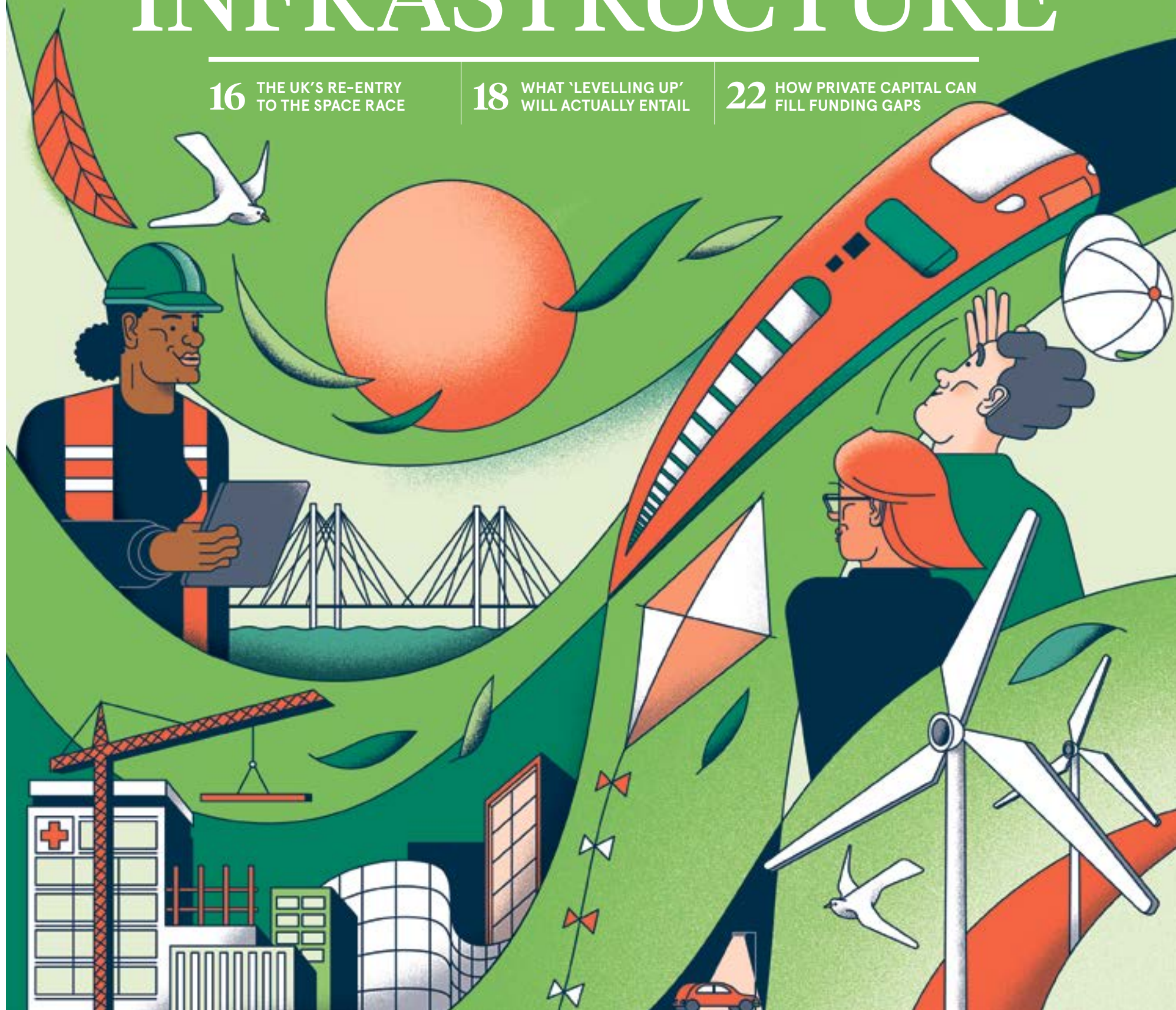


FUTURE OF INFRASTRUCTURE

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FUTURE OF INFRASTRUCTURE

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WORKFORCE

The big rebuild: construction faces up to its image problem

The industry needs to attract more talent from diverse backgrounds if it's to help the nation achieve its house-building ambitions and hit the government's net-zero goals

Cath Everett

The construction industry needs more young workers – and fast. To attract them, it must not only promote itself better, but also improve its image.

The sector is key to supporting key UK aspirations for the coming years, such as building new housing and moving to net zero by 2050. But age-old recruitment problems are standing in its way.

Both the public and private sectors are proposing high levels of infrastructure investment, which are likely to result in output increasing at an average annual rate of 4.4% between 2021 and 2025. To service such growth, the construction industry will need to hire an extra 43,000 workers a year over that period. That's on top of the usual figure needed to maintain the status quo, taking the total size of the workforce to 2.84 million, according to the 2021 *Construction Skills Network* report from the Construction Industry Training Board (CITB).

But this ambitious target comes at a time of worsening skills shortages and intense competition for talent across all parts of the economy – a situation that's causing wage inflation, among other problems.

To make matters worse, the number of workers lost to the industry owing to both Brexit and the pandemic has been significant, says Marcus Bennett, the CITB's head of industry analysis and forecasting. He fears the true gap in supply could now be even larger than indicated by last year's report.

For example, as many as 25,000 migrant workers have returned home over the past couple of years at the same time as the traditional talent pool of young skilled workers from the EU is dwindling. This means that the departing workers aren't being replaced.

The industry has lost domestic workers too, reports Rosie Gloster, principal research fellow at the Institute for Employment Studies.

"Losing skilled European workers has had an impact, but construction also has a lot of self-employed and sole traders," she says. "The UK's furlough scheme during the early stages of pandemic didn't necessarily protect their incomes."

Workers have moved to other sectors, including lorry driving, where the demand for skills is high. Some have chosen early retirement.

All of this means that, while demand for construction skills is greater



Shutterstock via Getty Images

“There's a big divide between what happens on the inside and the perceptions of those on the outside

than ever, 223,000 workers have left the sector since the summer of 2019, according to research by the Construction Products Association.

Nearly half of those leavers were experienced workers in the industry's core age bracket – 45 to 55 – which accounts for 35% of its total workforce. That's according to a blog post by Oscar Watkins, head of

research for the Institute for Public Policy Research (IPPR) think-tank. By way of contrast, only 20% are aged under 30.

Even more worryingly, the IPPR's February 2021 *Skills for a Green Recovery* report indicated that, over the next 15 years, up to 750,000 UK construction workers are expected to either retire or will be about to

16% of construction workers in England are women

7% of construction workers in England are BAME



But only **2%** of those female employees are site operatives

Construction Industry Training Board, 2021

retire – a situation that it believes “threatens to undermine the government's plans”.

Even newer and potentially more attractive fields such as renewable energy – where a positive social purpose might be expected to appeal to younger people – are not immune. Here, under-30s account for only 13% of the total labour pool, according to the Engineering Construction Industry Training Board.

Suzannah Nichol is CEO of industry body Build UK. She believes that a key challenge is the sector's broad range of activities and fragmented nature, which means “it's not easy to present a coherent narrative” to potential new entrants.

All but 3% of the industry is made up of micro-companies employing 10 people or fewer, with about 40% of all workers being self-employed. Even the 50 or so large employers tend to operate “behind hoardings”, which results in the sector having a “low profile”, Nichol says.

Another problem is presented by the wide array of occupations, including tradespeople such as plumbers and electricians, as well as professionals such as engineers and surveyors. There are also support functions such as HR and marketing. Each has its own entry route.

“The biggest challenge is the entry route, as there's no obvious career path and it's complex and confusing,” Nichol says. “It's not very clear what the right qualifications are and it's difficult for young people and their parents and teachers to find the right information, so they are often not aware of the opportunities and go elsewhere.”

Other barriers include the problems faced by young people seeking part-time or Saturday jobs, which are considered useful in helping them to see if construction is for them. Even if such tasters are available, young people tend to be put off by a demand for basic qualifications in areas such as health and safety.

This situation isn't helped by a common practice among small employers of recruiting via word of mouth, using their own networks of friends and relations, shrinking the talent pool in the process.

The result is that construction is still “very white and male-oriented” and is “seen as old school and non-diverse”, says Nivene Powell, head of community engagement at house-builder EcoWorld London.

The CITB's *Rethinking Recruitment* report reveals that women make up only 14% of the total workforce, a



figure that falls to 3% in front-line, site-based roles. Members of ethnic minorities also account for 6% despite comprising 14% of the wider working-age population. It's perhaps unsurprising that only 30% of research respondents felt that construction was for people like them.

"I don't think construction is marketed in an attractive way," Powell says. "In terms of recruitment and raising the profile of the industry, you don't see anything in local shops or on the Tube or in places visited by diverse groups."

For women, barriers include not only the sector's male-dominated nature, but also expectations of having to move from site to site and a lack of flexible working opportunities. It's particularly off-putting for those with caring responsibilities.

"The construction sector has an image problem, with many people

feeling that it has quite a laddish culture," Gloster says. "Interestingly, though, when we spoke to women and other minority groups, that wasn't necessarily their perception of working there, so there is a big divide between what happens on the inside and the perceptions of those on the outside, which needs to be addressed."

Internal skills development is another significant challenge, given the big divide between the industry's requirements and the reality on the ground. Although construction has had recruitment difficulties and underlying skills shortages for the past 15 years, it has done too little to address them, according to Gloster.

"The UK has relied on European labour as a sticking plaster and hasn't focused enough on training people already in the country," she says. "There's a need for long-term

work on building skills and capabilities to meet the country's infrastructure requirements."

To this end, the CITB is working with employers to introduce a range of initiatives. For example, funds from its membership levy have been used to finance the Go Construct portal. This is designed to help anyone considering a career in construction to explore possible jobs and careers and learn how to get into them.

The CITB has also supported the development of the Talentview Construction website, which aims to match industry entrants to employers offering work experience, an apprenticeship or a first job. Another initiative is the Go Construct STEM Ambassador scheme, which encourages participants to promote the industry and talk about their experiences to young people in schools and colleges.

"The aim is to provide practical support," Bennett says. "There are lots of things going on individually that make a bit of a difference, but collectively they have the potential to make a big difference."

To tackle the industry's challenges effectively, Bennett believes it won't be enough to simply find new people to undertake traditional skills, such as bricklaying.

Instead, it will be vital to train existing workers and bring in new types of expertise, ranging from digital and environmental knowledge to leadership and management skills. The aim is to boost both quality and productivity and make the most of the skills and experience of the people already working in the sector.

"Every occupational group in the construction industry requires more people with a greater diversity of skills and abilities," Bennett explains. "But, in terms of achieving net-zero carbon emissions, for instance, we don't necessarily need more people; we just need them to do things slightly differently."

There is awareness of what has to be done and effective direction from organisations such as the Construction Leadership Council, Bennett says. But, if the industry is to be able to hit its green goals and other targets, "we will need to do more – and do it quicker". ●

43,350



Encouraging diversity

The skills shortage is having a detrimental impact on the capacity of some companies to take on work, according to Build UK's Suzannah Nichol. In some cases, they're having to turn projects down, ask employees to do more overtime and/or rejig their programmes to access agency staff at times when they're available. Some larger players, such as Laing O'Rourke and Ilke Homes, have established factories to manufacture many of the components used in their projects. This set-up appeals to a wider demographic, including women. Activities are more attractive for many, as they take place indoors. And the location and hours are fixed, which makes flexible working easier. The automated nature of these facilities also means that fewer workers are required, which is valuable at a time of widespread skills shortages.

These bigger companies are also increasingly going down the digitisation route on their sites. This approach includes introducing tools to enable the remote operation of equipment.

Other employers, meanwhile, have focused on training and development. Civic Engineers is a civil, structural and transport engineering practice. It has a graduate entry scheme and offers degree and HNC-level apprenticeships, as well as providing work

experience to paid interns studying for engineering degrees. The aim is to build an ongoing pipeline of talent.

To train its [wider] existing workforce, the company has also set up the Civic Academy. It offers "bite-sized learning" each fortnight in key areas such as carbon-neutral design and green infrastructure, says Caroline Todd, the firm's head of people and culture.

"We're not going to solve the climate crisis by continuing to do the same thing, so we've got to develop a much wider skill set and ensure that our workforce reflects our diverse society," she says.

With this in mind, the company has been working to

shift its gender balance over the past five years from an 80:20 male-female split to 60:40. It has targeted female engineers, including returners, with focused recruitment activities, showcasing their stories and taking action to "create a culture that's inclusive and attractive to everyone".

EcoWorld London has also worked to increase its pool of diverse talent. Together with the London Borough of Hounslow and local training provider MIT Skills, it has set up a free pre-employment programme to equip unemployed people with the basic skills and trade certifications required to work on a construction site. Participants also spend two weeks of the four-week course gaining work experience at an EcoWorld London site.

About 60 people have completed the scheme so far, with 29 going on to secure employment and seven entering long-term apprenticeships. The company's goal is to expand the initiative to other sites. Over time, it will require contractors and subcontractors to sign up to provide suitable apprenticeships and/or jobs as part of the initial tender process.

"We will also be looking at working with specific organisations, such as Women in Construction and Disability Rights, to help bring more diverse groups into the sector," says Nivene Powell. "We'll discuss with them how to make it more attractive and address skills gaps across the industry, because we can't do it alone. There needs to be a partnership across the private, public and voluntary sectors if we're going to solve this problem."

