Sunnica Energy Farm EN010106

Cambridgeshire County Council

East Cambridgeshire District Council

Suffolk County Council

West Suffolk Council

Local Impact Report: Index of Appendices

28 October 2022

Appendix Ref.	Title	Available
Appendix 1	Forest Heath Core Strategy Development Plan 2001-2026 (2010) [Adopted 12/05/10]	https://www.westsuffolk.gov.uk/planning/Planning_Policies/local_plans/forestheathcorestrategy.cfm [Accessed 28/10/22]
Appendix 2	Joint Development Management (DM) Policies Document (Feb 2015) [Adopted 27/02/15]	https://www.westsuffolk.gov.uk/planning/Planning_Policies/local_plans/jointdevelopmentmanagementpoliciesdocument.cfm [Accessed 28/10/22]
Appendix 3	West Suffolk's Emerging Local Plan Part 1 (Strategic Policies) [Reg 18 October 2020 version]	PDF uploaded separately
Appendix 4	West Suffolk's Emerging Local Plan Part 2 (Non-Strategic Policies) [Reg 18 October 2020 version]	PDF uploaded separately
Appendix 5	West Suffolk's Emerging Local Plan Part 3 (Site Allocations) [Reg 18 October 2020 version]	PDF uploaded separately
Appendix 6	East Cambridgeshire Local Plan [Adopted 21/04/15]	PDF uploaded separately
Appendix 7	Suffolk County Council Minerals and Waste Local Plan (2020) [Adopted 09/07/20]	PDF uploaded separately
Appendix 8	Cambridgeshire and Peterborough Minerals and Waste Local Plan [Adopted 28/07/21]	https://www.cambridgeshire.gov.uk/business/planning-and-development/planning-policy/adopted-minerals-and-waste-plan#:~:text=The%20Cambridgeshire%20and%20Peterborough%20Minerals,and

Appendix Ref.	Title	Available
		%20waste%20developments%20until%202036. [Accessed 28/10/22]
Appendix 9	Newmarket Neighbourhood Plan [Made 25/02/20]	https://www.westsuffolk.gov.uk/planning/Planning_Policies/neighbourhood-planning/neighbourhood-planning-in-newmarket.cfm [Accessed 28/10/22]
Appendix 10	Freckenham Neighbourhood Plan Area Designation Statement [2/11/18]	https://www.westsuffolk.gov.uk/planning/Planning_Policies/neighbourhood-planning/neighbourhood-planning-in-freckenham.cfm [Accessed 28/10/22]
Appendix 11	Fordham Neighbourhood Plan [Made 19/12/18]	https://www.eastcambs.gov.uk/local-development-framework/fordham-neighbourhood-plan [Accessed 28/10/22]
Appendix 12	Isleham Neighbourhood Plan [Made 19/05/22]	https://www.eastcambs.gov.uk/local-development-framework/isleham-neighbourhood-plan [Accessed 28/10/22]
Appendix 13	Suffolk County Council Local Transport Plan Part 1 [2011]	https://www.suffolk.gov.uk/roads-and-transport/transport-planning/transport-planning-strategy-and-plans/ [Accessed 28/10/22]
Appendix 14	Suffolk County Council Local Transport Plan Part 2 [2011]	https://www.suffolk.gov.uk/roads-and-transport/transport-planning/transport-planning-strategy-and-plans/ [Accessed 28/10/22]

Appendix Ref.	Title	Available
Appendix 15	Green Access Strategy (Rights of Way Improvement Plan) [2020]	PDF uploaded separately
Appendix 16	Cambridgeshire County Council Rights of Way Improvement Plan (2016 update) [Adopted 04/16]	PDF uploaded separately
Appendix 17	SCC Travel Plan Guidance [Adopted 09/22]	PDF uploaded separately
Appendix 18	Suffolk Guidance for Parking [May 2019]	PDF uploaded separately
Appendix 19	NALEP Economic Strategy for Norfolk and Suffolk 2022	Attached below
Appendix 20	NALEP Integrated Transport Strategy for Norfolk and Suffolk	Attached below
Appendix 21	SCC Energy Infrastructure Policy [Adopted 23/02/2021]	https://www.suffolk.gov.uk/planning-waste-and-environment/major-infrastructure-projects/energy-infrastructure-policy/ [Accessed 28/10/2022]
Appendix 22	Draft Overarching National Policy Statement (EN-1) [Published 06/09/2021]	https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements [Accessed 28/10/2022]

Appendix Ref.	Title	Available
Appendix 23	Draft National Policy Statement for Renewable Energy Infrastructure (EN-3) [Published 06/09/2021]	https://www.gov.uk/government/consultations/planning-for-new-energy-infrastructure-review-of-energy-national-policy-statements [Accessed 28/10/2022]
Appendix 24	East Cambridgeshire Natural Environment SPD 2020 [Adopted 24/09/2020]	PDF uploaded separately
Appendix 25	Community Acceptance for Large Solar Farms study [What shapes community acceptance of large-scale solar farms? A case study of the UK's first 'nationally significant' solar farm, P Roddis *et al.*, Solar Energy, Elsevier, 2020]	Attached below
Appendix 26	Air Quality Assessment Sunnica Energy Farm, SRL [31/05/2022]	Attached below
Appendix 27	Cambridgeshire Local Transport Plan 3 [2015]	PDF uploaded separately
Appendix 28	Joint Cambridgeshire & Peterborough Health & Well-being Strategy [2020-2024]	PDF uploaded separately
Appendix 29	Cambridgeshire County Council's General Principles for Development (GPD) [May 2021]	PDF uploaded separately
Appendix 30	Cambridgeshire County Council's Housing Estate Road Construction Specification (HERCS) [August 2020]	PDF uploaded separately
Appendix 31	British Horse Society Advice on Solar Farms	Attached below
Appendix 32	DEFRA Rights of Way Circular Guidance [October 2009]	PDF uploaded separately

Appendix Ref.	Title	Available
Appendix 33	West Suffolk Council Local Development Scheme [Effective December 2018, updated January 2022]	PDF uploaded separately
Appendix 34	Fens Biodiversity Audit	PDF uploaded separately
Appendix 35	West Suffolk Landscape Character Assessment	PDF uploaded separately
Appendix 36	West Suffolk Contaminated Land Strategy [Effective from 01/04/2019]	https://www.westsuffolk.gov.uk/environment/environmental-services/upload/WSC-Contaminated-Land-Strategy-2019.pdf [Accessed on 28/10/2022]

Appendix 19: NALEP Economic Strategy for Norfolk and Suffolk 2022

NORFOLK & SUFFOLK ECONOMIC STRATEGY

An ambitious blueprint for the UK's clean growth region

2022

Norfolk & Suffolk Unlimited

We are facing unprecedented social and economic change. The way we live, learn, work, and do business is transforming. The impacts of the pandemic, leaving the EU, the acceleration of digitisation and the need to address our impact on climate change and biodiversity are all contributing factors. There are challenging times to come and more will need to be done to support our people, businesses, and places to adapt, transition and flourish.

This is the time for strong leadership, bold action and far-reaching interventions. This Economic Strategy is the blueprint for how local authorities, businesses large and small, business support organisations, Voluntary Community and Social Enterprise (VCSE) organisations, colleges, universities, independent training providers and the Local Enterprise Partnership (LEP) will work together, aligning relevant actions and investment, to build a cleaner, stronger and more productive economy where everyone benefits.

Collaboration and hard work from all partners has been at the heart of our success to date. Together we have invested and delivered transformative projects and initiatives. Through LEP programmes alone over £300m has been invested into the region's economy in the last decade, unlocking a further £1.3bn of investment. Partners too have secured significant investment from the bridge crossings in Great Yarmouth and Lowestoft (£247m) to five town deals – Great Yarmouth, Ipswich, King's Lynn, Lowestoft and Norwich totalling £120m. Collectively we have created, safeguarded and supported thousands of jobs, businesses, start-ups, and learners.

Above – Aerial view of Great Yarmouth port (Credit: Mike Page)

Our ambition is to transform our economy into a globally recognised, technology-driven and inclusive economy which is leading the transition to a zero-carbon economy through sustainable food production, clean energy generation and consumption and digital innovation; becoming one of the best places in the world to live, work, learn and succeed in business.

We recognise that this will not be achieved by one partner alone, or by any single strand of investment or action. We have always been most successful when we work together for the benefit of those who live in, work in, learn in and visit Norfolk and Suffolk.

The actions in this strategy will help lead us out of these challenging circumstances and deliver on our region's potential.

C-J Green
Chair, New Anglia LEP

Cllr Carl Smith
Chair, Norfolk Public Sector Leaders Group

Cllr Suzie Morley
Chair, Suffolk Public Sector Leaders Group

Local partners across business, business support organisations, local authorities, public health, education providers and the VCSE sector have come together to agree this strategy and are all committed to:

Collaborating to secure and aligning investment and actions to build a cleaner, more inclusive, and productive economy.

Inspiring the next generation, current workforces, businesses, VCSE organisations and communities to innovate, embrace automation and clean growth through strong collaborative leadership.

Innovating by exploiting our expertise and innovation capabilities to pioneer solutions to the major challenges facing the world in the 21st century. Ensuring we capitalise locally on the application and diffusion of this innovation and the emerging growth opportunities.

Investing in people, sustainable infrastructure, innovation, social and environmental value, health and wellbeing, leveraging in more investment to deliver on our ambitions.

Cover images show agri-food research, the Lotus Evija at Hethel, Peerless Plastics, the new CEFAS headquarters and cyclists in Breckland.

WHAT WE WANT NORFOLK AND SUFFOLK TO BE:

A higher performing clean, productive and inclusive economy,

where business invest in people and innovation, new sustainable techniques and technology, leading to decarbonisation, increased value in our foundation sectors, reductions in wage inequalities and pressure in overall living standards and productivity improvements.

An inclusive economy with an appropriate and highly skilled workforce, where everyone benefits from clean economic growth.

Norfolk and Suffolk will continue to promote collaboration between business, HE, FE, schools, VCSE organisations and the public sector to provide the training opportunities and work experience that enable businesses and people to fulfil their full potential.

An international facing economy with high value exports,

where our sectors are producing and exporting more sustainable value-added goods and services, entering new global markets and capitalising on new trade links to other economies.

A place with a clear, defined, ambitious offer to the world,

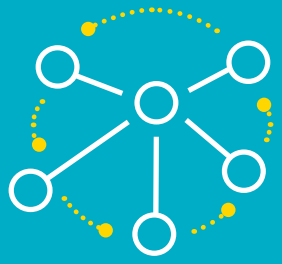
which showcases the strengths of Norfolk and Suffolk as the UK's clean growth region to the UK and beyond. Offering diverse, high quality, sustainable and affordable housing where people want to live, with a strong vibrant culture and leisure offers and a clear sense of why people and business choose to live and work here.

A well-connected place, locally, nationally and internationally.

Investment in sustainable infrastructure – affordable housing, roads, rail and digital – is coordinated to build the communities and connections that people and businesses need.

The place where high growth businesses with aspirations choose to be,

with excellent sustainable sites to locate, grow and innovate, with easy access to support and finance which fit the need of businesses.



A centre for the UK's clean energy sector,

exploiting the strength and diversity of the energy sector and supply chain, our strategic location, skills base and connectivity to other regions. Where local communities and businesses are benefiting from these strengths.

WHY DO WE NEED A STRATEGY?

The Norfolk and Suffolk economy is diverse and in the face of recent difficulties has proven comparatively resilient, but we face some real challenges.

Employment levels are higher than the UK average, yet we don't have enough people to fill current vacancies and some sectors face significant skills shortages – particularly with regards to science, technology, engineering and maths (STEM) related skills and capabilities. We must support and inspire businesses to commit to developing skills in their workforce and find ways to spark innovation.

Increasing costs and demand for resources and materials will bring pressure for both businesses and people. Our comparatively low level of productivity is inherent, but increasing our productivity levels to the UK average would contribute an additional £4bn gross value per annum to the regional economy. We also have opportunities to add social value and reduce fragility in supply chains.

There is an urgent need to accelerate our economy's transition meeting global, national and regional climate ambitions in order to drive sustainable change within businesses of all sizes. Capital investment and land use needs to be better aligned with our social and environmental ambitions to ensure our cities, towns and communities are vibrant, healthy, sustainable, and resilient.

Alongside our world-leading research strengths, the cross-sector innovation opportunities are particularly exciting. They position us well to tackle the challenges our economy faces and we are well placed to make a major contribution to solving them nationally and globally.

The purpose of the strategy

This strategy identifies the social and economic challenges, strengths and opportunities which are needed to support clean, inclusive and productive growth.

It is our response to the Government's Plan for Growth and provides the foundations to secure government funding. It will bring a wide range of partners together around shared ambitions and actions and help position Norfolk and Suffolk as a place to pilot initiatives and activity and as a place to invest.

It sets out our potential at a regional level and will complement and support county, district, sectoral and institution plans. This strategy looks to 2036 but focuses on the actions we need to take over the next three to five years to secure long term success. It provides a framework for partners to develop plans specific to their geography, sector or institutions. Much of the delivery will take place through these plans.

If we succeed, we will:

- *Accelerate our economy's transition to net zero.*
- *Connect and empower businesses - through innovation, supply chain development and access to new markets.*
- *Secure public and private investment through promoting the area's unlimited potential.*
- *Enable all people to upskill, reskill and access employment, attracting and retaining talent to the area.*
- *Support our places and communities to be more vibrant, healthy, inclusive, sustainable and resilient.*

OUR PLACE

Map key

- Clean Energy Cluster
- Finance & Insurance Cluster
- Digital Cluster
- Life Science, Advanced Food Tech & Biotech Cluster
- Food Enterprise Zone
- Innovation Hub Projects (via Connected Innovation network)
- University
- Enterprise Zone
- Oil & Gas Rig
- Wind Farm
- Gas Terminal
- Nuclear Power Station
- Airport
- Shipping Port
- The National Stud
- RAF Base
- Rail

OUR ECONOMY AT A GLANCE

£38bn
contribution to the UK plc

£244,354
Median house price
(England in 2020: £255,900)

25% higher salary in 'Green Jobs'
than the economy average

36%
STEM take
(UK 41%)

£28,452
median gross wage
(England £31,777)

£5.2bn
goods exported in 2019

75.9% employment levels, that's higher than the 74.4% UK average

63,460
independent enterprises

Increasing our region's productivity levels to the UK average would contribute an additional £4bn gross value per annum to our economy.'

28%* at level 4+
Only 28% of jobs require level 4+ (UK 32%)

*Our economy is skewed towards occupations requiring lower-level qualifications.

1,675,300 total population

All people 16-64 (working age pop): **978,000** (58.4%) vs. 62.3% for England.

65's & over: 406,800 (24.3%) vs. 18.5% for England

Workforce NVQ Qualification levels in Norfolk & Suffolk

35% Level 4 (UK 43%),
19% Level 3 (UK 17%),
18% Level 2 (UK 15%),
14% Level 1 (UK 10%),
7% None (UK 7%),
5% Other (UK 6%)

Technology and Economic Change ***Global Change*** ***Demographic and Climate Change***

HMT Build Back Better
Our Plan for Growth

Strategic Drivers

Norfolk and Suffolk Economic Strategy
An ambitious blueprint for the UK's clean growth region

Clean Growth: The UK's clean growth region

At the forefront of tackling the challenges and opportunities of climate change. Strengths in energy generation and usage, and high-tech, sustainable agri-food present major opportunities, in particular the cross-sector opportunities which will have a major contribution to the UK's transition to a post-carbon economy.

Clean energy powering the world

The epicentre of the world's largest market for offshore wind energy. The only place in the UK where all forms of energy generation exist together.

Agri-food feeding the world

Advanced and nationally significant agri-food and drink sector, with globally renowned companies. World-leading research base, at the forefront of global food and health research.

ICT and Creative Digital connecting the world

Global centre of research and development and innovation in communications technology. Fast growing digital creative hub, with an international reputation for producing graduates who excel.

Underpinning Sectors *Advanced manufacturing, Construction, Creative industries, Financial, Insurance & professional services, Health and social care, Life sciences and biotech, Ports & logistics, Visitor economy and VCSE.*

People: Build a workforce fit for the future and excited about purposeful jobs. Inspire and enable all people to access employment, upskill and reskill.

Business: Connect and empower businesses through innovation, supply chain development and access to new markets, accelerating our economy's transition to net zero.

Place: Transforming the Norfolk and Suffolk economy into one of the best places in the world to live, learn, work and succeed in business.

Local partners are committed to collaborate, inspire, innovate, and invest to support our people, businesses, and places to adapt, transition and flourish.

OUR ECONOMY

To underpin our ambitions and make sure we set the right priorities to deliver them, we have developed an accurate understanding of our economy in detail, how it works and how it is changing, through shared analysis and evidence base. A more detailed evidence report sits alongside this strategy providing further in-depth insight to our economy and places.

Thetford Forest

Norfolk and Suffolk has a £38bn economy and makes a major contribution to UK plc. It is an outstanding place to live, learn and do business. 140 miles of coastline, three Areas of Outstanding Natural Beauty – the Norfolk Coast and the Suffolk Coast and Heaths; Dedham Vale/ Stour Valley; and the Broads National Park – and a diversity of landscapes, internationally important wildlife reserves and historic sites.

The main urban centres of Ipswich and Norwich are dynamic with a rich cultural heritage. The area's market towns are important and are a significant anchor point for businesses and individuals, growing in relevance as a result of the pandemic.

People and skills

The age profile of Norfolk and Suffolk shows we have a higher proportion of older people, although there is a wide variance at a local authority level. Conversely, the area has a higher proportion of its population who are economically active in comparison to the UK average. Skill levels and wages however are lower, with more jobs than the national average in lower paying industries.

Only 35% of working age population have a NVQ level 4+ qualification compared to UK average 43%. This is even more pronounced in Great Yarmouth, Sudbury, King's Lynn and the area around Watton and Thetford (less than 15%). Qualifications in STEM subjects across the area is 5% below the England average.

Above – Ipswich Waterfront

Labour shortages are a particular challenge for our key foundation sectors, including logistics, agri-food, tourism and hospitality, construction and social care, as well as some of our potential growth sectors, including ICT and engineering.

Our workforce median annual wage is £2,000 below the national average with variance between local authorities - Mid Suffolk being £30,700 and Breckland £26,600. The expansion of the clean energy sector and the emergence of new clean growth opportunities will provide new employment opportunities, offering higher skilled and better paid jobs.

Our business base and its characteristics

Norfolk and Suffolk's business base is largely reflective of England's, with 99.7% of the business base made up of SMEs and micro businesses. The higher-than-average contingent of agricultural and tourism businesses means that pressure on seasonal labour supply, rapidly escalating materials and energy costs, combined with destabilisation of logistical supply chains poses a pertinent threat to our economy.

24% *of Norfolk and Suffolk's population is over 65 compared to 18.5% for England*

15% of Norwich's and 18.5% of Ipswich's while 33% of North Norfolk's population is over 65

The Gross Disposable Household Income (GDHI) per head of the population is £1,900 below that of the East of England, and £1,300 below England

1 scale up business
per 294 businesses

The business base grew 16% between 2011-2021, compared to 28% in the East of England and 35% in England. However, the area has good business survival rates. While the area has pockets of significant high-growth business activity, it is ranked 30th out of 38 LEP areas. There is work to be done to encourage more companies with higher growth potential to locate and establish themselves in the area.

Between 2013 to 2017 the volume of goods exporters in the eastern region increased by 6%, whereas the UK increased by 9%. However, the Eastern region saw an increase in the value of goods exported from 2013 to 2017 of 18%, compared to an increase of 14% for England over the same period.

Public investment in research and development has an important role in stimulating private sector spending. Businesses here are less likely to apply for Innovate UK funding than firms elsewhere and the area secures less funding. However, there are signs this is changing, with the volume of funding secured from Innovate UK over the past 3 years exceeding the average the area has secured for the past 10 years.

Below – Hunstanton

Economic growth, productivity and living standards

Productivity gains have stalled since 2014 and prior to that had only seen an incremental rate of increase, which was not keeping up with national trends. Locations in the area have recently been placed in top ten lists of most desirable locations to live in England, as well as similar rankings for 'best staycation' destinations. The areas housing affordability still compares favourably with other locations in the South East, though more recently housing costs have increased in certain parts of the area -due to the migration of higher paid office workers to more rural locations.

Land use, housing and infrastructure

Lack of housing is a key risk to economic success. Approximately 7,000 new homes are planned across Norfolk and Suffolk per year, delivery of these and associated infrastructure will need to keep pace. There is a significant need for affordable housing for those unable to access homes at market value.

The ratio of average wages to average house prices indicates the affordability of housing across an area. Norfolk and Suffolk has a ratio of 8.4 compared to the England average of 7.9 and East of England at 9.5. This indicates housing is less affordable in the area compared to the England average but more affordable than the rest of the East of England.

With more people working from home, there is an increasing demand for domestic work space. There has also been a sustained uptick in demand for more warehousing, as the pace of online shopping accelerates. There is also a fundamental reassessment of town centres, business parks and land designation and usage as work and footfall patterns look set to transition considerably.

Infrastructure is critically important, as we look more towards a net zero economy – from clean energy to the need for further fixed and mobile digital investment. Digital reliability and mobile connectivity improvements are even more critical than they were pre-pandemic. As a predominantly rural environment, attention also needs to be given to ensuring we are maximising the opportunities digital connectivity affords, especially in relation to public health, education and skills development, and more flexible job opportunities.

The need to find ways to support alternative fuel solutions has become more urgent. This poses a particular challenge for Norfolk and Suffolk.

5yrs

46% of firms *are still in business five years after starting up,* *higher than the UK average of 42.5%*

Transport *in is the single biggest contributor to the region's carbon emissions accounting for 34% and of this 94% is from road vehicles.*

OUR POTENTIAL

Our diverse economy and our sector specialisms mean that there are few places which are so uniquely equipped to make telling contributions to the major challenges facing the world in the 21st century – food and energy security, healthy ageing and living with environmental change in a world where technology is advancing rapidly.

There is an urgent need to transition to a decarbonised future and grow a clean economy that protects and restores our natural capital and provides a healthier, more resilient, inclusive future for all.

University of Suffolk

THE UK'S CLEAN GROWTH REGION

Norfolk and Suffolk has an established and growing low carbon economy and is at the forefront of tackling the challenges and opportunities of climate change. The area will be affected earliest by rising sea levels and changing rainfall patterns, and has major research, innovation and business strengths in adapting to the change which present significant cross-sector opportunities for the UK's transition to net zero. Norfolk and Suffolk:

- Is the UK's leading producer of clean energy. It is at the forefront of the Southern North Sea transition and has thriving bioenergy, hydrogen and energy storage industries and a strong low carbon goods and services offer.
- Has expertise in satellite applications and Artificial Intelligence (AI) which will benefit offshore wind, nuclear, precision farming, construction, manufacturing, health and social care, and the visitor economy.
- Is ripe to be a testbed for cross-sector innovation in industries such as farming and food production, transportation and construction where exponential transformation is urgently needed.

Clean growth is central to this strategy. There are economic and societal advantages for the businesses, communities and places which emerge as leaders, from new markets to new higher paid jobs and improved public health.

As the UK's clean growth region, we are committed to remaining at the forefront of tackling the challenges and opportunities of climate change.

Together we will:

Drive leadership and collaboration – Achieving the transformational change at the pace and scale required will not be possible without collaboration and alignment. Through the New Anglia Clean Growth Taskforce we will provide leadership and collaboration, championing projects to accelerate cross-sector innovation and the delivery of key government strategies. We will work to unlock green finance which delivers the step-change required and ensure clean growth is at the heart of local decision-making, investment and business activity.

