime Plan - Maritime 2050: navigating the future[14], the Government set out its vision for the future of zero emission shipping. It proposed that by 2025 all vessels operating in UK waters should maximise the use of energy efficiency, and that new vessels being ordered for use in UK waters should be designed with zero emission propulsion capability. Furthermore, by 2035 there would be a number of clean maritime clusters. focused on innovation and infrastructure associated with zero emission propulsion technologies, including bunkering of low or zero emission fuel. The Clean Maritime Plan was due to be updated in 2023 but an update has not yet been published.

UK Government hydrogen strategy

When produced as a low carbon fuel, hydrogen is expected to be a key enabler of the energy transition, replacing fossil fuels for many applications. The government's ambition is to have up to 10GW of hydrogen production capacity by 2030, with at least half of this coming from electrolysers. The near-term aim is to have up to 1GW of electrolytic hydrogen and 1GW of carbon capture and storage (CCUS) enabled hydrogen by 2025.

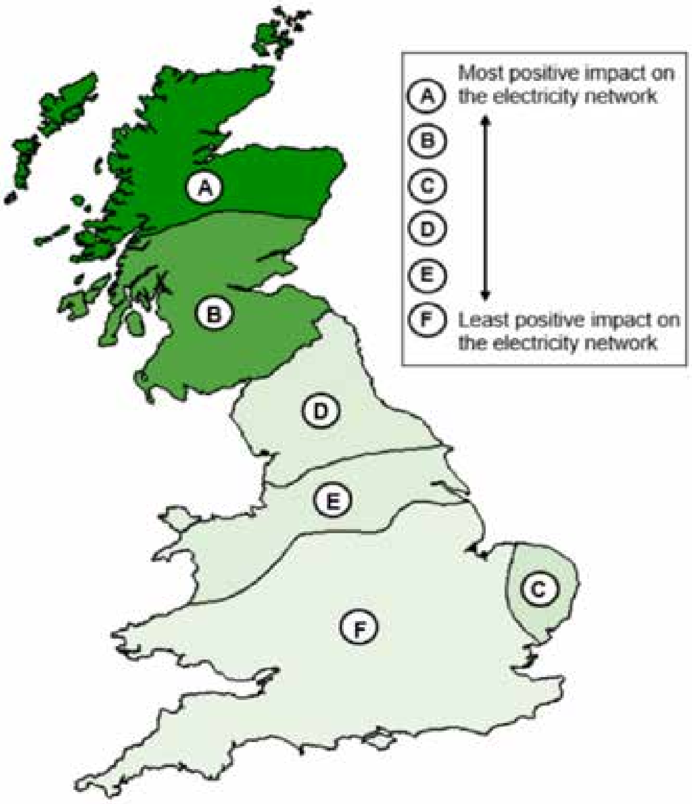
To kick-start this development, the government has developed business models that give revenue certainty thereby attracting private sector developers and investors. A process of annual allocation rounds has been established and in December 2023, eleven projects were offered contracts, totalling 125MW of capacity. The second allocation round has recently been launched with an aim to support a further 875MW of capacity.

This allocation round seeks to prioritise projects[15] that alleviate grid congestion by 'soaking up' excess low carbon generation as illustrated in the figure below. Freeport East lies in a high priority region.

14 https://www.gov.uk/government/publications/maritime-2050-navigating-the-future

15 https://assets.publishing.service.gov.uk/media/647762fc103ca60013039770/hydrogen-har2-market-engagement.pdf

Figure 5: Impact of the location of electrolysers on the GB electricity network



Ofgem regulatory policy

While government is responsible for setting policies to achieve net zero, and the CCC is responsible for reviewing these, much of the policy delivery is also impacted by the role of other regulators and decision makers, such as planning, safety, environmental, and other regulators.

A key regulator for the energy transition is Ofgem, the GB energy regulator which oversees the operation of energy markets and determines the investment funding and associated charges levied by monopoly energy networks. It also has a key role in ensuring that the energy industry governance and rules are fit for purpose in achieving net zero.

There are several key areas of energy regulation that are impacting progress on the energy transition. These include:

- Long grid connection queues, where new projects may be delayed by many years
- Slow electricity network reinforcement, where new investment has not been taking place ahead of need
- Uncoordinated national and regional energy planning

These issues have been recognised by government, Ofgem and the energy industry and improvements are already being introduced. These are highlighted below:

Grid connection queues

During 2023, the transmission network connection queue had grown to around 400GW (far more than the 225GW ultimately expected to be needed by 2050 to decarbonise the electricity system). Many of the projects with connection agreements (offered on a first come first served basis) were speculative and meant that connection dates for later projects were delayed by ten years or more. Similar delays were faced by distribution connected projects.

Measures are now being introduced to reduce this queue and speed up grid connections and release enough capacity to decarbonise our energy grid. This is being realised by:

- A more rigorous approach to removing speculative projects and accelerating projects that demonstrate they are ready to construct.
- Greater use of flexibility measures, where projects may be given limited operational windows, or may be able to participate in voluntary flexibility markets

Increased network investment

Increased investment within the electricity transmission and distribution networks is needed to connect new renewable energy resources, and new sources of demand and storage.

Distribution networks: in December 2022, Ofgem's Final Determinations for the RIIO-ED2 price control period (2023 to 2028) set the outputs that the 14 licenced electricity Distribution Network Operators (DNOs) can invest in their networks to deliver for their consumers. Ofgem emphasised the importance of scaling the funding to allow local networks to undertake anticipatory investment in grid capacity and more rapid network connections.

Transmission networks: also in December 2022, Ofgem announced an Accelerated Strategic Transmission Investment (ASTI) initiative to allow network infrastructure to be built faster. This committed an additional £20 billion of investment to connect 50GW of offshore wind by 2030 and reduce the risk of delays.

National Energy planning

The National Energy System Operator (NESO), the new national body that will bring together the planning for the electricity and gas systems, is responsible for preparing a national Strategic Spatial Energy Plan, and an associated Centralised Network Plan (CSNP). This plan will identify where, when and what energy infrastructure must be built. An early version of the CSNP was used to define the £20 billion ASTI investments described above.

In the East Anglia and Freeport East region, this plan should coordinate network corridors for offshore wind, together with planned electrolyser and other demand-side developments.

Regional planning

Currently regional energy planning is performed by individual licenced electricity and gas network companies, who are expected to liaise with local authorities and stakeholders in their respective geographic areas. This 'siloed' approach has significant limitations for 'whole' energy system planning needed to realise the energy transition across all sectors.

In November 2023 Ofgem announced that it will create regional energy planning[16] roles across Great Britain to improve local energy planning and speed up the transition to net zero. These Regional Energy Strategic Planners (RESPs) will be expected to work with local organisations including local government and gas and electricity networks, to improve understanding of the infrastructure and investment needed in different parts of the country.

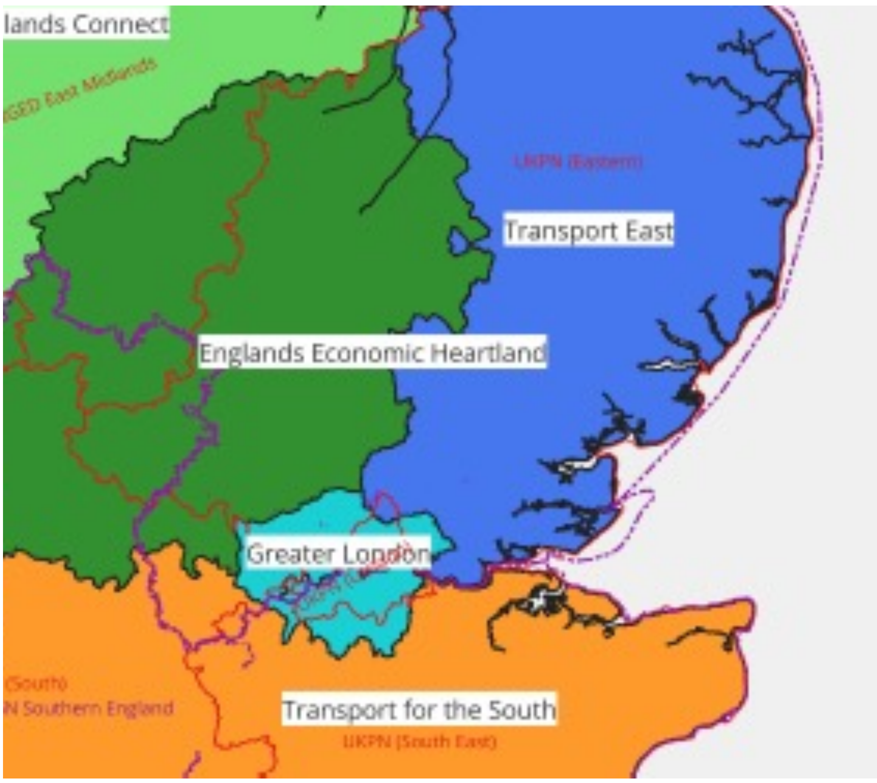
Ofgem's new approach to energy planning is expected to see RESPs create clear plans for how local energy systems need to be developed to reach net zero, considering both the national targets set by government, and the local needs and most appropriate approach in each area.

The NESO will be responsible for implementing up to 13 RESPs across Great Britain. The proposed RESP for Eastern England is illustrated below.

Ofgem is currently undertaking detailed design work on the functions of the RESPs and their outputs, consulting with stakeholders. They have also stated that, where appropriate, they will also explore the possibility of trial projects.

16 https://www.ofgem.gov.uk/publications/decision-future-local-energy-institutions-and-governance

Figure 6: Ofgem proposals for RESP geographic areas



6. Regional transport decarbonisation plans

The Government's Net Zero transport targets and policy initiatives described above require a radical reform affecting all elements of the transport value chain, from energy supply to transport operation to customer behaviour. The pace of change is significant, with the transition needed over the next decade. Given the long-term nature of most transport infrastructure, that means that planning and investing for the transport transition must begin now.

It is a critical issue - the UK is a major global trading hub and efficient, effective, international transport is critical to the national economy. But transport is also a very local issue, fundamental to local businesses, communities, and people's everyday lives. The investment required to transition to a decarbonised transport system is significant and will need to be mobilised and funded in the most efficient way.