Why we need a systems-led approach in UK infrastructure

There needs to be a reprioritisation around planning and projects in the engineering space. When it comes to the future of infrastructure, systems-led outputs must come before structures

As a soundbite it may sound quite obvious. Why wouldn't large-scale construction projects go in fully-armed with knowledge around all aspects pertinent to the final build? The answer is that, for the most part, they do. The issue is prioritisation and timing – and that systems are often left until the final ebbs of civil works.

Systems technologies and operations can evolve and improve even over the lifecycle of an engineering project, making initial plans for them redundant by the time it comes to implementation.

Similarly, the dynamics of the structure itself may have been altered, tweaked or expanded, with a presumption that it won't impact those initial systems projections. This is another fallacy that has tripped up more than one major project.

With this in mind, those same systems can no longer be an afterthought. Rather they should be the starting point from which a structure can be built around and upon.

With a clear idea of how the included systems will impact an ultimate structure from day one, a project can proceed knowing there won't be any unfortunate mismatches further down the line. Instead, should either the systems or structure evolve in their makeup or requirements, then both can be adjusted in tandem to facilitate the required output.

A sector recalibration

Failing to embed systems into the ongoing development of a civil structure isn't just a potential nuisance, it is poor lifecycle, budget and sustainability planning.

And it has not gone unnoticed. In the past year alone, two potentially game-changing industry documents have been released to force a recalibration in the sector and finally bring systems to the fore.

These documents are The Institution of Civil Engineers' (ICE) A Systems Approach to Infrastructure Delivery (SAID) report, and the UK Government's Transforming Infrastructure Performance: Roadmap to 2030 policy. Both lay out the significance of systems-led infrastructure as a trend and requirement for UK engineering projects moving forward.

The latter directly pulls upon the government's own centre of expertise for infrastructure and major projects: The Infrastructure & Projects Authority (IPA). The body cites issues such as climate change on the same level as systems-led infrastructure to demonstrate its importance over the next decade.

"A critical driver of infrastructure performance during this period will be... the need for adaptive capacity to be embedded in our infrastructure networks and systems," it reads. "The challenge is to use this foresight to make decisions and plans that build resilience and flexibility, and where possible, allow us to shape and adapt to the dynamic external environment."

What this refers to is the unpredictable nature of the engineering landscape while so many of its components are undergoing digital transformations. It has set the tone for ICE's research into how systems are acknowledged in the sector – and why they can no longer be an afterthought.

Andrew McNaughton, chair of ICE's review steering group, says in the report: "Technology in areas such as communications, transportation, power generation, distribution and storage is evolving at such a pace that it is forcing a change in how we design, integrate and commission infrastructure systems. Reflecting on the evidence we have gathered, it is abundantly clear that continuing as we are is not an option."

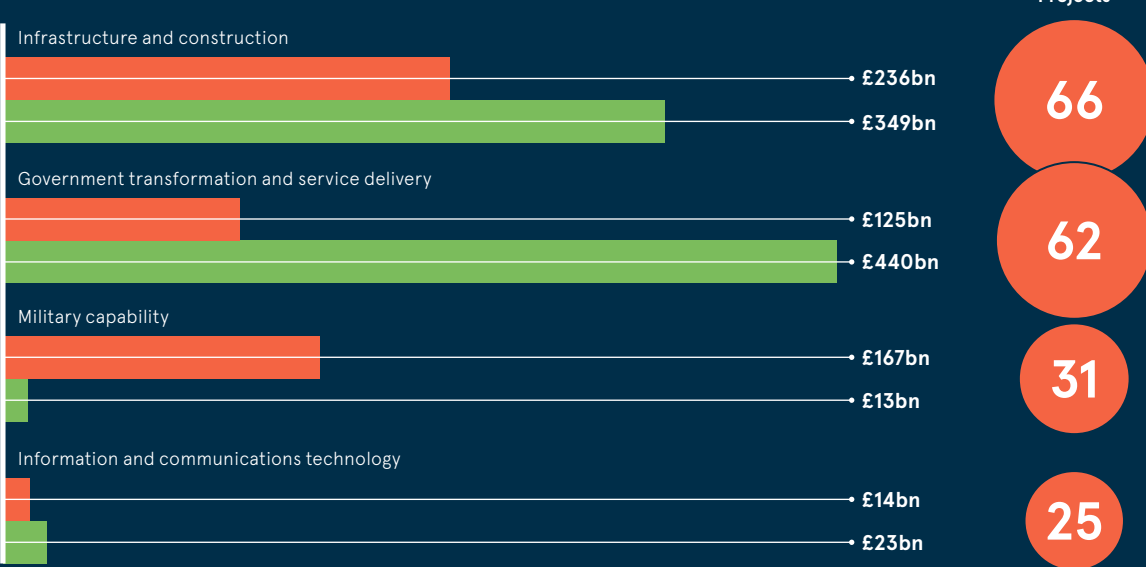
Embracing innovation

Digging into the Government Major

Commercial feature

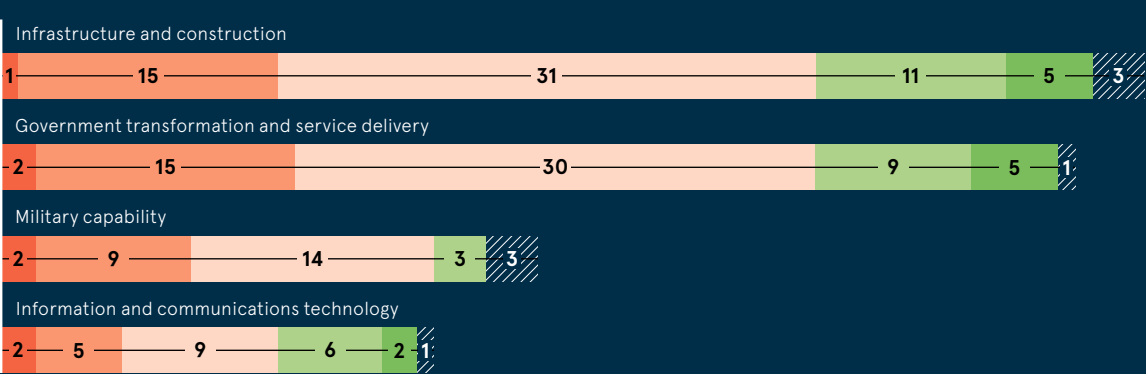
SUMMARY OF THE 2020-21 GOVERNMENT MAJOR PROJECT PORTFOLIO

Monetised benefit vs whole life cost ● Whole life cost ● Monetised benefits



DELIVERY CONFIDENCE ASSESSMENT

Confidence of successful delivery ● Not likely ● Unlikely ● Somewhat unlikely ● Likely ● Very likely ✕ Exempt



Projects Portfolio (GMPP), a basis and handbook for its roadmap, it becomes quite clear why a change in tack is required. It lays out the current value of infrastructure projects across the UK, before revealing that almost 75% of them are running behind and/or over budget.

This comes as more new projects join the GMPP every year and highlights how easy it is for the pace of change in the sector to outrun initial plans and projections for each of them.

On a deeper level, it also highlights that the sector is still failing to embrace a level of innovation that exists outside the core civil aspects of an infrastructure project. Despite the industry claiming to be breaking away from stereotypes of anti-innovation, there is still a vital strand, in the form of systems, that is being overlooked in favour

of their bread and butter – the structural elements.

Digital transformations in areas of communications, transportation, electrification, signalling, storage and much more have the potential to take an entire construction project to another level. But that is only possible if they're addressed first and monitored thereafter, not shoehorned in, in their most advanced state, at the final phase.

A vision for the future

McNaughton alludes to the potential of digital twins as the most potent and relevant example of a systems-led approach that leverages this technological pace of change.

By digitally replicating a system's role as part of the physical asset, a project can be much more responsive and agile to the changing needs of users, but also the changing nature and functionality of the systems themselves, and the changing dynamics of the project. System implementation will always be considered simultaneous to the wider project's evolution.

McNaughton goes as far as to suggest that traditional projects could "give way to the kind of work that may look and feel closer to a software upgrade".

To understand the interactions and advantages of multiple, inter-linking systems is another benefit of digital twins as part of a systems-led infrastructure. The onus now is on

individual projects to follow the advice of reports such as ICE's and of the 2030 Government Roadmap. Both clearly signpost this approach as an enabler of both project success and wider industry contributions to net-zero targets.

It is time to shake off traditional stubbornness and digital reluctance and harness the sustainability, efficiency, social, economic and technical advantages of a systems-led approach to infrastructure delivery.

In the TIP Roadmap, Nick Smallwood, head of project delivery function for the UK Government aptly calls for "a vision for the future in which we collectively prioritise the social outcomes we need, and use modern digital approaches and technologies, alongside improved delivery models to achieve them".

That is a call that all modern infrastructure companies need to heed.

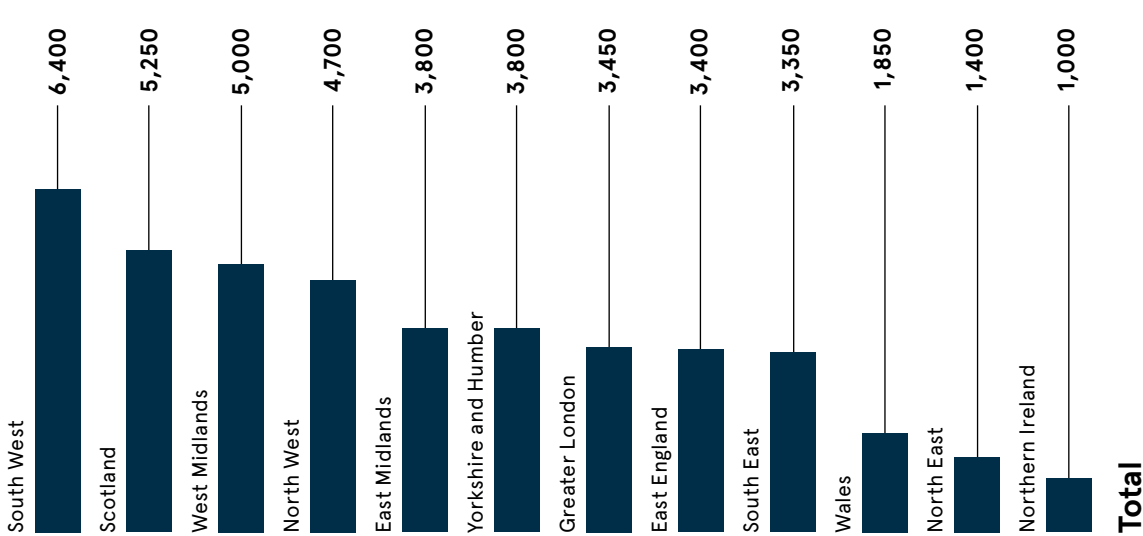
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UK CONSTRUCTION'S RECRUITMENT REQUIREMENTS

Construction Industry Training Board, 2020

Number of new recruits needed annually by the industry in 2020-25



OFFSHORE WIND

Gathered on the grid: the UK’s offshore challenge

Building a hi-tech power distribution network in the North Sea would boost Europe’s energy independence, while reducing both costs and environmental impacts. But this will be no easy task

Heidi Vella

Russia’s invasion of Ukraine has prompted several nations in Europe to consider how they might accelerate their energy transitions. For both the UK and the EU, offshore wind could hasten their advances – but only if grid innovation keeps pace.

The UK wants to generate 40GW through offshore wind by 2030. The recent ScotWind seabed leasing round awarded a record-breaking 25GW-worth of potential projects – enough to power about 1.5 million homes – setting the country on a path to meeting this target. The EU is aiming for at least 60GW by 2030 and 300GW by 2050.

But, while offshore wind technology costs are falling rapidly, grid innovation must keep up, or we risk missing these targets. Research suggests that, when offshore wind assets are built at the scale planned, single point-to-point connections from these wind farms to the on-shore grid (as is currently standard)

will be inefficient, more expensive, and less environmentally friendly.

One possible solution to this is the creation of a multi-country connected offshore meshed grid in the North Sea, built using novel tech. This would enable much higher levels of energy to be transported with lower losses. Crucially, supply would be more easily shifted to meet demand across the five big European offshore wind players: Belgium, Denmark, Germany, the Netherlands and the UK.

There are already some point-to-point interconnectors transporting energy between European countries – of which the UK has four. But a meshed offshore grid would be like “the London to Brighton main line” says Fay Lelliott, global practice leader for power transmission and distribution at consultancy Mott MacDonald.

“It’s not only point-to-point. It is possible to travel from London to Brighton using lots of routes,” she explains.