Support businesses to capitalise on the opportunities and become net zero, pursuing a circular economy – Through peer-to-peer knowledge exchange and an agile business support offer which provides the tools business need to adapt, innovate and access new markets. Attracting new businesses to the area which share our clean growth ambitions.

Create a skilled workforce fit for the future to support a zero-carbon economy – Building on the existing assets and strengths of our education providers, we will work to embed approaches to achieving net zero in all training and skills provision and supporting research, innovation and new technology adoption and commercialisation to businesses.

Deliver new and adapt existing infrastructure so that it is flexible, resilient and sustainable, supporting people, business and places – We will build on the area's strengths and expertise in clean energy, AI and emerging opportunities in hydrogen alongside businesses such as Lotus and Anglian Water. Our rurality offers both a challenge and an opportunity in this regard. Working with neighbouring Cambridgeshire and Peterborough Combined Authority we are developing an Alternative Fuel Strategy and action plan.

Defining Clean Growth – Growing an environmentally positive and resilient economy by exploiting the region's strengths, driving the adoption of clean technology, efficient use of natural resources and reducing waste, accelerating sustainable infrastructure, equipping and empowering business and people to take advantage of the opportunities in moving to a zero-carbon economy.

What does Net Zero mean? Balance between greenhouse gas emissions emitted and removed from the atmosphere.

CLEAN ENERGY - POWERING THE WORLD

Norfolk and Suffolk is the UK's epicentre for energy generation with its unique mix of onshore and offshore renewables, gas and nuclear generation and emerging opportunities for hydrogen.

Leading the clean energy transition

Norfolk and Suffolk is well placed to be a global exemplar for clean energy production, exporting services and skills globally, while increasing the availability of affordable, sustainable energy for local communities and businesses.

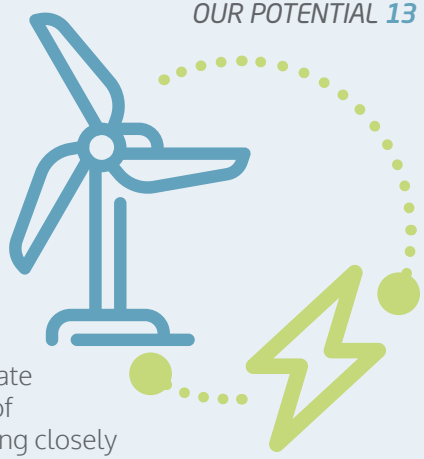
Norfolk and Suffolk has expertise in all forms of energy generation and is at the epicentre of the world's largest market for offshore wind energy, worth almost £1bn a year. Planned investment in new generation projects will make Norfolk and Suffolk the largest contributor of clean energy to the UK, providing power for 58% of the UK's homes and central to the UK's successful transition to a zero-carbon economy.

This all-energy expertise combined with a unique blend of ports, infrastructure, transferable skills, and innovation in future energy technologies is the key reason the area will play a leading role in decarbonising the country's electricity grid by 2035 and delivering the net zero ambitions.

The Southern North Sea is the UK's natural gas basin, with a third of the UK's domestic gas requirements handled at Bacton Gas Terminal in North Norfolk. Recent Oil and Gas Authority and Hydrogen East reports have highlighted Bacton's potential to become a significant hydrogen production site for London and the South East, stimulating local markets for clean transport solutions and decarbonising the regional economy.

New and innovative energy technology concepts are in development to deliver the North Sea Transition Deal. These include offshore desalination, leading to hydrogen fuel production; carbon capture and storage; and gas to wire developments. These showcase Norfolk and Suffolk's significant opportunity to become a 'test and demonstration zone', highlighting its national and global value.

Left – All Energy Coast - Image by Jan Arne Wold



OrbisEnergy is at the forefront of supporting businesses innovate across all forms of energy and working closely with key innovation hubs across Norfolk and Suffolk to enhance cross-sector innovation and support the transition to net zero.

Despite the area's strengths in clean energy, access to power is limited, holding back housing and industrial development in many parts of the area. Transforming the local energy system and new innovations in wider energy resource use is a priority.

GENERATE

The stakeholder-led, LEP-funded GENERATE project has created a coherent, co-ordinated and collectively-owned brand to consolidate the target area's position as a world leader in offshore wind and clean energy generation, maximising its visibility to Government/ investors and enable it to compete effectively with established locations.

Offshore energy production

Norfolk and Suffolk has the potential to benefit a great deal from growth in offshore wind jobs, with an additional 6,150 full time well-paid skilled jobs by 2032 (+600% growth).

The ports of Great Yarmouth and Lowestoft have become strategic centres for the offshore wind sector, positioning themselves as England's premier energy ports, with the potential for further growth in their world class operations and maintenance (O&M) facilities, manufacturing and assembly. Both ports are progressing plans to develop facilities to capture O&M investment.

The £18m O&M Campus in Great Yarmouth will be at the forefront of technological advancements in O&M once this is developed and the new Lowestoft Eastern Energy Facility (LEEF) is a £25m project being promoted by Associated British Ports. In addition, Great Yarmouth port has two sites ready to accommodate component manufacturing and plans to create an additional 10ha if demand is there. The whole site can accommodate assembly.

The existing and planned windfarms, including the £6bn East Anglia Hub, provide rich opportunities upon which the region can capitalise, from contract opportunities to new clean skilled jobs. However, there are challenges such as grid constraints, onshore-offshore connectivity, and delays to energy projects. To remain at the forefront of generating the country's clean energy supply we must support and work with government and our communities to overcome these challenges.

Onshore energy production

Suffolk is home to three nuclear power stations at different stages of their planning and lifecycles bringing resilience to the UK's electricity grid – Sizewell A is in decommissioning; EDF's Sizewell B is the UK's only pressurised water reactor in operation; and the examination phase for the Sizewell C nuclear new build project has now concluded with a final decision likely in spring 2022.

Sizewell C power station could inject up to £200m a year into the regional economy during peak construction and £40m per year during its 60 years of operation and will create 25,000 roles during the construction phase with 900 permanent operational jobs. Sizewell C Consortium has pledged to invest £4.4bn in the East of England, including £2bn in Suffolk. If Sizewell C receives the green light, there will be significant opportunities for local businesses to win contracts.

Norfolk and Suffolk is the leading area nationally for animal waste biomass installations with a third of the national capacity in two large plants at Thetford and Eye power stations. One of the UK's newest straw-fed biomass plants has opened at Snetterton, whilst brewer Adnams operates an anaerobic digester which was the first to export biogas to the grid produced from brewery and food waste.

The bioenergy industry is worth nearly £2bn and is based on the scale of agriculture locally, with 13.7% of England's crop output and 9% of the livestock output. Norfolk and Suffolk is a leading straw producer in the UK with 313,000 ha of cereals and 60,000 ha of oilseed crops, with an estimated straw yield of 1.06m tonnes per year. Norfolk and Suffolk see more sunshine than other parts of the UK, a crucial region for the development of solar technologies. We must continue to innovate in this area.

Left – Orbis Energy

Norfolk & Suffolk

has the potential to supply up to 50% of the UK's 40GW target from offshore wind by 2030.

7% of the UK's

low carbon power for the next 60 years will come from the proposed new nuclear power station at Sizewell C

£330bn *market potential in decommissioning over the next 30 years*

the over 100 gas fields, over 150 gas platforms and 4,500km of pipelines

27,000 new job

opportunities will be generated by the clean energy sector in Norfolk and Suffolk between 2019-2030.

Local partners will work together to:

Promote opportunities for existing and potential supply chain businesses across the energy sector and provide business support.

Support Hydrogen East to deliver a viable route map for Norfolk and Suffolk to become a leading 'hydrogen region', maximising the opportunities at Bacton and through the Sizewell C and Freeport East projects.

Develop and deliver the vision for an Energy Systems Integration Centre of Excellence in partnership with ORE Catapult and local stakeholders, maximizing the potential across our energy offer.

Collaborate with the Greater South East Energy Hub to develop and deliver investable clean energy projects which unlock clean growth, securing UKPN grid connections where needed.

Develop ambitious projects to further strengthen our expertise in offshore wind operations and maintenance, ensuring we are at the forefront of technological developments and attracting investment.

Communicate the all-energy inward investment offer globally through the Generate branding.

Bring forward new investment opportunities on Enterprise Zones to support future expansion in the energy sector supply chain.

Measures of success:

- *Investable projects developed and delivered.*
- *Increase in local businesses securing contracts linked to the clean energy*
- *New businesses attracted to locate here to capitalise on the opportunity*
- *Clear investable hydrogen proposals developed and investment secured.*
- *A transformed local energy system*

AGRI-FOOD – FEEDING THE WORLD

Norfolk and Suffolk has some of the most productive farmland in the UK. This supports an advanced and nationally significant food and drink sector and a world-leading research base which is at the forefront of global food and health research. These strengths put us at the heart of a healthy food future.

The region plays a vital role in UK food production. But the sector is undergoing the greatest changes within living memory - farming subsidies, trade arrangements, climate change and labour shortages.

Businesses need specialised support as they adapt. Norfolk and Suffolk's strong climate science, automation and plant science innovation expertise presents the opportunity to address some of these challenges, continuing to pioneer and apply new approaches to sustainable agriculture. We are in a good position to increase value-added processing, exports and embed sustainable practices throughout the food chain by utilising our strengths in clean energy and digital innovation.

A regional focus for agri-food innovation

Norwich Research Park is at the forefront of global agri-food research and innovation. It is making a leading contribution to the challenges of food and energy security, healthy ageing and environmental change. It brings businesses together with research organisations with global reputations - the John Innes Centre; the Earlham Institute; the Quadram Institute; The Sainsbury Laboratory; and University of East Anglia.

This supports an advanced and nationally significant food and drink sector and a world-leading research base which is at the forefront of global food and health research.

The major commercial opportunities arising from this expertise have been acknowledged by the Department for International Trade (DIT) who have designated it as a High Potential Opportunity in nutrition.

Right – Our region grows 12% of the UK's cereals

The Centre for Fisheries and Aquaculture Science (Cefas), in Lowestoft, is a world leader in marine science and technology providing innovative solutions for the aquatic environment, biodiversity and food security. The planned collaborative Marine Science Campus will promote and develop local talent to support clean growth and offer cross-sector opportunities. Cefas is working with partners such as UEA and the new Broadland Food Innovation Centre to explore opportunities around aquaculture and seaweed. This work supports partners such as the Renaissance of the East Anglian Fisheries to ensure a sustainable and profitable future for the East Anglian fishing industry.

Agricultural
businesses make up 9%, compared to 4% nationally

The climate, labour and technology challenge

Climate change will have a significant impact on agriculture. Changing rainfall patterns are already leading to water quality concerns and abstraction restrictions which need proactive collaborative solutions. Biodiversity and healthy soils are key to a sustainable environment and effective carbon capture. The University of East Anglia has developed evidence to inform natural capital projects and are working on new sustainable farming approaches with conservation farmers, such as the Holkham Estate in north Norfolk.

Controlled environment farming is an emerging specialism for the area, especially with Bom Group's tomato greenhouses in Cantley and Ingham and the development of the UK's largest vertical farm at the Food Enterprise Park on the outskirts of Norwich. There are also game-changing capabilities for agri-food businesses to take advantage of including 5G, satellite applications, robotics and drones on offer at Adastral Park through BT's global R&D headquarters and the wider Connected Innovation network. This adoption of technology would improve productivity and sustainability across the supply chain. It could also address labour challenges and create high skilled, high paid jobs.

Local businesses have a growing appetite to meet these challenges and with the right kind of support, there is significant opportunity to improve idea diffusion throughout the sector.

Increasing processing value

The region's advanced food and drink processing sector and specialists in growing markets, like plant-based foods, have the potential to grow in domestic and international markets. The enhanced use of technology and other innovations presents opportunities to increase productivity, enhance sustainability and reduce emissions and water use. The area only processes 50% of the food it grows. There is a substantial opportunity to add value, a 50% increase in high-tech production would add more than £2bn to the economy. There is strong commitment to help businesses develop the right skills and technology needed to embrace these opportunities.

Collaborating to grow

Eastern England is the UK's food gateway to the world - the single most important area for export and import of food in the UK. We are working with partners in Lincolnshire, Cambridgeshire and Peterborough to develop major regional initiatives in shared areas of interest – automation, agri-tech, plant science and nutritious diets – which present significant opportunity and will unlock our collective potential. Together we can drive the transition to net zero, support with healthier diets, deliver the levelling up agenda, and support a strong global Britain.

Right – Our region is home to a world-leading research base which is at the forefront of global food and health research.

12%
of the UK's cereals

16.6%
of the UK's fruit & vegetables

22.7%
of the UK's pigs

17.6% *of the UK's poultry production*

60%
of the UK's sugar

Local partners will work together to:

Deliver a regional innovation support programme at the Broadland Food Innovation Centre and establish a regional Food and Drink innovation cluster to add value by significantly increasing the amount of local produce processed locally.

Maximise the potential of the Food Enterprise Zones in Norfolk and Suffolk, attracting investment to and capitalising on the Freeport East opportunity.

Develop collaborative investments where there are economies of scale in storage, distribution and processing as a catalyst for adding value to our agricultural products.

Collaborate across the region to develop new projects that harness research strengths to support clean growth and develop automation solutions contributing to address labour shortages.

Develop a world-leading hub for plant and microbial research at the John Innes Centre with The Sainsbury Laboratory and explore its translational potential for agri-food innovation and growth.

Work with farmers, land managers and environmental specialists to target environmental land management initiatives, maximising natural capital and enabling productivity.

Grow skills provision for the agri-food sector to ensure future farmers are equipped with the knowledge needed for sustainable land management, and support those already in the sector with the right skills to adapt to new opportunities.

Measures of success:

- *Businesses supported to innovate and grow, and the case made for successor investment*
- *New inward investment secured*
- *Collaboration leads to a pipeline of new regional initiatives which secure funding*
- *An increase in translational and spinout activity with new products and processes developed*
- *New environmental schemes developed and delivered, informed by excellent natural capital data*
- *Growth in agricultural productivity and increased take-up of sustainable methods of production*
- *New business investment, and inward investment to establish new production facilities to meet local demand thus shortening supply chains and reducing food miles*

Left – Food processing

ICT DIGITAL – CONNECTING THE WORLD

Through thriving digital creative tech clusters, Norfolk and Suffolk's ecosystem will support the digital transformation required across sectors to deliver net zero and productivity gains. We will work to create a more sustainable landscape for start-ups and scale-ups, with more highly skilled and higher paid jobs. Norfolk and Suffolk's digital tech opportunity is both fast-growing and offers significant value for our economy, underpinning the future development of our sectors.

Catalyst for clean growth and cross sector innovation

Norfolk and Suffolk is a national leader in 5G and future network infrastructure and is at the cutting edge of digital innovation, with distinct strengths in telecoms, cyber security, satellite applications, data centres, software development, quantum technology, artificial intelligence, Internet of Things and user experience design. The region is playing a central role in developing and deploying these technologies, which align with the seven key technology families identified in the Government's Innovation Strategy, with a series of challenge-led cross-sector innovation events to demonstrate potential use cases for key sectors and supporting businesses as they adapt to change and adopt and diffuse technologies.

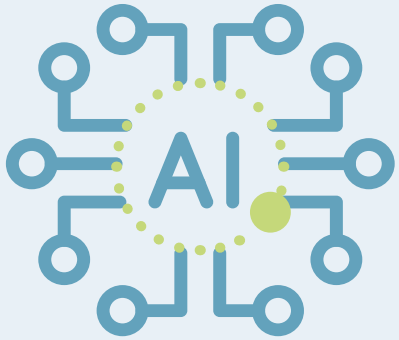
Globally significant innovation assets

This strategy will continue to grow and secure the clusters across Norfolk and Suffolk, located at Adastral Park and Norwich, given their strategic importance as national assets and testbeds. The strengths of our specific clusters have led to increased demand for physical and virtual tenancies as businesses seek to be closer to these specific ecosystems as they recover and grow.

Adastral Park

Adastral Park, near Ipswich, is home to BT's Global Research and Development headquarters, and a growing cluster of over 150 high-tech companies at Innovation Martlesham, from global organisations like Cisco and Nokia to key local companies such as Inawisdom, Ijyi, and Chronos Technology, collectively employing almost 4,000 people. It generates approximately £1bn GVA per annum and has a comparatively high productivity rate of £140,000 per job.

Right – Adastral Park



Adastral Park is home to the largest test and integration facility in Europe and the world's first 'real-world' demonstration of quantum encryption. Adastral Park is a top three investor in R&D in the UK over the past ten years, the third largest patent filer of all UK-based companies, and number one for artificial intelligence technologies, spending over £2.5bn on R&D over the last five years. It offers unrivalled experience in the development of 5G, digitalisation, satellite applications, future technology and future networks.

Major trials of national and global significance take place at this strategic site, which has a range of technical facilities available to cluster companies, such as Showcases, shared R&D facilities and an experimental Quantum Communications Network. Government has recognised Adastral parks strengths, identifying it as a national High Potential Opportunity (HPO) for 5G and Digitalisation.

3rd highest
patent filer in the UK and number 1 for Artificial Intelligence

Norwich Digital Creative Cluster

The cluster is characterised by several high performing home-grown businesses, many of which are global players, including Epos Now, Rainbird, Fountain Partnership, and Foolproof, as well as micro start-ups and freelancers. There is real growth potential, alongside the financial and insurance services and business services sector, as a driver across a broader business base.

University of East Anglia (UEA) and Norwich University of the Arts (NUA) are key to the supply of talent. With a global pull of students drawn to specialisms, both have also secured an international reputation for producing graduates who excel in a constantly evolving industry. NUA is also home to the Ideas Factory incubation centre for digital creative businesses and user experience lab, and has developed strong ambitions around net zero skills, across its spectrum. Both have developed partnerships to respond to the digital demands of the FinTech sector and support SMEs through local networking. UEA's new FinTech Lab will also support the next generation of entrepreneurs in building new and exciting start-ups.

£551.3m
is the worth of the ICT & Telecom services & product development specialism

Above right – Students at NUA specialise in art, design, architecture and media
Right – Thyngs contactless payment technology

Cambridge Norwich Tech Corridor

The Cambridge Norwich Tech Corridor offers 100km of opportunity across Cambridgeshire, Suffolk and Norfolk for start-ups, growing businesses and investors. It joins up many strengths and assets with a shared ambition to make the Tech Corridor a top-tier destination for technology businesses, talent and investors from around the world.

Growing technical and digital skills

Together we have agreed a clear set of collective commitments focused on producing the skills required to accelerate digital research and innovation; stimulate wider industry growth through digital skills; and provide the foundation of basic digital skills required for inclusive growth and increased applications in the workplace.

We are committed to inspiring and creating the next generation of technical and engineering professionals and upskilling those already in the workforce. Institutions provide the opportunity to learn in new state-of-the-art facilities and specialist laboratories with industry-connected educational courses. Over £60m has been invested in recent years, bringing together collaborations between industry leaders and education institutes to ensure the training being offered meets the needs of local employers.

£59,100
GVA per job

£1.4bn *contribution to the UK PLC*

Our ambition and commitment does not stop here. A compelling collaborative bid, led by University of Suffolk, has been submitted to government to secure and establish an Institute of Technology. This will further reinforce the provision of a skilled pipeline for those people focussed on technical careers, through the offer of attractive and aspirational career pathways across Norfolk and Suffolk and beyond.

Further investments in the College of West Anglia School of Nursing, University of Suffolk's Integrated Care Academy and the complementary new Health and Social Care facility at Suffolk New College will bring technology and learning together through real-life clinical environment and high-tech simulation equipped with simulation mannequins to provide clinical experience in a teaching environment. There will therefore be a fully integrated pipeline of training channelling talent into the sector.

£60m state-of-the art investment:

City College Norwich Digital Technology Factory delivers interconnected digital technology, engineering and design courses.

Suffolk New College Tech Campus provides specialist courses in Creative Media production, computing & esports, games design and game art.

East Coast College Energy Skills & Engineering Centre supports development of higher-level technical skills and expertise in energy, maritime and engineering.

West Suffolk College STEM Innovation Campus provides training and FE and HE for employees in energy, engineering and advanced manufacturing.

International Aviation Academy based on the northside of Norwich trains the next generation of aviation professionals.

University of Suffolk DigiTech Centre at BT's Adastral Park provides cutting-edge digital skills for people looking to pursue careers in ICT, as well as exploring digital health and smart living research innovations .

University of East Anglia Productivity East and School of Engineering is a new regional hub for engineering, technology and management.

Right – Digi Tech Factory at City College, Norwich

Local partners will work together to:

Deliver the Adastral Park vision and work with the Department of International Trade to maximise the opportunities arising from the HPO in 5G and digitalisation.

Develop the potential for a Net Zero Creative Digital Media Studio in Norwich, led by NUA, to attract digital production to the region, becoming a national leader in net zero production training and build a linked digital creative business cluster and inward investment offer, creating opportunities for local talent entering the industry.

Further develop the cluster's expertise in FinTech, supporting start-ups and skills.

Delivering hackathons and challenge-led events to encourage and enable cross-sector innovation and working collaboratively to ensure local people including school pupils have the right skills to succeed in the sector.

Develop the economic case for a Smart Emerging Technology Institute and testbed (SETI) – a unique advanced high-speed optical and wireless network (including 5G) which interlinks Internet of Things testbeds to support large-scale experiments and data transfer.

Measures of success:

- *New products to market, increasing engagement between SMEs and sector groups with Adastral Park*
- *Investable projects developed and funded*
- *Business cluster developed and businesses engaged*
- *More people developing the right skills for opportunities in digital creative businesses*

OUR UNDERPINNING SECTORS

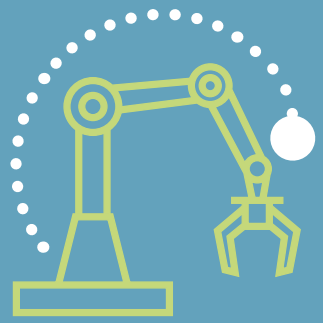
This Strategy also recognises the strengths and the importance the underpinning sectors in the Norfolk and Suffolk economy. There is significant opportunity for cross sector collaboration and innovation. The regions strengths in clean energy, agri-food and ICT digital can support our underpinning sectors to grow, adapt and innovate. Tackling the labour, supply chain and productivity challenges in these sectors and maximising their growth opportunities are key parts of this strategy.

Advanced manufacturing and engineering

National expertise in automotive, civil aviation, space, composites, and pharmaceuticals.

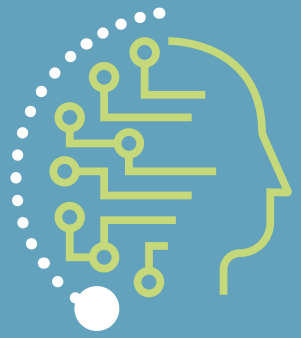
Forecasted to grow into 2022. Sustainable HR management, lean and digitisation will deliver innovation, productivity and support the transition to net zero.

Construction and development



Large and diverse, with emerging specialisation in Passivhaus and sustainable design. Major opportunities linked regional infrastructure projects. Delivering Net Zero Strategy through retrofitting and more sustainable methods of construction.

Creative industries



Strong and diverse sector, with major concentrations around Norwich and Ipswich Strong ambitions around net zero production skills and supporting and retaining young people into the sector.

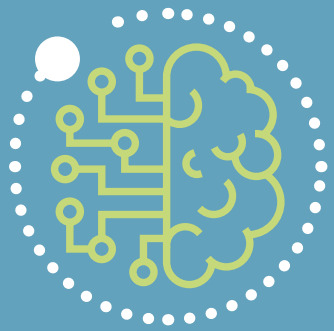
Financial services, insurance & professional services

One of the largest general insurance and financial services clusters in Europe, with strong growth ambitions, particularly around the major FinTech offer. This sector underpins the development of many other sectors and is critical to achieving the clean growth aspirations.