The previous section described the targets and policy initiatives at a national level. In order to consider the practical challenges and opportunities that could apply to Freeport East, this report also examines the policies and plans pertaining to transport decarbonisation in the Freeport East region.

Freeport East - transport decarbonisation plans

The UK Freeport delivery roadmap

The first UK Freeports were announced in March 2021 as a means of rebalancing regional economies in disadvantaged areas of the UK, leveraging the economic advantages of local sea and air ports. Freeports were given initial funding together with a suite of supporting investment incentives measures including tax reliefs.

The Government Freeport delivery roadmap[17] proposed that delivery of each Freeport is led by a 'Freeport Governing Body', comprising local partnerships of councils, businesses and other key stakeholders. Local delivery is to be supported by departments across government including HMT, DBT, DEFRA, DfT and DESNZ, with DLUHC as the lead department.

The delivery roadmap is structured around:

- creating investable sites – preparing sites and enabling infrastructure, especially transport infrastructure and grid connections, ready for businesses to invest
- landing investment – promoting Freeports, providing tax incentives, and working with business to secure investment
- creating clusters and local economic growth

17 https://www.gov.uk/guidance/freeports-delivery-roadmap

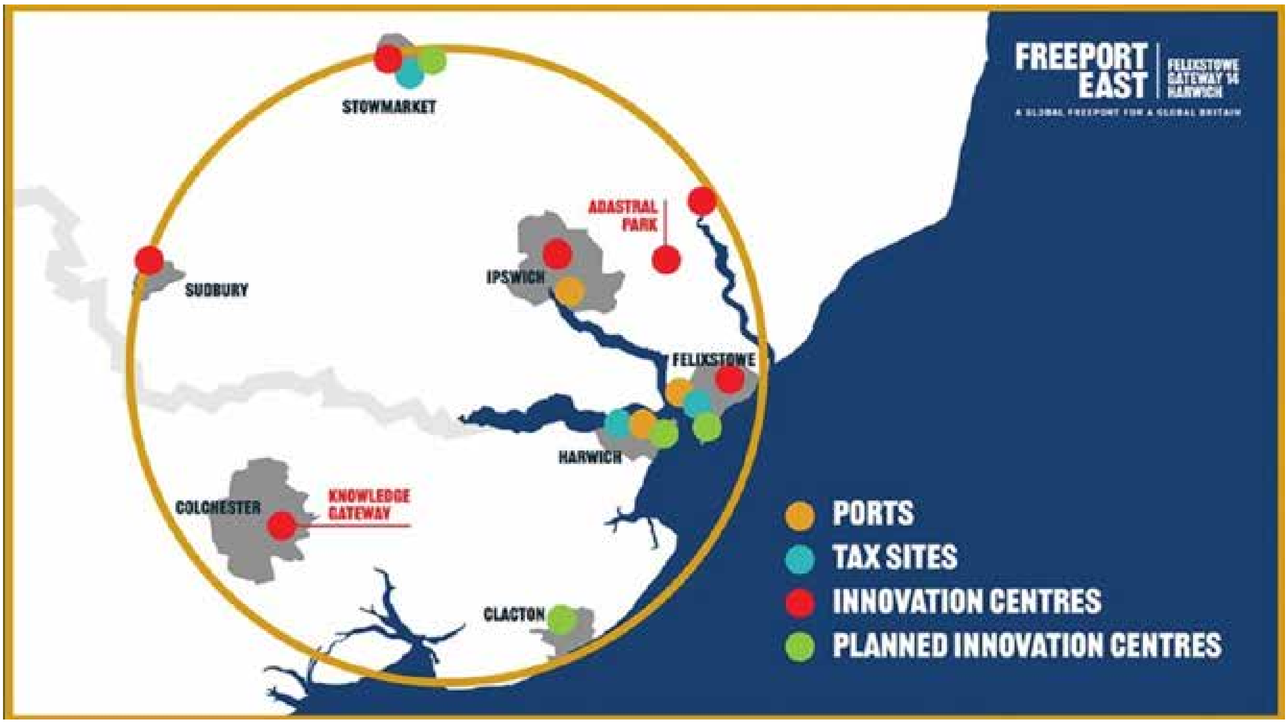
– capitalising on early investment to attract a wider supply chain and foster a cluster, while reinvesting in the local economy and communities.

- decarbonisation – Freeports are expected to be at the vanguard of the energy transition to Net Zero, refocusing local economies towards green energy and industry

Freeport East strategy

Based around the ports of Felixstowe and Harwich but extending across 1000 square kilometres, Freeport East is aiming to attract billions of additional investment into a coastal and rural area with pockets of high deprivation. The ambition described in the Freeport East business case[18] is to transform the region by creating 275 hectares of new development land in a Freeport environment, more than 10,000 high-value new jobs and a GVA of up to £5.5bn over a 10-year period. The geographical area of Freeport East is shown below.

Figure 7: Freeport East Region



Specific initiatives described in the business case include:

- Trade: A unique global trading opportunity linking the UK's largest container port to create a springboard into Europe for UK businesses and inward investors and attracting new capital and investment to the UK.
- A Green Energy hub: The Freeport has the potential to become the southern North Sea's leading Green Energy Hub, providing competitive services to the offshore wind markets on the east and southeast coasts of the UK, winning business from competitors in Europe.
- Innovation: Energy from offshore wind and new nuclear will support the development of a new purpose-built Green Hydrogen Hub, utilising the existing mass of road, rail, and maritime freight movements at the ports to deploy an effective and influential hydrogen programme for uses across the freight sector and creating thousands of new, high-skilled jobs.
- Levelling Up: a vital role in an ambitious regeneration and growth of the sub-regional economy and in creating sustainable new job opportunities and skills in communities affected by long-term inactivity and barriers to labour market entry, which have been exacerbated by the negative economic impacts of COVID-19.

18 https://freeporteast.com/wp-content/uploads/2023/07/Freeport_East_FBC_June_2023.pdf

Transport East – Transport Strategy (2023 – 2050)

Transport East was established in 2018 and is the subnational transport body for Norfolk, Suffolk, Essex, Southend-on-Sea and Thurrock. Its role is to bring together councils, business leaders and the Government to develop a collective vision for the future of transport in the region and set out the investment priorities needed to deliver it.

The figure below shows the six strategic transport corridors linking growing urban areas, ports, and airports with each other and the rest of the UK. They are a priority for investment.

Transport Strategy: The draft Transport East Strategy was published in February 2023[19] and sets an approach to deliver safe, efficient and net zero transport networks, enabling wider societal and economic benefits in the region. The strategic priorities to achieve this vision by 2050 are:

1. Decarbonising transport - supporting local living and working, encouraging switches from cars to active travel and public transport, and enabling switching to sustainable fuels for all transport forms.

Figure 8: Strategic Corridors in the Transport East region

2. Connecting growing towns and cities – improving transport connections and access within urban centres and to the rest of the UK to support business growth, skills development and employment.

3. Energising coastal and rural communities – improving transport accessibility for these communities to education, training, services, and jobs.

4. Unlocking international gateways - improving port and airport transport connectivity and reliability for freight, passengers and employees; also increasing the use of alternative low carbon fuels.

Strategic Investment Programme: This is a strategic framework for prioritising investment proposals and other initiatives to deliver the strategy. This programme focuses on improving six core movement corridors together with transport across urban, rural and coastal places.

In its plan, Transport East states that further work is needed to develop and refine cost estimates for many of the projects and programmes. An indicative cost estimate for the region's programme of projects in 'development' and 'delivery' pools is between £4.6bn and £6.3bn.

Transport East identifies that multi-year national government funding is likely to be required,

19 https://freeporteast.com/wp-content/uploads/2023/07/Freeport_East_FBC_June_2023.pdf

7. Assessing the decarbonisation challenge for Freeport East

This section examines the energy transition for the Freeport East region, assessing the changes needed for the region to become completely carbon neutral by 2050. It considers the current energy consumption profile across power, heat and transport for the region and assesses the potential future energy consumption for 2035 and 2050.

Key potential barriers to realising the energy transition in the region are also assessed.

A.Whole energy system decarbonisation

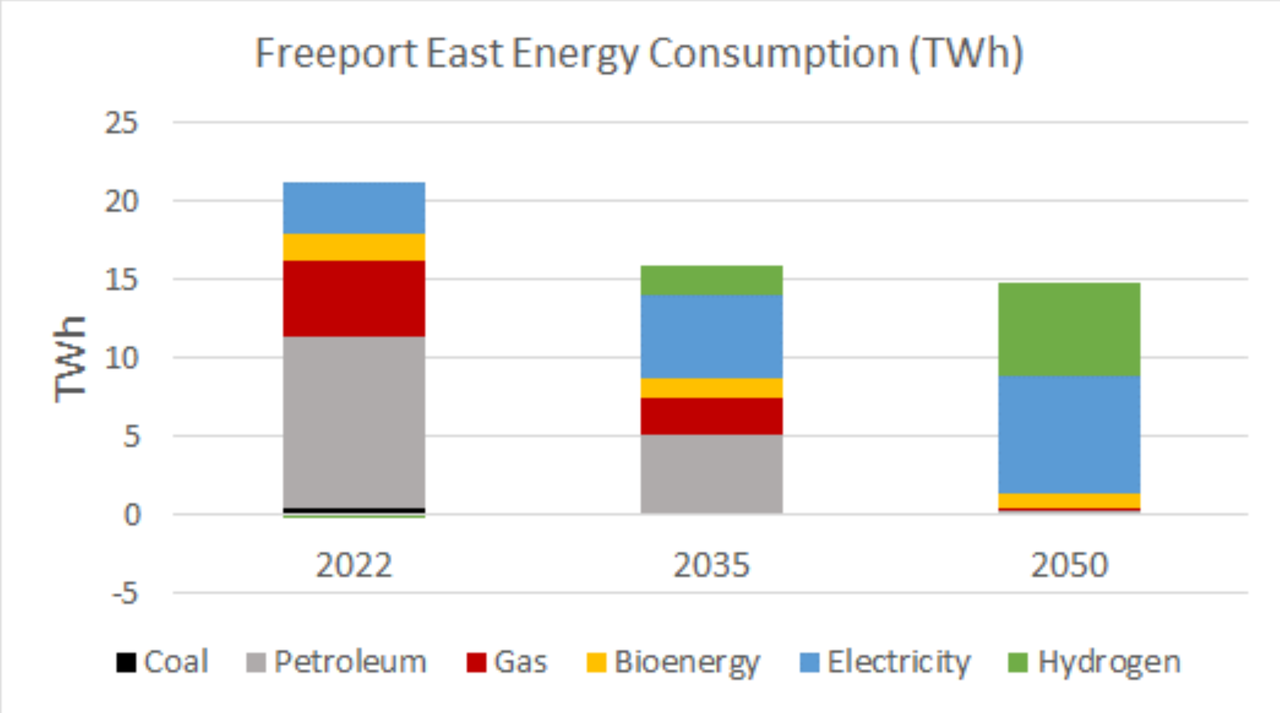
UK and international targets and policies for decarbonisation will drive a dramatic change in the future energy mix in the Freeport East region. To illustrate this, we have compared the overall actual energy consumption in the Freeport East region in 2022 with a Net Zero scenario for 2050. This includes all, or whole system energy use, across power, heat, and transport sectors.