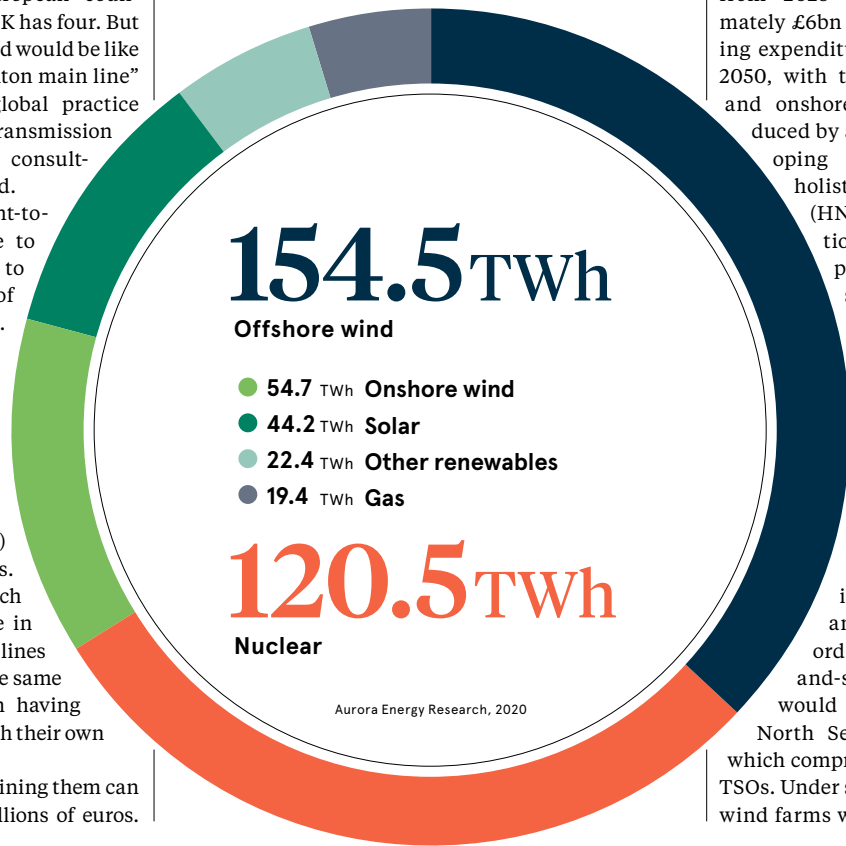
Cornelis Arie Plet, principal consultant at the DNV Group, has coordinated a recent project to advance the development of high-voltage direct-current (HVDC) meshed offshore grids. He explains what such integration looks like in practice: “This is two lines coming together at the same location, rather than having two separate links with their own converter stations.”

Plet says that combining them can save hundreds of millions of euros.



OFFSHORE IS SET TO BECOME THE NATION’S NUMBER-ONE ELECTRICITY SOURCE

Primary forecast electricity generation in Great Britain in 2050, by energy source



“Doing this consistently across the North Sea lowers costs significantly.” British electricity system operator National Grid ESO has determined that taking an “integrated approach” for wind farms delivered from 2025 could save approximately £6bn in capital and operating expenditure between now and 2050, with the number of cables and onshore landing points reduced by about 50%. It is developing what it’s calling a holistic network design (HND), due for completion in June, that is expected to incorporate some of these insights and recommend how the 2030 target, including 11GW from ScotWind, can best be achieved.

Integration ideas are taking shape. TenneT, the largest transmission network operator (TSO) in Europe, advocates an internationally co-ordinated modular hub-and-spoke concept. This would be created by the North Sea Wind Power Hub, which comprises several European TSOs. Under such a model, offshore wind farms would be connected to

multiple countries – the kind of expansion that’s important, says Saskia Jaarsma, head of offshore development at TenneT.

“We will not achieve the objectives of the Paris agreement on climate change with 1GW or 2GW systems. It makes sense to combine things internationally. This [hub-and-spoke model] is a sufficient solution,” she says.

While such a concept is years away from realisation, grid integration at national level is starting to take shape. TenneT’s 2GW programme, which has just started the tendering process, will build at least six offshore grid connection platforms – three in Germany and three in the Netherlands – that will use a new cable system and have a transmission capacity of 2GW. The stations will require half as many grid connections and greatly reduce space compared with combining two 900MW platforms, as was previously proposed.

The company is also working with 50Hertz, a German TSO, to deliver 4GW of energy from two offshore wind parks into one onshore multi-terminal hub, so that only the one AC/DC converter station needs to be built instead of the usual three.

Denmark’s Energinet has proposed building two artificial energy island hubs in the North Sea, where

about 200 wind turbines with a combined capacity of 3GW would be installed in the first phase of the programme. The hope is that there will eventually be the potential for 10GW and the ability to connect to other countries.

In the UK, Alice Etheridge, senior manager for offshore coordination at National Grid ESO, says that the company is considering an offshore wind farm project sharing connections to the mainland for the HND, potentially linking up offshore cables from projects in Scotland to England and Wales, instead of just directly to Scotland, plus higher-capacity connections and potentially multipurpose interconnectors.

Taking a Europe-wide approach “absolutely has its benefits”, she says, but adds that progress should be phased. “It’s likely to be something we’ll build up to in the future. As we find a more enduring path, we will probably head towards increasing levels of integration with Europe – we all have similar decarbonisation targets. Having a diverse supply is going to be really beneficial. It will help us with ensuring security of supply and getting value from low-carbon generation.”

Etheridge doesn’t believe that Brexit is prohibitive, but says it might require some “practical matters to be clarified”. In the short to

“We will probably head towards increasing levels of integration with Europe

medium term, the UK and EU trade cooperation agreement should be helpful, she says.

While there seems to be a Europe-wide consensus for developing a North Sea high-voltage grid, creating such an expansive piece of international infrastructure using novel technology – some of which may not be ready until 2030 – throws up technical, regulatory and political complications, as well as supply chain challenges.

To accelerate the concept, collaborative planning between national stakeholders and countries needs to happen now.

“It seems like an empty sea, but it’s really crowded with users and stakeholders. This can never be developed without a strong governmental backup,” Jaarsma warns.

Working in the absence of multi-stakeholder coordination could store up problems for later. For example, HVDC grids with different voltages are extremely expensive or impossible to connect.

Collaboration among tech vendors is also a key challenge. There are only three leading regional manufacturers for the HVDC technology needed – GE, Siemens and Hitachi Energy – and manufacturers are not always forthcoming in sharing information. The costs will also be high – the project that Plet worked on estimates that the offshore transmission infrastructure would cost in the region of €1bn (£850m) per gigawatt on its own.

And time is running out. It typically takes more than a decade to build a grid, with initial integrated connections not expected until 2030. In its assessment, National Grid ESO warns that the delay in developing such infrastructure could put the UK at risk of missing its 2030 targets.

“The sooner that coordination starts, the greater the benefits. But there are practicalities to consider, such as that many of the projects to meet the 2030 target are already in progress,” Etheridge says. “But this kind of coordination will be really important to help other projects get their consent and therefore reach the target.”

To galvanise development of a meshed North Sea grid by traditionally conservative TSOs, governments are likely to need to facilitate more technology-testing pilot programmes. This would help to boost confidence and reduce costs.

Despite all the challenges, Plet believes that an offshore grid in the North Sea is “now inevitable”, with the US and China also contemplating the concept to support their own green energy ambitions. ●

Reliable broadband critical to UK’s economic growth

Businesses and consumers alike count on new technology to transform ways of working and living. However, their experiences and productivity are being hampered by poor broadband speeds and reliability

C loud computing, remote collaboration, and the Internet of Things have long been rising up the agenda in businesses, but their importance grew dramatically during the pandemic.

Yet many organisations consistently face problems using these services because of unreliable internet connectivity and slow speeds. All too frequently, video calls are interrupted or voices drop out, while cloud-based applications fail to function effectively, frustrating staff and draining productivity. IoT systems also struggle to operate in these conditions, which can affect the smart and sustainable operation of business premises.

“Both cloud and IoT technology have enormous promise in improving ways of working and productivity, but so often they are dragged down by the broadband connection. Managers end up being quickly disappointed by the functioning of many services and it’s due to failings within their infrastructure,” explains Nick Bratt, head of business development at Swish Fibre.

When businesses run systems that require 50 megabits per second (Mbps) of bandwidth to operate properly, but their broadband is not up to speed and runs at 10Mbps, bottlenecks quickly develop. This renders standard processes practically unworkable. Bratt explains: “Running the data on those networks is like trying to empty bath water through a straw, or attempting to drive a sports car quickly down a congested motorway – it doesn’t work.”

Similar scenarios often unfold in consumer contexts, too, with people eagerly accumulating the latest connected devices without realising the consequences for their home WiFi.

Recent research by the insurance firm Aviva showed the average UK home



already has more than 10 internet-connected devices, including mobile phones, laptops and tablets, as well as watches, games consoles, security alarms and cameras. That figure is sure to increase in the coming years.

“When a home has someone working in the cloud on their laptop, another person having a video call, and the kids watching Netflix or gaming on their PlayStation, its network is unlikely to hold up well,” Bratt says. Worse still, broadband operators’ marketing materials can often obfuscate the slow upload speeds responsible for disrupting many such activities.

More broadly, the UK is urgently tackling what has become a national broadband problem. The country punches well below its weight in terms of connectivity, at a poor 52nd in the international rankings of broadband speeds. However, efforts are underway to plug in gigabit speeds nationwide by 2030, a move essential to bolstering economic productivity and job creation. Fibre optic cables will be extended across the country and all new properties must now be built with gigabit-ready infrastructure.

Swish Fibre is among the cutting-edge broadband providers enabling these changes – and it has gone even further in terms of speeds.

“We’re now building a 10,000Mbps network that will truly future-proof areas for all their upcoming business and consumer needs,” Bratt explains. Unlike many providers, Swish is assigning the same prioritisation to rural areas as to big cities, while its networks offer clear, symmetrical download and upload speeds.

“Across the country, work and ways of living depend on this infrastructure,” Bratt says, highlighting that high speeds are now necessary and expected in all walks of life and work. “It’s also absolutely critical for people operating in technology-led environments, not least in the metaverse, which will be a major source of jobs.”

With the government driving ahead to ‘level up’ all areas of the country and keep Britain at the cutting edge of technology, ultrafast and reliable connectivity is fundamental to the UK’s future prosperity and global competitiveness.

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“We will not achieve the objectives of the Paris agreement on climate change with 1GW or 2GW systems. It makes sense to combine things internationally

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RENEWABLES

Big green storage: tech for conserving eco-energy

Renewable power may well be the future, but delivering a consistent supply calls for more large and efficient repositories. Fortunately, new solutions are emerging

Emma Woollacott

The price of natural gas has been rising steadily since last summer, with the war in Ukraine increasing the pressure. Add this to the urgent need to mitigate the effects of global warming and it's never been clearer that the whole world has to move towards renewable energy generation.

But there's an obvious problem – most forms of renewables don't produce energy on demand. The power needs to keep flowing even when the wind doesn't blow and the sun doesn't shine. This means that the amount of energy storage on the UK grid will need to expand from 3GW today to more than 30GW in the coming decades, according to power generation firm Drax.

The words 'power storage' might make you think of batteries, but there are big problems using such systems for large-scale storage. The development costs and end-of-life disposal of lithium-ion batteries

are high, while their lifespan generally isn't all that long. They also require rare and expensive materials such as cobalt and lithium.

Battery technologies are making steady progress, but other methods are still required. The main form of energy storage around the world is pumped hydro, in which water is moved between two reservoirs at different heights. When there's demand for electricity, water is released from the upper reservoir, spinning turbines and generating electricity. When power needs to be stored, conversely, the same turbines use electricity to pump water back to the upper reservoir, ready for release once again.

Although pumped hydro is used widely around the world, it has its limitations. For one thing, only certain locations are suitable – and these may not be the most convenient sites for energy generation.

But this may be about to change. For example, Dutch startup Ocean Grazer has started building a sub-sea version of pumped hydro that can be used to store energy from onshore and offshore wind farms by pumping seawater in and out of huge bladders on the ocean floor.

"I think that we could find our solutions being deployed at almost any location where there is a wind farm being built," observes Ocean Grazer's CEO, Frits Blik. "We have talked to the main offshore wind developers. In effect, they all want to test and exploit the possibilities that the technology can provide."

Other new systems are emerging. One is thermal storage. As with a domestic hot water tank, this tech involves storing energy in the form of heat until it's required. The largest installation of this kind is being constructed at the Finnish city of Vantaa in Finland. This will store water 100m underground under so much pressure that it can be heated to 140°C without boiling.

The Vantaa Energy Cavern Thermal Energy Storage project will have a capacity equal to the annual heat consumption of a medium-sized town. It will allow excess heat – such as waste heat from air conditioners, solar and geothermal – to be stored in the summer, then used to flatten demand peaks in winter.

Many methods are limited by where they can be located. But one technique that's relatively efficient and can be used almost anywhere is gravity storage. Spare energy is used to hoist a weight to the top of a tower or an underground shaft. When the weight is lowered, the energy is released.

"Our current storage solutions are insufficient. Both pumped hydro – which is 90% of the market – and chemical batteries face significant issues with respect to their scalability, economics and environmental risks," observes Robert Piconi, the



Lam Takhong, a pumped storage power plant in central Thailand

co-founder and CEO of Energy Vault, which is building a demonstration unit in Arbedo-Castione, Switzerland. His company believes that its model will yield 30% to 40% lower 'levelised costs' (the ratio of the total costs of a plant to the amount of electricity generated over the plant's lifetime) than lithium-ion batteries. The technology also has a long lifespan.

With so many promising possibilities, the UK government recently allocated £68m to fund a competition for innovators called the Longer Duration Energy Storage Demonstration. According to the minister of state for energy, clean growth and climate change, Greg Hands, the aim of the scheme is to "allow us to extract the full benefit from our home-grown renewable energy sources, drive down costs and end our reliance on volatile and expensive fossil fuels".

Nearly £7m has been awarded in total so far to 24 projects, with more funding to come for those deemed worth commercialising.

One candidate is a project run by B9 Energy Storage at Ballylumford in Northern Ireland. The scheme will initially receive nearly £1m for a storage system known as power to X. This uses spare energy to

create hydrogen, which can be used at a later date.