Health and social care

Transformational partnership working to deliver first of its kind Integrated Care Academy and research impact through the Norwich Institute of Healthy Ageing. With a national exemplar in development - the Integrated Care Academy at University of Suffolk.

Life sciences and biotech



International expertise in the fields of food, health, and microbiome – advanced cluster of animal health and emerging pharmaceutical manufacture.

Norwich Research Park High Potential Opportunity in Plant Science and Nutrition utilising the latest technology such as NGS (next generation sequencing) and development of bioinformatics pipelines.

Ports and logistics

UK's largest container port at Felixstowe and nationally significant ports for the energy and agri-food sectors, with a strong logistics cluster. With significant opportunities through Freeport East, A14 corridor emerging as a major location for smart logistics hubs and Port expansion and innovation plans (e.g., O&M Campus, 5G technology, PowerPark).

Visitor economy

A varied and significant tourist offer, from coast and countryside Areas of outstanding natural beauty to postcard market towns, underpinned by a dynamic and pioneering cultural sector. Home to important heritage sites and the home of horseracing at Newmarket.

Voluntary, community and social enterprise

The voluntary, community and social enterprise sector, together with adult learning provision, has an important role to play in supporting those furthest from the labour market by reintegrating, raising confidence levels and re-skilling through training, volunteering or employment. The sector is extremely diverse and such diversity requires further analysis to enable the relative strengths of the sector to be optimised.

PEOPLE

INSPIRE AND ENABLE ALL PEOPLE TO ACCESS EMPLOYMENT, UPSKILL AND RESKILL

Our people, whether in traditional or more niche careers, micro businesses, arts and culture or supporting others in the community, are central to all our ambitions. We want to raise and support aspiration across all ages, unlock private sector investment in the workforce and support providers to respond quickly and in a hands-on way to address the long term needs of people and businesses.

BT at Adastral Park

Accelerating trends in remote working, digitalisation and push to net zero is changing the nature of jobs at all levels but presents significant opportunity for creation of higher-value roles in all sectors. It is leading to increased demand for technical and digital skills.

What do we need to achieve?

Build a workforce fit for the future and excited about purposeful jobs. Improve attainment levels and align provision to employers needs and inward investment opportunities particularly STEM, enabling the transition to a zero carbon economy. Despite progress in recent years in raising overall attainment skills levels there is still a shortfall in higher-level skills attainment and take-up particularly in science, technology, engineering and maths (STEM) subjects. In addition, apprenticeship starts for all ages has fallen due to the pandemic. Ensuring the institutional and physical infrastructure and raising the aspirations of our people is imperative in addressing clearly defined skills gaps and capitalising on the opportunities.

Address labour market shortages through a combination of automation, reskilling and attracting talent to learn and work here. Shortages are exacerbated in the region's largest sectors - agri-food, logistics, tourism and hospitality and care. Tutor shortages in engineering and construction where industry wages are more attractive is impacting on the supply of new entrants into the sectors. Three universities attract ambitious people to the area each year but there is a need to enhance and capitalise on the opportunities to retain the talent.

Empower and enable lifelong learning and progression for all, unlocking private sector investment in the workforce. Enabling residents to capitalise on higher level employment opportunities. The area has a higher proportion of over 50s than the national average. Recent research indicated people aged 50 and over who are unemployed are twice as likely as younger adults to be long-term unemployed. It also highlighted they are the least likely to receive 'off the job' training, hampering their ability to keep up to date with new skills. Research shows that, for UK employers, upskilling would yield positive economic returns in 75% of cases.

*There is a **25% higher** on average salary for clean growth jobs in Norfolk and Suffolk compared to the economy wide average.*

*A young person is **86%** less likely to be unemployed or not in education or training if they have had four or more encounters with an employer and can earn up to 22% more during their career.*

90%+ of the UK workforce will need to be trained if workers are to realise the full benefits of reskilling over the next decade

Inspire and improve aspirations, connecting businesses, education and young people. Continuing to develop employability and work readiness amongst young people, whatever their educational starting point is. Inspiring and preparing young people for the fast-changing world of work and a net zero future is essential to driving the supply of the future workforce and key to social mobility.

Invest in health and promote social and economic equality. The pandemic has highlighted the link between the health and wellbeing of our workforce and the health of our economy. Investing in and improving health will fuel growth by enlarging the workforce, increasing productivity and growing our resilience. The pandemic has also further showed us the importance of addressing inequalities in our society, particularly among minority groups and low-income households.

Tackle barriers to employment and training supporting all people to access employment. Providing a good job with development prospects and earning at least the living wage. There are pockets of deprivation across urban, rural and coastal communities within Norfolk and Suffolk, with quite different needs. Building confidence, aspirations, skill levels and improving digital and physical connectivity are important to open up opportunities to study and give a greater choice of employment. The VCSE sector has an important role by providing volunteering, work experience and entry level employment opportunities for those who are not economically active and do not engage with traditional learning and employment activity.

Local partners will work together to:

Provide a range of opportunities that enable all residents to upskill, reskill and access employment throughout their lives, by:

Improving adult careers advice, developing locally relevant resources, tools and provision to promote high value jobs in growing sectors and deliver a flexible, accessible approach to lifelong learning. Encouraging business to invest in skills improving in-work training, work progression and workforce agility.

Developing further initiatives which develop high quality, innovative business leaders across all our sectors from start-ups to established companies including leadership training, and innovation cluster programmes.

Continue to evolve and deliver a collaborative job support offer, which includes working with the VCSE sector, to ensure that unemployed, inactive and under-employed people are supported to secure good jobs, and ensuring that groups with challenges and barriers to employment get the support they need.

Build on existing support programmes that support the health and wellbeing of the workforce, they are embedded across our economy including within businesses and organisations as a lifelong offer to staff.

Close the skills and labour gaps, aligning provision to current and future employer needs and clean growth opportunities, especially in digital and technical skills by:

Delivering strategic leadership in skills development, ensuring employers have a central role in training and curriculum development at all levels and in strategic groups like the Skills Advisory Panel, building on the Sector Skills Plans and rolling out Local Skills Improvement Plans when the request comes from government.

Securing funds and investing in upgrading learning facilities across the Higher and Further education sectors providing workplace experience in a teaching environment through technology and high-tech simulation with employer-led training which delivers our net zero ambitions. Including a national 'Institute of Technology' and Decarbonisation Academy.

Delivering targeted campaigns to attract the talent from inside and outside of the region into key sectors and teaching, thus promoting transferable skills.

Building on the Ipswich and Norwich Opportunity Areas to promote and improve social mobility through partnership working and engagement with schools, families and communities.

Developing and delivering employer-led collaborative projects which promote, incentivise and enable employer-focused qualifications such as apprenticeships, traineeships, T levels and university internships, building on current projects and maximising levy sharing.

Improve aspirations and continue to develop employability and work readiness among young people, including:

Accelerating the delivery of the Youth Pledge projects, providing an integrated offer that links young people to opportunities and support to help them into education, training and employment.

Seeking opportunities to offer targeted grants to VCSE organisations to deliver employability and skills support to hard-to-reach groups in disadvantaged communities or remote areas.

Providing co-ordinated support that schools and colleges can draw on that enables, enhances and improves careers provision for all young people including learners with special education needs or disabilities (SEND) developing virtual solutions to help the continuation of high-quality career engagement through the New Anglia Careers Hub and other work inspiration initiatives. STEM will be a pivotal area to focus on.

Further developing the opportunities for Level 4, 5 and 6 study and work with employers to develop roles which require these skills alongside showcasing the entry routes.

SUCCESS STORIES

New Anglia Enterprise Adviser Network and Careers Hub

New Anglia Enterprise Adviser Network and Careers Hub is working with education institutions and wider work inspiration programmes, including 'icanbea', to meet the eight Gatsby benchmarks at a consistently significant rate above the national average. It is facilitating collaboration between schools and businesses across Norfolk and Suffolk to deliver inspiring careers strategies that will prepare the next generation of workers.

The integrated health and work programmes

The integrated health and work programmes are playing a vital role in Norfolk and Suffolk, addressing a rising proportion of long-term unemployed people in the area and unlocking their potential to address labour shortages and enhance productivity levels.

Sketchbook Games

Throughout its 4 years of existence, Game Anglia has gone from a small group of game developers to a nationally-relevant organisation. By working with the New Anglia LEP, Suffolk County Council and Norfolk County Council, they have created skills and business support programmes which saw new companies and jobs created and dozens of young people in games jobs.

BUSINESS

CONNECT AND EMPOWER BUSINESSES THROUGH INNOVATION, SUPPLY CHAIN DEVELOPMENT AND ACCESS TO NEW MARKETS, ACCELERATING OUR ECONOMY'S TRANSITION TO NET ZERO.

Our economy is faced with a period of intense change which will impact businesses and sectors in different ways - regulatory change, global supply chain issues causing delays and price increases in materials, cash flow, shortages and difficulties with retention and recruitment of staff and in the long term, the changing climate. We want to create more high-growth businesses, increase entrepreneurship and help businesses take the decisions they need to be agile, innovative, productive and sustainable.

Above – Staff at Peerless Plastics, recipients of a New Anglia LEP grant © Peerless Plastics

Norfolk and Suffolk is a great place to build and grow a business, with stable and resilient firms, strong levels of business support and good business survival rates. This strategy looks to build on our nationally recognised innovation and research assets, to help foster the partnerships and collaborations that are increasingly driving the take-up of new technology and ideas that drive clean growth.

How we guide businesses through this change, nurturing opportunities and providing business support, will be our measure of success. It is of paramount importance that we equip businesses with the know-how and tools to attract and develop the skilled people needed, adopt the right technologies, and understand the opportunities and requirements as we transition to net zero.

What do we need to achieve?

Provide agile and adaptable business support that meet the needs of businesses imparting the knowledge and tools for business to transition to net zero, become more productive and resilient. Preparing for climate change will enhance the resilience of businesses and offers major benefits including better competitive positioning, access to new markets, procurement opportunities and the potential for new products and services through innovation. Failing to prepare could affect the performance and risk profile for businesses. Financial services, insurance and related professional services are vital in providing the finance businesses need to achieve this. We must continue to promote and support the significant assets across our two major centres in Norwich and Ipswich, and key assets in our market towns.

Empower businesses to innovate, accelerate adoption and diffusion of innovation and access new markets. Well-connected networks where people can easily and informally access the right expertise, and collaborate and share knowledge, are essential. 99% of Norfolk and Suffolk businesses are micro businesses and SMEs and many have found it challenging to invest time to understand what technologies and innovation will enhance their business and deliver resilience and sustainability. Strengthening this knowledge, support for start-ups, scale-ups, and the connections between entrepreneurs, existing businesses, and researchers (from both higher education institutions and innovation clusters) is a core priority of this Strategy. Innovative businesses can, with the right support, opt for markets they may never have thought were possible and expand their market share. This will become even more important as procurement frameworks strive to deliver net zero.

Build resilient, shorter and sustainable supply chains. Both the pandemic and the new trading arrangement with the EU have exposed and exacerbated long-standing fragilities within a range of long supply chains, with delays to and shortages of key materials and additional cost implications for businesses. This has presented opportunities for local businesses who can demonstrate they are efficient in business resilience, innovation, and sustainability. Equally, it has challenged others to focus more on these key objectives to ensure that they can retain and win contracts.

There are significant supply chain opportunities for businesses across Norfolk and Suffolk, with major infrastructure projects and public sector procurement alone offering vast potential. It is vital that these opportunities are promoted effectively to local businesses, with the right provision of support and knowledge transferred to ensure they stand a strong chance of securing contracts.

Right – Outdoor education firm Wildplay received a Business Resilience and Recovery grant to support diversification
© Wildplay

Local partners will work together to:

Sharpen and evolve the high-quality business support offer to ensure it meets the changing needs of businesses adapting to new ways of working, new technology and transition to net zero, by:

Joining the UN's Road to Net Zero, embedding net zero into business advice and support, helping to enhance the knowledge and understanding of the scale of the opportunity for business, as well as putting in place a package of support, unlocking green finance to move our economy to zero carbon.

Identifying opportunities to build on current public sector equity and loan schemes for businesses to provide a full range of green finance options for our businesses including investment in early stage and high-risk innovation.

Further develop 'investor-led' programmes that supports businesses to understand and prepare to raise equity and other forms of finance.

Develop a specialist business support programme to grow a resilient, self-sufficient and effective voluntary, community and social enterprise sector, enabling them to provide inclusive supported work opportunities.

Widen the cross section of businesses innovating and strengthen collaboration, learning and partnership between science, research and business by:

Simplifying the innovation support and routes to innovation funding through the New Anglia Growth Hub collaborating with Innovate UK EDGE, delivery of Funding Fit workshops, embed innovation challenge funding, and providing bid writing support and mentoring ensuring a key focus on clean innovation.

Identifying and brokering commercialisation opportunities between the existing business base and our key research institutions, both higher education and private.

Supporting ongoing cluster development, talent sharing, peer-to-peer networking, mentoring and innovation across our sectors building on our world class research and innovation facilities and the Connected Innovation project.

Further define the region's capabilities to drive forward new innovations, develop supply chains and access to new markets, by:

Enhancing targeted support for high-potential businesses, delivering supply chain support programmes that equip local SMEs and the wider business base to maximise their potential to bid for and access local and national supply chains opportunities.

Building upon existing programmes such as Scale up New Anglia and Fit4OR New Anglia Programmes.

Providing industry leadership through the All-Energy, Agri-Food and Digital Tech industry councils to develop collaborative initiatives which unlock clean growth and capitalise on market opportunities including inward investment.

Developing a resilient and sustainable VCSE sector, delivering innovative solutions and relevant goods and services.

Develop a new regional space sector plan and cluster group to help deliver net zero activities relating to diverse areas such as – sustainable agriculture, crop science, climate change, marine science, offshore wind, transport and logistics. Proposed activity includes developing a regional satellite application hub and regional micro-gravity launch and test facility to enable testing of products in a 'space environment'.

Creating partnerships with other parts of the UK, including leading universities, to scope out shared and complementary capabilities to drive forward new clean growth innovations, develop supply chains and access to new markets.

Promoting regional businesses to strengthen and stimulate supply chain opportunities through Inward Investment and enterprise zone development.

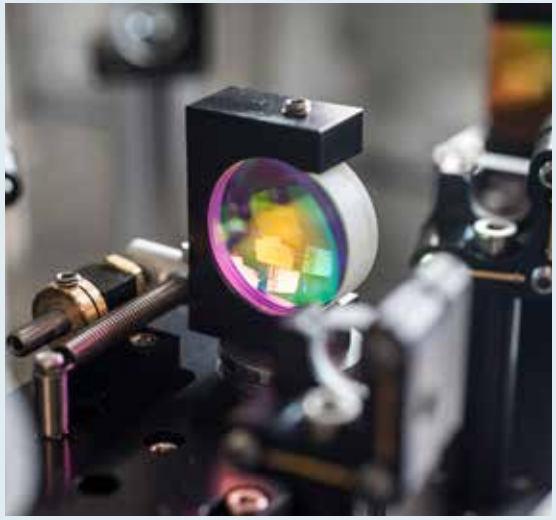
SUCCESS STORIES

Business Support

There is an extensive network of business advice services across Norfolk and Suffolk, centred around the New Anglia Growth Hub, which has supported 12,200 companies, awarded 1,400 grant applications and provided 70,000 hours of support. The wider network includes start-up agencies, business intermediaries, professional services firms and the VCSE sector.

Low Carbon Innovation Fund

The Low Carbon Innovation Fund is a co-investment initiative worth over £100m aimed at SMEs operating in the East of England developing or deploying environmentally beneficial technologies. Beauhurst ranked LCIF number one for being the most active impact fund. Impact defined as funds that have explicitly stated that having a positive social or environmental impact is central to all of their decisions.



Connected Innovation Project

The Connected Innovation Project links Norfolk and Suffolk's innovation hubs with business to drive increased levels of business innovation and supports the adoption and diffusion of key technologies. The network provides expertise on technology trends, delivers challenge-led events and strengthens peer to peer learning between the hubs and the wider innovation ecosystem.

PLACE

TRANSFORMING THE NORFOLK AND SUFFOLK ECONOMY INTO ONE OF THE BEST PLACES IN THE WORLD TO LIVE, LEARN, WORK AND SUCCEED IN BUSINESS.

Places and communities are interconnected, depend on transport and digital links, and draw on many of the same labour markets and supply chains. The pandemic has changed the way businesses and communities live, learn and work and demonstrated the need for resilient, reliable and adaptable infrastructure. It has impacted places in different ways with the rise of the 'hyper-local' as people have had to stay closer to home, meaning larger centres have taken on a different role too.

A family enjoying Bury St Edmunds.
© Visit East of England

Low wages, high levels of seasonal working, rise in cost of housing and connectivity are challenges that are particularly pronounced in rural and coastal areas, impacting certain demographics even more so than others. There are significant opportunities to address these challenges which this Strategy looks to take advantage of.

What do we need to achieve?

Promote Norfolk and Suffolk as a place rich with clean growth investment opportunities. Utilising Norfolk & Suffolk Unlimited, through proactive, targeted campaigns and defined commercial propositions to attract and retain businesses and talent focussed on our strategic opportunities i.e. clean energy and GENERATE; ICT digital and 5G digitisation; agri-food and nutrition.

Deliver local smart energy systems taking advantage of the region's strengths in clean energy generation. With the demand and cost of energy increasing significantly there an urgent need for business-led innovative projects that will speed up the uptake of smart energy systems by local communities to start benefiting from cleaner, cheaper and more consumer-friendly energy. A new approach to tackling the region's power supply is needed. At a Norfolk and Suffolk level, Local Area Energy Planning may be explored as part of the solution.

Ensure everyone has digital connectivity. Digital reliability and mobile connectivity improvements are even more critical than they were pre-pandemic with those businesses able to diversify into digital markets proving more resilient. An 'Outside In' approach with respect to full fibre delivery will help coverage across the area and support levelling up in places that may otherwise struggle to see the improvements needed.

Deliver innovative clean transport solutions that reduce the need to travel, encourage modal shift and support a thriving economy across all our geographies. We must consider how we exploit the benefits observed around travel behaviour due to the pandemic alongside the deployment of alternative fuels (electric, hydrogen and biofuels) to support the decarbonisation of transport. Alongside this there are several pinchpoints that need to be overcome to support the resilience, reliability and flexibility of infrastructure.

Deliver the right mix, quantity and quality of sustainable, energy efficient, affordable homes, commercial space and communities that are fit for the future and meet need. Partnership working with housing associations, developers and local authorities is imperative to meet the identified needs. Long-term certainty on housing retrofit (heat, energy and transport), promotion of best practice support for sustainable new build and skills is needed. New development should deliver on biodiversity net gain and minimise harm to natural capital.

Reduce the demand for water and energy through resource efficiency measures, ensure flood resilience and develop an innovative and circular economy. Protect and enhance the natural capital of Norfolk and Suffolk enabling where possible greater public access for tourism and personal health and wellbeing.

Freeport East will further accelerate the UK's gateway to Asia and Europe, both in trade and investment, while establishing itself as a key component of the UK's hydrogen strategy and drive towards net zero. Comprising three Tax Sites at Felixstowe, Harwich and Gateway 14 together with seven Customs Sites, Freeport East can be developed at pace and provide the capability for businesses to promote Global Britain internationally whilst providing a return on investment. Over £300m of private sector funding will be unlocked, resulting in over 13,500 new jobs.

Centred on the UK's largest intermodal ports cluster, Freeport East is directly connected to European and Global shipping routes. Inbound components and raw materials can enter the Freeport directly from the point of entry into the UK and exports can access markets anywhere in the world by the most direct and cost-effective routes. 35% of the UK's containerised trade already passes through the Freeport area.

Vibrant, healthy, resilient and reimagined cities, towns and communities that take advantage of their diverse heritage, environmental and cultural assets and offer a high quality of life for people and business. The pandemic has shown the importance of our local centres and we must further support them to thrive by being creative, enterprising and entrepreneurial. There is a need to better align capital investment and land uses with the region's aspirations of clean, inclusive growth.

Local partners will work together to:

Promote the economic, environmental and social potential and qualities of Norfolk and Suffolk by:

Continuing to build Norfolk & Suffolk Unlimited, communicating a clear, ambitious offer to the world to attracting the people, investors and businesses of the future.

Working with the Department for International Trade to develop and promote high-potential opportunities to foreign investors.

Delivering the East of England Destination Development Plan, ensuring we have strong and sustainable destination management organisation which together supports the delivery of a strong and sustainable visitor economy, with a particular focus in our Market Towns.

Delivering the right mix of sustainable, energy efficient, intelligent homes, commercial space and communities that are fit for the future including:

Continuing to develop the Enterprise Zones, accelerating investment in clean growth, seeking to embed clean energy generation, carbon reduction and striving for a circular economy.

Left – Norfolk & Norwich Festival ©ChrisTaylor

Identifying and addressing specific pockets of under-supply of suitable commercial space to accommodate business growth.

Maximising the potential of our key transport corridors, especially the A14, A11 and A47, for the provision of high-quality premises allied to clean growth.

Enhancing fixed and mobile digital infrastructure building on initiatives such as the Norfolk & Suffolk Innovation Network, ensuring full coverage across urban and rural areas by working with network operators to maximise the impact of planned investments.

Working with Transport East and Rail Taskforce groups to promote and deliver green travel choices and innovation, as well as pinchpoint solutions and rail upgrades that improve infrastructure resilience, reliability and flexibility as well as more effective integrated services.

Seeking investments in the Alternative Fuel Strategy and Action Plan being delivered with the Cambridgeshire and Peterborough Combined Authority.

Working with Water Resources East to develop a Regional Water Management Plan with linked initiatives to manage resources and improve quality, with particular focus on agri-food.

Delivering the huge potential of Freeport East to drive clean growth through clean energy, clean maritime, innovation, skills, trade and investment over its 25-year lifetime.

Delivering low carbon, smart homes, seeking to influence and inform the scope and ambition of new developments, reducing the need to travel where possible.

Delivering at scale 'fabric first' retrofit of buildings.

Delivering flood defences that unlock or protect housing and commercial development.

Right – King's Lynn

Developing exemplar clean energy generation, networks and storage which benefit local businesses and communities including:

Working with UK Power Networks to address grid constraints for existing and new demand and generation, moving away from the business-as-usual connection model to managing demand more flexibly, using smart technologies, and developing local power storage solutions.

Increasing the number, quality and scale of local energy generation and storage projects working with the Greater South East Energy Hub, utilising relevant funds and support and maximizing the clean energy opportunity on public sector premises.

Next generation technologies focussed on reducing demand including the generation of hydrogen; carbon capture storage; and a new resilient, flexible transmission network.

Nurturing vibrant, inclusive and resilient cities, towns and communities by:

Identifying solutions that deliver affordable, low carbon, smart housing, especially in rural and coastal areas, ensuring people in rural areas can access work and training opportunities flexibly.

Developing and piloting new approaches to local services through multi-purpose hubs and mobile facilities to reach all communities ensuring prosperous future for all.

Delivering the five town deals already secured and securing more.

Building on the collaborative vision and expertise across the Norwich Institute for Healthy Ageing, linking researchers and clinicians with care providers and developers to develop exemplar ageing society assisted living communities.

The Norfolk and Suffolk multi-site Enterprise Zones will continue to drive investment and jobs growth in key locations and enhance supply chains across our high value sectors. The 16 commercial sites have already helped leverage more than £490 million of public and private investment in recent years with around 200 businesses supported and 4,500 jobs created. Retained business rates income has been reinvested into site infrastructure, new commercial buildings and economic development activities to help unlock sites and accelerate development. A new five-year plan was developed and launched in 2021 which sets out an exciting new direction for Enterprise Zones and a stronger focus on innovation and clean growth with new commercial developments already underway or in the pipeline.