The 2050 Net Zero scenario for Freeport East is based on the national scenarios used in the CCC Balanced Pathway, which is their recommended scenario for achieving UK decarbonisation targets. The energy data from this national scenario has then been scaled to represent the Freeport East region.

Further detail on data sources used for Freeport East 2022 energy data and how the 2035, and 2050 energy forecasts have been derived is included in Annex 1. The annex also includes data for Stanstead airport, a major aviation hub in proximity to Freeport East.

The following chart shows TWh of total energy consumption within the Freeport East region in 2022. It illustrates the equivalent energy consumption in 2035, and then in 2050 if Freeport East is to achieve Net Zero, in line with the CCC Balanced Pathway assumptions. The chart includes data for the residential, industrial & commercial, surface transport and shipping sectors. It does not include any additional electricity needed to produce hydrogen.

Figure 9: Potential Freeport East region energy consumption – 2022 to 2050

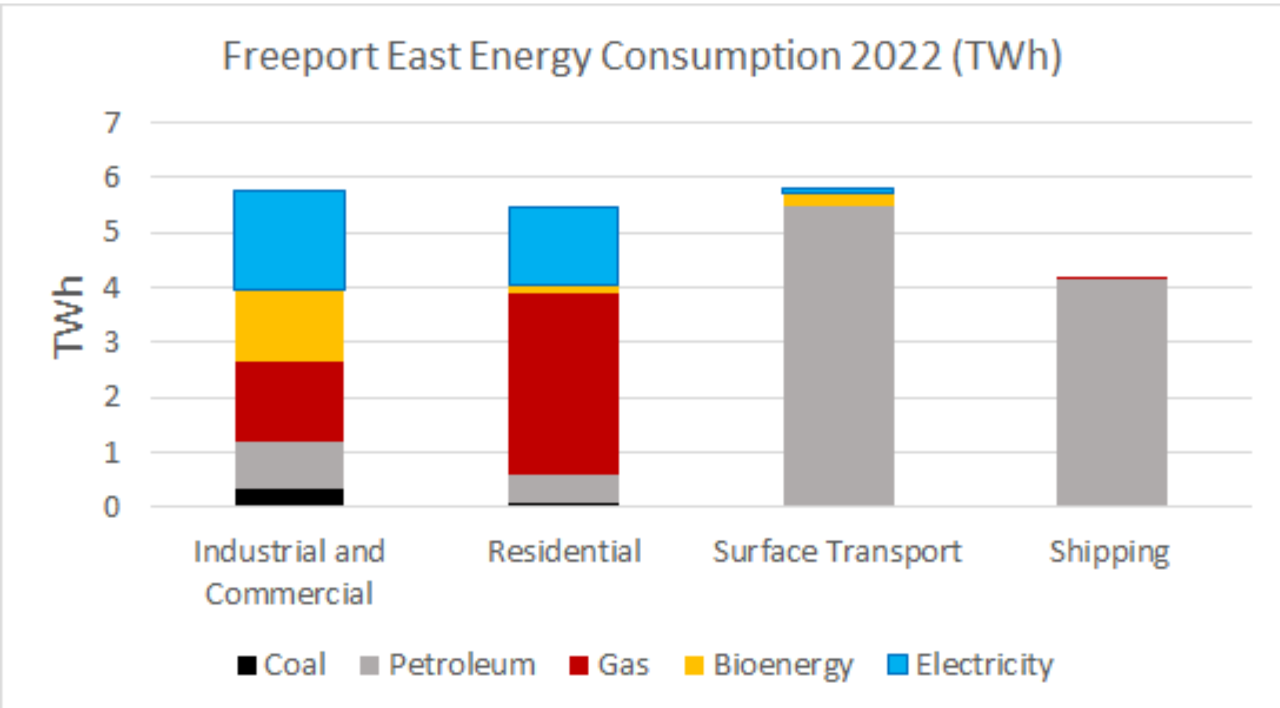


The chart shows total energy demand of 21 TWh in 2022 falling to 16 TWh by 2035, and 15 TWh by 2050, an overall reduction of 30% from 2022 to 2050. The reductions are driven by energy efficiency savings across the local economy, except for shipping demand which is expected to increase.

By 2050, it is assumed that petroleum (mainly used for transport) and natural gas (mainly used for heating) will be almost eliminated and replaced by hydrogen and electricity. Hydrogen is assumed to be used in the form of ammonia or methanol for shipping or aviation fuels. Electricity is expected to be used for heating and surface transport.

The following charts provide a more detailed breakdown of the potential changes from applying the CCC Balanced Pathway decarbonisation scenario to Freeport East local energy demand. They show the breakdown of energy sources in 2022 (and scenarios for 2050), broken down into industrial & commercial, residential, surface transport, and shipping for the Freeport East region.

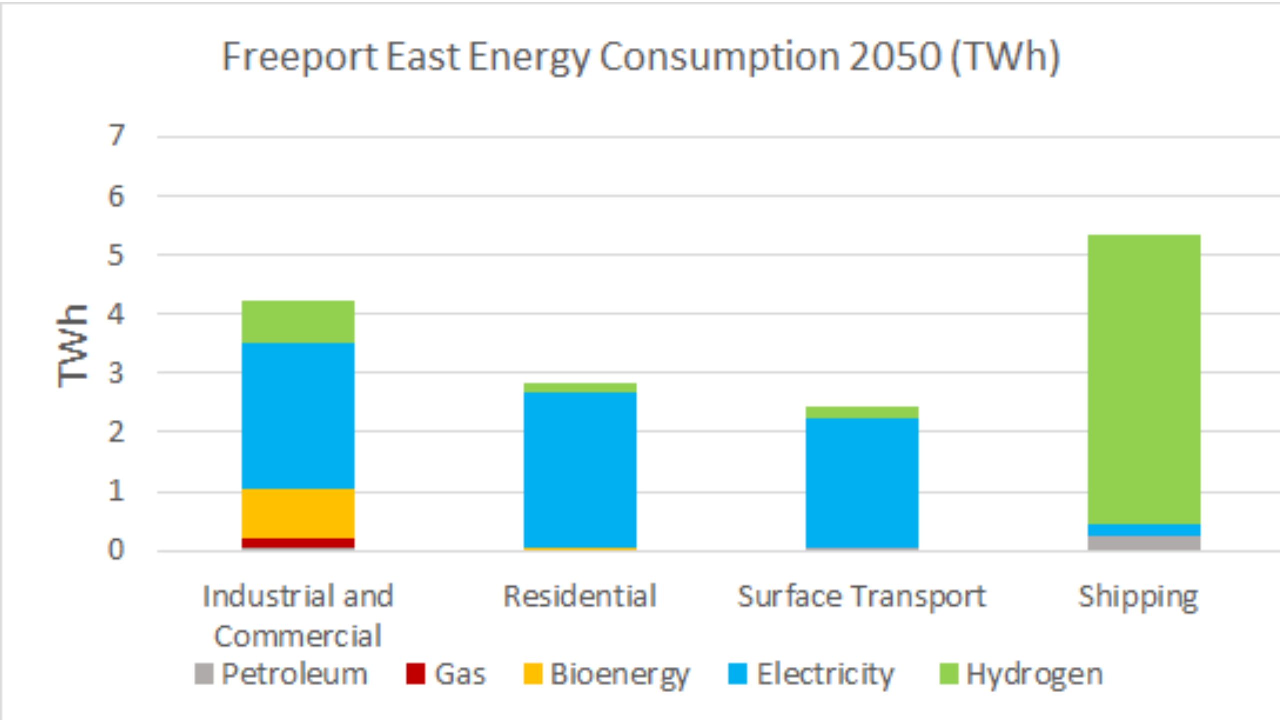
Figure 10: Freeport East region energy consumption (TWh) - 2022



The chart shows that residential, industrial and commercial, and surface transport energy consumption was reasonably similar in 2022, Shipping energy demand (from the ports of Felixstowe, Harwich, and Ipswich) was around 20% lower than the other sectors.

The CCC Balanced Pathway decarbonisation scenario is then used to illustrate Freeport East region energy consumption in 2050. This is shown in the chart below.

Figure 11: Freeport East region energy consumption (TWh) - 2050



By 2050, the CCC assume some significant changes in each of these energy sectors.

- Industry & commercial energy consumption falls by around 25% by 2050 as energy efficiency savings are realised. Petroleum and gas are largely replaced by electricity and hydrogen.

- Residential energy consumption falls by around 50% by 2050, due to major increases in household energy efficiency measures.

- Surface transport energy consumption shows the largest decrease of nearly 60% by 2050, as travel miles reduce alongside improvements in vehicle efficiency. The CCC analysis[20] assumes transport volumes decrease due to a) societal change e.g., increased home working and internet shopping, b) increases in car occupancy, c) a shift to active travel i.e., walking, cycling, and d) a shift to public transport. Efficiency improvements are assumed from factors such as improved aerodynamic design, eco-driving, lower speeds, improved traffic management and improved freight transport logistics.

- Shipping energy consumption, by contrast, is expected to grow by around 25% by 2050. Increased freight volumes and energy demand are offset by efficiency savings.

Overall, delivery of this transition will be challenging. For example, the phasing out of natural gas for domestic heating is a significant logistical, economic, and social challenge, as will be the transition for transport to electric vehicles and active transport. Energy efficiency measures and electrification growth will require significant up-front investment. Also, additional population and business growth will drive additional energy demand, including for transport.