"There are world-leading levels of renewable penetration here in Northern Ireland, but mechanisms to store surplus renewable generation at times of low demand are urgently required to minimise the curtailment of this energy," says Mark Alexander, energy transition manager at Mutual Energy, a member of the project. He adds that the power-to-X storage medium can fulfil a long-term need, because it potentially exceeds the levels of energy storage needed for net zero.

But the future of energy storage will inevitably involve a mix of methods, Alexander says. "While power to hydrogen is essential to deliver robust security of energy supply within a net-zero context, providing an energy storage solution for renewable energy over days, weeks, months or even years, this does not remove the need for other storage systems, particularly

“While power to hydrogen is essential, it does not remove the need for other storage technologies

those that work on intra-day cycles, such as batteries, compressed air and pumped hydro,” he says.

According to McKinsey, long-duration energy storage could handle up to 10% of all electricity consumed by 2040 worldwide. It could also avert the release of up to 15% of the energy sector's current greenhouse gas emissions.

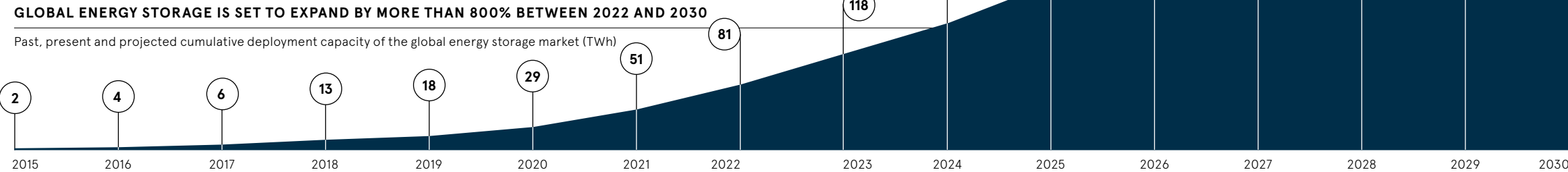
There's a good chance that these technologies will be cost-effective, the firm adds. Projections indicate that significant savings are possible and are in line with those achieved by other emerging energy technologies in the recent past.

Dr Jonathan Radcliffe is a reader in energy systems and policy at the University of Birmingham. He believes that the potential costs of failing to increase energy storage need to be factored in.

"Until now, we have had energy stored in fossil fuel, giving us security, although the current energy crisis shows in part that we have taken even the storage of gas for granted," he says. "As we move to a net-zero electricity system and many tens of gigawatts of offshore wind are deployed over the next 10 years, markets must adjust to reflect the value of reliability and resilience under conditions where we could face long periods without generation from renewables."

GLOBAL ENERGY STORAGE IS SET TO EXPAND BY MORE THAN 800% BETWEEN 2022 AND 2030

Past, present and projected cumulative deployment capacity of the global energy storage market (TWh)



Energy Monitor, 2021

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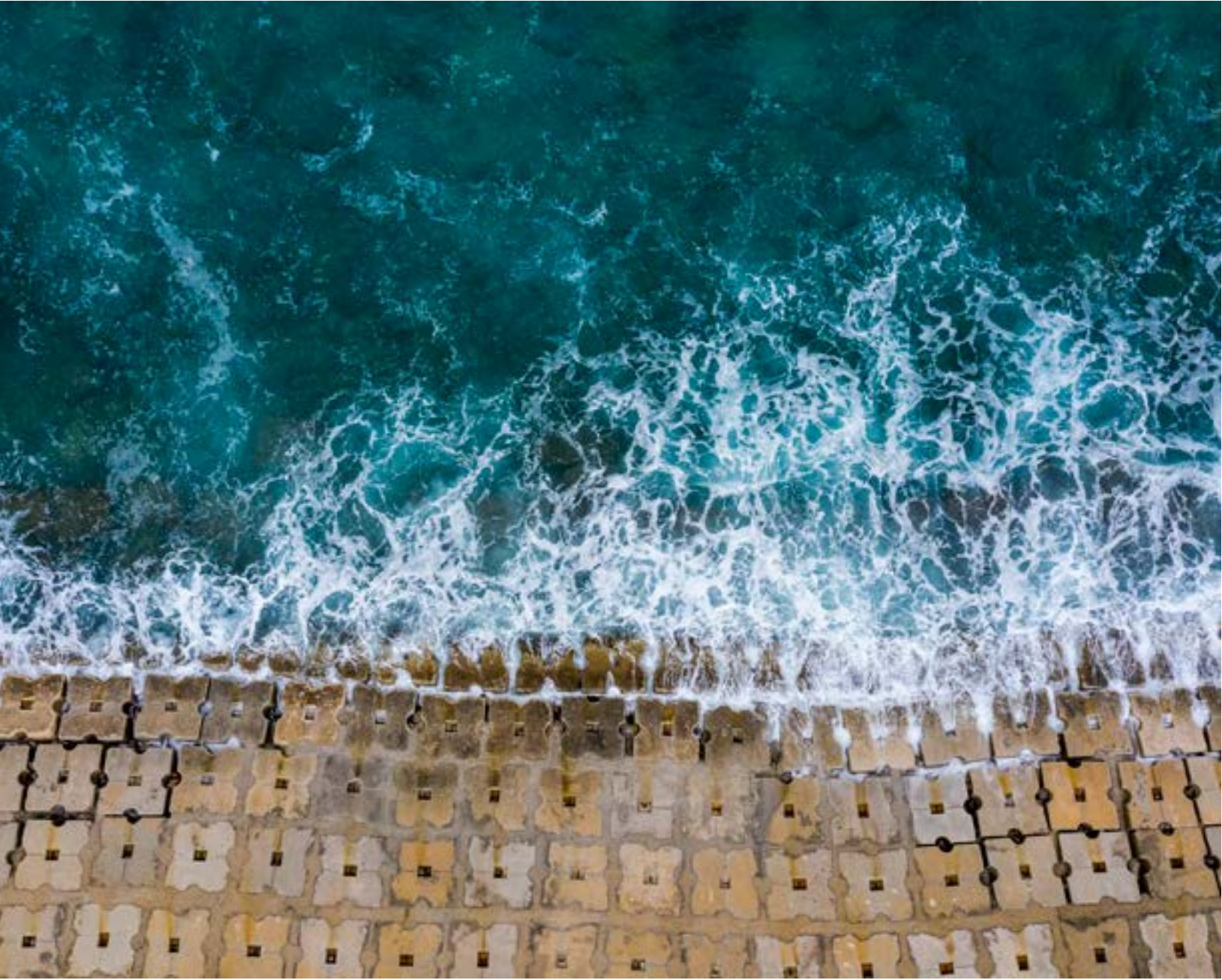
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INTERVIEW

‘All our evidence suggests that investments in resilience make sense’

To turn all the talk about investing for resilience into action, financiers need effective tools to inform their decision-making. **Carlos Sánchez**, executive director of the Coalition for Climate Resilient Investment, is determined to meet their requirements

Oliver Balch

Back in 2015, the Bank of England’s then governor, Mark Carney, made a blistering speech at Lloyd’s of London about the economic threat presented by climate change. Listing the ramifications of sea-level rises, droughts, storms and other increasingly severe weather events, he warned that insurers needed to be at the “cutting edge” when it came to managing the risks posed to critical infrastructure.

Carney’s stark message wasn’t lost on Carlos Sánchez, an expert in climate finance who was working at the time for a multilateral lender on climate resilience projects in Latin America. The Spaniard believes that the speech helped to instil “a change of mentality in the financial industry about how climate risks are processed and assimilated. This was not just ethically driven. It was also motivated by strategic and financial materiality.”

Today, Sánchez is executive director of the Coalition for Climate Resilient Investment (CCRI), which was formed in 2019 to bring together parties ranging from insurers and investors to governments and credit rating agencies. The CCRI is chaired by his current employer, risk advisory firm Willis Towers Watson, with close support from the UK government and HSBC. The coalition takes its cue from Carney’s call to be at the cutting

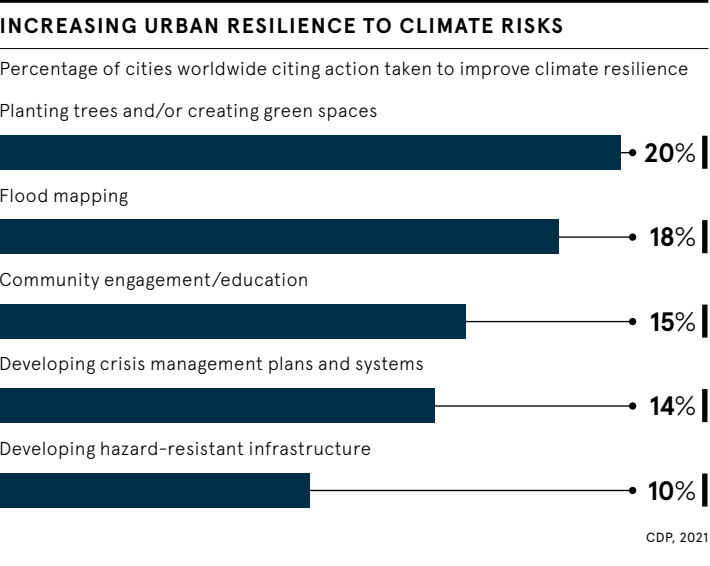
edge of climate risk management for infrastructure projects. At the core of its mission is an acceptance that financial markets worldwide have made slow progress in incorporating climate resilience into their decision-making processes. This shouldn’t be read as a lack of interest, stresses Sánchez, who points out that the CCRI’s ability to convene infrastructure players with a combined asset base exceeding £19tn indicates a general readiness to act. The CCRI is not the only player in this field, either. The Coalition for Disaster Resilient Infrastructure, the Global Commission on Adaptation and the Finance to Accelerate the Sustainable Transition – Infrastructure initiative are just a few of the other collectives to have formed in recent years.

The problem instead, he says, is the absence of a standard set of tools to identify, assess and, most crucially, value improvements to the climate resilience of infrastructure assets. Because of this, financiers are flying blind. They are unable to accurately price future climate risks into potential infrastructure investments. The infrastructure sector is therefore facing a massive “resilience gap” in financing, which represents a serious challenge. Research published by Anglia Ruskin University and the Mott MacDonald consultancy in the year of Carney’s speech estimated that \$200bn (£152bn) would be needed annually by 2035 to address \$1tn of losses from climate impacts. The current level of investment in this area is a mere \$30bn a year, according to the World Bank Group and its Global Facility for Disaster Reduction and Recovery. To make matters worse, infrastructure managers and developers who take climate resilience seriously gain precious little reward from the insurance, credit and equity markets. The higher insurance premiums or costs of capital that infrastructure sponsors often face if they disclose resilience risks associated with assets are the “real tragedy”, according to Sánchez. “Coalition members tell us: ‘We’ve been in competitive processes for infrastructure investment where, as a result of recognising that an asset is subject to a high level of exposure, we’re automatically placed at the back of the queue because our proposition is not attractive,’” he says.



“There has been a change of mentality in the financial industry about how climate risks are processed and assimilated. This was not just ethically driven. It was also motivated by strategic and financial materiality

Carlos Sánchez
Executive director of the Coalition for Climate Resilient Investment



The CCRI has mounted a two-pronged response to these evident market failures. Its first key move has been a top-down effort to help national governments assess the systemic risks and resilience needs of their most critical infrastructure assets. Over the past 18 months, a group of 50 members has been developing a metric for gauging the overall risk exposure of a given country’s built infrastructure, coupled with a tool for prioritising resilience-related investments.

Such equipment is not only an aid to decision-makers in putting a price on climate risks, Sánchez says. It also helps them to build the political case for redirecting public resources to resilience projects. He has in mind a recent stress test conducted by reinsurance giant Swiss Re, which found that 18% of the world’s economic output could be lost before 2050 if climate risks are ignored. Despite this, Sánchez acknowledges that it could still be contentious to redirect public funds towards flood defences, say, rather than hospitals. “Policy-makers are saying: ‘If you are asking us to reallocate money from non-climate issues to climate issues, and if we might not see the value of doing that for 20 years, that’s not very appealing.’” In an ideal world, the CCRI’s resilience metric would act as a proxy for a credit rating agency, thereby presenting an immediate incentive in terms of lower costs of capital for resilient infrastructure projects. For regulatory reasons, credit rating agencies are not involved in the CCRI’s evolving discussions, but Sánchez is confident that its metric will gain traction quickly once it is finalised. The CCRI’s second key move in response to the market failures is more bottom-up in nature. This is focused on helping investors to integrate climate risks into their cash flow models. The goal here is to counter the common misconception that climate resilience entails high initial costs that take a long time to recoup. The coalition’s analysis of returns data from real case studies indicates that the opposite is true, reports Sánchez, who adds: “All our evidence suggests that investments in resilience make sense in terms of the projects’ net present value.”