Right – The new Greater Anglia fleet

SUCCESS STORIES

Destination Development Plan

Visit East of England, Destination Management Organisations, local authorities and the LEP created the Destination Development Plan for East Anglia which seeks to nurture and develop a sustainable tourism offer through a sustainable tourism group and plan, deliver the skills required for the sector through the East Academy for Skills in Tourism and consider how further application of digital and technological innovation can enhance the year round offer and productivity of the sector.

Growing Norwich's £107m social enterprise economy

Norwich's new accreditation as a Social Enterprise Place recognises the already strong social enterprise sector in the city. It currently comprises of at least 53 businesses that are collectively employing 2,714 staff with a combined turnover of over £107m. The aim of FUSE Norwich is help develop and strengthen the sector and so play a vital role in ensuring Norwich has a diverse, inclusive, resilient economy that works for the whole community. The value of Norwich social enterprises is two-fold: they tackle local social and environmental issues as the very mission of their business, and they put the profit from doing that back into the community's pocket.

FUSE NORWICH
SOCIAL ENTERPRISE PLACE

Suffolk Inclusive Growth Investment Fund

In response to Covid 19 Suffolk's Public Sector Leaders launched the Suffolk Inclusive Growth Investment Fund totalling £1.65m to support projects that responded to the significant impact of the pandemic on Suffolk's businesses, employees, and the local economy. Projects supported include the creation of an Innovation Lab in Woodbridge, a package of digital business recovery support for over 100 businesses in Ipswich town centre and town centre projects in Eye, Sudbury, Hadleigh and Stowmarket to generate new business opportunities and footfall.

MAKING IT HAPPEN

This strategy reflects the opportunities and needs of Norfolk and Suffolk's growing clean economy and how it will respond in a fast-changing world.

Local partners have put in place a strong partnership that has a track record of delivery. Norfolk and Suffolk partners know that the economy is most successful when they work together for the benefit of the people who live, learn and work here.

This strategy will not be delivered by one partner alone or by one strand of investment or actions. Local partners have a strong track record of delivery. Businesses, New Anglia LEP, business support organisations, local authorities, VCSE organisations, colleges and universities collaborate to deliver shared ambitions rather than focusing on organisational, sectoral or geographic boundaries.

The way in which government is structuring funding and what private sector investors are looking for is changing with environmental, social outcomes and governance becoming more important. To succeed, our approach to developing and delivering interventions, programmes and projects needs to adapt.

Addressing the challenges and making the most of the opportunities presented in this strategy requires strong leadership and robust governance. We will build on our existing governance model which has put Norfolk and Suffolk in a good position enabling us to be fleet of foot, but accountable to stakeholders.

We collaborate to deliver shared ambitions rather than focusing on organisational, sectoral or geographic boundaries. Our ambitions will be achieved through using the whole system to deliver, including local action plans and strategies and statutory planning documents. This is the best way of integrating action and investment to achieve the value for money and impact that our residents and businesses expect.

The following tools and systems will support this way of working:

Delivery and investment plans – This strategy provides a framework for partners to develop plans specific to their geography, sector or institutions which set out how projects and priorities will be delivered and funded, their outcomes and how partners will be mobilised to achieve them. Much of the delivery will take place through these plans.

Drive delivery through existing groups and structures including local authorities, industry councils, sector groups, business support organisations, the New Anglia LEP Innovation Board, the New Anglia Skills Advisory Panel, the New Anglia Clean Growth Taskforce, VCSE, education and anchor institutions.

Collaborate with and learn from other parts of the country, in particular our neighbours in Lincolnshire, Cambridge, Peterborough and Essex.

Shared economic evidence base which continues to evolve and stay live, providing partners with a reliable and consistent source of quantitative and qualitative evidence to support bids to secure funding, inform action and investment decisions.

Shared Indicators which we will use to track progress and prioritise.

Identification of funding routes across government, private sector and other funding providers.

An annual stock-take of progress, which will review progress and identify where changes are needed to reflect new economic or policy circumstances.

Embedding evaluation at the outset of planning, developing, and implementing interventions and actions, shearing lessons learnt embracing a shared process of continuous improvement.

Local partners have come together to agree this strategy and are all committed to collaborate, inspire, innovate, and invest to support our people, businesses, and places to adapt, transition and flourish.

GLOSSARY OF KEY TERMS

Defining Clean Growth Growing an environmentally positive and resilient economy by exploiting the region's strengths, driving the adoption of clean technology, efficient use of natural resources and reducing waste, accelerating sustainable infrastructure, equipping and empowering business and people to take advantage of the opportunities in moving to a zero-carbon economy.

What does Net Zero mean? Balance between greenhouse gas emissions emitted and removed from the atmosphere.

Sustainable infrastructure is the physical structures and facilities (e.g. buildings, roads, power supply) that meets society or enterprise essential needs, is environmentally friendly from end to end and is inclusive through design, to remove inequalities.

Innovation is developing and executing new ideas to create value - new ways a business or organisation delivers its products or services.

Norfolk & Suffolk Unlimited

Appendix 20: NALEP Integrated Transport Strategy for Norfolk and Suffolk

THE>EAST

INTEGRATED TRANSPORT STRATEGY FOR NORFOLK AND SUFFOLK

A STRATEGY FOR
GROWTH AND OPPORTUNITY

MAY 2018


OUR PLACE
KEY
Trunk Road
Proposed MRN
Local MRN priorities
Wind Farm
Gas Terminal
Nuclear Power Station
Airport
Shipping Port
Rail
Sheringham
Cromer
Hunstanton
A149
A148
A140
Bacton
North Walsham
Fakenham
King's Lynn
A17
A1065
Norwich Airport
A1270
A47
Wisbech
Swaffham
Norwich
Great Yarmouth
To the North
A141
Downham Market
A146
Peterborough
A10
A134
A11
Lowestoft
To the Midlands
Diss
Ely
A132
Thetford
Southwold
A1(M)
Mildenhall
A12
To the M6
A134
A143
Eye
A14
A11
A140
Sizewell
A14
Bury St Edmunds
A428
Cambridge
Newmarket
Stowmarket
Aldeburgh
A1307
Haverhill
A134
A421
A1
Sudbury
Woodbridge
Ipswich
M11
A14
Felixstowe
A131
M1
A120
Harwich
A120
A133
Stansted Airport
A12
A1(M)
M25
London
M25
Worldwide destinations and markets 50 minutes away
Worldwide markets - UK's biggest container port: 40% of all trade
The Hook
Amsterdam
Rotterdam
Netherlands
Zeebrugge
Antwerpen
Calais
Belgium
France

FOREWORD

To create an environment where **businesses continue to flourish**, we need to further improve our transport infrastructure. Effective transport networks can help to **boost inward investment and enterprise creation** as well as **increase productivity** by improving access to markets and increasing value for money.

Doug Field: © Pagepix

[redacted]

DOUG FIELD
Chair of
New Anglia Local
Enterprise Partnership

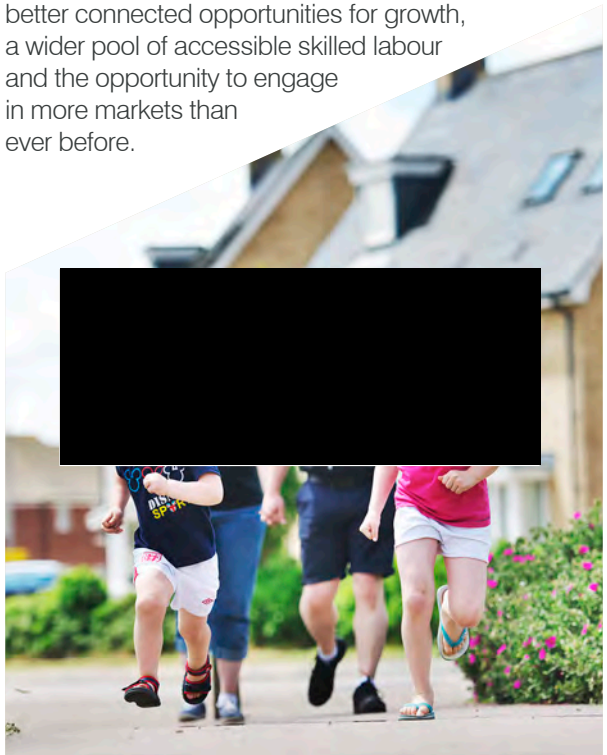
They can also help to unlock **opportunities for balanced and inclusive growth** and provide people with better and **safe access** to services, products and opportunities.

The future is changing rapidly. These changes will affect our networks and the way in which we use them. It is vital that our networks are innovative in their response to these changes to ensure we embrace the opportunity they present, to the benefit of everyone.

Reliable and resilient networks are a fundamental building block to the ongoing success and growth of our £35.5bn economy and in ensuring the East realises its future ambitions as set out in the **Norfolk and Suffolk Economic Strategy**. However, our potential is sometimes constrained by journey times and capacity which compound the perception that our area is a 'long way' from the rest of the country.

The New Anglia Local Transport Board partners have developed this Integrated Transport Strategy which sets out our ambition, our collective goals for delivery and how we might see them brought to fruition. Importantly, this Strategy provides a robust foundation for the newly formed sub-national transport forum: Transport East.

Most importantly it sets out how our transport network can help to continue to make Norfolk and Suffolk a great place to trade, live, work, visit and learn. For the East continue to thrive we must work together to develop a network that meets our aspirations both now, and in the decades to come. If implemented successfully future business will benefit from better connected opportunities for growth, a wider pool of accessible skilled labour and the opportunity to engage in more markets than ever before.



[redacted]

THE STRATEGY

Our Strategy looks ahead to the 2040s but focuses on the actions we need to take over the next three to five years to help secure the foundations for long-term success. It is a dynamic and living blueprint to guide the work and investment of many interested partners. Together we have:

Examined the evidence, making sure we understand our transport networks and modal needs in detail and how we can remain agile to future opportunities and challenges.

Set challenging but achievable ambitions, based on evidence, that describe the place and transport solutions we want for Norfolk and Suffolk.

Agreed the themes under which we will prioritise action and investment in transport improvements.

Identified actions and measures for success, with partners, to drive delivery and measure success.

© Mike Page

NORFOLK AND SUFFOLK TODAY[1]

The East is a geographically and **economically diverse area**, with an established, **growing** and ageing population of over 1.6 million people.

Exploiting an advantageous geographic position, Norfolk and Suffolk retain a **strong commercial relationship** with the rest of the world. **The Port of Felixstowe** is the UK's major container gateway to the world, handling some 28m tonnes of imports and exports per year (42% of the country's container traffic) with east-west links and maritime connectivity continuing to be crucial to the ongoing movement of freight into and out of the country from both here and the other ports including the **Ports of Ipswich, King's Lynn, Great Yarmouth and Lowestoft**.

Also looking outward, **London Stansted Airport**, within an hour's reach of many parts of Norfolk and Suffolk, provides access to many national and international destinations and currently serves 26 million passengers a year (set to rise to 35 million before 2023); It is also the country's third busiest freight airport handling in excess of 220,000 tonnes per annum. **Norwich Airport** provides access for over ½ million passengers a year to a number of regional airports and to the many energy installations in the North Sea as well as Europe and beyond, usually via Amsterdam Airport Schiphol. Easy access to these international hubs, both by public and private transport methods, will help to ensure their ongoing success. The recently completed **Broadland Northway** demonstrates the collaborative local delivery of a project of national significance and has the potential to provide jobs, help businesses and bring over £1bn of economic benefits to Norfolk as well as a high-quality link to Norwich Airport.

The area has important strategic connections with London, Cambridge, Peterborough and beyond, with key rail routes including the Great Eastern Main Line (GEML), the West Anglia Main Line (WAML), and the Felixstowe to Peterborough route which connects into the East Coast Main Line. The Strategic Road Network (SRN), via the A11/M11, A12/A120, A14/M6, A47/A1 and A428/A421 and beyond to Oxford, provides connectivity to these locations as well as to the Midlands, the North and the rest of the country. Our economy will continue to rely on making sure that there is good connectivity to and from the East.

In addition, priority corridors have been identified as the **Cambridge-Norwich Growth Corridor**, with an abundance of high tech businesses; the **A14 growth corridor**, between Felixstowe and Cambridge; the **A47 growth corridor** between Lowestoft and Peterborough (projects included in the first Roads Investment Strategy); and **King's Lynn** and the **A10 growth corridor** to Cambridge. Ensuring reliable and resilient connections will be critical to driving business growth and productivity in the East.

Ipswich and **Norwich** are the largest economic centres for our area with specialisms in the **financial services and insurance** sector and **ICT, tech and digital creative** at Adastral Park and Norwich. Coastal towns such as **Great Yarmouth** and **Lowestoft**, are also important centres of activity, particularly in the globally competitive energy sector; together, they form part of the **Norfolk and Suffolk Energy Coast** along with Sizewell, Bacton and the offshore windfarm clusters as part of the East of England Energy Zone. In addition, Norfolk and Suffolk has a thriving **life sciences and bio-tech** sector clustered around Norwich Research Park, the National Stud (the home of horseracing) in Newmarket and CEFAS (Centre for Environment, Fisheries and Aquaculture Science) in Lowestoft. Each of our key sector clusters, together with our other sector strengths, need to be well-connected in order to continue to be catalysts for innovation and opportunity and to drive our strong and growing economy.

Other significant centres, including but not limited to, **Bury St Edmunds, Haverhill, King's Lynn and Thetford**, are the focus for our local economies, each with their own successful economies and uniqueness and this diversity must be maintained in order to secure our ongoing economic success: Transport and connectivity to larger economic centres including Cambridge remains a key facilitating factor for their local economies.

However, our transport networks can suffer from **reliability and resilience issues**, particularly during periods of bad weather, and have a number of pinch-points that can contribute to the perception that Norfolk and Suffolk are a 'long way' from the rest of the country. Transport in the East must do all it can to reduce these barriers to **inward investment, business creation and productivity**, recognising business needs, whatever their size.

SOCIAL INCLUSION AND SKILLS

We must also consider how transport can drive social inclusion and skills, using innovative and digital means, as well as more traditional methods, so that people can access education, training and labour market opportunities and are able to meet their full potential, raising living standards and social mobility and re-balancing the economy.

[1] https://newanglia.co.uk/wp-content/uploads/2017/12/2017-12-05-FINAL-Economic-Evidence-Report-single-pages-HighRes.pdf

NORFOLK & SUFFOLK PROFILE AT A GLANCE

101 REGULAR SCHEDULED FLIGHTS DEPARTING FROM NORWICH AIRPORT PER WEEK

3,300 DEPARTURES PER WEEK FROM STANSTED

50 MINS FROM NORWICH TO AMSTERDAM

STANSTED HANDLES **220K** TONNES OF FREIGHT PER YEAR

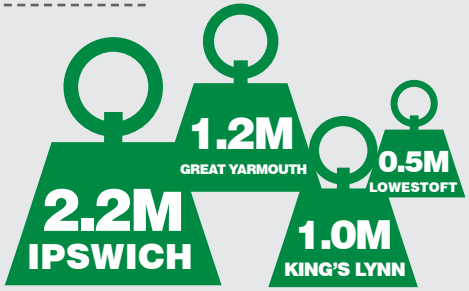
28M TONNES OF FREIGHT PER YEAR

FELIXSTOWE PORT IS THE BUSIEST CONTAINER PORT IN THE UK AND 7TH BUSIEST IN EUROPE

NORWICH	COMPARED TO	STANSTED
10,000 PASSENGERS PER WEEK		490,000 PASSENGERS PER WEEK

STANSTED IS 4TH BUSIEST AIRPORT IN THE UK

70% OF CONTAINERS COMING THROUGH FELIXSTOWE ARE DELIVERED TO THE 'GOLDEN TRIANGLE'



TONNES HANDLED PER YEAR VIA OUR PORTS

SECURED RAIL SERVICE IMPROVEMENTS WILL INCREASE CONNECTIONS

60 MINS IPSWICH TO LONDON	90 MINS NORWICH TO LONDON	75 MINS CAMBRIDGE TO IPSWICH	90 MINS PETERBOROUGH TO NORWICH
▼ 5 MINS	▼ 15 MINS		

330 RAIL FREIGHT MOVEMENTS INTO AND OUT OF THE PORT OF FELIXSTOWE PER WEEK

SEVERE CONGESTION

A14
- J55-J58 SOUTH OF IPSWICH
- BURY ST EDMUNDS AND NEWMARKET (J36-J38 AND J42-J44)

A47
- GREAT YARMOUTH TO ACLE

REGULAR CONGESTION

A11
- BETWEEN MILDENHALL AND THETFORD (CAN BE SEVERE TOO)

A47
- BETWEEN NORWICH AND HONINGHAM
- AT KING'S LYNN

SPEEDS FOR REGIONAL JOURNEYS SLOWER THAN TO MAJOR NATIONAL CENTRES

FUNDING AND DELIVERY OF PLANNED IMPROVEMENTS NEEDS TO BE SECURED TO IMPROVE THESE AVERAGE SPEEDS

BY CAR, FROM NORWICH TO:

33 MPH	36 MPH	37 MPH	41 MPH	51 MPH	54 MPH
SHERINGHAM	IPSWICH	GREAT YARMOUTH	KING'S LYNN	CAMBRIDGE	LONDON

BY CAR, FROM IPSWICH TO:

34 MPH	36 MPH	37 MPH	49 MPH	49 MPH	51 MPH
FELIXSTOWE	NORWICH	LOWESTOFT	STANSTED	LONDON	CAMBRIDGE

% MODE SHARE TRAVELLING TO WORK

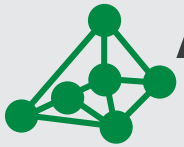
4.5%	12.6%	4.1%	1.8%	74.7%

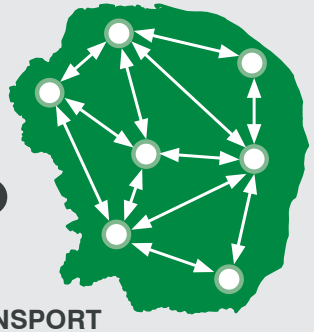
ENGLAND AVERAGE:

↑ 3.3% CYCLING	↑ 12.1% WALKING	↓ 4.9% BUS	↓ 4.6% TRAIN	↑ 73.1% CAR

COMMUTING PATTERNS ARE PRIMARILY CONCENTRATED ON

NORWICH IPSWICH A14 CORRIDOR KING'S LYNN





6%

TRAVEL VIA PUBLIC TRANSPORT IN NORFOLK AND SUFFOLK

COMPARED TO

10%

UK AVERAGE IN ALL NON-METROPOLITAN AREAS

PLANNING FOR THE FUTURE

There are a number of significant socio-economic trends which present various challenges and opportunities for the East which will impact how, when and why we access and use our transport network:

DEMOGRAPHIC

A growing and ageing population, many of whom may work longer, the impacts of net migration and the ongoing trend of urbanisation.

SOCIAL

The rise of the "sharing" economy and the growth in "immediacy" expectations will impact the traditional models of transport access, ownership and use, particularly in younger generations.

ENVIRONMENTAL

Impacts of climate change, particularly in low-lying and coastal areas, scarcity of resources and the role of renewable energy.

TECHNOLOGICAL

Significant and rapid future change, which will alter how, when and where infrastructure and services are provided and accessed:

- **'Big Data', Artificial Intelligence (AI) and cognitive thinking and self-learning systems** will improve transport operations and services and how customers engage with them;
- **Automation and robotics** have the potential to improve maintenance and safety. The most visual aspect of this change will be Autonomous Vehicles;
- **Propulsion and energy decarbonisation** will have air quality benefits but could negatively impact energy distribution networks;
- **Material science** improvements will mean cheaper, more functional and sustainable use within vehicles and infrastructure;
- **3D printing** techniques have the potential to allow local production of components and products that will likely impact traditional supply chains; and
- **Shared mobility** will provide agile alternatives to traditional fixed public transport routes and car ownership models, particularly in urban areas.

ECONOMIC

The rise of the "gig" economy, local manufacturing (including 3D printing) and the just in time culture on business models, e-commerce, freight and last-mile delivery.

POLITICAL

Devolution of decision-making, future economic uncertainty regarding national political decisions, changes in legislation, the impacts of globalisation and the protectionism of markets.

The way the economy responds to these future challenges and opportunities will have important implications for the area's land-use and transport strategy. Indeed, global trends will impact our key sectors in different ways and it is important to recognise how to maximise the associated economic and transport opportunities effectively. We have considered some future scenarios for technological and mobility changes on pages 12 and 13, whilst recognising that their availability, application and social adoption is difficult to predict, especially considering the speed at which these developments may occur.

CHALLENGES AND OPPORTUNITIES

Improving strategic connectivity across the East, especially London, Cambridge, Peterborough and beyond will help to open up as yet untapped opportunities and help drive business growth and productivity in the East.

Making the most of our advantageous location with respect to **accessing global markets** is another key opportunity for our area. Ensuring the ongoing success, access to and growth of the Port of Felixstowe and our other ports at Ipswich, King's Lynn, Great Yarmouth and Lowestoft as well as airports at London Stansted and Norwich will help to improve our Offer to the World, help to boost enterprise formation and inward investment in the region.

Capitalising on our geographic diversity and meeting the needs of our significant urban centres and market towns as well as our rural and coastal communities will ensure that the needs and aspirations of all our communities and businesses, no matter their size, are realised. Our road and rail networks can help to achieve this **improving capacity and journey times**, as well as **reliability and resilience** in times of strain.

We must also help to ensure that the East continues to **increase its contribution to UK plc**. In doing so our economic diversity must be maintained and enhanced and our transport network can help to support our **world-leading competitive clusters** in clean energy, financial services and insurance, ICT, tech and digital creative and life sciences and biotech to thrive. Our other key sectors, for which Norfolk and Suffolk have a competitive advantage, will also contribute to this ambition and we must ensure that our transport network supports each of these clusters to continue to drive our competitive advantage.

Contributing to **driving social inclusion and skills** uplift is another opportunity for the East. Transport and digital connectivity can help to improve access to learning, both now and in the future, so that people have the right qualifications and improved access to opportunities, helping boost social mobility and living standards in turn. In addition, we must also help to achieve modal shift, improve air quality, reduce the impact of flooding and ensure we mitigate and adapt to **environmental challenges**.

Our network must accommodate an ever **growing and ageing population** and digital technology will have a part to play to help us reduce overall demand thus improving access to services outside the more traditional forms of transport.

We must stand ready to ensure our strategic ambitions are realised. We must be agile, encourage innovation and look to exemplars to help guide the development of robust, **viable solutions** to these changes. In doing so we will **develop relationships** with new and existing partners in relevant and growing sectors to understand their needs and drivers and clearly **articulate our vision** for transport in the East, with Transport East, in the short, medium and longer-term.

Transport and digital connectivity is an integral part of the East's economy, helping to unlock the area's substantial resources in land, labour and capital, and therefore a significant driver of productivity. Addressing connectivity issues is a crucial building block to our future growth and economic success. Working with our partners we have a **strong track record** of addressing constraints through targeted investment. However, more needs to be done to make sure our transport network is truly integrated and agile to future changes.

The Government's Industrial Strategy (and its underpinning Clean Growth Strategy) sets out Grand Challenges to put the UK at the forefront of the industries of the future, ensuring that the UK takes advantage of major global changes, improving people's lives and the country's productivity. The first four Grand Challenges are focused on the global trends which will transform our future:

- growing the Artificial Intelligence and data driven economy;
- clean growth;
- future of mobility; and
- ageing society.