If these sectors are unable to realise their transition targets, then other forms of emission reductions will be needed to compensate for potential shortfalls.

This report focuses on the decarbonisation of transport in the Freeport East area, and each of the key transport sectors is examined in more detail below. Analysis is included for aviation alongside surface transport and shipping.

B.Transport decarbonisation

The CCC's Balanced Pathway 2050 scenario includes the following key assumptions for the transport sector:

- Surface transport (Road/Rail) - a 75% reduction in surface transport energy consumption. Petrol/diesel cars are replaced by electric vehicles, by active transport and mass transit systems.
- Shipping - a 40% increase in shipping volumes across both freight and passenger traffic, leading to a 20% increase in energy consumption after efficiencies are included. But fossil fuels are replaced by ammonia for propulsion and electricity for shore power.
- Aviation - a 20% increase in aviation volumes, which largely continue to use jet fuel. But fuel consumption is expected to fall by 20% as efficiencies are realised.

Each of these sectors is considered in relation to Freeport East.

Surface transport

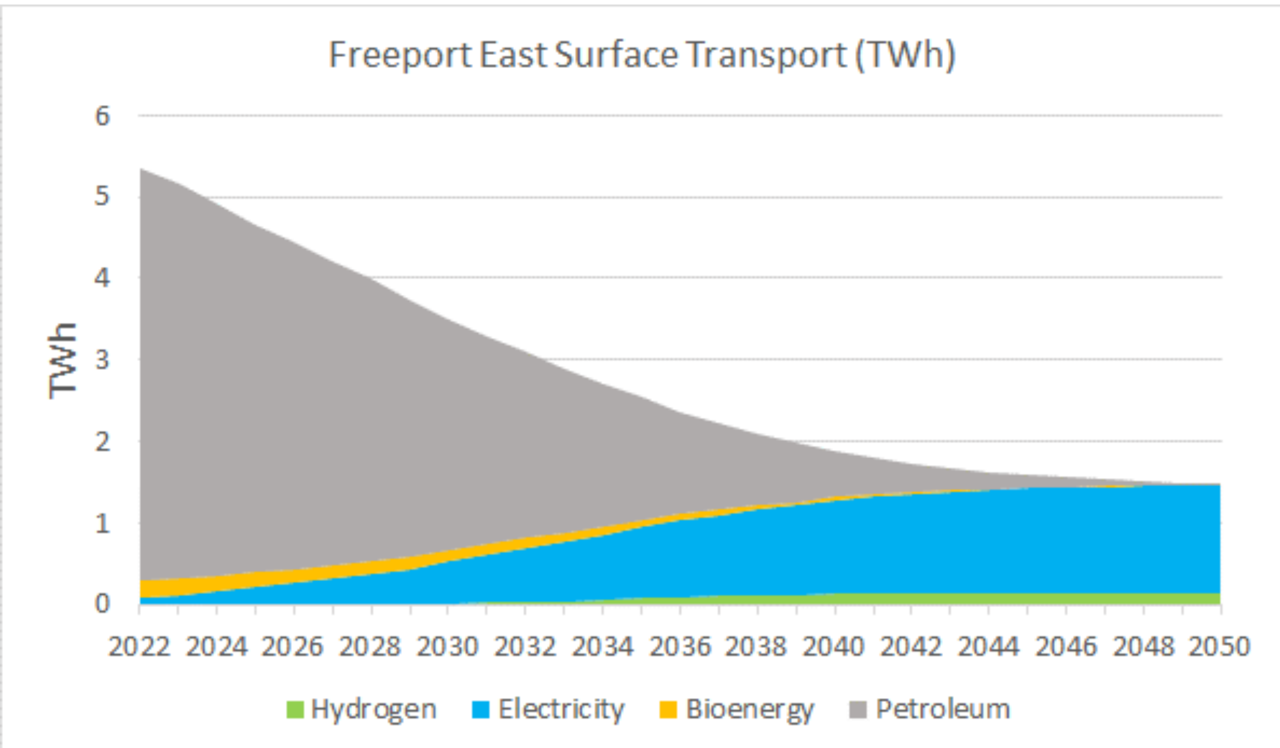
Using the CCC Balanced Pathway scenario, Freeport East's surface transport pathways to Net Zero will require reducing emissions to near zero by 2050. It will need a combination of behavioural change to reduce or change demand for travel, efficiency improvements to fossil fuel vehicles and the introduction and uptake of zero-emission vehicles.

The main surface transport decarbonisation pathways are expected to include:

- Electric vehicle (EV) growth, including charge-point expansion and incentives for EV use; improved vehicle efficiency; reduced miles driven due to remote working.
- Increased mass transit, including buses
- Increasing active transport, including cycling, walking and car-sharing
- Rail electrification and increased use of freight corridors.
- Heavy Goods Vehicle decarbonisation, efficiency improvements, improved logistics from higher loading, reduced empty running, and expansion of distribution centres.

The CCC assumptions are that surface transport is mainly expected to transition to electricity. The following chart uses the CCC Balanced Pathway profile to illustrate the potential change in demand and fuel type between 2022 and 2050 for Freeport East.

Figure 12: Freeport East Surface transport energy consumption 2022-2050 (TWh)



The previous chart illustrates a dramatic decline in petroleum use over the next decade, accompanied by a major increase in electricity consumption for surface transport. By 2050, the CCC scenario suggests that hydrogen will supply around 10% of surface transport energy.

Delivering a reduction in transport demand, introducing alternative forms of transport, and electrifying the remaining surface vehicles will be challenging. While the technology and initiatives to deliver this change are becoming better understood, the main barriers are likely to be ones of cost and how to successfully realise societal behavioural change.

In the widespread Freeport East region, with high levels of port related traffic, reducing surface transport volumes by this scale is likely to be especially difficult. As such, transport energy consumption is likely to be higher than the consumption modelled above.

Shipping

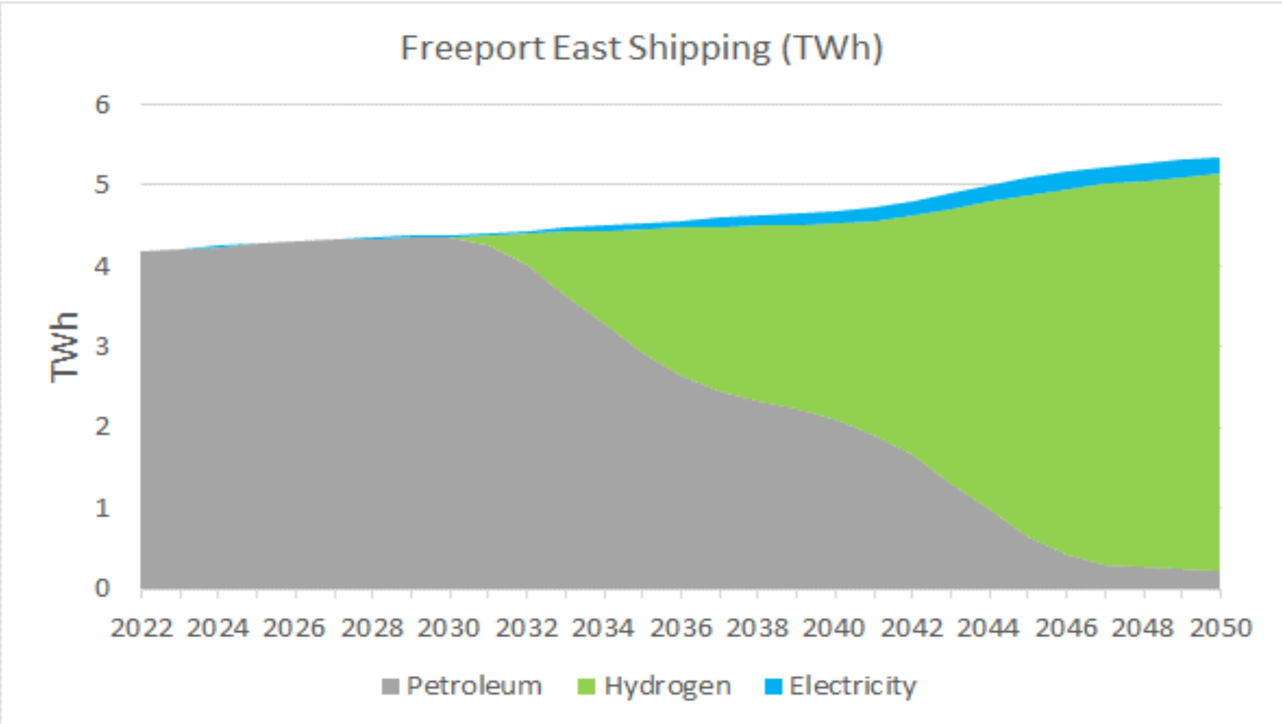
The CCC 2050 Balanced Pathway for shipping includes an assessment of both UK and associated international energy use.

The main marine decarbonisation pathways are expected to include:

- Shore side electrification including shore power, cranes and ancillary equipment
- Shore side propulsion charging
- Shore side sustainable fuel production (hydrogen, ammonia, methanol, etc,.). Green hydrogen could potentially be produced locally by electrolysis
- Shore side sustainable fuel bunkering

The CCC Balanced Pathway scenario suggests that the overall UK shipping energy use will increase together with hydrogen (or ammonia or methanol produced from hydrogen) replacing petroleum. Overall, a circa 40% expected increase in shipping volumes by 2050 is expected to be offset by annual efficiency savings of around 1%.

Figure 13: Shipping energy consumption 2022



[20] https://www.theccc.org.uk/wp-content/uploads/2020/12/Sector-summary-Surface-transport.pdf.

The previous figure illustrates this change, with a significant energy change from petroleum to ammonia or methanol derived from hydrogen. Increased traffic forecasts result in an increase in shipping energy consumption of about 30% between 2022 and 2050.

The main emissions reduction options for the domestic and international shipping sectors are expected to be:

- Fleet efficiency improvements, via a combination of operational optimisation, ship design and engine efficiency improvements, onboard renewable power generation (e.g., solar) and wind propulsion systems.