“The beauty of our methodology is that it provides a menu of incremental investment actions

The positive financial return for infrastructure investors is evident in the decision by Mott MacDonald, Standard & Poor’s and HSBC to collectively assign more than 20 employees on a pro-bono basis to the CCRI’s work on cash flow modelling. “I’m not fooled into thinking that they’re doing it because they like my face,” Sánchez jokes. “They’re doing it because they can see that this is really strategic for them.” In a practical test of the robustness of the CCRI’s modelling techniques, a group of six data providers associated with the coalition is conducting in-depth analyses of five major infrastructure projects around the world. The CCRI’s standardised analysis has been designed to deliver a clear assessment of the climate risks associated with each project, plus a detailed cost-benefit analysis of the potential resilience measures. “The beauty of our methodology is that it provides a menu of incremental investment actions and models the implications of different combinations of these in terms of their capex, operating expenses and so forth,” he explains. Sánchez acknowledges that the CCRI’s mission to accelerate investment flows in climate resilience still has a long way to go. Another of its priorities is to help providers of finance and insurance to introduce innovative new products that are better suited to promoting resilient investments. As part of that objective, he has set his sights on mobilising \$5bn in infrastructure investments that use the CCRI’s climate risk assessment methodology before the end of this year. But the clock is ticking. “Just one minute’s delay,” he warns, “and all that we’ll be able to do is focus on minimising an absolute disaster.” ●



Accelerating UK solar: investors are given a renewables boost

Solar is often overlooked when it comes to hitting net-zero targets but a new fund from NextEnergy Capital aims to boost the market

The UK Government’s net zero 2050 target and the Climate Change Committee’s subsequent roadmap may have made renewable energy’s role in the UK a more pressing and considered strategy. Solar PV is at the forefront of innovation, at a time when action is urgent. The latest government partnership relating to solar is interesting and, potentially, ground-breaking. We know that solar plants can take up to four years less time to come online than wind parks. And now solar is a commercially viable proposition too, thanks to the role of NextEnergy Capital’s latest fund, NextPower UK ESG (NPUK), which is focused on unsubsidised, new build, utility-scale solar assets in the UK. Group CEO Michael Bonte-Friedheim explains: “NPUK ESG is something of a snow plough for solar, opening the market up for others to follow. This is because it removes the need for regulatory support from the government to roll out projects, also meaning it doesn’t fall to the end user to cover the cost through their bills.” The UK Infrastructure Bank is providing financing to the initial seed assets of NPUK ESG, comprising two major subsidy-free solar farms in the UK. It also plans to invest up to £250m, half of the fund’s total target fund size, on a match-funding basis with the private sector. It is expected that this support will lead to significant investment in the UK subsidy-free solar sector. “Because the individual cost of installing a utility scale solar plant has come down so far, we no longer need government subsidy or support for investors to look at solar as a profitable proposition,” says Bonte-Friedheim.

“It’s more of an attractive standalone investment and we’re paving the way for investors to finally capitalise on the quickest and cheapest form of power generation out there.” The fund already has two seed assets, one being the UK’s largest solar farm comprising 75MW of capacity. The aim is to leverage NextEnergy Group’s internal pipeline, off the back of the company’s pre-existing status as a solar leader in the country. However, while there are clear sustainability goals embedded in the incentive – the hope is to mitigate 370,000 tonnes of CO2 equivalent, the same as taking 250,000 cars off the road – there is also a new sense of pragmatism around solar’s influence. “Emissions reductions figures alone aren’t enough for investors to justify parting with their money, but that’s why solar in this new framework is so attractive,” says Bonte-Friedheim. “For example, from a financial perspective,

“Solar is not a donation or an ethical tick-box exercise, it’s a way to deliver much needed energy goals and financial returns simultaneously

once we reach our target of building 1GW of new solar in the UK, this also equates to around £175m yearly in avoided gas purchases from other countries. Over 10 years, this inflates to nearly £2bn.” Alongside CO2 emission reductions and financial viability benefits, there is the prospect of wider biodiversity projects and community engagement opportunities as part of a more progressive and pragmatic overall package. This new era can finally capitalise on solar’s undoubted potential, as part of a broader recognition that net-zero targets are only realistic if we address the challenge holistically, and together. Bonte-Friedheim says: “The reason why a roadmap has been put in place is to mobilise the entire economy and therefore catalyse the process. Solar is the quickest and most cost-effective way to incrementally increase the delivery of new renewable energy capacity in the UK within the context of pursuing net zero by 2050, while also providing investors with attractive financial returns. “With this in mind, I’d call upon institutional investors to focus on solar as this strong and viable contributor. It’s not a donation or an ethical tick-box exercise, it’s a way to deliver much needed energy goals and financial returns simultaneously.”

To find out more about NextEnergy Capital and NextPower UK ESG, visit nextenergycapital.com





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GREEN HYDROGEN

In its element: the rise and rise of hydrogen

Surging fossil fuel prices have made green hydrogen a viable option, with profound implications for energy infrastructure

Nick Easen

Russia's war on Ukraine has supercharged the price of natural gas, posing problems for governments, businesses and consumers alike. As nations consider the future of their energy supplies, is it time to get serious about green hydrogen?

Green hydrogen is made when water is electrolysed using renewable energy. The process splits water molecules into oxygen and hydrogen, which can then be used as a clean energy source. The burning of hydrogen emits only water.

This renewable fuel has become cheaper than natural gas, so this could be the ideal moment to consider its role in the future energy mix. For some in the industry, green hydrogen holds vast potential, not only in improving energy security but also in contributing to nations' climate goals and the race to net-zero greenhouse gas emissions.

Hydrogen could meet as much as 12% of the world's energy needs by 2050, according to the International Renewable Energy Agency. Green hydrogen has the potential to rewrite the energy infrastructure map for the net-zero age, since energy production could shift to those nations that have excess low-carbon energy and invest heavily in green hydrogen infrastructure.

"We are seeing a strong increase in the number of global hydrogen strategies, many of which centre on green hydrogen," says Dr Graham Cooley, CEO of ITM Power, which makes electrolysing equipment.

There are profound implications for the global energy market, he says. "As we are seeing, the weaponisation of energy supply means that energy security has risen to the top of the agenda for almost all nations. Green hydrogen is the only zero-carbon energy gas and it can

be produced anywhere that has renewable power resources."

There is already significant interest in hydrogen around the world. According to the Hydrogen Council, a business-led organisation backed by many traditional energy companies, 520 projects offering 90GW of capacity have been earmarked so far. This amounts to £123bn of investment, although this is for all forms of renewable and low-carbon

“Green hydrogen is the only zero-carbon energy gas and it can be produced anywhere that has renewable power resources

hydrogen, including that made from fossil fuels through carbon capture and sequestration. Funds are being allocated around the globe, from Saudi Arabia to Australia and from Japan to Germany.

"We are starting to see offshore and onshore wind developers bringing forward green hydrogen projects at scale," says Clare Lavelle, leader of Arup's energy consultancy in the north of the UK. "But these green hydrogen suppliers need to be confident that they have customers who will offer them a route to market."

The sector is still in an early stage of development. Infrastructure is limited and scaled-up deployment presents challenges. The upfront costs of developing the technology are significant, as is the investment required in bulk plant, safe storage and secure distribution.

What's more, producing green hydrogen from water is an energy-intensive process. Businesses and communities are better off using the electricity generated from renewable sources directly wherever that's possible. The process of using electricity from renewables to make and then burn hydrogen is roughly 30% efficient. In comparison, batteries are more than 80% efficient as an energy store.

"More research and evidence is needed to understand the optimal net-zero energy system and the balance of gas and electrons that can deliver an economic transition," Lavelle says.

But in energy-intensive industries such as steel production, where high-grade heat is needed, green hydrogen could replace coking coal to provide a more environmentally friendly alternative. In some transport situations where battery technology tends to struggle, such as in ships and heavy goods vehicles, hydrogen also comes into its own.

Hydrogen can also be used to produce ammonia through a well-known process called Haber-Bosch. Ammonia is a vital chemical that's used to produce fertilisers – an area of concern in the UK for at least as long as supplies from Ukraine and Russia are in doubt.

Green ammonia can also be used as a fuel source. It's easier to transport than hydrogen and is more energy intensive as a fuel, with the global shipping industry looking to green ammonia to power vessels.

"Hydrogen is an excellent energy vector that has applications in a variety of sectors. It can be produced when there is excess or cheap electricity and stored as ammonia," says Ben Sawford, vice-president at KBR Global Sustainability Advisory

Consulting. "It can then be utilised at another time, when demand is high and supply is low. Additionally, cogeneration in nuclear power plants offers massive advantages not seen with other technologies."

Cogeneration occurs where excess heat, electricity or other forms of energy are used to generate another form of power, preferably one that can be stored or used immediately.

For example, 65% of the energy generated by nuclear power plants is typically lost as heat, which is extremely inefficient if this isn't used. New advanced nuclear technologies are being developed that will be able to operate at significantly higher temperatures than existing plants, which could prove beneficial when it comes to generating hydrogen.

"The process can utilise these high temperatures alongside electrolysis to produce hydrogen," says Neil Leggatt, group business manager for nuclear at the Frazer-Nash Consultancy. He adds that steam electrolysis using nuclear heat and electricity could produce hydrogen using 35% less electricity, with an overall efficiency of about 50%.

Some green hydrogen projects feature plans to locate manufacturing plants alongside nuclear reactors to achieve cogeneration. There are also efforts to locate production facilities close to sources of renewable power, such as wind farms, so that when excess electricity is generated it can be converted into another source of energy.

The complexity of the energy transition and future energy mix demands a joined-up approach in government policy and energy security. A combination of low-carbon energy streams and infrastructure will be needed to provide a consistent supply. Green hydrogen production could ensure that less energy is wasted and help critical energy-intensive industries that have traditionally relied on fossil fuels.

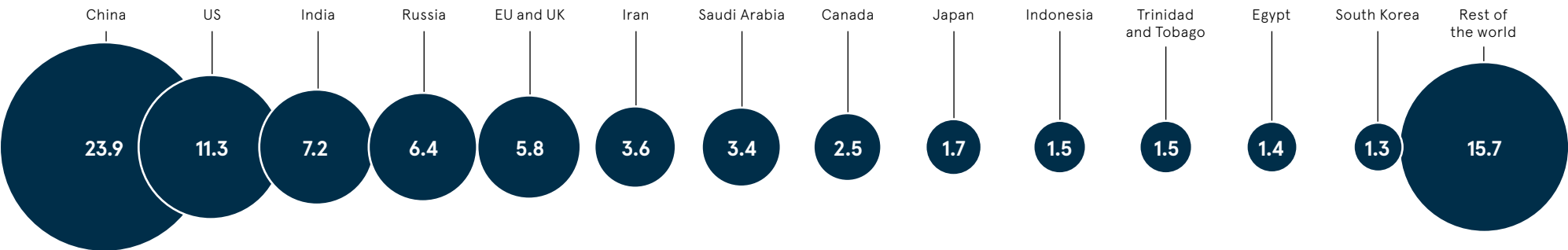
What's more, nations with abundant sources of renewable generation that produce energy beyond their own demands will be able to export it by shipping hydrogen or ammonia to where it's needed.

"Renewable-rich nations will increasingly have the opportunity to supply nations that do not meet their own energy demands," Lavelle says, pointing to collaborations between Scotland and Germany and between Japan and Australia.

The future looks bright for green hydrogen, then. But its careful and considered deployment will be crucial if it's to become truly valued in the future energy mix. ●

THE WORLD'S BIGGEST CONSUMERS OF HYDROGEN

Annual hydrogen consumption among largest users in 2020 (million tonnes)



International Renewable Energy Agency, 2022

‘To bridge the funding gap, we need a partnership between government and private investors’

A Q&A with **Lawrence Slade**, CEO of the Global Infrastructure Investor Association, on the future of private infrastructure investment

Q What trends are emerging in infrastructure investment?

LS One of the top trends we're seeing has to be digitalisation – getting fibre to the door, so to speak. Only a few years ago, with older internet connections, if I had wanted to download a film, it would have taken me several hours. Now it's almost instant. Developing that kind of speed elsewhere offers tremendous investment potential. Rolling out fibre across the UK, the US and Europe presents hundreds of billions of pounds in opportunities.

Connected to that is data-centre infrastructure, everything needed to support 5G and, perhaps surprisingly to some, energy infrastructure. Ultimately, we are building a connected world in which data plays an enormous role. On the path to building that future, things such as network management and the development of smart grids become crucial. Charging stations for electric vehicles will generate billions of pounds of investment opportunities alone. And this is before we even start talking about the smart solutions that exist in offshore wind and district heating.

And, while it receives relatively little attention, water is another significant opportunity. How do we manage it and move it? How do we tackle pollution? Solving such challenges will require billions of pounds in investment over several years.

Q What are the barriers to unlocking more investment?

LS If you look around the UK, the US and Europe, you're seeing a lot of positive public spending trends – some massive numbers linked to infrastructure. Yet it's still not enough. Governments are putting in huge amounts of capital, but they simply cannot give us the infrastructure we require by themselves. What that tells us is that there's a need for private capital.

The extent of that need is a little unclear, but we're looking at significant sums to achieve some of the goals I've already outlined. Judging from the conversations I've had, for Europe's 5G and fibre roll-out alone we're probably looking at hundreds of billions of euros over 15 years.

Among members of the Global Infrastructure Investor Association,

there is probably about £225m ready to go. But the scary part is that we are likely to need several multiples of that over the next decade to hit our infrastructure targets.

If we're to mobilise more capital, we need to see clear project pipelines and investable opportunities – and that rests with the government.

Q What are the key solutions to these challenges?

LS The most important thing will be to obtain clarity from the government, ensuring that ministerial rhetoric is turned into regulatory instruments. Investors must be able to see that, if they fund a piece of infrastructure, it will be a stable prospect over the next decade. This is more straightforward for certain projects, but with others – and especially as we start the push towards net zero – a kick-start will be needed from the government, which means that it must be clear about its long-term policy objectives.