BROMPTON

INDICATIVE TIMELINE

EARLY 2020s

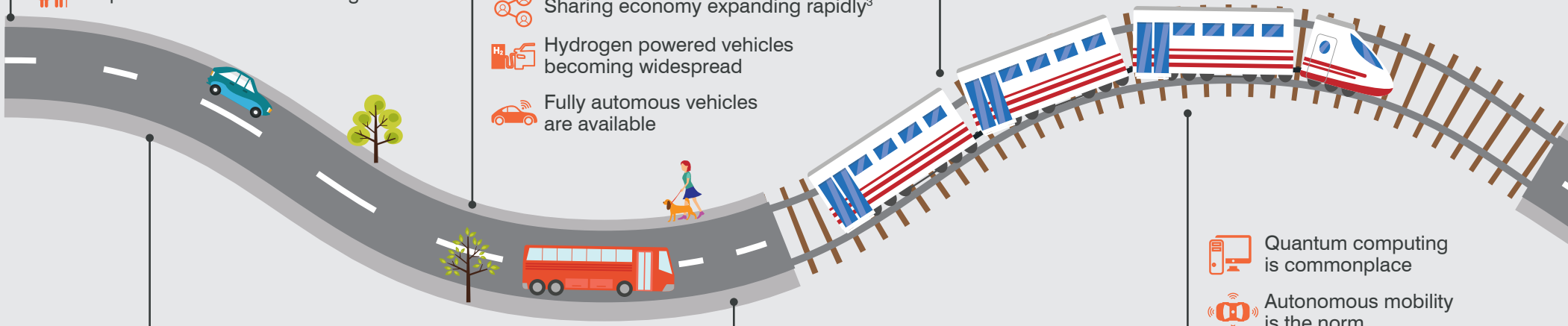
- Autonomous vehicles coming to market
- 3D printing cheap, fast and readily available
- Electric vehicles re mainstream
- E-bikes widely and cheaply available
- Populations over 65 increasing

LATE 2020s

- Sharing economy expanding rapidly[3]
- Hydrogen powered vehicles becoming widespread
- Fully automous vehicles are available

MID 2030s

- Hypersonic airliners and hyperloop enter service
- Diminishing natural resources
- Warmer and wetter winters and hotter and drier summers
- Petrol and diesel propulsion being phased out



MID 2020s

- 5G wireless becoming the standard
- Connected vehicles are the norm
- Offshore wind supplies 4m homes
- Urbanisation continuing
- Mobility as a Service solutions available
- Robotic technology assisting humans

EARLY 2030s

- Web 4.0 mobility networks
- On-demand manufacturing more cost-effective and commonplace
- Drone and droid delivery commonplace

LATE 2030s

- Quantum computing is commonplace
- Autonomous mobility is the norm

[3] PWC

2030s

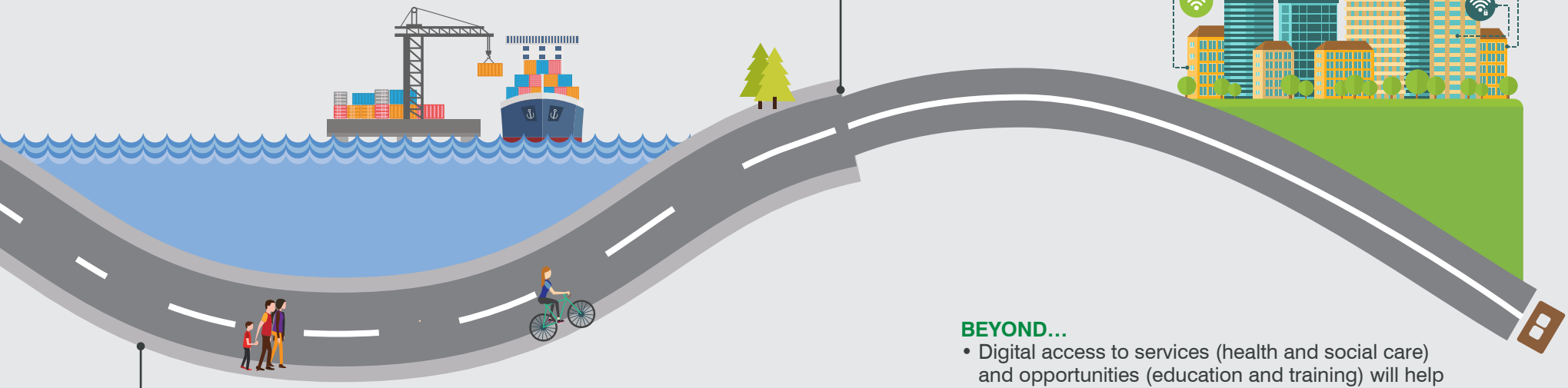
- Digital connectivity improved allowing people to access opportunities from home and on the move
- Key pinchpoints addressed and improved network capacity and operation will make journeys more reliable and resilient
- Better access to information will lead to 'peak' travel spread and allow people to make choices with more certainty

MID 2040s

Norfolk and Suffolk population exceeds 2 million…
...migration a big influence

LATE 2040s

Robots and automation widespread in society…
…over 30% of jobs now completed by them



EARLY 2040s

- Artificial 'energy islands' developed
- Increased global communication reach
- Global democracy growing in strength

2040s

- Connected vehicles the norm, improving safety and smoother running of the network
- Agile, on-demand, responsive transport services that offer more choice and efficiencies
- Decarbonisation largely complete supported by alternative generation and storage solutions and air quality benefits

BEYOND…

- Digital access to services (health and social care) and opportunities (education and training) will help people be more productive
- New service models will reduce costs and provide for hard to reach communities
- Direct rail access between key centres with faster journey times and higher capacity…Local rail services will have more reliable rolling stock and improved customer experience
- On-account, seamless, barrier-less payment technologies will facilitate Mobility as a Service (MaaS)…A priority for our communities

PRIORITY THEMES AND PLACES[2]

The Norfolk and Suffolk Economic Strategy considered what future success looks like for the East. We have mapped our Economic Strategy themes to our key transport themes below:

Our Offer to the World / Competitive Clusters close to Global Markets

CONNECTING THE EAST, ACCESSING THE WORLD

Quicker, more reliable and resilient strategic connections to boost our contribution to UK plc., encouraging improved perceptions, economic participation and inward investment for our key sectors and competitive clusters.

Driving Business Growth and Productivity

AGILE TO CHANGE

Embracing new technologies and digital connectivity to enable remote access to services and opportunities to facilitate Mobility as a Service (MaaS).

REGIONAL CONNECTIVITY AND OUR PRIORITY PLACES

Keeping people and products moving in and around our growing Priority Places and Enterprise Zones through new investment, placemaking, maintenance and an integrated public transport network with opportunities for walking and cycling.

Driving Inclusion and Skills

LOCAL AND COASTAL

Innovative on-demand transport solutions and improvements to facilitate local sustainable growth, walking and cycling, recognising local distinctiveness, and offering access to services and opportunities through digital means.

Collaborating to Grow

MAKING IT HAPPEN

An accompanying Delivery Plan for Norfolk and Suffolk to help gain the momentum needed to unlock and deliver, through innovative means, the key strategic interventions identified by new and existing partners.

OUR PRIORITY PLACES

Our Priority Places are the areas where the evidence shows there are significant opportunities and commitment for continued growth:

- Ipswich and the surrounding area;
- Norwich and the Greater Norwich area;
- The Norfolk and Suffolk Energy Coast, including Bacton, Great Yarmouth, Lowestoft and Sizewell, with assets on and offshore;
- The Cambridge-Norwich corridor growth – connecting two global centres of research;
- The critical east-west growth corridors along the A47 from Lowestoft and Great Yarmouth to King's Lynn and the A14 from Felixstowe through Ipswich, Stowmarket, Bury St Edmunds, Newmarket and Haverhill to Cambridge and Peterborough; and
- King's Lynn - and the A10 and rail corridor to Cambridge.

[2] https://newanglia.co.uk/our-economic-strategy/

OUR STRATEGY

We aim to provide the foundations for an integrated, total transport solution which serves our growing economy, links our people and their activities with our developing Priority Places, and is fit for agile digital, socio-economic and transport developments.

With our partners, we will drive business growth and productivity, improve inclusion and skills, benefit health and well-being and do so in an environmentally sustainable way, with safety at its core.

From our Priority Places, ports, airports and the strategic corridors that link them, to our rural and coastal communities, transport needs vary greatly and as such there are a myriad of both short and longer distance journeys for every one of our businesses, residents and visitors. It is therefore critical that we consider how we best serve all levels of our community with a reliable and resilient integrated transport network. In order to rise to the challenges and opportunities presented previously we have grouped our Strategy priorities under the following themes, based on the different unique market opportunities they present to the East.

This integrated approach will not only increase access to opportunities irrespective of circumstances. If successful, it will consider the use of digital data to help balance supply and demand across all transport networks delivering significant benefits across the economy.

Transforming your railway with new trains

- **Connecting the East, Accessing the World**
- **Regional Connectivity and Our Priority Places**
- **Agile to Change**
- **Local and Coastal**
- **Making it Happen**

CASE STUDY

THE GREAT EASTERN MAIN LINE TASKFORCE

Successful partnerships in action

Launched in summer 2014 the Great Eastern Rail Campaign demonstrates the drive, enthusiasm and ability of our partners in the East to deliver our collective aspirations. Over 100 of the region's most senior business and education leaders representing more than 111,000 employees and students pledged their support and more than 1,600 commuters and rail users joined the campaign to deliver significant improvements to rolling stock, infrastructure and journey times between Norwich and London, known as 'Norwich in 90'.

Delivered to government in 2014 the Great Eastern Rail Report set out our aspirations, subsequently forming part of the re-franchising specification. Last year it was announced that Greater Anglia was successful with its bid which will deliver a major package of improvements for rail services in the region, including: replacement of the entire fleet of trains with 1,043 new carriages which will start to come into service from 2019, journey times to be cut by 10%, delivery of at least four 90-minute services between London and Norwich each weekday and two 60-minute services per day between London and Ipswich, and provide up to 32,000 more seats by 2021 and free Wi-Fi for all passengers.

CASE STUDY

THE PORT OF FELIXSTOWE

Keeping UK trade moving

The Port of Felixstowe is Britain's biggest and busiest container port, and the seventh busiest in Europe.

The port handles more than 4 million TEUs (Twenty-foot Equivalent Units) and welcomes approximately 3,000 ships each year, including the largest container vessels afloat today. Crucially the port provides some of the deepest water close to the open sea of any European port. Around 30 shipping lines operate from Felixstowe, offering approximately 90 services to and from 400 ports around the world.

Road and rail connect it to distribution hubs in the Midlands and elsewhere across the UK. Felixstowe plays a pivotal role in keeping the UK's trade moving, and delivers real benefits to customers, the community and the industry.

CONNECTING THE EAST, ACCESSING THE WORLD:

OUR OFFER TO THE WORLD

The world is "getting smaller" and competition in global markets more intense meaning that businesses that rely on international trade for raw materials and import/export markets will need stronger connections to international gateways in the East to remain competitive.

Improved access to international markets will also help business to business connectivity in terms of realising opportunities and encourage inbound and outbound tourism directly to and from the East.

International access is a key strength and opportunity for the East. Access to the Port of Felixstowe as the nation's largest container gateway and our other ports as well as Airports at London Stansted and Norwich are clear priorities for our area.

To capitalise on our position, we will work together with partners in the port and airport sectors to improve our offer to the world by:

- Ensuring the ongoing success of the **Port of Felixstowe** as the country's largest container port, and our other ports, including the **Ports of Ipswich, King's Lynn, Great Yarmouth and Lowestoft**, to maximise future import/export and bulk cargo opportunities for the East and UK plc. by making the case for and securing investment in strategic routes, and their facilities, and in maritime connectivity, to improve freight accessibility and ensure the UK remains relevant to international markets capitalising on the recent DfT study of England's Port Connectivity and;

- Ensuring greater choice for international air travel by encouraging the development of additional services and good connectivity to and from **London Stansted and Norwich Airports** and other international hubs outside the region, and the UK, through road and rail improvements from Norwich, Ipswich and our other Priority Places, ensuring future agility.

Connectivity between the East and the rest of the UK is essential to enabling businesses to have strong links to customers and supply chains. Fast and reliable links to London, Cambridge, Peterborough and beyond are key to business to business connectivity, realising new opportunities and future economic performance and competitiveness of the East and UK plc. With the Midlands Engine and Northern Powerhouse strengthening their reach and influence, the strategic case for better east-west connections through East West Rail and the Oxford to Cambridge Expressway is ever greater, both in terms of international freight and passenger movements. Strong national links are also crucial for access to the Norfolk and Suffolk Energy Coast and our unique tourism offer.

Importantly, we recognise that many of our partners also have aspirations outside the region which may

have a reliance on the accessibility and connectivity of the East.

We will work together with our partners to drive business growth and productivity and connect the East by:

- Ensuring a **resilient Strategic Road Network (SRN)** that is agile to future opportunities, the timely delivery of already committed schemes and certainty that the A11, A12 (south of Ipswich), A14 and A47 feature prominently in future Roads Investment Strategies by strengthening relationships with Highways England. In doing so, the importance of the SRN and Major Road Network (MRN) outside the East (like the A120 and A1307) and the integration with the local road network will be highlighted and championed;

- Ensuring a **better connected rail network** to London, Cambridge, Peterborough and the rest of the country that is resilient to future changes, through the delivery of schemes like Felixstowe to Nuneaton and the North (F2N) and the Eastern Section of East West Rail (to leverage the benefits from investment in the Oxford – Cambridge – Milton Keynes arc), key upgrades such as Trowse Bridge, Ely Area Enhancements, Haughley junction, loops south of Colchester, the introduction of **digital signalling** as well as improved regional route journey times through infrastructure upgrades by strengthening relationships with Network Rail, franchise operators and potential third party funders;

- Making the East a more attractive proposition to inward investors by **challenging perceptions** about connectivity and i**nfluencing peak demand requirements** to improve network capacity and reliability;

- Making **whole journey reliability** a priority by improving timetabling, access to and facilities, including parking, at **transport hubs**, by all modes; and

- Encouraging the development of more **regional air services** to and from Norwich Airport to improve direct, fast connectivity with other parts of the UK.

CASE STUDIES

The A47 Alliance

NO MORE A14 DELAYS IN SUFFOLK

Working together to promote improvements

Suffolk Chamber is leading the multi-partner *"No More A14 Delays in Suffolk"* campaign to secure:

- improvements to key junctions on the A14 at Ipswich Bury St Edmunds and Newmarket;

- major maintenance schemes on the A14 between Haughley and Woolpit and between Copdock and the Orwell Bridge; and

- a comprehensive feasibility study of the A14 from the M11 at Cambridge to Felixstowe to address remaining concerns about the A14 and the impact of future growth in the county and across the UK.

The "*No More A14 Delays in Suffolk"* campaign has the backing of many partners including businesses, all of the county's MPs and local authorities, and New Anglia and GCGP LEPs.

THE A47 ALLIANCE

Making it happen through collaboration

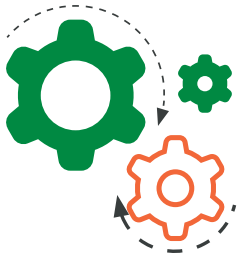
The A47 Alliance is a very successful lobbying group which is pushing for full dualling of the A47 between Peterborough and Lowestoft. The dualling of the A47 has cross-party, cross-county support and in 2014 government awarded a £300m funding package for dualling and junction improvement schemes along the A47. The A47 Alliance brings together the Chambers of Commerce, local authorities, LEPs and MPs along the route and is also supported by other stakeholders including the RAC, Eastern Daily Press and local businesses.

The Eastern Daily Press, Norfolk Chamber of Commerce and Norfolk County Council are currently spearheading the 'Just Dual It' campaign to push government to invest further in the A47 and get a commitment for full dualling of the A47 by 2030.

REGIONAL CONNECTIVITY AND OUR PRIORITY PLACES:

DRIVING BUSINESS GROWTH AND PRODUCTIVITY

Improving accessibility between our economic centres is essential to the realisation of our future aspirations.
It provides better access to jobs, education and healthcare, encourages the clustering benefits of development and services and attracts inward investment.
A strong digital and transport network across the East will link businesses and suppliers to markets and provide the backbone for the East to thrive.



Improved digital and transport connectivity between areas within the region will support the growth of specialist clusters of economic activity such as clean energy, finance and insurance, digital and life sciences and biotech. These clusters strengthen the economic interactions between Ipswich, Norwich, Bury St Edmunds, Great Yarmouth, Haverhill, King's Lynn, Lowestoft and Thetford as well as Cambridge.

In order to enable a more connected region we will work together with our partners to:

- Deliver a **reliable Major Road Network (MRN)** with improved journey times between our Priority Places, through the creation of an integrated MRN Action Plan for delivery, that includes the **Ipswich Northern Route(s)** and the **Norwich Western Link**, connecting the new Broadland Northway from the A1067 to the A47 west of Norwich, to improve the flow of traffic around our growing communities and ensure the network is kept in a good state of repair; and

- Make **public transport the 'go to' option** for our Priority Places by encouraging a consistent, affordable, smart-ticketed, integrated public transport network (including the use of innovative and community solutions where appropriate) with high quality, multi-modal interchanges, real-time, predictive and personalised information and more frequent services.

Our local transport networks are the lifeblood of our communities and improving access to, from and within them is essential so we can capitalise upon the strengths of our economic centres to serve those that live, work, learn and do business there. Our Priority Places and their transport networks need to be truly integrated in order to serve growing and changing populations, in a sustainable way, supporting new and existing communities alike. They must also be agile to the changing shape of private (including passenger and freight), public and shared transport to adequately link people and places both now and in the future.

Recognising this we will work together with our partners to:

- **Facilitate better connectivity** which provides more reliable and resilient journey times within and between our Priority Places through making the strategic case for and the delivery of infrastructure investment including new **river crossings** (in Great Yarmouth, Ipswich and Lowestoft), **orbital links and relief roads** (including the **Ipswich Northern Route(s)** and the **Norwich Western Link**, connecting the new Broadland Northway from the A1067 to the A47 west of Norwich), and **junction improvements**, prioritising infrastructure that will facilitate the delivery of significant housing and jobs growth;

- Ensure the success of our **Enterprise Zones, Food Enterprise Zones and key sectors** by working to resolve infrastructure constraints;

- Facilitate place-making by **improving public realm**, tackling air quality and other environmental issues and delivering joined-up **cycling** (including e-bikes) and **walking networks** in our Priority Places to ensure flexible access to services, to suit the changing needs of our populations and encourage a safe, active and healthy lifestyle; and

- Develop and promote **local freight centres** to reduce the impact of local deliveries in our Priority Places.

CASE STUDY

CYCLE INFRASTRUCTURE

'Pushing Ahead: Your Journey Your Way'

Sustainable transport and multi modal partnership has been supported across the region through initiatives using the Sustainable Transport Transition Year (STTY) funding particularly the Pedalways in Norwich, the "A to Better" travel planning programme, Lowestoft Local Links project and Local Growth Funding.

The Access Fund award in 2017 of £1.488m for Pushing Ahead will enable revenue funding to build on the previous capital investments and expand the impact of sustainable active travel for commuting and recreation, helping the region to move towards the ambition to double the modal share for walking and cycling to 10% by 2025.

AGILE TO CHANGE:

DRIVING BUSINESS GROWTH AND PRODUCTIVITY

To respond to the future challenges and opportunities we must remain agile to change.

We will ensure that connectivity is not a barrier to making the most of these opportunities by working together to:

- Ensure **complete superfast broadband** coverage and the delivery of **ultra-fast broadband**, firstly in our Priority Places, but also in our rural areas, and **5G technology**, as soon as possible, to provide excellent and reliable digital capacity, to meet the region's needs[4];
- Promote the East as being **'open' to innovative new technologies**, particularly where change could facilitate growth in our key sectors, by encouraging the take up of low/zero emission vehicles (including hydrogen), recognising the need to ensure the appropriate electricity network infrastructure, and the trial of autonomous vehicles and drones for commercial and freight services, where appropriate, ensuring the necessary supporting infrastructure both at home and on the move, with particular opportunities focussed along the A11 and A14 corridors;
- Establish the East as a location for **remote home and hub working**, providing access to education and health services as an alternative to travelling particularly in 'hard to reach' areas;
- **Shape collaborative future mobility** by encouraging new business models, led by evidence, to increase personal autonomy through affordable, convenient and digitally enabled business and personal travel plans to boost journey-sharing opportunities and the blending of traditional public and private transport modes and provide the widest accessibility offer;
- Encourage the **use of data** to enable the more intelligent operation of our networks and the adoption of connected, self-monitoring technologies for roadside infrastructure to improve network reliability and performance; and
- Encourage **behaviour and cultural change** so that shorter journeys are made actively wherever practicable and that sustainable choices are easy to access and use, to the benefit of health and well-being.

MOBILITY AS A SERVICE(MaaS)[5]

Traditionally our mobility has been provided for by managing fleets of vehicles around networks, framed by strategic transport planning objectives. MaaS, as a service model, turns this on its head by putting the customer first and framing the mobility systems around customer preferences. MaaS offers an opportunity to improve how people and goods move, both from the perspective of the policy maker and for travellers themselves.

[4] https://www.betterbroadbandnorfolk.co.uk/ and http://www.betterbroadbandsuffolk.com/
[5] Transport Catapult – Mobility as a Service – July 2016

CASE STUDY

MARKET TOWNS

A vital part of the East

The market towns of Norfolk and Suffolk are diverse in their activities, economies and transport provision. They are a vital part of our economy being home to countless businesses providing local employment opportunities for thousands of people as well as providing many distinctive retail and tourism offers. Norfolk County Council is embarking on a number of Market Town Network Improvement Strategies, many of Norfolk's market towns and larger villages have a considerable amount of planned housing and employment growth identified. Addressing the transport pressures this growth will bring is vital to facilitate the economic prosperity of these towns and villages and as such planning this ahead of growth allows Norfolk County Council to respond accordingly. These transport strategies will identify the most effective transport improvements to support future planned growth and help address transport issues such as congestion, enhancements to safety and access to public transport.

LOCAL AND COASTAL:

DRIVING INCLUSION AND SKILLS

The Norfolk and Suffolk Energy Coast is a significant contributor to our economy and serves Sizewell nuclear power station, Bacton Gas Terminal and the significant offshore energy sector as part of the wider East of England Energy Zone.

Indeed, our smaller local and coastal communities are also a vital part of the East's economy, providing some of the UK's most attractive places to live and work, and transport has a key role to play in providing access to services and opportunities in these areas. Our local and coastal communities need strong, reliable and resilient networks to help encourage sustainable access to our local markets as well as our unique tourism and culture offer.

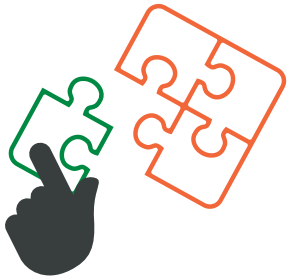
Working together with our partners we will:

- Ensure **complete superfast broadband** coverage and the delivery of ultra-fast broadband, firstly in our Priority Places, but also in our rural areas and **5G technology**, as soon as possible, to provide excellent and reliable digital capacity, to meet the region's needs;
- Cater for the growth aspirations and development plans in market towns by identifying and **prioritising local road improvement schemes** to release pinch-points, recognising the network's importance to the agriculture sector;
- Encourage service providers to provide **cost-effective, on-demand public transport services** by using better data, to meet rural and coastal needs and improve economic and social inclusion;
- Improve **hub and home working** to help offer innovative, flexible and/or remote digital alternatives for post-16 transport strategy and access to healthcare and social care services, ensuring opportunities and access for all;
- Support **community rail partnerships** for rural and coastal branch lines to identify capacity and station improvements (including parking) and differentiate individual offers, to promote to a wide audience and encourage use and provide evidence for possible service expansion;
- Encourage **walking and cycling** by developing Walking and Cycling Investment Plans and through the delivery of projects on the National Cycle Routes and those such as the Greater Broads Cycling Country project, to benefit public health and well-being and the environment.