- Zero-carbon emission fuels – the main alternatives appear to be ammonia, methanol, or hydrogen. Ammonia appears to have greater potential due to higher energy density than hydrogen (and therefore smaller on-board fuel tanks) and lower retrofitting costs. However, while methanol production is expected to be more expensive than ammonia, it has technical and safety advantages which may result in greater early adoption.

- Electrification, to mainly provide shore power when vessels are docked in port and also used for some hybrid or full electric propulsion vessels (using onboard batteries and motors).

The key enablers for shipping decarbonisation will be the availability of shore power and low-carbon fuels. Given the prominence of the maritime sector in the Freeport East economy, it would appear this should be a priority sector for decarbonisation. Prioritisation of shipping decarbonisation would bring economic benefits by enabling Freeport East to:

- Take a leadership role in developing new decarbonisation-led commercial opportunities and

- Mitigate the threat of competition from more efficient and decarbonised transport hubs both in the UK and Europe.

Aviation

The CCC’s 2050 Balanced Pathway for aviation includes both UK domestic and international aviation. In this scenario, aviation energy consumption remains relatively constant between 2022 and 2050, although increases in traffic volumes are offset by efficiency improvements.

While noting that Stansted airport is outside the Freeport East geographic area, there is an opportunity to address its significant energy transition needs with the energy transition measures planned for the Freeport East region.

The following diagram suggests how the aviation energy transition might look if applied to the energy profile of Stansted airport. This report has assumed that Stansted airport transports 11% of UK air freight and passengers, and that it consumes 11% of UK aviation fuel as a result. Assumptions are detailed in Annex 1.

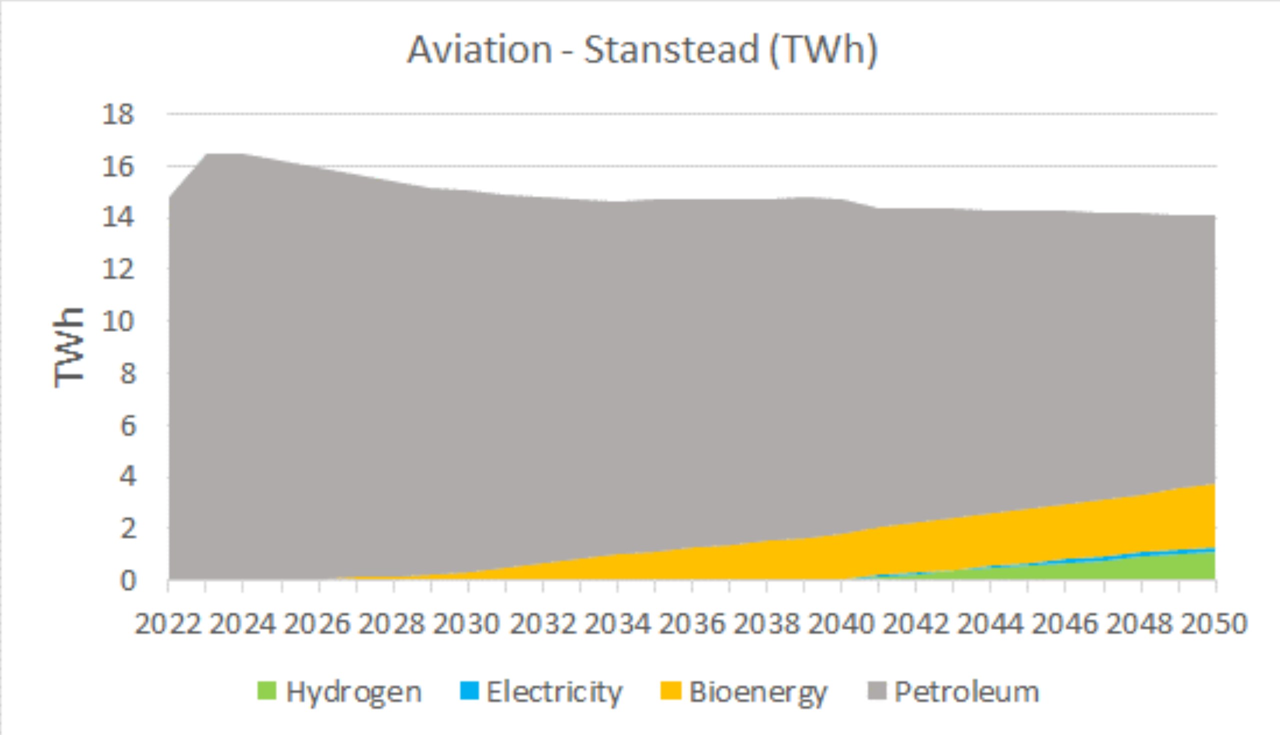
The main aviation decarbonisation pathways are expected to include:

- Efficiency improvements to aircraft fuel consumption and utilisation

- Sustainable fuel use, including bioenergy and electricity (including production and storage)

- Decarbonisation of airports including ground operation, transport and ancillary equipment

Figure 14: Stansted Aviation energy consumption 2022-2050 (TWh)



The chart illustrates an increased use of sustainable fuels in aviation, but petroleum still dominates.

The CCC's 2050 Balanced Pathway assumes that the potential for increased passenger demand and energy use is capped by increased travel taxes or offset by more efficient aircraft fleets. Overall, a circa 20% expected increase in passenger volumes is expected to be offset by annual efficiency savings of 1-2%, resulting in a decline in aviation fuel use of about 5% between 2022 and 2050.

There is potential for alternative pathways to evolve for sustainable aviation fuels, including bioenergy or synthetic fuels. These sustainable fuels could be produced in the nearby Freeport East area, enabling Stansted to achieve the energy transition.

C. How can Freeport East realise these decarbonisation targets?

The above analysis shows that Freeport East and the surrounding area faces a huge opportunity but also a significant challenge in reaching Net Zero. Industrial, commercial, and residential energy transition will need to deliver significant change, especially through electrification and decarbonisation of heating. The transport sector will need to provide a major contribution and especially the economically critical maritime sector.

Freeport East faces major challenges in realising these decarbonisation targets. It will be critical that sufficient economic electricity is available, and that sufficient investment capital can be attracted for the low-carbon infrastructure that will be needed. Furthermore, delivery will depend on the availability of sufficient people with the necessary skills and expertise.

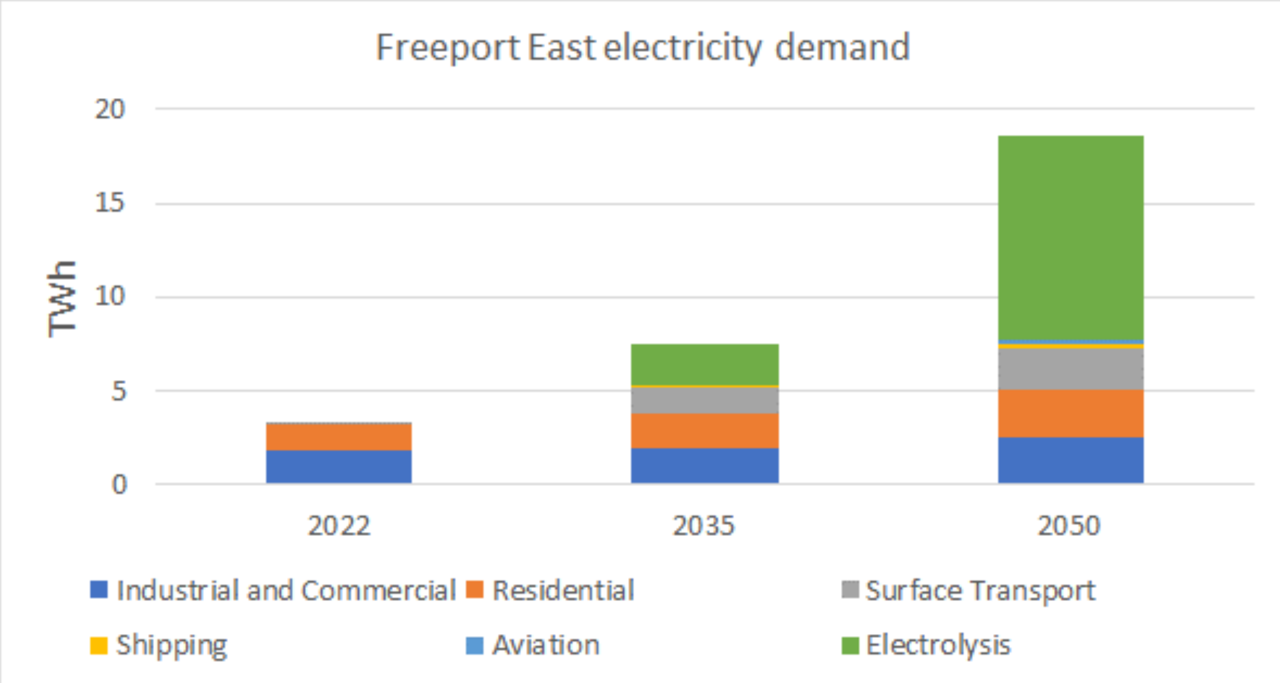
Enhancing electricity capacity

There will need to be dramatic changes in the energy mix with petroleum and gas being replaced by low carbon electricity and hydrogen. Electrolysis to produce green hydrogen and its derivatives will add significantly to the electricity demand.

Analysis earlier in this report of potential hydrogen consumption for Freeport East shipping and surface transport suggests that some 500MW of electricity demand would be required for electrolysis by 2035, rising to some 2.5GW by 2050. Assuming a 50% electrolyser load factor, this results in additional electrolyser electricity demand of 2.2TWh p.a. by 2035, and 11TWh by 2050. The following figure shows the scale of the electricity demand challenge:

[21] https://ukpowernetworks.opendatasoft.com/pages/ltds_ndp_landingpage/#:~:text=The%20Long%20Term%20Development%20Statement%20(LTDS)%20for%20each%20licence%20area,developments%20for%20five%20years%20ahead.

Figure 15: Freeport East Electricity demand 2022-2050 (TWh)



Based on these assumptions, the chart shows that electricity consumption increases by six times (from 3TWh to 18TWh) between 2022 and 2050, driven by the increase in hydrogen production. Even without electrolysis, the remaining electricity demand more than doubles over the period (from 3TWh to 8TWh). This will all need to be low carbon electricity if Net Zero targets are to be realised.