To bridge the funding gap, we need a partnership between government and private investors. We want to work with governments at various levels to help them understand where best to use private capital and how to combine it with public funds.

Lastly, private investors need to show that they are good custodians of public facilities. It is a social contract of sorts: if they are transparent about their operations, and if they can demonstrate their ESG commitments, the public will be less concerned about their involvement in essential infrastructure. ●



Lawrence Slade
CEO, Global Infrastructure Investor Association

Bridging the global digital divide

High throughput satellite technology has the potential to help connect billions of people globally. Cooperation between the British government, UK businesses, and their counterparts around the world are making its delivery a reality

Some 3.7 billion people around the world do not have internet, the majority of them living in developing countries. New and more affordable technology is helping to change that, by moving away from complex, cost-prohibitive infrastructure.

High throughput satellite technology, operating mainly in the powerful Ka-band frequency spectrum, enables local network operators and tower companies to provide cheaper access to reliable, fast communications. The setup results from an unprecedented collaboration between terrestrial and satellite operators that accelerates the provision of internet access in developing nations, including in remote regions.

"Governments and the private sector have realised they needed to be more creative about how to get internet to unconnected people. By bringing together different parts of the ecosystem, connectivity can be delivered at less than a tenth of the cost," explains Kyle Whitehill, chief executive at the satellite provider Avanti Communications.

Under Avanti's Extend service, high performance 2G, 3G and 4G can be quickly and affordably rolled out to local mobile network operators, bolstered by smaller and smartly-powered cell tower sites. The technology is being advanced even further under the company's Instant5G project with the

European Space Agency, technology businesses and universities.

The effects of such communication changes on people's lives are quickly visible. "Providing proper connectivity allows people to access education and healthcare, and work more effectively to be able to feed their family and have security," says Whitehill. "We believe everyone has the power to 'be more' – and by breaking down these technology barriers, opportunities will be unlocked for them."

High throughput satellite projects are already apace across sub-Saharan Africa, where only 26% of people have mobile internet. In northern Nigeria, satellite capacity provided by Avanti to the tower company IHS and mobile

network operator MTN has enabled mobile connections in extremely rural areas. Elsewhere, in Kenya, a collaboration between the British government, technology companies including Avanti, and private investors – as part of the Global Partnership for Education – is enabling school connectivity for underrepresented communities. The Red Cross in Kenya has also worked with Avanti to use satellite technology as part of their disaster communications, to enable rapid, reliable communications during humanitarian disasters.

As take-up of mobility services grows, users will inevitably start to rely more on data, and 5G powered by satellites will become key to meeting this demand. "Many people in Africa have relied on mobile phones for years but the big move now is access to fast data for crucial aspects of their lives. Reliable and superfast internet connectivity will give people essential support for advancing their education and businesses," explains Whitehill. A major tipping point is expected in the coming years as 5G handsets become significantly cheaper.

Alongside projects by the British government and its counterparts globally, the UK's private sector has an important role to play in helping lives in the developing world become more secure and empowered, Whitehill notes. Existing projects that Avanti is heavily involved with include helping marginalised people access education and technology in Kenya, South Sudan, Rwanda, Ghana and Angola. In Kenya alone, over 200 schools and more than 170,000 children now have internet at school.

"Getting high throughput satellite technology across Africa will bring measurable changes to people's lives. While in Europe and the UK we might think of 5G in terms of faster streaming and enabling connected cars, for Africa the first benefit will be depth of coverage that unlocks vital life opportunities," Whitehill concludes. "Given the significant growth in bandwidth that will be needed, high throughput satellite technology will enable rapid and affordable progress."



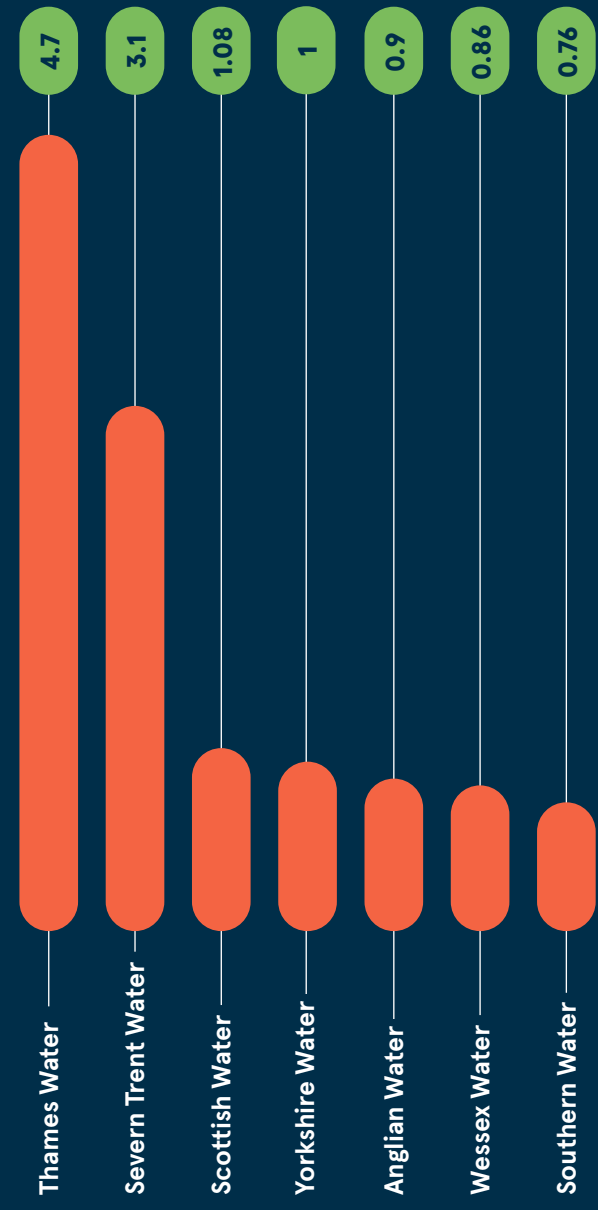
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WASTEWATER TREATMENT IN THE UK

Volume of wastewater treated daily by utility companies last year (billions of litres)

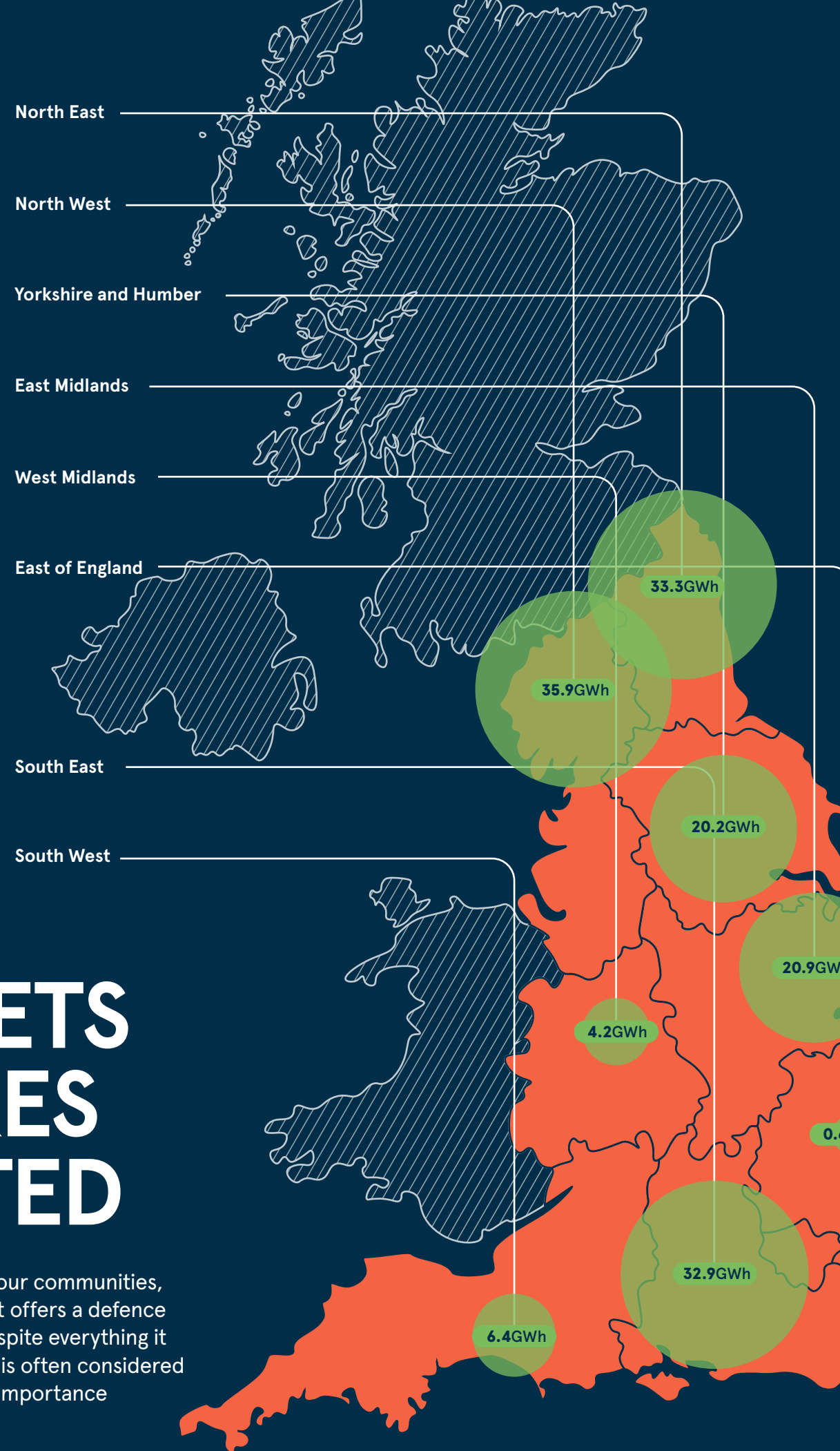
Statista, 2021



HYDROELECTRICITY ACROSS ENGLAND

Electricity generation from hydropower in England in 2020, by region

Department for Business, Energy and Industrial Strategy, 2021



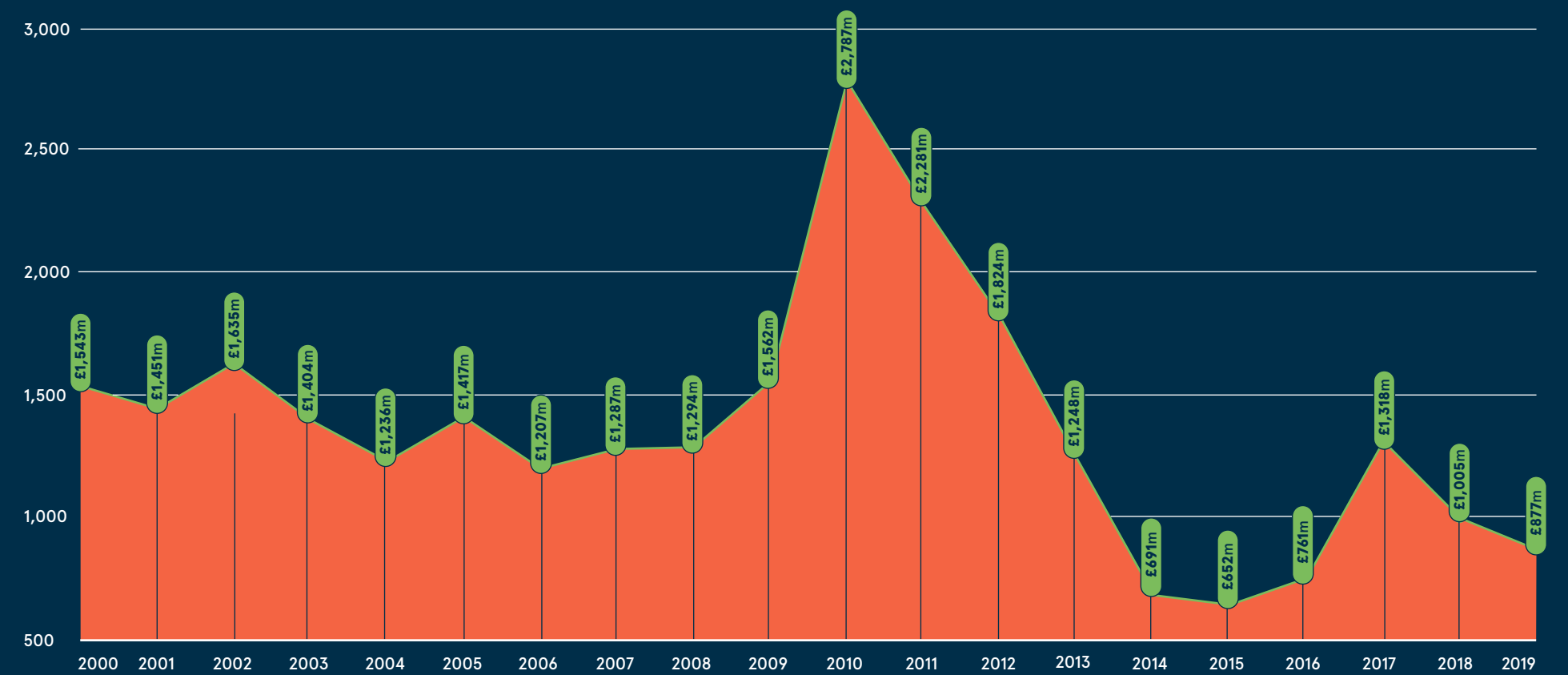
LIQUID ASSETS THE UK TAKES FOR GRANTED

It provides potable water to us; it helps to power our communities, transport our goods and manage our waste; and it offers a defence against floods and other natural disasters. Yet, despite everything it does for the nation, the UK's water infrastructure is often considered to be overlooked and underfunded relative to its importance