MAKING IT HAPPEN:

COLLABORATING TO GROW

We are at the start of our journey and we are **ambitious**. Local and collaborative delivery is important, having the potential to make a real difference and we need the skills, experience and resources from a number of new and existing partners to help bring our ambitions to fruition.



One of our first actions will be to broaden our dialogue and engagement to develop the momentum necessary for delivery. We will **collaborate with partners** to determine our strategic priorities for delivery, with this dialogue being informed by the Norfolk and Suffolk Economic Strategy. We will collaborate with informal stakeholder groups to stimulate specific issue debates and encourage **innovative and creative partnerships** to help accelerate delivery. We must bring forward strategic investments, through collaboration, to not only unlock growth in the corridors and places they serve but to act as a catalyst to other interventions for further, integrated improvements.

Together with partners we will:

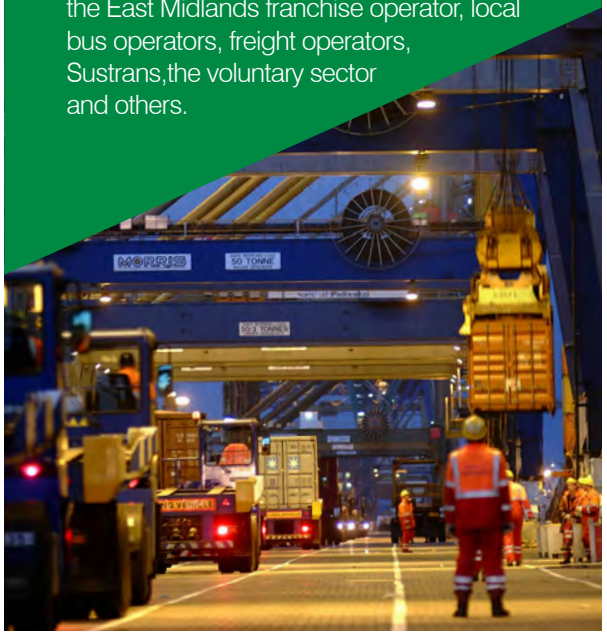
- We will work up and publish a **3-year Delivery Plan**, in line with strategic funding timescales, to support this strategy showing what we propose to deliver, how we propose to do this, and by when;
- Work across sectors to enable collaboration on increasingly common requirements for technical know-how and **access to new markets and techniques** that might once have been more distinct, such as telecoms and logistics;
- Work between public and private sectors to explore **innovative approaches to funding and finance**, driving returns on investment in infrastructure; and
- Work with other regions on regional, national and international opportunities through **Transport East**.

Our Delivery Plan will not start from scratch. Whilst development of this strategy has enabled us to take a long-term look at the interventions required, it has also confirmed the value of many of the projects we have already been working on. The Delivery Plan will also detail how we will measure success considering delivery against key, relevant ambitions in the Economic Strategy assessing how emerging transport outcomes contribute to those aims.

We will be successful when our transport network, in all its existing and future forms, is recognised as a seamless enabler helping our business and communities thrive, helping to make the East one of the UK's most attractive places to do business, live, learn, work and visit.

PARTNERS WILL INCLUDE:

- Transport East;
- Government including HMT, DfT, BEIS, DCMS, MHCLG and GO Science;
- Members of Parliament;
- Network providers including Highways England, Network Rail and communications companies;
- Highway Authorities;
- Local Planning Authorities;
- Norfolk and Suffolk Chambers of Commerce, the Federation of Small Businesses and the wider business community including the tourism sector; and
- Other local partners including Norwich Airport, London Stansted Airport, Hutchison Ports, Associated British Ports, Peel Ports, Greater Anglia, Govia Thameslink Railway, the East Midlands franchise operator, local bus operators, freight operators, Sustrans,the voluntary sector and others.



THE>EAST

NEWANGLIA

Local Enterprise Partnership
for Norfolk and Suffolk

Appendix 25: Community Acceptance for Large Solar Farms study

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Solar Energy

journal homepage: www.elsevier.com/locate/solener

What shapes community acceptance of large-scale solar farms? A case study of the UK's first 'nationally significant' solar farm

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ABSTRACT

New renewable energy infrastructure is essential to deliver net zero policies in response to climate change, but a lack of community acceptance is a potential barrier. It is therefore important to understand what shapes community acceptance and identify policy responses. This paper presents a case study of community acceptance of a large-scale solar farm in the UK, the first to be classified as 'nationally significant' infrastructure. In doing so, it provides the first empirical study of community acceptance of a large-scale solar farm in a developed country context, building on existing studies which use hypothetical approaches such as choice experiments, or surveys which measure general attitudes rather than responses to specific developments. The paper uses mixed methods (quantitative content analysis of online comments on the planning proposal; qualitative semi-structured interviews with local residents and key stakeholders; and participant observation) to identify determinants shaping community acceptance of large-scale solar farms. We discover 28 determinants which we group into eight categories: aesthetic, environmental, economic, project details, temporal, social, construction and process. We argue that these findings help to reveal broader issues underlying community acceptance of solar farms and other renewable energy infrastructure: 'green-on-green' tensions; issues of scale and place attachment; policy, process and justice. We also contribute a novel understanding of community acceptance as 'relational', by which we mean it is informed by the deployment of other energy technologies and the wider energy policy landscape, not just the specific project. We conclude with recommendations for how policymakers can respond to the issues identified by this article.

1. Introduction

Large-scale solar farms are increasingly being built around the world to generate renewable energy. These are ground-mounted arrays of solar photovoltaic (PV) panels which convert sunlight into electricity, sometimes called solar parks or solar fields. Whilst having advantages in terms of meeting rising energy demand and decarbonising electricity supplies (Sharma, 2011), some solar farm developments have provoked strong negative public reactions. However, the reasons underlying this have not been well explored in academic literature. This paper explores the issues surrounding public acceptance of a large-scale solar farm project in the United Kingdom (UK). It is the first solar farm to be classified as a Nationally Significant Infrastructure Project (NSIP), which is the way the planning system in England and Wales deals with major infrastructure that fulfils a national need (Rydin et al., 2018). This is a timely topic of research as a growing number of large-scale solar farms are being proposed, driven by low carbon transition policies to meet net zero emissions targets in response to climate change.

We draw upon the influential framework by Wüstenhagen et al. (2007) which distinguishes between three dimensions of social acceptance: socio-political, community and market. Socio-political acceptance refers to general support for a technology or policy from the public, policymakers or other actors; community acceptance refers to responses to specific infrastructure projects or proposals by local publics

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or wider 'communities of relevance' (Batel, 2018); market acceptance refers to the process of market adoption of technologies or innovations by consumers (e.g. the public) or investors. Whilst each are enacted and shaped by various actors, we focus on the role of the public as a key stakeholder across multiple dimensions of social acceptance (Walker, 1995; Boudet, 2019). Though each dimension is fundamental in the implementation of energy innovations (Wolsink, 2018), we focus on community acceptance as a particularly important consideration at the deployment stage because government officials and companies must negotiate with local people (and broader communities of interest) through planning processes (Carley et al., 2020). Without community acceptance, it may not be possible to roll-out an innovation, despite acceptance in the socio-political and market realms. In some cases, this can have wider ramifications such as in the case of onshore wind in the UK, for which government subsidies were removed as a result of local backlash (Cowell, 2017). Thus, community acceptance is commonly recognised as a critical factor in the successful implementation of renewable energy policies (Devine-Wright, 2009).

To date, there has been limited research on what shapes community acceptance of large-scale solar farms. This is important because their high land-take and potential conflict with other land uses gives rise to a unique set of environmental, social and economic issues (Jones et al., 2015), which are not necessarily directly comparable to more frequently studied technologies such as onshore wind. Against this backdrop, this paper asks the following research questions: *What are the key determinants shaping community acceptance of large-scale solar farms? What does this reveal about broader issues underlying community acceptance of renewable energy infrastructure? How can these issues be better addressed by policymakers?* The paper is structured as follows. In the following section, we review existing academic literature on community acceptance of solar farms and outline our research gap. We then introduce our case study and the mixed (quantitative and qualitative) methods used to address our research questions. Next, we present our results and discuss the broader significance of our findings. In the final section, we offer key academic and policy conclusions and suggest directions for further research.

2. Literature review

Solar farms as conceived in this paper are distinguished from Concentrated Solar Power (CSP) plants which use mirrors to direct sunlight onto a small area to generate thermal energy. They are also distinguished from PV installations on rooftops or on water i.e. 'floating' solar farms. Existing solar farms range from small arrays with an output less than 1 MW to 'mega-projects' covering thousands of hectares with an output of 2000 MW; the largest projects are in China, India and Mexico in semi-arid and desert landscapes (Wolfe, 2019). They are also increasingly developed in densely populated areas such as in Europe, on agricultural and brownfield land. To date, however, research has overlooked public responses to solar farms in these settings.

Yenneti and Day (2015) and Yenneti et al. (2016) focus on the case study of Charanka Solar Park in Gujarat, India: one of the largest solar farms in the world. Through stakeholder interviews, they find that some local residents have been dispossessed of resources in the land acquisition process for the project, threatening livelihoods and exacerbating vulnerabilities. Nkoana (2018) identifies corruption and inadequate consultation in the planning process surrounding two solar parks in Limpopo, South Africa, thereby "leaving room for powerful stakeholders to thrive over vulnerable community members" (p34). Issues surrounding livelihoods, access to land, community consultation and fair process thus appear likely to shape community acceptance of solar farms, though it is unclear whether this is specific to developing countries with higher levels of subsistence living and with weaker institutional governance. However, similar issues have been identified in developed countries in relation to other types of energy infrastructure such as oil and gas in Canada (Garvie and Shaw, 2014), onshore wind farms in Australia (Gross, 2007) and marine renewable energy in Ireland (Reilly et al., 2016).

Another notable body of solar farm research focuses on the United States (US). For example, Carlisle et al. (2014) investigate predictors of support for large-scale solar farms in California, finding that the prospect of positive impacts, such as jobs, had a stronger effect on attitudes than potential negative impacts, such as construction traffic. Carlisle et al. (2015) explore whether attitudes vary between a national US sample and a sample in the Southwest: a key area for solar farm development. They find that support is similar across these samples: 82% nationally and 80% in the Southwest, varying slightly according to demographic characteristics. This indicates that public opinion is generally favourable and that direct experience of solar farms has a limited effect. This corresponds with research on wind energy finding that direct experience can in fact lead to increased support, suggesting an 'Inverse NIMBY' (Not In My Back Yard) syndrome (Warren et al., 2005). Carlisle et al. (2016) identify high support for solar farms in Southern California, though find that visual impacts and buffer distances can alter people's attitudes.

Whilst useful in identifying broad trends in public attitudes towards solar farms and key factors influencing this (e.g. jobs, visual impacts, buffer distances), these studies are limited in that they do not focus on empirical solar farms. Thus, they are not rooted in a specific context or place, which research shows to be fundamental to community responses to energy infrastructure as a result of issues around place attachment (i.e. connection to the local area) and place identity (Devine-Wright, 2009). Studies which use hypothetical projects to explore community acceptance are limited for similar reasons. For example, Yang et al. (2017) conducted a choice experiment in South Korea in which respondents chose between imagined solar farms with differing traits. They found a greater willingness to pay for policies to reduce light pollution, habitat loss, hazardous materials and landscape destruction, the precise amount varying between these impacts (in descending order). Such studies can be influenced by hypothetical bias, in which respondents state how they think they would feel in a given situation, rather than reporting on how they actually experience it (Loomis, 2011). Thus, there remains a research gap on determinants shaping actual community responses to solar farms, which is important as public support has been found to shift when people are asked to think concretely rather than abstractly about the impacts of solar energy projects (Sütterlin and Siegrist, 2017).

Though not focusing on one empirical case, Roddis et al. (2018) provide a first attempt at understanding community acceptance of solar farms in a densely populated, developed country. They analyse planning applications for solar farms in Great Britain (GB) to identify types of project that are more or less likely to gain planning approval. They find that solar farms proposed on the highest quality agricultural land are on average five times less likely to be approved than those on non-agricultural land. This reflects planning guidance to protect the 'best and most versatile agricultural land' (NPPF, 2012) but may also reflect community opposition to solar farms perceived to conflict with traditional land uses such as farming. This has parallels with existing research on high voltage power lines finding that the 'fit' of energy infrastructure with the landscape shapes community responses (Devine-Wright and Batel, 2013), and indeed may be even more pronounced for solar farms given their higher land-take.

Roddis et al. (2018) also find that solar farms are 15% more likely to be approved in more socially and economically deprived areas, raising issues of distributive justice (i.e. the distribution of costs and benefits across society) and procedural justice (i.e. fair and representative decision-making processes) of renewable energy (Heffron and McCauley, 2017). Perceived injustices can in turn have an effect on public perceptions of energy infrastructure (Tabi and Wüstenhagen 2017), highlighting the importance of attending to justice issues when considering public acceptance. Indeed, issues of justice are identified as important for community acceptance of other energy infrastructure such

as onshore wind (Simcock, 2016) and shale gas (Cotton, 2017). Finally, Roddis et al. (2018) find that smaller solar farms are more likely to be approved than larger ones, indicating that scale is another potentially important issue shaping community acceptance. This would support suggestions from scholars that large-scale infrastructures are more likely to face opposition from the public (Batel et al., 2013).

3. Case study and methods

3.1. Cleve Hill solar Park

Cleve Hill Solar Park (henceforth referred to as Cleve Hill) was proposed in 2018 in Kent, South East England, and received planning consent in May 2020. It is the first solar farm to be classified as an NSIP, which is how the planning regime in England and Wales deals with major infrastructure developments such as energy, transport and water projects, as established by the Planning Act 2008 (Lee et al., 2013). All onshore energy projects with a capacity above 50 MW are classified as NSIPs, as well as offshore energy projects with a capacity above 100 MW (Natarajan et al., 2018). Cleve Hill has a proposed capacity of 350 MW, making it the second largest solar farm application in GB to date and the third largest application in Europe (following Pizarro in Spain). In line with the NSIP threshold, this paper defines 'large-scale' as solar farms with capacities greater than 50 MW. In GB, there are currently around 1,000 operational solar farms and the average installed capacity is around 8 MW (Roddis et al., 2018).

The average capacity of British solar farms has been increasing in recent years, particularly following changes to the UK Government's subsidy regime in 2015/2016 which substantially lowered Feed-In Tariff rates and closed the Renewables Obligation (the main subsidy scheme at the time) to new solar PV capacity (Burke, 2015). This resulted in a marked drop in the number of planning applications in 2016 (Fig. 1). This makes public acceptance of large-scale solar farms a timely topic of research as proposals for large subsidy-free projects such as Cleve Hill come forward which rely on economies of scale to make them financially viable. Two further solar farm NSIPs have submitted planning applications since Cleve Hill: Little Crow Solar Park (150 MW) in December 2018 and Sunnica Energy Farm (500 MW) in March 2019, seemingly indicating this growing trend. Thus, Cleve Hill acts as an "instrumental" case study from which insights can be drawn into the issues surrounding community acceptance of large-scale solar farms more broadly, whilst recognising the specifics of the case (Stake, 1995).

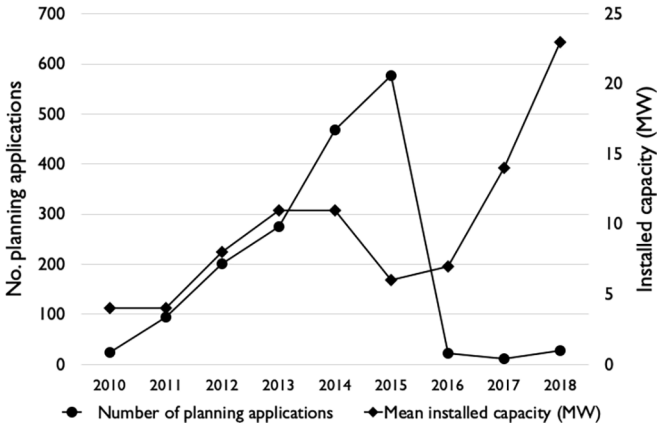

Fig. 1. Planning applications for solar farms in Great Britain (150kw+) from 2010 to 2018. Round markers show total annual number of planning applications (left Y axis); diamond markers show annual average (mean) installed capacity of installations (right Y axis). Data is from the UK Renewable Energy Planning Database (monthly extract December 2019). NB. Subsidies for solar farms were reduced by the UK Government in 2016, resulting in a fall in applications.

Cleve Hill is a joint venture between two private companies, Hive Energy Limited and Wirsol Energy Limited. The development includes around 1 million solar PV panels along with a battery storage facility, covering a total area of around 1000 acres (Arcus Consulting, 2017). The land is currently used for arable farming and is classified as 'moderate quality', with an Agricultural Land Classification of 3b (Arcus Consulting, 2017). The land is reclaimed saltmarsh, lending the name Graveney Marshes to the area. The site is bordered to the north by the Swale channel; to the east by a main road and substation infrastructure; to the south by dispersed residential properties; and to the west by the Faversham Creek tidal estuary (Fig. 2). There are a number of designated habitats and nature reserves close to the site though not directly overlapping with it, including a Site of Special Scientific Interest (SSSI), Special Protection Area (SPA) and Ramsar wetland site. It is adjacent to or overlapping a number of public footpaths such as the Saxon Shore Way. The site is low lying and prone to flooding. Unlike other British solar farms which are south-facing, the panels are proposed in a novel east-west design to maximise their number and thus electricity generating potential.

The Cleve Hill project is located in the Swale Local Authority District (LAD) on the north coast of Kent, near the rural village of Graveney (population ~500) and the historic market town of Faversham (population ~19,000) (ONS, 2016). The Swale is a popular tourist and retirement destination with a higher percentage of retired people than the English average (15.1% vs 13.7%) (ONS, 2016). It is a relatively deprived district, ranked 69 out of 317 LADs (IMD, 2019), though there is substantial diversity in terms of affluence within the LAD. There is no community ownership or community benefit scheme attached to the development.

Cleve Hill's proposal sparked substantial debate within the local community about the pros and cons of solar farms, leading to the formation of a local opposition group 'Save Graveney Marshes'. It therefore makes an interesting case study as community acceptance has become a significant issue surrounding the project. All documentation for NSIPs is publicly available online, making these types of projects good case studies in terms of data availability. As an NSIP, Cleve Hill is also a useful case study to explore issues surrounding scale and governance as the planning process is managed centrally by a government body, The Planning Inspectorate, thereby introducing a possible tension between local impacts and national need (as well as the wider global climate benefits of renewable energy).

3.2. Methods

To address our research questions, we used both quantitative and qualitative methods. Quantitatively, we carried out content analysis of online comments written by members of the public in response to the Cleve Hill planning proposal ($n = 816$). These were obtained from the 'Relevant Representations' section of the National Infrastructure Planning website. Qualitatively, we conducted semi-structured interviews with members of the public living near the proposed site and other key stakeholders i.e. planning officials and campaigners ($n = 12$). We also carried out participant observation at three public hearings and an official site inspection held by The Planning Inspectorate. Our observations allowed us to gain deeper insights into the local context, thus helping to interpret the online comments and interviews.

Online comments (or 'representations') were submitted between December 2018 and January 2019. Statutory and non-statutory authorities and businesses were also able to submit representations; however, we focus on comments made by members of the public to directly address our research questions. Only one comment is allowed per person, though it is allowable to make a comment on someone else's behalf if specified. The Planning Inspectorate requests that comments focus on the aspects of an application a person agrees and/or disagrees with and their reasons why. They ask not to receive comments on issues surrounding compulsory acquisition of land or rights over land, or the

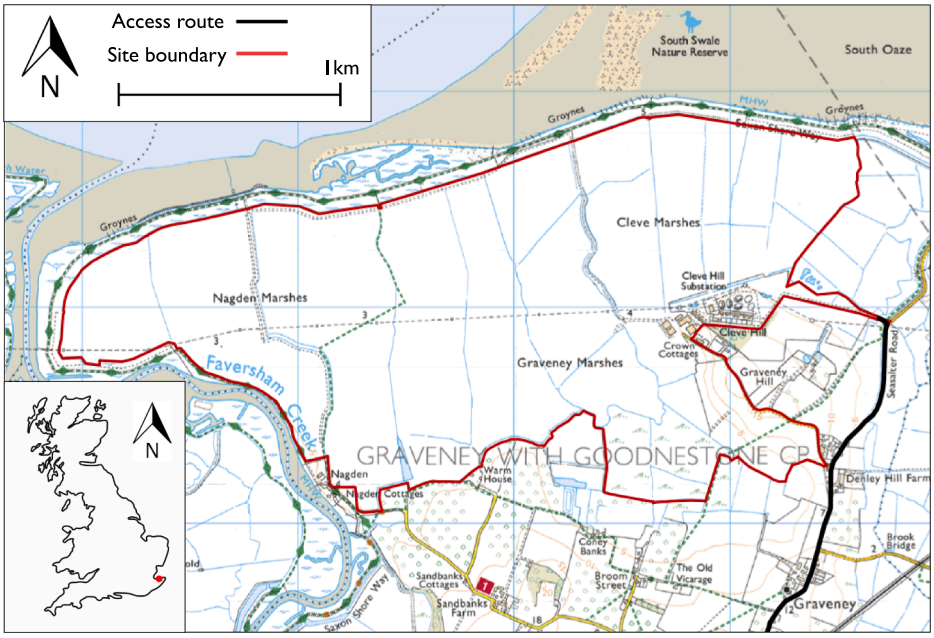

Fig. 2. Map of Cleve Hill Solar Park site. Insert shows approximate location in Great Britain (red dot). Image adapted from Scoping Report (Arcus Consulting, 2017), reproduced from Ordnance Survey digital map data. Crown copyright and database rights 2017 Ordnance Survey. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

merits of a policy set out in a National Policy Statement (which underpin the NSIP regime). There is no word limit though they do request that comments focus on key points and do not allow attachments. This may mean that not all determinants shaping community acceptance are captured in this dataset as people may exclude certain concerns, prioritise the issues they raise or tailor their comments towards what they think will have most traction in the formal planning process.

To identify determinants which are captured by this dataset, we drew upon the conceptual framework by Roddis et al. (2018) on community acceptance of onshore wind and solar farms. This is the only community acceptance framework the authors are aware of which focuses explicitly on solar farms. We followed an 'abductive' research approach whereby a conceptual framework is applied with a view to modifying it and thus developing new theory (Bryman, 2012). We therefore used the Roddis et al. (2018) framework as the basis for developing a coding scheme, adding new codes where we identified determinants not captured by the original framework. As recommended by White and Marsh (2006), where the coding scheme was modified during the coding process it was then re-applied to the data already coded to ensure consistency. We used the data analysis software Nvivo to carry out the coding process.

To select interviewees, a purposive sampling approach was taken whereby key stakeholder groups were identified and targeted (Palinkas et al., 2015). Interviewees can be categorised into four groups: active residents (who actively engaged with the planning process for Cleve Hill e.g. by submitting online comments and/or attending public hearings); passive residents (who did not engage with planning process for Cleve Hill); campaigners (who were actively involved in the campaign against Cleve Hill); and planning officials (who were professionally involved in the planning process for Cleve Hill). Questions were tailored for each of these groups, however specific topics were asked about consistently to improve comparability e.g. general views on solar farms as a way of generating electricity, specific views on Cleve Hill, relationship with the Cleve Hill site, participation in the Cleve Hill planning process. Interviews followed a semi-structured format to allow flexibility. Interviewees were recruited in a variety of ways: social media; information sheets placed in public spaces; the lead researcher's attendance at public hearings for the Cleve Hill planning proposal; and snowball sampling.