Enhancing electricity networks

The availability of cost-effective electricity supplies and electricity network capacity will be a critical pre-requisite if this electricity demand profile is to be realised. As highlighted earlier, grid congestion and connection queues are critical issues which must be addressed.

The following figure shows the current electricity capacity at some of the key substations in the Freeport East region. There is currently 162MW of capacity available at the Felixstowe, Colchester, Harwich, Ipswich, Stowmarket, and Sudbury grid supply points. However, because this capacity is divided over multiple locations, it is currently not possible to pursue projects that require a large grid connection in one location, e.g., green hydrogen projects.

UKPN advise that there is a £16m investment programme in place over the next four years to increase capacity in the region as well as increasing resilience to climate change and increasing network resilience. The Felixstowe grid capacity will be uprated with 132kV assets replacing 33kV ones. Additional capacity uprating works are currently being reviewed in collaboration with National Grid.

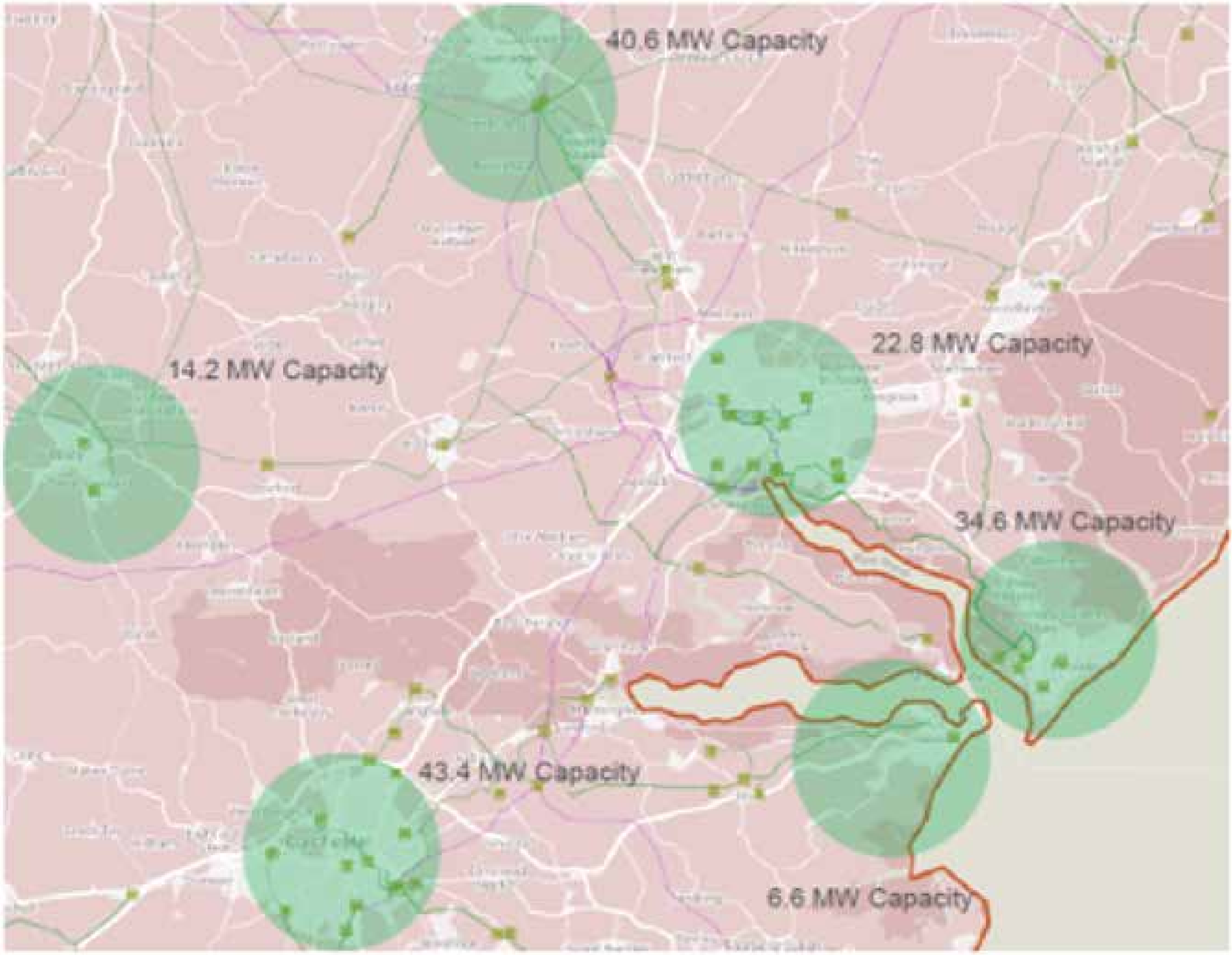
This current position is presented in the UKPN Long Term Development Statement (LTDS) for the Freeport East area[21]. The UKPN LTDS also presents forecasts through to 2050 for the future uptake of renewables, heat pumps, electric vehicles and district heating in the region.

While the UKPN LTDS may take account of increased electricity infrastructure needed across the residential, commercial & industrial, and surface transport sectors, it does not fully reflect the potential future maritime and aviation demand. If electricity demand in the Freeport East region is to increase sixfold by 2050, then significant investment in electricity infrastructure, i.e., distribution and transmission networks, and low carbon generation, will be required.

Decarbonisation policies from Government and funding approvals from the regulator, Ofgem, should be sufficiently flexible to ensure that electricity and gas network companies can reinforce and adapt their infrastructure to support the new demands needed to deliver Net Zero transportation targets.

But investment will need to extend beyond these networks into customer and publicly owned infrastructure, to establish new shore power and methanol or ammonia supply facilities for example. Investment in this customer-focused infrastructure will need to be coordinated to ensure it is delivered and utilised in the most efficient way, such as by sharing capacity to reduce duplication and higher than necessary overall costs.

Figure 16 UKPN Freeport East Network Capacity - 2022



Investing in other low-carbon infrastructure

Overall, the investment scale needed to decarbonise transport and fuel infrastructure is vast. Delivering this change will need investment in the whole energy supply chain, including production and storage of new low carbon energy, associated distribution infrastructure, and new equipment and devices to use it. The investment needs include:

- Zero-carbon fuel infrastructure – hydrogen, methanol, and ammonia demands are expected to increase significantly. New facilities will be needed for production, transportation, and storage/bunkering. Carbon capture and storage investment may also be required.
- Zero-carbon vehicles – alongside this enabling infrastructure will be the vast requirements for new ships, trains, aircraft, cars, buses, and all other forms of transport that are Net Zero compliant.
- Electricity applications – investment will be needed in heat pumps to replace gas boilers, electric vehicles, and hydrogen electrolysers, but cost may be offset by local renewables, battery storage, smart grids and customer demand management. Investment will be needed for electric vehicle charge-points and electricity networks, including for shore-side electrification.

Alongside new investment needs, there are significant opportunities to gain efficiencies through better co-ordination and integrated planning. For example, the flexibility provided by electric vehicles and heating demand can reduce the amount of new electricity infrastructure that is needed. Such flexible demand can be switched off or reduced at times of peak electricity demand, thereby reducing the need for generation or networks to be built to meet these short periods of peak demand.

Financing and delivery models

Local authority and industry collaboration and leadership will be important in delivering this investment efficiently and effectively. There are several alternative delivery models to deliver the necessary integration, management, and financing, which include these overleaf:

Public sector-led investment models

1. *Local Authority/Agency solutions* - where investment solutions are designed and funded by a local authority or agency. However, potentially large investment costs and funding may not be available from central government/agencies or local taxes. Performance and cost overrun risk remains with the local authority/agency.

2. *Strategic delivery partner* – where investment solutions are provided to the local authority/agency by a strategic delivery partner through a public/private partnership. Concession contracts would need to be flexible so performance and cost overrun risk may remain with local authority/agency. Contracts would require revenue commitments by the local authority/agency.

3. *Regulated private utility solutions* - investment is delivered by private regulated utilities such as electricity/gas distribution networks. Investment is agreed by Ofgem and funded by network charges socialised across customers. Performance risk lies with the utility.

Private sector-led investment solutions

4. Private direct investment - where solutions are designed and funded by private sector developers, investors, and lenders. This is likely to be most applicable to major infrastructure investment e.g. hydrogen electrolysers, methanol production and bunkering. However, large investments may not be viable without long-term revenue contracts. Delivery and performance risk lies with the infrastructure asset owner who will need to make returns on their investment.

5. Customer-led investment - where businesses or individuals undertake their own investment, or contract with solution providers for energy supply and low carbon infrastructure. This may lead to inefficient overall investment if not coordinated.

In addition to the above approaches, the role of the state-owned UK Infrastructure Bank (UKIB) may provide valuable additional support for well-defined projects. The UKIB is mandated to invest in accord with the following principles:

1. The investment helps to support the Bank's objectives to drive regional and local economic growth or support tackling climate change.

2. The investment is in infrastructure assets or networks, or in new infrastructure technology. The Bank will operate across a range of sectors, but will prioritise in particular clean energy, transport, digital, water and waste.

3. The investment is intended to deliver a positive financial return, in line with the Bank's financial framework.

4. The investment is expected to crowd in significant private capital over time.

D. Freeport East 'Green Transport Hub' - addressing the barriers

The transport sector, covering surface transport, aviation and shipping, currently accounts for about one third of the UK's overall greenhouse gas emissions. Decarbonisation of transport will be critical for achieving the UK's legislated targets for Net Zero emissions. Furthermore, the global transition to green transport fuels means that current fuel supply chains for surface, sea and air transport will need to change.

As a major UK transport region, Freeport East aims to evolve into a 'Green Transport Hub', enabling innovation and exploiting new technologies, and bringing significant economic benefits to the area and the wider UK economy.

The opportunity for Freeport East

Freeport East can use its geographical advantage as a major transport hub to produce and supply green fuels for maritime, surface, and air transport (including for the nearby Stansted airport). Freeport East has an opportunity to gain additional economic benefit for the region by producing and bunkering green shipping fuels. Alongside initiatives to electrify surface transport in the region, Freeport East ports can deliver decarbonisation by replacing fossil-fuel shore-side energy and shipping fuels with low carbon alternatives.