BUILDING WATER INFRASTRUCTURE

Annual construction output value of new water infrastructure in England, Scotland and Wales from 2000 to 2019 (£m)

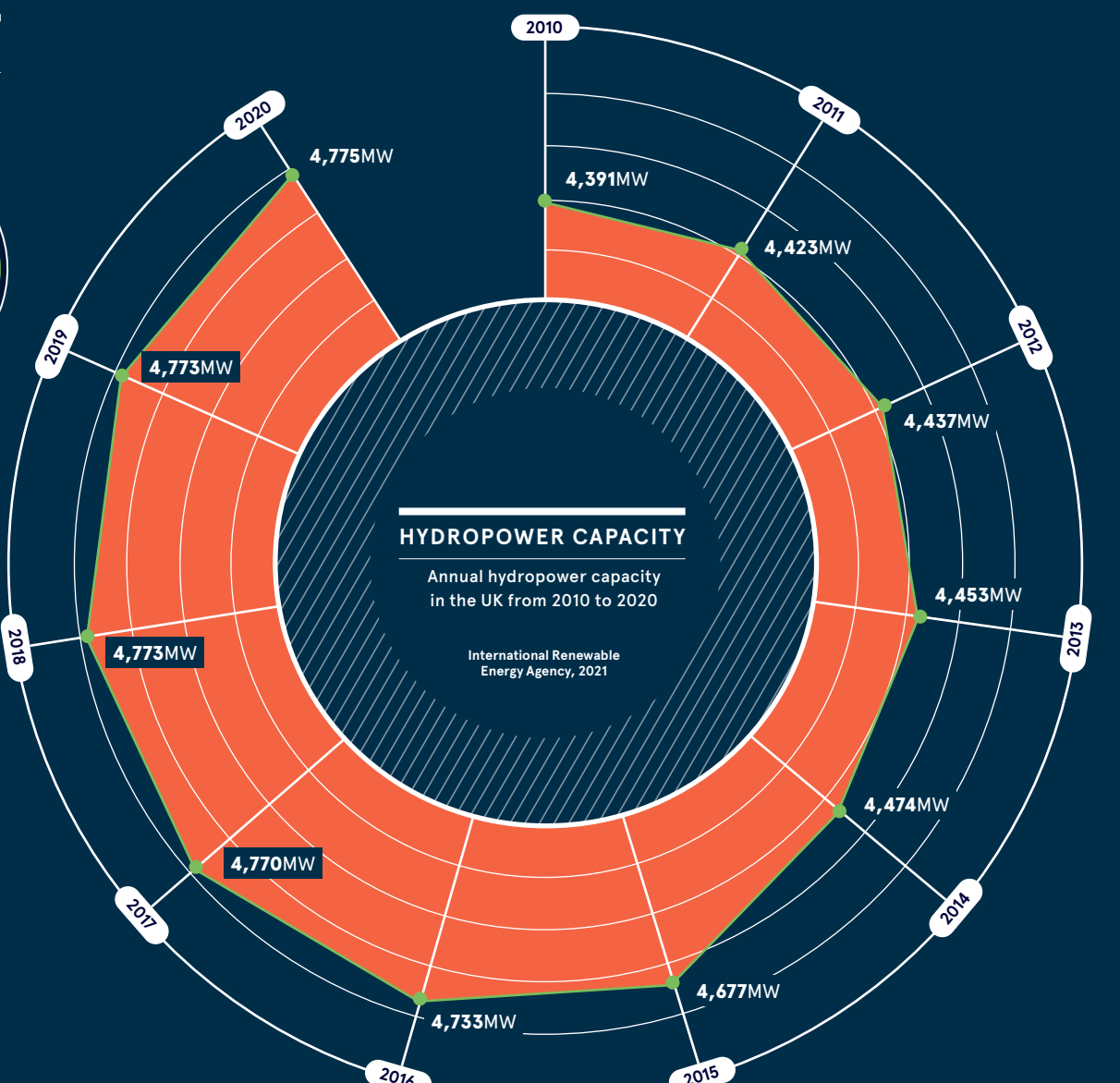
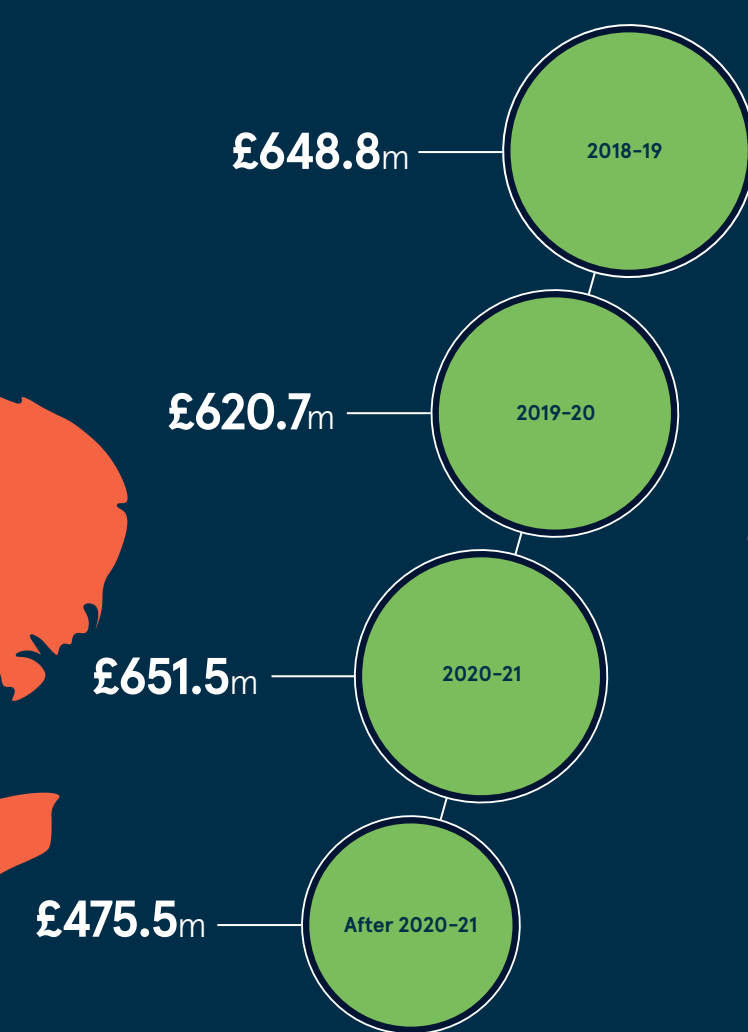
Office for National Statistics, 2021



FLOOD DEFENCE PLANNING

Value of planned UK infrastructure and construction pipeline projects for national flood defences

Gov.uk, 2018





SPACE

High hopes: the UK counts down to a real launch event

This country has been a satellite manufacturing base for many years, but only now is it set to gain the resources to put them into orbit

Mark Piesing

The UK is a world-leading centre for the production of satellites, with one missing element: the ability to launch them. But that is about to change. The private sector has been leading the development of the facilities – from Spaceport Cornwall all the way up to SaxaVord Spaceport in the Shetlands – required to make the UK a force in the launch industry. The government’s goal is to grow the nation’s share of the global space market from 5.1% to 10% by 2030. The new spaceports would earn about £4.2bn in launch revenues in the process. There are more than 4,800 satellites in Earth’s orbit, 1,800 more than last year. Elon Musk’s SpaceX alone hopes to deploy nearly 15 times that number just for its satellite internet service. The burgeoning industry has led to a rocket renaissance. Last year 144 orbital launches were attempted worldwide, of which a record 133 were successful. Spaceports have been proposed in nations ranging from the US to Indonesia. “We are one of the biggest manufacturers of small satellites, but we don’t yet have the capability to launch them,” says the UK Space Agency’s commercial spaceflight director, Matt Archer. With demand increasing rapidly, particularly for

the launch of small satellites, there is a real commercial opportunity, he says, especially as Westminster is able and willing to help the industry grab a slice of the action. “This will give the UK an end-to-end supply chain, which we know from surveys is what customers want,” Archer says. “To a degree, it’s also about the UK developing strategic independence by gaining its own capability.” The refusal of the Russian state space agency, Roscosmos, to launch a rocket carrying 36 OneWeb satellites because of the UK’s “hostile stance towards Russia” has highlighted the risks of relying on other nations. OneWeb is a global satellite internet access provider in which the UK government has a big stake. Chris Larmour is co-founder and CEO of Orbex Space, a launch company with a rocket factory in Forres, near Inverness. Orbex is planning to launch rockets up to 12 times a year from a single launchpad at the £17.3m Space Hub Sutherland in the Scottish Highlands, providing the spaceport with vital income. It’s vital that the UK has its own spaceports, according to Larmour, who says: “It is important for us to be able to drive to the spaceport in a couple of hours rather than having a long logistical chain that involves flying or shipping. If there weren’t

spaceports in the UK, we’d have to go overseas to Norway or Sweden or even French Guiana to launch these rockets – and that destroys the cost model for a rocket of this scale.” When most people hear the word ‘spaceport’, they might first envisage a vast facility such as Nasa’s Kennedy Space Center. The UK’s proposed spaceports are far more modest in scale. SaxaVord will have three launch pads on the Lamba Ness peninsula on the Shetland isle of Unst at a cost of £43m, rising to £100m over five years. While Space Hub Sutherland will launch rockets from a single partner, SaxaVord will generate revenue from several, including UK-based Skyrora. Others include US aerospace giant Lockheed Martin and its rocket technology partner ABL Space Systems, which are planning the first vertical launch of a satellite in the UK by the end of this year. Both of the Scottish spaceports intend to launch mini- or micro-rockets the old-fashioned way: vertically, just like the rockets that blast off from Cape Canaveral, as opposed to horizontally, when they are launched from an aircraft. They are about the same size as an intercontinental ballistic missile rather than one of Elon Musk’s much longer Falcon 9 workhorses. This is because they are designed to carry small satellites and nano-satellites into the low Earth orbit needed by clients such as OneWeb and SpaceX’s Starlink. The extreme northern location of the two Scottish spaceports makes it easier to launch such satellites, which are intended for polar orbit. And, surrounded as they are by sparsely populated land and the Atlantic, they can go about their business causing minimal risk and disruption to the public. At the other end of the country, Spaceport Cornwall plans to launch satellites horizontally up to 12 times a year by 2030 from rocket-carrying aircraft such as Virgin Orbit’s Boeing 747. These will take off and land using the existing runway at Newquay Airport, alongside planes ferrying holidaymakers to and from the resort. What is the UK government’s role in establishing spaceports? Initially, it seemed set to select national champions from several competing bids. This competition was then cancelled in favour of a licensing system through which many spaceports will be established, whether for horizontal or vertical launches. The government has supported this by putting up more than £40m in grant funding, including £2.5m to help develop Sutherland; £5.5m to Orbex for a new rocket; £23.5m

“It is important for us to be able to drive to the spaceport in a couple of hours rather than having a long logistical chain

to Lockheed Martin to establish its launch operations at SaxaVord and build and test a space vehicle; and £7.5m to support a launch by Virgin Orbit from Spaceport Cornwall. “The government has set a target for building a native launch industry and provided some encouraging funding to get that done,” Larmour says. “Seed grants of a few million pounds aren’t much in space launch terms, but they have been enough to get companies moving. They also act as a seal of approval that means investors take them seriously.” Westminster’s policy of nurturing spaceports led to the Space Industry Act 2018 and the launch of the UK’s spaceflight programme. The Civil Aviation Authority approves licences. Instead of a fixed-rocket threshold for operators to meet, companies in the UK must demonstrate that they have considered the risks and have, as much as reasonably possible, taken appropriate precautions to minimise them. “The government wants a balance between competition, access to US [customers], attracting known providers and building a UK launch capability,” Archer says. The US and UK governments have signed a ground-breaking deal on technology safeguards to protect export-controlled tech on US vehicles flown from UK spaceports. Westminster ‘owns’ space policy, but devolved governments such as Holyrood – as well as local authorities – see spaceports and their supporting ecosystems as economic opportunities for local communities and will offer help accordingly. A spaceport the size of Sutherland should generate about 40 new jobs, for instance. Westminster views spaceports as a commercial endeavour. It believes that the government’s role is to de-risk the initial investment and stimulate a market that might not otherwise exist to the same extent. “In the UK there are opportunities for multiple spaceports, each with its own niche,” Archer says. “But there will be consolidation if the demand for them isn’t there.” That said, the government would be unlikely to sit and watch if the whole industry were to decline. “That’s one thing that we will continue to monitor and test,” Archer says. “It is part of the regular conversations we’re having with Cornwall, Shetland and Sutherland. We have a good deal of confidence in those

WELCOME TO OUR PADS

Proposed sites for seven UK spaceports

- Spaceport 1
- Spaceport Machrihanish
- Prestwick Spaceport
- Spaceport Snowdonia
- Spaceport Cornwall