As far as possible, individuals were sampled from different demographic groups (namely gender and age) as well as differing levels of engagement with the planning process to provide a diversity of perspectives and experiences (Table 1). This was informed by the insight that attitudes to solar farms vary across social groups (Carlisle et al., 2015). The interviews took place either in person or by phone, lasting between 30 minutes and an hour. They were held within a four-week period between July and August 2019, coinciding with the examination stage for Cleve Hill. We conducted fieldwork at this time because it enabled an understanding of how the NSIP planning process shaped people's perspectives, as well as the proposal itself. It also meant that awareness of the proposal was high amongst the local community (public consultation having commenced in 2017). The content analysis

Table 1
Interviewee details including stakeholder type, participation in the Cleve Hill Solar Park planning process and demographic information (gender and age).

Interviewee	Stakeholder type	Participation	Demographics
1	Active resident	Online comment	Female, 40–60
2	Active resident	Online comment	Male, 40–60
3	Active resident	Online comment	Male, 40–60
4	Active resident	Online comment and public hearings	Male, 60+
5	Passive resident	None	Female, 40–60
6	Passive resident	None	Female, 40–60
7	Passive resident	None	Male, 20–40
8	Passive resident	None	Female, 20–40
9	Campaigner	Online comment, public hearings and campaigning	Male, 60+
10	Campaigner	Online comment, public hearings and campaigning	Female, 40–60
11	Planning official	Decision maker	Male, 20–40
12	Planning official	Decision maker	Male, 40–60

was carried out prior to the fieldwork to familiarise the research team with the case and key public concerns. We did not find it necessary to further modify the coding scheme subsequent to the fieldwork.

A mixed method multi-strategy approach allowed breadth and depth of analysis, which has been shown to bring greater understanding of a phenomenon than by using individual approaches (Bryman, 2006). We followed a triangulation mixed methods design (Creswell and Plano Clark, 2007), whereby complimentary yet distinctly different data was gathered and then integrated for interpretation of the research phenomenon (Almalki, 2016). Importantly, the interviews enabled us to capture perspectives of individuals who had not responded to the online consultation, and the participant observation enabled us to contextualise our analysis.

There are limitations to our methods which are important to acknowledge. Firstly, there is likely to be bias in the sample of respondents who submitted online comments. Research shows that people who feel strongly against a proposed project are more likely to engage with the planning process than those who feel support, qualified support or indifference (Bell et al., 2005). Therefore, our analysis of determinants is likely to be skewed towards those who feel strongly against Cleve Hill. Secondly, our analysis is limited to the specific time period in which our data were collected i.e. the planning stage. Research shows that community acceptance of energy infrastructure varies across time stages of the project, usually dipping during the planning stage and rising again following construction (Wilson and Dyke, 2016). Thirdly, the number of interviewees is relatively small due to resource constraints (n = 12). However, we feel the interview data provides an important balance to the online comments because people may have limited or tailored their online comments for the purpose of the planning process and/or formulated them to gain greater political legitimacy and avoid being dismissed as self-interested 'NIMBYs' (van der Horst, 2007). Additionally, the interviews help to reveal perspectives of community members who did not directly engage with the Cleve Hill planning process and which would therefore otherwise be overlooked.

4. Results and discussion

Our content analysis showed that 98% of online comments (n = 803) were opposed to the Cleve Hill proposal and 2% were in favour (n = 13). This does not necessarily mean that 98% of the community is opposed, rather this corresponds with other research finding that people who feel strongly against a proposal are often most likely to engage with planning processes (Bell et al., 2005). Across the 816 comments, we identified 28 codes (i.e. determinants) which collectively recurred a total of 3776 times. Eighteen of these were identified by our analysis; ten were from the original framework by Roddis et al. (2018). We classified these codes into eight categories: aesthetic, environmental, economic, project details, temporal, social, construction and process. The first five of these categories are from Roddis et al. (2018); the latter three were identified by our analysis thus adding to the original framework. We did not identify determinants in the demographic, political or geographical categories of the original framework as this data is either not collected or made available by The Planning Inspectorate. The breakdown of codes within each category is shown in Fig. 3 and the breakdown of all codes is shown in Fig. 4. Our full coding scheme is shown in Fig. 5 and a more detailed description of what each code refers to is provided in Table S1 in Supporting Information.

4.1. Green-on-green tensions

Our quantitative results show that the most commonly articulated concern regarding Cleve Hill was its potential impacts on wildlife and habitats, accounting for approximately 18% of all 3776 codes. Of particular concern was its potential impacts on birds, which accounted for 51% of all codes on wildlife and habitats. This highlights the 'green-on-green' character of community acceptance of solar farms, whereby

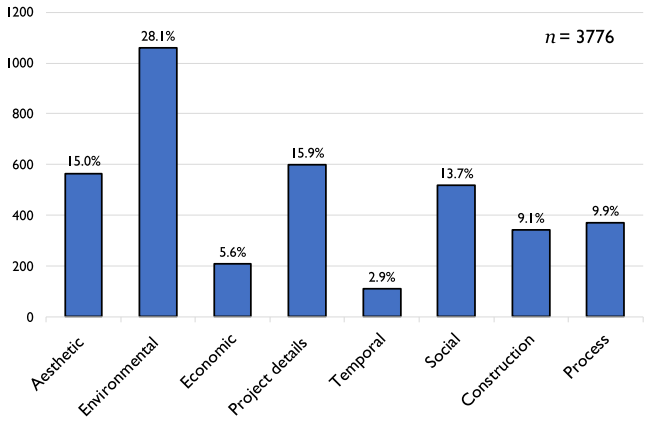

Fig. 3. Frequencies and percentages of codes (i.e. determinants of community acceptance) in each category of our coding scheme for analysing online comments from the public on the Cleve Hill Solar Park planning proposal.

measures to mitigate climate change come into conflict with other environmental priorities such as wildlife conservation (Warren et al., 2005). This tension is particularly pronounced for Cleve Hill as the site is close to several protected areas for biodiversity and hosts charismatic species such as the Marsh Harrier. Similar concerns have been identified in relation to other renewable energy infrastructure such as wind turbines (e.g. Devlin, 2005); the key difference with solar farms is that the scientific evidence on biodiversity impacts is still evolving meaning there is higher uncertainty (Randle-Boggis et al., 2020), particularly for solar farms the size of Cleve Hill and those with an east-west design. This means that *perception* of impacts is a particularly important issue in this context, as well as as *known* impacts.

Interestingly, although very few online comments were in favour of Cleve Hill, wildlife was also one of the most frequent codes in support of the project. Specifically, these comments highlighted the creation of a wildlife habitat area adjacent to the facility which was perceived very positively by those who mentioned it. Concern for wildlife was also a common theme across interviewees who supported the project. For instance, interviewee 7 commented:

> *"We have so little time to deal with climate change. Anything that has to happen, it has to happen now […] As long as you don't wipe out ecosystems, you can still walk around and still see birds, that doesn't bother me that much because psychologically you know why they're there, and they're there to make sure there still is an ecosystem."*

This indicates that biodiversity is a driver both for *and* against solar farms; some people were concerned about the immediate impacts of the infrastructure on wildlife and habitats, whilst others were concerned about the longer-term threat to wildlife posed by climate change. This highlights a temporal dimension to green-on-green conflicts which is often overlooked. It also indicates that the perception of the impacts of solar farms may vary depending on one's concern for climate change.

Other interviewees highlighted the complexity of deciding what actually counts as 'green'. As interviewee 10, a lead campaigner from 'Save Graveney Marshes', expressed:

> *"We all know that we need clean energy and we've got to do something about climate change, but we have to be mindful of the actual environment we're destroying to create that 'clean' energy. You have to look at where those solar panels are coming from, and things like transport, not just the generation of the energy. You have to look at the whole thing to decide whether it's green, and I don't think we can say that is the case here."*

This reveals a sophisticated understanding of the various sustainability metrics for energy, with direct carbon emissions only one of a number of environmental impacts that arise over the lifecycle of energy

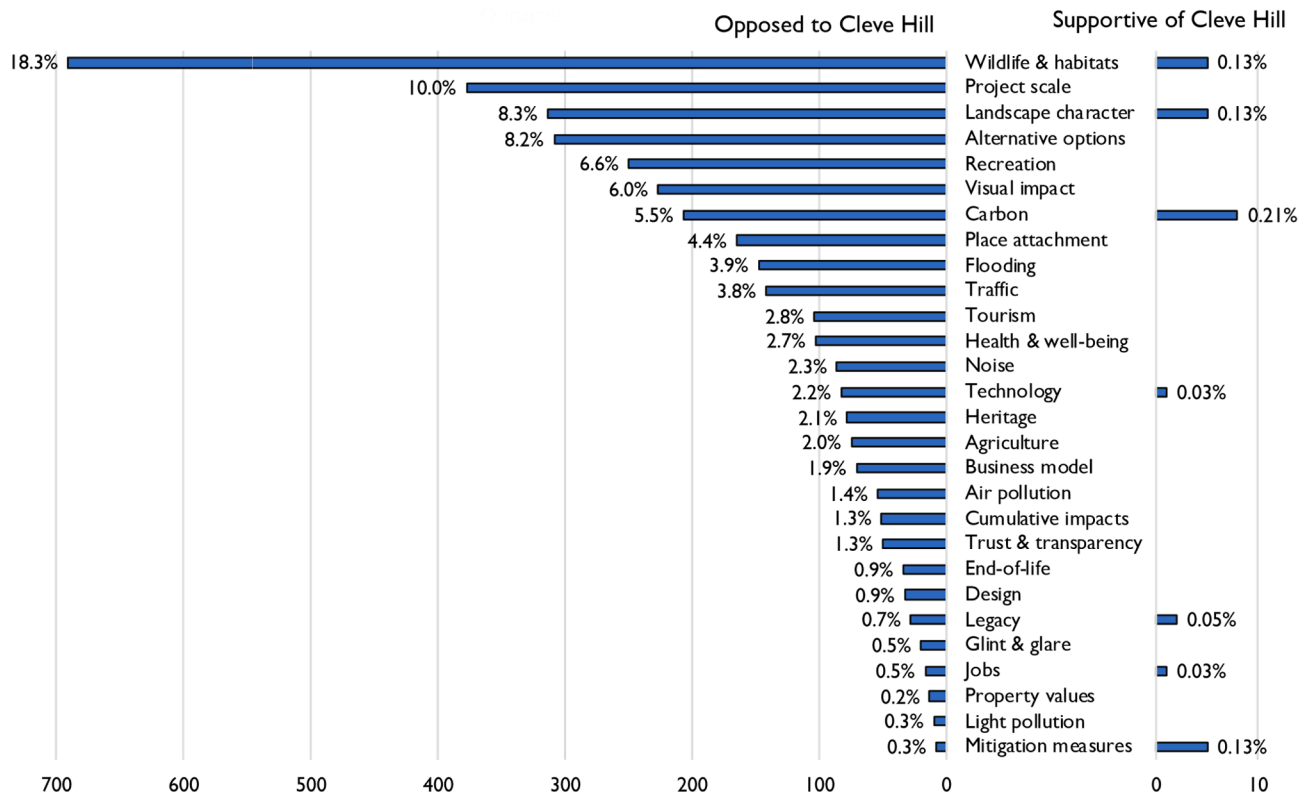

Fig. 4. Frequencies and percentages of codes ($n = 3776$) for each determinant (supportive and opposed) identified in our content analysis of online comments on Cleve Hill Solar Park.

projects. This demonstrates the complexity of evaluating the 'most' sustainable option when deliberating green-on-green tensions such as large-scale solar farms and other types of renewable energy, given the multiple environmental dimensions at play such as land usage, impacts on wildlife and carbon emissions.

Another interesting aspect of the Cleve Hill case study is that it is proposed on land which is prone to flooding and acts as a flood plain. This means that the panels must be raised to avoid flood water, thus adding to the project's visual impact. Climate change makes this elevation all the more necessary due to sea level rise and increased flood risk. Currently, the site's flood risk is managed by the (EA), a statutory body; however, the developer is due to take over this responsibility. The online comments and interviews reflected concern that the developer would prioritise the protection of their infrastructure rather than local residences and businesses. Others raised the point that if the EA continues to manage the site there are plans for coastal realignment whereby the land will be reverted to saltmarsh to help mitigate flooding and enhance carbon sequestration. This exemplifies a complex set of green-on-green tensions which are specific to community acceptance solar farms as opposed to other renewable energy infrastructure such as wind turbines. The amount of land required for solar farms forces consideration of how best to utilise space to meet environmental objectives including carbon reduction, carbon storage, visual amenity, flood management and wildlife conservation. In turn, these must be weighed against the societal need for energy. This accords with other scholars such as Holland et al. (2016) and Randle-Boggis et al. (2020) who argue that an ecosystem services approach to energy planning may be beneficial to evaluate these interactions, and to identify trade-offs that the public and other stakeholders are most (and least) willing to accept. In some cases, it may be that solar farms could in fact improve ecosystem service provision for example by planting wildflowers in the margins of solar farm developments (Randle-Boggis et al., 2020).

4.2. Issues of scale and place attachment

The code that appeared in the online comments most frequently after wildlife and habitats was the scale of the project, accounting for 10% of codes. This included references to the land area of the site (roughly equivalent to 750 football fields), the height of the panels (raised to 3.9 m to avoid flood water) and the generating capacity (350 MW). It was commonly described as a "*megaproject*" and comments relating to the scale were framed in a pejorative way such as "*ridiculously enormous*", "*very intrusive height and expanse*" and "*far too big for such a small area of Kent*". This raises an interesting dynamic between the relative scale of the project and the space it occupies, similar to the finding that the 'fit' of energy infrastructure in the landscape shapes community responses (Devine-Wright and Batel, 2013; Devine-Wright and Wiersma, 2020). The comparable area of the site to Faversham was also frequently highlighted by interviewees, emphasising that a project of this size was not seen to 'fit' with the local area. These findings also show the influence of the Save Graveney Marshes campaign on people's responses (Fig. 6), indicating the socially constructed nature of community acceptance i.e. people do not form their views in isolation, but also take cues from their peers and those around them (Devine-Wright, 2008).

One explanation for the negative responses to the scale of the project is that it emphasises the change in the traditional use of the landscape. Indeed, the third most frequent code was landscape character. England is a fairly settled landscape, meaning that people are accustomed to the landscape being the way that it currently is (Selman, 2010). New energy infrastructure disrupts this sense of "landscape permanence" and can trigger public opposition (Pasqualetti, 2000). This has been found to be important issue for wind energy and may be even more so for solar farms as they largely preclude the land continuing to be used for other purposes. Thus, they may come to be regarded by the public as a more fundamental change to the landscape than wind turbines. Interestingly however, although the Cleve Hill site is currently agricultural, impacts

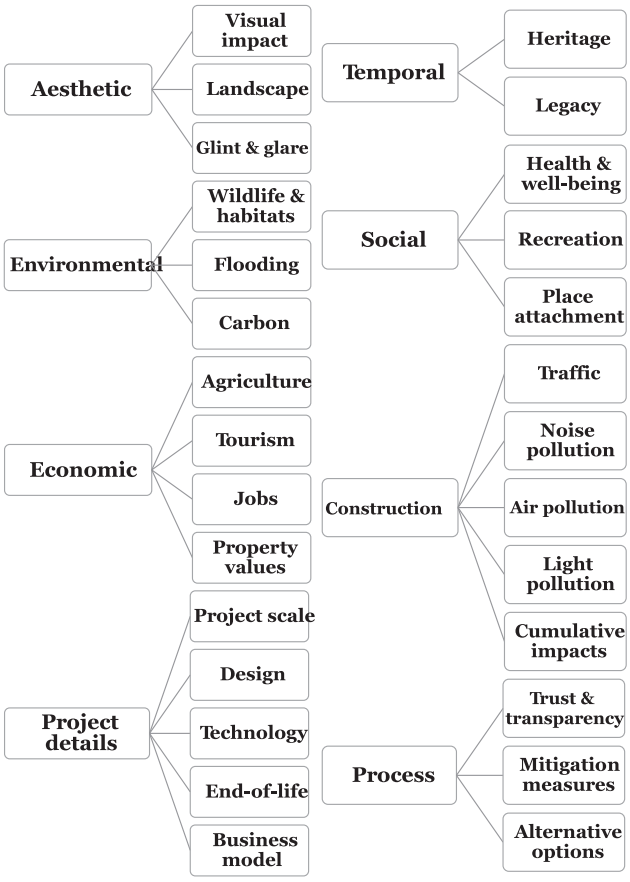

Fig. 5. Coding scheme developed in this paper for analysing online comments made by the public on the Cleve Hill Solar Park planning proposal in order to identify the determinants of community acceptance of large-scale solar farms. The aesthetic, environmental, economic, project details and temporal categories are from the conceptual framework by Roddis et al. (2018); the social, construction and process categories were added by this paper. 18 of the 28 codes (i.e. determinants) were identified in this paper; 10 are from the original framework.

on agriculture were not identified in the interviews or content analysis as a very strong determinant of community acceptance, representing 2% of codes. Instead, the underlying concerns around the project's scale appear to be more strongly driven by place attachment, as indeed existing research has identified as important for other types of energy infrastructure.

Place attachment refers to the bonding between individuals and their environments (Scannell and Gifford, 2010). In our content analysis, 4.4% of codes explicitly expressed place attachment i.e. they expressed love or strong affection for the Cleve Hill site or wider area. However, many other codes are also intertwined with place attachment, such as landscape character (8.3%), recreation (6.6.%), visual impact (6%), and health and well-being (2.7%). Our interview data also identified place attachment. For example, interviewee 5 commented on the spiritual value of Graveney Marshes and how they were saddened by the prospect of losing a place that they frequently visited and was very special to them:

> *"I love nature. In terms of my faith, I feel close to God when I'm near nature, and we won't have that anymore. It will just be industrial."*

This demonstrates the religious or spiritual importance of the marshes to the community, another important component of place attachment. This can be described as a 'cultural ecosystem service' (Fish et al., 2016) i.e. the non-material benefits people obtain from nature, further demonstrating the value of applying an ecosystem services approach to public acceptance of renewable energy.

The issues of scale and place attachment discussed here are particularly relevant to NSIPs as they are underpinned by a policy presumption of national need (Johnstone, 2014). Both online respondents and interviewees frequently acknowledged the need for low carbon energy generation, taking into account the national scale (energy supply issues) and the global scale (tackling climate change). However, their views are deeply embedded in the local scale and concerns over the local impacts of the Cleve Hill project. Interviewee 5 described this tension as a "*battle in my head*" because they recognised the broader benefits of the project but were distressed about the loss of a highly valued place in their local area. Similarly, many online respondents stated that they supported solar technology generally because of its low carbon emissions (6% of all codes) but did not support Cleve Hill specifically, demonstrating the multi-scalar character of community acceptance of renewable energy. This supports calls to provide policymakers with more realistic measures of community acceptance to avoid misleading expectations of public responses to solar energy (Sütterlin and Siegrist, 2017). It also supports existing research (e.g. Roberts and Escobar, 2015) which finds that the public deliberate a range of complex issues when formulating their opinions on energy infrastructure, supporting a shift away from simplistic accusations of NIMBYism.

4.3. Policy, process and justice

Other key themes arising from our analysis relate to policy, process and the justice implications of these issues. The fourth most frequent code identified in the online comments (8.2%) related to alternative options i.e. the perception that other locations or technologies were more suitable for generating electricity and reducing emissions, frequently accompanied by a perception that these had not been adequately considered by decision-makers. In particular, the topic of rooftop solar was a common theme across the interviews, as well as the online comments: 32.4% of the 'alternative options' codes referred to putting solar on industrial or domestic rooftops. This indicates that community acceptance of solar farms is 'relational' rather than absolute; by this we mean it is informed by the deployment of other energy technologies and the wider energy policy landscape, not only the specific solar farm. This builds on conceptions of community acceptance as 'qualified' or 'conditional' depending on project characteristics or attitudes to the technology (Bell et al., 2005; Ellis et al., 2007).

This relationship between community acceptance of solar farms and the wider energy policy context is illustrated well by this comment from interviewee 2:

> *"I think there's a big problem in the UK with building regulations and how we use energy. In Faversham, we have around a thousand new homes being built around the town; none have solar panels on the roof or are designed with any idea that you could retrofit because of the way they're oriented. It's cheaper and easier to use a greenfield site, but it's using up an environmental space. So it's a case of I'm not against solar farms, but we need a far more grown up and integrated approach to energy in total. It's the lack of a national integrated approach that bothers me."*

Similarly, interviewee 8 expressed that their views towards Cleve Hill were intertwined with policy, referring to the UK government's subsidy cuts for rooftop solar (Kabir et al., 2018):

> *"I think it would be better if we use space where there are already structures, like if you put solar panels on top of houses then you're utilising the space much better. But if the government aren't going to support that, we haven't really got another option."*

We believe the insights offered by these results are a novel contribution to the literature, showing that community acceptance is not only conditional on the specifics of a project or views towards the specific technology in question (Ellis et al. 2007), but is also *relational* i.e. it is

Fig. 6. 'Save Graveney Marshes' campaign posters on a board overlooking the proposed site for Cleve Hill Solar Park, one reading: 'No to the solar park! As big as Faversham' and the other highlighting landscape impacts. Photograph was taken by the lead researcher in July 2019.

deeply intertwined with wider policy context and the context of which other energy technologies are currently being deployed.

In line with extant research on solar farms (e.g. Nkoana, 2018), we also find that consultation processes are a noteworthy consideration. Issues relating to 'trust and transparency' (regarding the developer and the Planning Inspectorate) accounted for 1.3% of codes. For example, online comments described a "*misleading and deceitful public consultation process*" and argued that "*the procedure followed does not offer meaningful consultation and tends therefore to create its own momentum, which is procedurally unjust*". This sentiment was echoed by interviewee 9 who described the process as "*asymmetrical warfare*" because they judged that the developers had greater resources and influence in the planning process than local people. This shows that as well as the project itself and the wider policy context, process surrounding planning for large-scale solar farms can be an important factor shaping community acceptance. This supports other research (e.g. Lee et al., 2018; Natarajan et al., 2019) which finds that participation in NSIP planning processes should be made more inclusive of the public and community stakeholders.

Other online comments highlighted the privatised business model and lack of community benefits for Cleve Hill (1.9% of codes), commenting there was "*no benefit whatsoever for the local people*". This sentiment also arose in the interview data, for example interviewee 6:

> *"I don't know where the power from this development is going to go, it would be good if it was consumed locally. Where is the profit going? Where is the power going? The people of this area will be looking at the solar panels, but will they have any benefit from it? I think some money should come off the energy bills of the local people."*

This reveals a perception of unfair distribution of costs and benefits i.e. a distributional injustice, as well as the procedural injustice noted in the previous paragraph (Walker, 2009). Another 'cost' is the risk of fire from the battery storage which is a relatively untested technology, accounting for 2.2% of codes (coded under 'technology'). This indicates that unjust distribution of costs, risks and benefits does influence community acceptance, supporting existing research which finds that perceptions of injustice shape responses to renewable energy infrastructure (Tabi and Wüstenhagen, 2017). It also adds to calls on the need for a holistic 'just transition' which takes into account the full range of impacts, risks and benefits arising from the transition to a low carbon society (Heffron and McCauley, 2018).

5. Conclusions and recommendations

This paper contributes the first empirical study of community acceptance of a large-scale solar farm in a densely populated, developed country context. The key contributions are as follows. Through content analysis of 816 online planning responses, supplemented with 12 qualitative interviews and participant observation, we build on the conceptual framework established by Roddis et al. (2018) to describe the key categories of determinants shaping community acceptance of large-scale solar farms: aesthetic, environmental, economic, project details, temporal, social, construction, and process. The latter three categories are identified in this paper and are thus a new contribution towards the existing framework. We also identify 28 determinants of community acceptance within these eight overarching categories, of which 18 are original contributions. Further research could test other frameworks for comparison (e.g. Harper et al., 2019) and draw upon different data sources such as social media content, given there are limitations to using planning responses as a measure of community acceptance and our relatively small interview sample size. This type of research could also be repeated at a different stage of the Cleve Hill project's lifespan, as our results focus on the planning stage before the project is actually built.