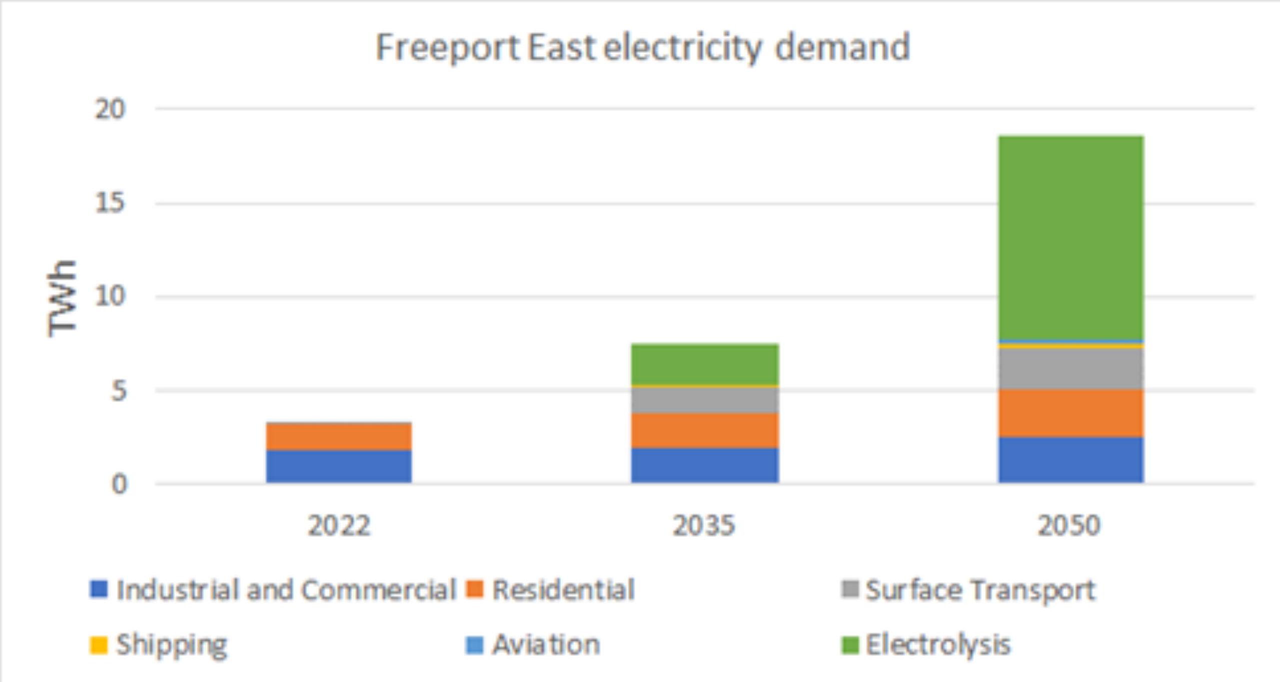
The barriers faced by Freeport East

1. Electricity networks

Freeport East's aim to become a 'Green Transport Hub' is dependent upon sufficient electricity capacity being available in the region for both import to supply demand growth and for export of renewable energy. Grid reinforcement and connection queue barriers must be addressed.

The below chart illustrates that electricity consumption could increase significantly (estimated at six-fold from 2022 to 2050) to supply electricity for transport and hydrogen electrolysers.

Figure 17: Freeport East electricity demand



The Freeport East region electricity transition will need significant new electricity infrastructure investment, as well as resolution of network connection queues.

2. Green hydrogen and green fuel production

Analysis commissioned by Freeport East projects the future hydrogen demand for both shipping and surface transport as:

- By 2030, a total hydrogen demand of 207 tpd, and c500MW of electrolyser capacity
- By 2050, a total hydrogen demand of 1130 tpd and c2.5GW of electrolyser capacity

Any aviation or industrial demand for hydrogen would be additional to this total.

Again, major investment will be needed in Freeport East region hydrogen production and storage facilities to supply green transport fuels

3. Financing and delivery

The delivery of the above capacity in electricity and hydrogen related infrastructure will require significant capital investment.

Raising this finance is expected to require a mix of public funding or support alongside direct private investment, including from regulated utilities for network investments. Enabling private investment will require an attractive investment environment such as the UK's hydrogen allocation round process, which gives certainty to developers and finance providers – without it, finance is unlikely to be available and investment will not take place.

4. Integrated transport and energy planning

Freeport East's aim to become a 'Green Transport Hub' faces major delivery risks if the related energy and transport developments and investments are not coordinated.

It will be important that a coordinated investment pathway for new electricity capacity, hydrogen production, and the associated transport/fuel infrastructure is identified. Freeport East will need to:

- Develop an integrated energy and infrastructure resource plan for the region, identifying the key investment priorities
- Develop a financing and investment strategy, deploying both public and private sector solutions

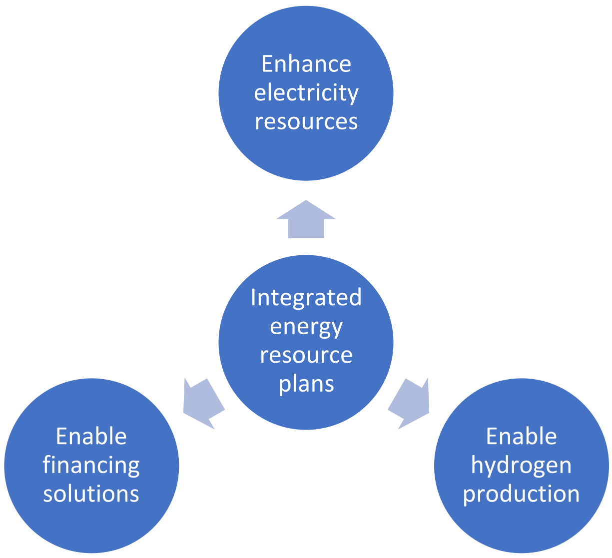
8. Recommendations

The Freeport East region can leverage its existing position as a major UK transport hub with the energy transition to become a major UK and international 'Green Transport Hub'. This is a valuable opportunity that should deliver major benefits to both local and national economies.

But to achieve this goal, sufficient low-cost renewable energy supplies and associated networks must be available, plus a green fuel production, supply and storage chain. This will require significant investment and must be cost-competitive in a highly competitive trade and transport marketplace. Also, the evolution to a 'Green Transport Hub' must be coordinated with other energy transition measures for power, heat, and transport across the region.

The following diagram illustrates four strategic themes that are proposed to achieve the 'Green Transport Hub' vision for Freeport East. The delivery of investment for electrification and green fuels will require financing solutions, all enabled in the most efficient and effective way by an integrated 'whole system' energy resource plan.

Figure 18: Proposed Strategic themes for Freeport East



The following key initiatives and requirements are proposed for each of these strategic themes. These will each require the assessment of requirements and how these may be realised:

Theme 1: Enhance electricity resources

- Electricity networks – investment is needed to increase network capacity for transport electrification and electrolysers, also deploying intelligent, flexible grid solutions.

- Customer electricity infrastructure – investment is needed for electric vehicle charge-points and for port shore-side, airport, and rail electrification.

- Electric vehicles – investment is needed both for low carbon electricity supply and for the vehicles themselves.

Theme 2: Enable Hydrogen Production

- Electrolysers – identification of investment needed in hydrogen electrolyser capacity; there should be a favourable environment to attract investment in these projects

- Hydrogen and derivative fuel infrastructure – identifying and enabling investment needed in the associated supply chain for methanol/ammonia fuel production, distribution, and storage

- Hydrogen vehicles – a favourable investment environment is needed for these new forms of transport. Green Transport Corridors for shipping will need to be identified.

Theme 3: Enable financing solutions

A mix of public and private sector financing solutions are expected to be required, including:

- Ofgem approval of anticipatory investment in regulated energy networks

- Government tender rounds to provide revenue support for hydrogen projects

- Direct Government funding for green innovation and transport projects

- Financing support from UK Investment Bank and other lenders

- Private sector direct financing for projects

Securing finance from these alternative sources will require clear investment priorities and business cases to be defined, providing confidence to finance providers. Freeport East will have a key role to play in initial development and helping to enable funding.

Theme 4: Integrated resource planning and delivery

Co-ordinated national and local plans will be essential to optimise the cost of meeting Net Zero targets across the whole energy system. They also must connect effectively with the local businesses and communities that will be seeking to implement and benefit from the energy system transition. Key initiatives are expected to include:

- Create an integrated Freeport East region energy plan, mapping out future energy demand and supply across electricity, heat, and transport.

- Define the governance arrangements for this plan, including responsibility for coordination with key local/ national stakeholders.

- Prepare delivery plans which should identify priority investment needs and delivery models, identifying financing solutions. These plans should seek to enable pilot projects and investment in innovation and capability building.

Annex 1 – Energy Demand methodology and assumptions

2022 Freeport East Data Assumptions

Energy consumption data has been derived for 2022 across the major demand sectors. By 2022, transport demand had continued its recovery from reductions experienced during the Covid pandemic but was still lower than 2019 levels. In 2022, energy consumption in the residential, commercial, and industrial sectors was lower than might be expected due to the high energy prices caused by the Russia/Ukraine war.

The 2022 data assumptions for Freeport East and Stansted airport are shown in the following table and described in more detail overleaf.

Industrial & Commercial, Residential and Surface Transport

Final energy consumption data for Industrial & Commercial, Residential, and Surface Transport (Road/Rail) for the Freeport East area was sourced from the DESNZ 2021 local authority energy consumption statistics[22]. The six Local Authority Areas included for the analysis were Babergh, Colchester, East Suffolk, Ipswich, Mid Suffolk, and Tendring.

This data set (which excludes aviation and shipping data) provided a breakdown of consumption by primary fuels, including petroleum, coal, electricity, gas, and bioenergy.

The methodology used can be found at the following reference[23]. Electricity and gas data are based on real consumption recorded from meters which is then aggregated to local authority and regional level. Road transport fuel and residual fuel data are modelled using a national level and then disaggregated using spatial data.

This 2021 energy consumption data was then adjusted to 2022 levels by using the DESNZ aggregate energy balance for 2022[24]. This resulted in the following adjustments for 2022:

- A 3% reduction for industrial and commercial consumption from 2021 levels, again likely to be driven by high energy prices.
- A 14% reduction for residential consumption from 2021 levels, with the main driver likely to be the impact of the Russia/Ukraine war and the energy affordability crisis.
- A 3% increase from 2021 for surface transport after the pandemic, but 2022 energy consumption still remained 5% lower than pre-pandemic (2019) levels.