Another contribution is to highlight the 'green-on-green' character of community acceptance of solar farms. The most frequent concern raised about Cleve Hill in the online consultation was its potential impacts on wildlife and habitats. Whilst there is scientific uncertainty regarding impacts of solar farms on wildlife, particularly in relation to solar farms the size of Cleve Hill and those with an east-west design, it is clear that the *potential* conflict was a major determinant of community (non) acceptance. This indicates that research on the impacts of solar farms on wildlife should be prioritised by policymakers in order to enhance the evidence base and increase certainty. This article also raises many issues about how land is best used to achieve different policy goals including energy generation, wildlife habitat, agriculture, carbon storage and

flood mitigation. In the context of low carbon transitions, policymakers may need to more strategically plan how land is going to be used in order to balance these competing goals, potentially drawing upon an ecosystem services approach as suggested by other scholars to identify synergies and trade-offs. This may involve prioritising rooftop PV installations or solar farms on brownfield sites to avoid the green-on-green tensions identified in this paper. Despite the UK government's previous policy attempts to encourage developments in these locations (Cowell and Devine-Wright, 2018), lack of subsidies appears to be driving large-scale proposals such as Cleve Hill, perhaps due to the need for economies of scale for viability.

This links closely to another key contribution of this article which is to highlight issues of scale and place attachment as important to community acceptance of solar farms. The scale of the Cleve Hill project was the second most frequent concern identified in the online comments. This connects to many other frequently raised concerns such as landscape character, visual impacts and recreation, all of which are intertwined with place attachment. Issues of scale are particularly important for solar NSIPs because they are designed to fulfill a national need and have global benefits for the climate, but their impacts are experienced locally. Policymakers could address these multi-scalar issues by limiting the area of land that can be used for any one energy development, or by implementing a minimum MW output/per unit of land area. Alternatively, the total area of land used for energy production could be capped through spatially explicit strategic planning.

Finally, we highlight the role of policy and process in shaping community acceptance of solar farms. We find that people's broader views on energy policy feed into their views on specific infrastructure projects such as Cleve Hill, which we describe as a 'relational' understanding of community acceptance. This builds on conceptions of community acceptance as 'conditional' or 'qualified' depending on project characteristics or attitudes to that technology (e.g. Bell et al., 2005; Ellis et al., 2007). This highlights the need for joined-up energy strategy to meet climate goals which takes account of public acceptance across the whole energy system, not just isolated aspects of it. We also show that consultation processes are an important factor, emphasising the need for developers and The Planning Inspectorate to reconsider their approach to consulting local people and find ways to make this more inclusive. Another policy approach would be to make more use of community benefit funds to compensate host communities for the impacts of solar farms. This would help to more equally distribute the costs and benefits of renewable energy and has the potential to improve perceptions of justice, though should not be regarded as a 'silver bullet' for community acceptance (Cass et al., 2010).

Whilst our results are inevitably tied to the Cleve Hill case study, they may provide insights into how communities may respond to other large-scale solar farms. This is particularly topical given the increasing average capacity of solar farms in GB, as well as the rising number of solar farm mega-projects around the world. It may also help to understand acceptance of other renewable energy infrastructure, which is important in the context of climate crisis and policy targets to reach net zero emissions. A key difference between our results and other studies is that potential negative impacts were much more prominent than positive impacts such as jobs, in contrast to Carlisle et al. (2014) who found the opposite. In our analysis, the issue of employment featured in only 0.5% of codes. This is perhaps an indication of the difference between research elicited from participants in relation to hypothetical solar farms versus the concerns of communities when faced with the reality of a proposed project. Whilst this may reflect bias in the people who responded to the consultation and the topics which tend to arise through invited consultation in planning processes, it also emphasises the importance of triangulating results from hypothetical studies with empirical data on community acceptance (ideally via multiple methods) to provide policymakers with better evidence to make decisions about the ongoing transition to renewable energy.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.solener.2020.08.065.

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Appendix 26: Air Quality Assessment Sunnica Energy Farm by SRL

Telephone [redacted]
Birmingham, London, Manchester, Sudbury

80633-SRL-CO-YQ-01-S2-P1
31 May 2022

Isaac Nunn
Senior Planning Officer (NSIPs)
Growth, Highways & Infrastructure
Suffolk County Council
Endeavour House
8 Russell Road
Ipswich
IP1 2BX

Dear Isaac,

Sunnica Energy Farm - Air Quality Assessment Review

Introduction

You are working on Suffolk County Council's (SCC) response to a large solar and battery storage Nationally Significant Infrastructure Project (NSIP) with West Suffolk Council. One of the matters you would like to consider is the air quality effects of potentially toxic emissions from the batteries in the event of a fire.

This has been assessed by the applicant (ref *EN010106-001872-SEF_ES_6.2_Appendix_16D_Unplanned Atmospheric Emissions from Battery Energy Storage Systems*). I have reviewed the methodology of the applicant's assessment and commented below.

Review

The introduction states that "*details of the design for the battery energy storage system (BESS) elements, including their power and energy ratings, and their final enclosure dimensions and appearance, are currently in development and, therefore, the assessment has been based on maximum parameters which would not be exceeded*" and lists the details that are known. Using the "*maximum parameters*" is a reasonable methodology in the absence of exact data because this will likely represent the worst-case scenario. Once the details of the BESS are known, the assessment must be updated with the expected outcome.

Section 2 explains "*the battery technologies proposed for the Sites are based on sealed cells with no excess electrolyte. This removes the potential for venting or out-gassing of gaseous substances during normal operational use. If the battery cells become damaged by heat or are burnt within a fire affecting a single module, a rack of*

modules or multiple racks, then the combustible materials consumed in the fire could give rise to a range of organic and inorganic air pollutants. A standardised set of emission factors for BESS is not currently available from the Environment Agency and, therefore, equivalent data must be sourced from manufacturers and the research literature."

The assessment refers to *Hazard Assessment of Lithium Ion Battery Energy Storage Systems* by The Fire Protection Research Foundation to understand the likely pollutants from batteries in the event of a fire. Although this study is different from Sunnica, it is a useful reference as it has similarities to Sunnica and highlights some potential emissions.

The *Hazard Assessment of Lithium Ion Battery Energy Storage Systems* found that pollutants from batteries in the event of a fire include methane (CH_4), chlorine (Cl), hydrogen fluoride (HF), and carbon monoxide (CO). Only HF and CO are of concern however, as Cl and CH_4 are emitted in very low concentrations. Research by Anderson et al supports the finding of HF emissions.

Section 2.1.8 states that "*emissions of methane, chlorine and carbon monoxide are not considered further in this report, as they are unlikely to be emitted at measurable concentrations*", despite Section 2.1.5 saying that CO is of concern. No evidence is presented to show that CO is not of concern. This may be because the *Hazard Assessment of Lithium Ion Battery Energy Storage Systems* found that "*CO was detected in the first 30 minutes of the test and this decreased to near zero during the main period of self-sustaining combustion*" but this is not clear and the assessment report appears to contradict itself on this issue. Evidence should be clearly presented to support a conclusion that CO is not of concern, or CO emissions should be modelled if it is of concern.

Notwithstanding the above comment on CO, the assessment identifies HF as the only pollutant of concern. The assessment refers to Public Health England's *Incident Management* guidance for HF limits. The assessment refers to emergency response planning guidelines (ERPG) and acute exposure guideline levels (AEGL) and adopts the most conservative values, which is a reasonable methodology for a worst-case assessment. The effects of HF on ecological receptors have not been considered; this should either be assessed, or reasons should be given for not assessing this.

The Methodology states that "*as a definitive emission rate will not be known until later in the detailed design stage, once battery technology and the number of modules, racks and containers is fixed, the dispersion model has not been used to predict absolute impacts at specific receptor locations.*" Once this information is known, the impacts at specific nearby receptors must be modelled. It is noted in Section 4.1.8 that "*once the make, model, and layout of the BESS is known, if necessary, consequent modelling will be undertaken to demonstrate the impacts associated with an unplanned fire*".

Section 3.2.2 explains the source has been modelled as a volume source. A volume source isn't necessarily representative in a fire scenario because the fire could be contained and the emissions could escape from small orifices. This use of a volume source for the model should be reviewed and addressed.

Section 3.2.2 states the source has been modelled with "*no initial vertical momentum*". This isn't necessarily a conservative approach because:

- emissions from this type of source might not disperse very effectively and dispersal could be smaller
- a thermally-buoyant plume, however, could travel further with little dilution.

As the model is not used to assess the impact at specific receptors, it is instead used to assess the HF dilution with distance from the source, which is a reasonable method to assess how the HF concentration changes over the study area.

The reasoning for using meteorological data from Stansted Airport is clearly explained and sufficient detail on the use of the meteorological data is given. There are nearer and possibly more representative meteorological stations to the site, such as Mildenhall, but this is unlikely to have much effect on the assessment conclusions.

"*As the exact emissions from the BESS cannot be meaningfully estimated at present, the modelling is based on emissions that have been modelled as a volume source, at a nominal emission rate of 1 µg/m^3/s*". Using a unit emission rate is common practice with post-processing of the modelling results to account for different emission rates.

The emission parameters and model conditions are clearly listed in Table 2 and it is noted that these conditions have been used to make the model conservative in its outputs. Table 2 notes an emission temperature of 15°C. Volume sources in ADMS are at ambient temperature by default, so the emission temperature would be the same as that in the met (i.e. weather) file for each hour, meaning it wouldn't be 15°C.

5 years' worth of meteorological data have been used, as recommended by the Environment Agency, and the wind roses for these data sets are presented. It is noted that 2018 data has not been used but this is because the meteorological data is very similar each year, as shown by the wind roses. Using 2018 meteorological data would make this assessment more robust, although it is unlikely to have a significant impact on the assessment outcome.

The assessment explains that the criteria for including building effects have not been met so are not included in the model. The assessment provides sound reasoning for selecting a surface roughness of 0.5m. As the batteries are housed in a solid structure, this could cause building downwash effects, which must be considered.

It is explained that results are shown for the smallest dilution rate under any meteorological conditions, dilution rate under 100% of meteorological conditions, 99% of meteorological conditions, and 90% of meteorological conditions. It is stated that "*these represent the lowest level of dilution and longest distances to achieve that level for the stated percentage of the year*", with the intention of being conservative.

Assumptions have been made on the scale of modules, number of racks, central estimate of HF content (based on information from *LeClanche SA for the Cleve Hill Development Consent Order*), a steady state emission rate, and the time period of the fire based on the FPRF BESS fire test. These assumptions are evidenced where possible. The assumption of 5 racks doesn't appear to be evidenced however, so the applicant must justify why 5 racks is considered conservative. For instance, the incident report from the recent BESS fire in Victoria, Australia[1] states that two Tesla Megapack BESS units were involved in a fire which lasted 6 hours, so is the 5 racks modelled conservative with this in mind?

[1] Energy Storage News (2022). Accessed via: [redacted]

The figures for "*Concentration of 2m x 2m x 2m volume at source*" in Table 4 appear to be an emission rate in mg/m³/s and not the mg/m³ shown. If this is the case, it isn't clear that these values can be compared to the AEGL value as AEGL values are in mg/m³.

Even given the conservative intentions of the assessment, it finds that "*assuming a BESS facility that takes the form of a 5 rack fire before fire control measures bring the fire under control, emissions of HF could cause concentrations over time periods of 10 minutes, 1 hour or up to 6 hours that are below the AEGL-1 value at locations within 100m of the fire. In most instances the AEGL-1 value would be achieved within the Order limits and in all cases in a shorter distance than that to the nearest sensitive receptors*" and that "*the potential consequence at actual receptor locations surrounding the BESS at plots W17, E18, and E33 would be exposure to hydrogen fluoride at concentrations below the AEGL-1 value*".

The safety design elements of the BESS are explained. This, coupled with the findings of the modelling, logically concludes that "*even should all the systems fail and a large-scale fire break out within one of the BESS containers then the resultant hydrogen fluoride concentration at the closest receptors would be below the level that PHE has identified as resulting in notable discomfort to members of the general population*".

As mentioned above, Section 4.1.8 confirms that "*once the make, model, and layout of the BESS is known, if necessary, consequent modelling will be undertaken to demonstrate the impacts associated with an unplanned fire*". I agree this should be done and the assessment updated.

Conclusions

Overall, this assessment uses appropriate logic and presents a reasonable methodology for assessment of emissions from the batteries in the event of a fire. The assessment highlights where there is a lack of research and evidence in some areas. The assessment has found that "*the potential consequence at actual receptor locations surrounding the BESS at plots W17, E18, and E33 would be exposure to hydrogen fluoride at concentrations below the AEGL-1 value*".

The following points should be addressed to further evidence the methodology and make the assessment more robust:

- Once the details of the BESS are known, the assessment should be updated (this is noted in Section 4.1.8)
- Evidence should be clearly presented to support the conclusion that CO is not of concern or CO should be modelled if it is of concern.
- The use of a volume source should be reviewed and addressed.
- Consider the possible building downwash effect of the batteries being stored in a solid structure and update the assessment where necessary.
- Review the methodology to calculate dilution; mg/m³/s appear to have been compared to mg/m³ to assess this
- Review whether 5 racks is a conservative assumption, update the model and assessment with more racks, and report increase in HF emissions.

Yours sincerely,

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For and on behalf of
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Tel: [redacted]
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Appendix 31: British Horse Society Advice on Solar Farms

ADVICE ON

Solar Farms

The British Horse Society

Solar electricity is generated by daylight rather than direct sunlight and the intensity of the daylight in some parts of the UK is capable of producing high enough levels of electricity for solar farms to be viable.

Solar farming is very new in this country, which has a higher density of population, roads and routes used by horses than most other countries where solar farms are more commonplace, so there is little knowledge of the effect of solar farms on equestrians using byways, bridleways and roads or on equestrian businesses. There are instances of glare and glint causing problems which were not foreseen or reported pre-construction; there could be other problems which are not yet evident.

The potential effect of solar farms on horses should be carefully considered on any route used by horses – including byways, bridleways, roads and permissive routes – and on equestrian businesses where horses are kept or trained.

A solar farm involves the installation of solar photovoltaic panels on open land that is usually relatively even across the site. Flat land is more likely to be used than a hillside for ease of installation, maintenance and to reduce visual impact. Some levelling may occur during construction but if much is needed the site is unlikely to be financially viable as earth movement is expensive.

Lines of linked panels, called arrays, are aligned for optimum exposure to sunlight by their orientation and angle to the sun. Small developments may track the sun to optimise solar gain but this is not cost-effective in large commercial developments so, in England or Wales, panels will normally be fixed facing south and tilted at approximately 45 degrees. The arrays will be spaced at two to three times their height to avoid shading at any time of year. The whole site is likely to be fenced for security and may also be hedged for screening if required by planning conditions.

Standard photovoltaic panels are around 1.6m high and 1m wide which are mounted on frames. Their height above ground is usually up to 2.75m. They are designed to absorb rather than reflect light for efficiency – reflected light or heat is wasted energy – and although the amount of reflection varies with the component materials and the angle, the incidence of glare is usually much less than from glass windows or car windscreens. Any glare is most likely when the sun is low in the sky as reflection increases the further the sun's rays are from perpendicular to the panel.

It is possible, and is likely to be required as part of the planning application, for computer modelling of the glare and sightlines. Analysis of these patterns for potential impact on equestrian businesses should be considered. For riders or carriage drivers out hacking, glare is unlikely to present a direct problem because they are moving unless their route is directly towards the arrays at an elevation and time of day where glare is possible.

Arrays should be avoided where glare is likely to affect users of an equestrian route or an equestrian business.

The panels do not make any noise or movement and require very little maintenance – occasional cleaning, inspection and vegetation control. Rain hitting the panels will make a gentle sound which is likely to be lost in the general ambient noise in those conditions. There are no moving parts or machines except for inverters which produce a low humming sound and are housed in small buildings, which should be sound-proofed. The noise of inverters increases with load, so in strong sunshine will be greater than on a dull winter day and can be disturbing. Depending on the previous use of the land and its quality, it may become grassland that can be used to graze sheep or poultry to reduce the need for vegetation cutting.

Solar farms are relatively straightforward to build involving erecting the racks, making trenches for cabling and small buildings to house inverters. Tracks may be built to facilitate vehicle movements around the site during construction or for subsequent maintenance.

The racks to support the panels are piled into the ground and can be easily removed when the farm is decommissioned. In some circumstances, such as presence of archaeological interest, the racks may be mounted on concrete blocks on the surface. Photovoltaic panels are attached to the racks.

Trenches run between the arrays and carry cabling to an inverter building where the direct current produced by the panels is converted to alternating current and fed to the National Grid.

As part of the planning process, the developer will conduct a range of studies, typically to find out about the existing ecology and other aspects of the site. The effect on public rights of way should be included in these studies. The results and the design for the solar farm will make up the planning application so you can see at that stage whether rights of way have been correctly considered.

The life of a solar farm is usually 25 years, often with an option to renew for a further period, although some planning permission will specify a return to original use without extension.

The construction phase of a 40-acre site is likely to be around 16 weeks. Over this period there would be up to 100 lorry deliveries to the site. There may be some construction noise, of which pile-driving is potentially the most disturbing. Components are not large so abnormal load vehicles should not be required.

Solar farms are usually secured by fencing which may include hedge screening. The most common type of fencing in use is open mesh 1.8 to 2m high, which is the least intrusive and this can be stipulated in the planning permission.

After construction, traffic to the solar farm will be minimal, with occasional maintenance visits and ground maintenance – through mowing or grazing, for example. If the site is currently farmed, usually it is maintained so that it can revert to agriculture after the life of the solar farm.

Planning authorities will normally require that a proposal will minimise disturbance to agricultural land and be mindful of visual impact on any brownfield or

agricultural site. As even large solar farms are considered temporary, all the structures and any works (such as tracks) must be capable of removal or reversible.

Vehicular access to the arrays will be controlled to prevent criminal removal of panels. Security lighting and cameras are also likely to be installed; however, such measures usually use infrared to avoid visible light and light pollution.

Factors which could affect equestrians and should be considered during the planning phase are:

Construction

Construction traffic will create many vehicle movements, relative to the size of the site, but is likely to be much greater on some days than others. A traffic effect plan should be produced during the planning application which should take into account the safety of users of rights of way both on and adjacent to the site and on roads used in the locality. Traffic can be restricted by planning conditions to normal working hours, avoiding the early mornings, evenings and weekends when equestrians are most likely to be out.

Bridleways, byways and unsurfaced roads should not be used for site access. If it is unavoidable, every effort should be made to ensure that the surface will be maintained and restored to a surface material suitable for horses after construction of the solar farm. An alternative route for equestrians should be provided during construction to minimise conflict.

Closures without alternative routes should be avoided and, if necessary, construction traffic managed to reduce the length of closures, rather than an automatic blanket closure throughout the period of construction.

Trenches for cables should not cross or be laid along rights of way. If it is unavoidable, authorisation will be required from the Highway Authority to disturb the surface of the right of way. The surface must be reinstated to a firm and safe condition within a set period, which should be as short as possible to minimise inconvenience to users. If the surface is not reinstated, the Authority can restore it and charge the cost to the landholder. The finish must be one that is suitable for horse use.

There will be noise during construction, particularly from pile driving, which is unpleasant but its temporary nature means it is not usually a material planning consideration requiring control.

Inverter housing

The noise from inverters, particularly when energy generation is high, has been reported as very instrusive and may be disturbing to users of bridleways, horses kept nearby or equestrian businesses. Higher standards of sound insulation on the housing of inverters may be required where they are within audible range of horses. A horse's range of hearing is wider than a human's and sounds are audible at lower decibels.

Inverters should be sited as far away from bridleways, byways and equestrian

businesses or land used for keeping horses.

Drainage

Drainage provision for the radically changed surface of a solar farm compared with greenfield land must be taken into account to prevent potentially serious detrimental effects on equestrian routes on and immediately adjacent to the site and for some distance away, depending on drainage patterns, outflow and the terrain.

Hard surfaces create a very different drainage situation from an open field as run-off is immediate and much higher in volume. The extensive surface area of the panels could significantly change the nature of the drainage. Existing drainage may not be adequate to cope with the changed run-off and a holding pond may be required. New drainage to protect equestrian routes is essential to ensure they are not affected. This must be considered well beyond the site itself so that flash flood damage does not occur.

The effect of the construction process and vehicular access should also be considered. Levelling a site, soil stripping, trenching for cables, compaction and creating access tracks will all affect the drainage of the site and should be carefully provided for in the construction phase so that there is no adverse effect on equestrian routes.

Hard surfacing routes which currently have an adequate natural surface should not be the automatic answer; it is usually better to preserve the existing surface by attention to drainage. However, the existing surface and potential future use should be taken into account and the opportunity for upgrading the surface with a finish suitable for horse use should be taken if appropriate.

Fencing

Solar farms are valuable investments with material that is vulnerable to crime. They are usually fenced to above head height for security. If bridleways or byways are alongside or through sites, care must be taken not to create a narrow corridor. Fencing can be intimidating, especially at this height, and create a need for vegetation control.

It is not safe to fence users into too narrow a corridor, particularly for a length more than a few metres. The need to maintain adjacent hedges and surface vegetation so as not to further reduce the available width should also be considered, as well as vehicular access for maintenance if appropriate.

A minimum width of 4m is required (preferably 5m), irrespective of any recorded width of the right of way, with vegetation cut through the full width.

Where a bridleway or byway has been previously unfenced, it is likely that the used width has been at least 4m as users do not risk passing each other more closely than necessary, particularly on multi-use routes where horses, bicycles, pedestrians and dogs may be involved.

Use of open mesh fencing is preferable to close boarding or metal palisade-type

fencing with sharp points on top. The latter two are much more intrusive in the landscape so should not be permitted in a rural location; they also create unpleasant and intimidating alleys, even if relatively wide, in any location. Metal palisade fencing with spikes on top should be avoided as its rigidity and sharp edges are very dangerous and have safety implications for riders. While it may be above head height for a pedestrian, its top is likely to be below chest height for a rider and very serious injury is likely should a rider be thrown onto or against such a fence.

Security

There may be a wish to restrict vehicle access to the site to minimise theft or vandalism. Anti-vehicle barriers cannot be authorised on bridleways or byways for the purpose of security, only to control livestock or to safeguard users of the right of way. The site must therefore only be permitted if it can be secured without affecting bridleways, byways or roads. On permissive paths, barriers should conform to BHS Advice on Gates or Vehicle Barriers to ensure safety of users.

Alternative or additional access

Large developments are opportunities for increasing access, particularly those which contribute to community funds. There may be chance to upgrade a footpath to bridleway or to gain an additional route. Even very short links can have important effects by enabling greater or safer use of existing routes in an area.

It should not be necessary to divert a bridleway or restricted byway (a byway open to all traffic cannot be diverted under normal circumstances) as arrays can be arranged around the route. However, this could significantly reduce the number of panels that can be accommodated and there may be a proposal to divert a route to the edge of the site. In some cases, this may be acceptable if it provides a more advantageous route, but not if is less convenient or commodious. Diversions should be avoided, unless the proposal is more desirable than the existing route as the solar farm is a temporary structure. If it is essential to divert a convenient route, consideration should be given to it reverting to the original line on expiry of the planning permission for the solar farm.

If this advice note is a printed copy, please check for the latest version on www.bhs.org.uk/access-and-bridleways. 1/2017

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