Shipping

2022 UK energy consumption data for shipping was derived from the CCC model for the 6th Carbon Budget[25] where the 2022 total UK petroleum consumption for shipping was 59.6TWh. This forecast for 2022 was published by the CCC in December 2020 and took account of pandemic impacts.

DfT ship freight statistics show that the Freeport East ports of Felixstowe, Harwich and Ipswich accounted for 7% of UK freight traffic[26] in 2022 and around 6% of UK passenger traffic[27]. For this analysis, it has been estimated that 7% of all UK shipping energy use is attributable to Freeport East ports. This equates to 4.2TWh in 2022.

Aviation

While there are no major airports within the Freeport East geographic area, Stansted airport is within proximity and is likely to be an integral part of the regional transport and energy strategy. This report has therefore included analysis of the energy consumption associated with Stansted.

2022 UK actual energy consumption data for aviation was derived from DfT energy statistics (Table ENV0102)[28] where the 2022 total UK petroleum consumption for aviation was 10.6Mtoe or 124TWh. This is 22% below (2019) pre-pandemic levels.

DfT aviation statistics showed that, in 2022, Stansted airport accounted for 11% of total UK air freight and 11% of air passengers[29]. This percentage was used to calculate Stansted airport petroleum demand in 2022. This equates to 1.2Mtoe or 13.6TWh in 2022.

2035 and 2050 Freeport East Energy Assumptions

Energy consumption forecasts for 2035 and 2050 have been based on the assumptions made in the Climate Change Committee's Balanced Pathway scenario to meet Net Zero targets by 2050. The future consumption profiles have been applied to the 2022 baseline data derived above for the Freeport East area and Stansted airport.

The 2035 and 2050 energy consumption and fuel type forecasts for the Freeport East area and Stansted airport are shown in the following tables.

Table 1: Freeport East 2022 energy consumption (TWh)

2022	Electricity	Coal	Gas	Petroleum	Bioenergy	Hydrogen	Total
Industrial and Commercial	1.8	0.3	1.5	0.9	1.3	0.0	5.7
Residential	1.4	0.1	3.3	0.5	0.2	0.0	5.4
Surface Transport	0.1	0.0	0.0	5.5	0.3	0.0	5.8
Shipping	0.0	0.0	0.0	4.2	0.0	0.0	4.2
Aviation (Stansted)	0.0	0.0	0.0	13.6	0.0	0.0	13.6
Transport Sub total	0.1	0.0	0.0	23.2	0.3	0.0	23.6
Total	3.3	0.4	4.8	24.6	1.7	0.0	34.7

Table 2: Freeport East 2035 energy consumption scenario (TWh)

2035	Electricity	Coal	Gas	Petroleum	Bioenergy	Hydrogen	Total
Industrial and Commercial	1.9	0.0	0.6	0.4	1.0	0.3	4.3
Residential	1.8	0.0	1.8	0.2	0.1	0.0	3.9
Surface Transport	1.4	0.0	0.0	1.5	0.1	0.1	3.2
Shipping	0.1	0.0	0.0	2.9	0.0	1.5	4.6
Aviation (Stansted)	0.0	0.0	0.0	13.5	1.1	0.0	14.7
Transport Sub total	1.5	0.0	0.0	18.0	1.3	1.7	22.4
Total	5.3	0.1	2.4	18.5	2.4	2.0	30.6

The 2035 scenario shows an overall 12% expected reduction in energy consumption from 2022, mainly from residential, Industrial & Commercial and from surface transport. The 2050 scenario illustrates that reductions in surface transport energy are expected to continue.

Table 3: Freeport East 2050 energy consumption scenario (TWh)

2050	Electricity	Coal	Gas	Petroleum	Bioenergy	Hydrogen	Total
Industrial and Commercial	2.5	0.0	0.2	0.1	0.8	0.7	4.2
Residential	2.6	0.0	0.0	0.0	0.1	0.2	2.8
Surface Transport	2.2	0.0	0.0	0.0	0.0	0.2	2.4
Shipping	0.2	0.0	0.0	0.2	0.0	4.9	5.4
Aviation (Stansted)	0.2	0.0	0.0	10.4	2.4	1.1	14.1
Transport Sub total	2.6	0.0	0.0	10.6	2.4	6.2	21.9
Total	7.7	0.0	0.2	10.7	3.3	7.1	28.9

Major consumption changes between 2022 and 2050

The major changes between 2022 and 2050 for each of the consumption sectors are highlighted below, also showing the change in fuel mix between 2022 and 2050.

Industrial & Commercial

- an overall demand reduction of 26% is assumed from 2022 levels based on the CCC Balanced Pathway assumptions.

- Based on CCC Balanced pathway assumptions, the fuel type assumptions are: electricity - 66%, gas – 7%, hydrogen – 19%, bioenergy – 7% and petroleum 1%.

Residential

- an overall demand reduction of 48% is assumed from 2022 levels based on the CCC Balanced Pathway assumptions.

- Based on CCC Balanced pathway assumptions, the fuel type assumptions are: electricity - 92%, hydrogen – 6%, and bioenergy – 2%.

Surface transport

- an overall demand reduction of 58% is assumed from 2022 levels based on the CCC Balanced Pathway assumptions.

- Based on CCC Balanced pathway assumptions, the fuel type assumptions are: electricity - 90%, hydrogen – 8%, and petroleum 2%.

Shipping

- an overall demand increase of 28% is assumed from 2022 levels. This is based on UMAS/DfT modelling that shows a potential 40% increase in volumes/traffic for 2050. It is assumed the commensurate increases in energy demand are offset by annual efficiency savings of c1% per annum.

- Based on CCC Balanced pathway assumptions, the fuel type assumptions are: electricity - 4%, hydrogen (ammonia/methanol) – 91%, and petroleum 4%.

Aviation

- an overall demand reduction of 4% is assumed from 2022 levels. This assumes an UK air traffic increase of around 20% from 2019 levels (as envisaged by CCC/DfT analysis). It is assumed the commensurate increases in energy demand are offset by efficiency savings of c1-2% per annum.

- Based on CCC Balanced pathway assumptions, the fuel type assumptions are: electricity - 1%, hydrogen – 8%, bioenergy – 17% and petroleum 74%.

22 https://www.gov.uk/government/collections/total-final-energy-consumption-at-sub-national-level

23 https://www.gov.uk/government/publications/regional-energy-data-guidance-note

24 https://www.gov.uk/government/statistics/energy-chapter-1-digest-of-united-kingdom-energy-statistics-dukes Table 1.1

25 https://www.theccc.org.uk/publication/sixth-carbon-budget/

26 https://www.gov.uk/government/statistical-data-sets/port-and-domestic-waterborne-freight-statistics-port

27 https://www.gov.uk/government/statistical-data-sets/sea-passenger-statistics-spas

28 https://www.gov.uk/government/statistical-data-sets/energy-and-environment-data-tables-env

29 https://www.gov.uk/government/statistical-data-sets/aviation-statistics-data-tables-avi

Official Supporters

RWE

As an organisation with an ambition to have net zero emissions by 2040, RWE is committed to developing renewable energy projects, including green hydrogen production across the UK. To meet these ambitions, it is vital for us to work hand-in-hand with major UK transport hubs like the Freeport East region to decarbonise operations.

The opportunities for green hydrogen production, distribution and end use are vast, and Freeport East is well placed to capitalise on the upcoming social and economic benefits by working with the likes of RWE. We are ready to grow our footprint in the region, building on our exiting presence, but a coordinated effort is required to unlock some of the barriers that stand in the way.

This report highlights the vital need to enhance the electricity networks and renewable electricity generation infrastructure in the region, as well as the requirement to solve some of the wider issues that enable green hydrogen production - the supply chain, the need for hydrogen storage, as well as the capacity to utilise hydrogen for the production of green fuels for transport.

The opportunities for this region are clear. Raising awareness of the challenges and potential solutions is the first step towards building a successful green economy in partnership with ambitious industrial players like RWE.

MARITIME

Maritime Transport Limited is the UK's leading provider of integrated road and rail freight logistics with a network of 41 depots including 8 inland rail terminals. Maritime operate 1,200 HGV's covering 100m miles p.a. and 18 daily rail services for container and distribution customers.

The company's vision is to be the UK's most trusted supply chain partner and a leader in decarbonising logistics whilst delivering long-term sustainable road and rail solutions to create the cleanest full-load supply chain in the country.

This is being delivered by using rail where possible for journeys from/to ports with Maritime's network of inland rail terminals and planned deployment of battery electric HGV's for first and final mile transports from rail terminals, in addition to direct deliveries from/to ports including Felixstowe.

Maritime are participating in the Innovate UK / Department of Transport's Zero Emissions HGV & Infrastructure Demonstrator (ZEHID) programme which will involve them running 44 battery electric HGV's and 4 Hydrogen Fuel Cell vehicles for 5 years from 2025/26.

As such, availability of sufficient power is critical to the Maritime strategy and the transport industry as a whole for the UK to achieve its net zero goals.

Maritime therefore commend the analysis carried out by REA and support the conclusions and recommendations set out in this report.

Sizewell C

The power of **good for Britain**

Sizewell C welcomes Freeport East's strategy to become a Green Transport Hub in the region. The plans complement Sizewell C's mission to secure Britain's clean energy future by providing 3.2 Gigawatts of clean electricity for at least 60 years.

During construction, Sizewell C will contribute to the decarbonisation of transportation in the region by running a fleet of up to 150 hydrogen buses to take the construction workforce to and from site. It will also develop the necessary associated hydrogen infrastructure which can continue to serve the region (including future Freeport East Green Transport Hub stakeholders) beyond Sizewell's construction.

During operation, Sizewell C will support the decarbonisation of transportation not only through the generation of clean electricity but also through the ability to utilise heat from the power plant to produce hydrogen and capture carbon more efficiently. Such hydrogen and carbon capture technology could help a future Freeport East Green Transport Hub decarbonise road transportation and manufacture synthetic fuels for maritime and aviation use in the region.

We welcome Freeport East's plans to decarbonise transportation in the region and look forward to continued collaboration throughout the development of the Hub.

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