“In the UK there are opportunities for multiple spaceports, each with its own niche

projects. For the others, it is a developing business case that we are continuing to see.” The government hasn’t ruled out the future development of more powerful rockets that can lift bigger payloads into orbit, but a heavy launch capability would require it to get far more deeply involved. “That’s one thing we have looked at and we continue to keep under review, but it’s a significant undertaking and it’s not a commercial market,” Archer says. “For now, the strategic ambition isn’t there.” Building a spaceport is a straightforward undertaking, whereas running one is not, according to Scott Hammond, chief operating officer of SaxaVord Spaceport. “I know that the civil engineers won’t thank me for saying this, but the build is relatively simple: it’s about constructing concrete launch pads and industrial sheds. The hard part is the global nature of this business. When we launch, we may have to monitor the rockets and look at all the safety aspects out to 5,000 nautical miles from Shetland. The drop zones for some of our stages are likely to be up by Greenland.” An orbital rocket has never been launched from British soil. That’s set to change this year, potentially turning the UK into a leading player in satellite launch and restoring a capability it gave up 60 years ago. ●

Commercial feature

Q&A Why the future of infrastructure relies on long-term asset investment

The rapid rotation of asset ownership, driven by a short-lens investment approach, will fail to solve infrastructure issues, says **Gwénola Chambon**, CEO at Vauban Infrastructure Partners



Q How has infrastructure evolved as an asset class in recent years?
A Infrastructure is already a valuable asset class. The predictable, resilient cash flows provided by infrastructure ownership, especially public assets through which essential services are provided to communities, has led to this. But there are two phenomena that are making it even more popular, while reshaping infrastructure for the future: the acceleration of digitalisation at every level and the need to tackle climate change issues. These parallel trends require a lot of capex investment and will therefore drive significant activity in the market over the next decade – and beyond. For these reasons, infrastructure has become quite a popular asset class with interest from different kinds of investors, meaning that asset managers are able to generate strong returns by merely rotating assets. At the moment, they are incentivised to sell because it is a bull market and, as a result, the average time spent

owning any given asset is only around two and a half years.
Q What is the impact of this accelerated rotation of assets?
A The main impact is that most asset managers don’t feel they need to spend time creating extra value from those assets because the market is so dynamic that they can just sell what they purchased a couple of years before. This is really odd, and quite damaging, when infrastructure is known as something that takes time to build and deliver, and is supposed to last for several generations. Crucially, it’s just not in line with the very spirit of infrastructure and it’s not likely to drive the meaningful investments in core infrastructure to adapt to climate challenges and digitalisation.

Q What approach is taken at Vauban Infrastructure Partners?
A If there is one thing that characterises our approach it’s our long-term vision. Amid the accelerating rotation of asset ownership in recent years, we have sharpened our focus on the longer term. At Vauban, we are convinced that infrastructures must be efficient in the long run and procuring services resiliently over time requires constant adaptation to the needs of communities, which are evolving incredibly quickly. When assets are owned over long periods of time, as they are at Vauban, we are able to make the required investments to adapt infrastructures dynamically to climate challenges and emerging digitalisation trends. We are also able to measure our assets in ways other managers cannot. For instance, we measure the temperature of all our assets to ensure they will be physically resilient to a warmer

climate and more extreme weather events in the decades to come. A long-term approach provides the ability to unlock additional layers of value and gives private capital providers the proper license to operate those assets. If you’re not actively involved in long-term sustainability, constantly adapting your assets and focusing on the high-quality of service to end users, you’re at risk.

Q What can we expect in the future?
A The main point is the greater involvement of citizens in the asset management equation, alongside the greater collaboration between public sector and private finance. We’ve been observing a growing awareness among citizens of the importance of infrastructures that provide essential services, particularly during the pandemic when services had to be provided digitally. With so much investment to be procured in the next 10 years, climate awareness and the need for investments to meet long-term community needs will drive greater involvement from citizens in capex decisions. The public sector will not be able to finance all these capex needs and will continue to rely on the private sector for capital. But it can only work if citizens are involved in this equation. The next 10 years of infrastructure investments will be shaped by the dialogue between three parties: citizens, the public sector and the private sector.

For more information, visit vauban-ip.com



“At Vauban, we are able to make the required investments to adapt infrastructures dynamically to climate challenges and emerging digitalisation trends



Matthew Bridger / Alamy Stock Photo

REGIONAL DEVELOPMENT

Can the government close the northern infrastructure gap?

Westminster makes much of its ambitions for narrowing the north-south economic divide. But critics believe that a more targeted and better funded plan than *Levelling Up* is needed

Chris Stokel-Walker

Levelling up' critical infrastructure is an essential pillar of the government's socioeconomic strategy, aimed at bridging the gulf between the north and the south. But is there substance behind all the rhetoric? Buoyed by their electoral victories in northern England's 'red wall' seats – so called because they were such Labour strongholds – the Conservatives are attempting to redress the imbalance between the regions. And that imbalance is very real. For instance, in the five years to 2019-20, London received infrastructure investment at the equivalent rate of £12,147 per person,

compared with £8,125 per person in the north. In response, the government recently published its *Levelling Up the United Kingdom* white paper, promising to spread opportunity and prosperity to all parts of the country, including the north. This features 12 initiatives aimed at dragging the UK's "forgotten communities" up to scratch in the coming decade. These will aim at shifting power from Westminster into the hands of devolved regional authorities, increasing domestic public investment in R&D by 40% in the regions, including the north. The goal is to improve everything

from literacy levels to 5G broadband access and transport systems. That's what the government is saying, at least. What are its chances of success? Henri Murison, a director at the Northern Powerhouse Partnership, is unconvinced by what he's seen so far. "It's a case of *Levelling Up* white paper: good; Treasury resolve: less good," he says. "The idea of innovation deals focused on places like Manchester, Birmingham is a great idea, but we need more of them and they need to have more than £100m attached to them." Murison thinks that the previous government initiative that aimed

to boost the north of England – the Northern Powerhouse, from which his organisation gets its name – was a stronger proposition that was likelier to succeed. It placed more control over spending at the regional level, whereas the *Levelling Up* agenda is largely controlled from London and includes cash for southern communities. A spokesman for the government says that a "key ambition of our *Levelling Up* agenda is to take decisive action to spread opportunity and improve connectivity between towns and cities across the midlands and the north". The government hopes that by 2030 "the standard of local public transport connectivity across the country will be significantly closer to that of London, with improved services and simpler fares", the spokesman adds, noting that £96bn will be invested in a rail construction strategy for the midlands and north that will be delivered over the next 30 years. But critics believe that this figure isn't sufficient and is too thinly

The chancellor recently toured the site of the historic Spode pottery works in Stoke-on-Trent, which is being redeveloped using money from the government's levelling-up fund

spread across regions, rather than being focused on the north alone. The Institute for Public Policy Research (IPPR) North think-tank has analysed transport spending across the country, finding striking disparities among the regions. Between 2009-10 and 2019-20, the north received £349 per person in transport spending. That contrasts with an average of £430 per person across the UK and £864 in London. This huge gap in investment has wider ramifications. "The only thing that's 'levelled up' since the Northern Powerhouse and *Levelling Up* rhetoric began is the transport investment gap," says Arianna Giovannini, interim director of IPPR North. "This story is becoming far too familiar and it prevents regions such as the north from realising their potential." Northern investment experts are convinced that the current plans are insufficient. "It's a start, but it is only the start," Murison stresses. "It's not the whole. It's not enough to get us to where we need to be." Not everyone is convinced that it's the right strategy in any case. Dr Nicola Headlam is chief economist and head of public sector at Red Flag Alert, a Manchester-based provider of business insights. She says: "The integrated rail plan is not just the wrong plan; it's so wrong that I can't understand what they're trying to achieve with it." That plan is a 161-page document commissioned by Grant Shapps, the secretary of state for transport. It would overhaul the East Coast Mainline and reduce journey times

“The only thing that’s ‘levelled up’ since the Northern Powerhouse and *Levelling Up* rhetoric began is the transport investment gap

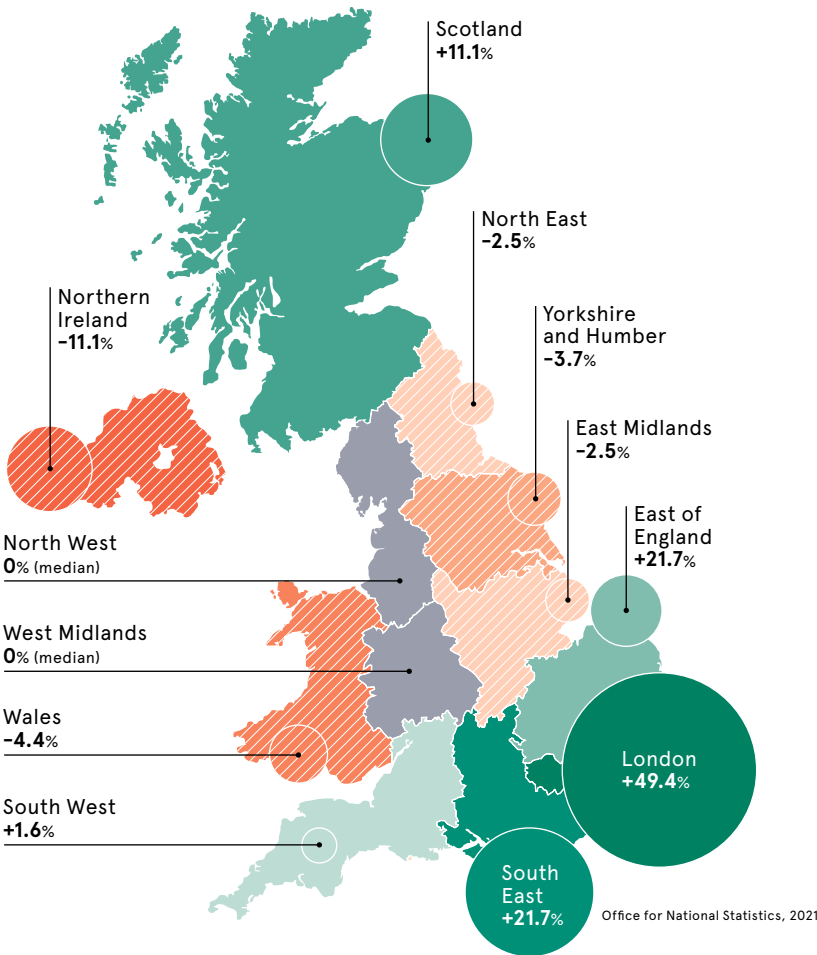
“The goal is to improve everything from literacy levels to 5G broadband access and transport systems

in the north of England and the midlands. But many critics view it as a meagre substitute for the development of High Speed 2's eastern leg. This aimed to improve connectivity between Birmingham and Leeds, but was controversially cancelled in November 2021. "It just feels like spite from the Department for Transport's side to do that and mess about with new lines," Headlam says. "I simply don't understand why. If *Levelling Up* is to mean anything, surely this is when the government could have been generous." Leeds is the biggest European city with no mass transit system. The journey times to traverse some parts of the north take almost as long as travelling the length of the country from Newcastle to London on the East Coast Mainline. Such factors weigh heavily on the regional economy, observes Tom Forth, co-founder and chief technology officer of The Data City, a Leeds-based firm that works with governments, analysts, investors and researchers "The main impact is that the economies of our cities are about half as strong as their equivalents in the rest of Europe," he says. If you take an equivalent city in continental Europe and compare it with Manchester or Leeds, "you'll

find that the European city has better public transport and a much stronger economy. It is then able to pay more tax, generate more revenue for public investment and develop more quickly." England's northern cities perform poorly on transport compared with their southern and European counterparts. "You can't get into them anywhere near as well as you can in their Continental comparison cities, or anywhere near as well as you can in London," Forth says. This means that the development of these cities is, in effect, being retarded. "You don't have the mass of workers you need to fill jobs. It just slows everything down." The government has suggested numerous ways to close the north-south divide. Many people think that several of its plans are aimed at the wrong things, but scrapping them isn't an option, Forth stresses. "That would simply mean a continuation of what happens now," he says. "London becomes increasingly prosperous. More and more of the fastest-growing companies and best jobs are there. They will have to pay more and more tax to fund the weaker regional economies." This is a national concern, says Headlam, who adds: "The point is that everyone suffers from a lack of investment in infrastructure." ●

THE UK'S REGIONAL DIVIDE

Output per hour relative to the median in 2019, by region



Q&A

Infrastructure investors push the circular economy forward

As interest in the circular economy grows, some infrastructure investors are seeking more sophisticated, higher-return opportunities. **Aaron Church**, partner in the infrastructure team at 3i, talks about evolving opportunities for investors and the planet



Q What factors, beyond the energy transition, are critical to the world achieving its sustainability goals?
A Everyone is talking about the transition to lower carbon and that is clearly very important, but another crucial factor is the circular economy. This is about increasing recycling and putting less waste, such as plastics, into landfill.
Q What are the key elements of the circular economy?
A The circular economy is an evolution of the way we produce and consume goods, and what we do with waste. For manufacturers, this means designing products to be more durable, reusable and recyclable. It also involves using less packaging and ensuring that any packaging that is produced can be easily recycled – something that is especially important with the significant rise in online shopping driven by Covid and the extra packaging used for home deliveries.

“Investors who moved early into the circular economy are now increasingly looking at more complicated parts of the sector, such as biogas, recycling plants and waste-to-biofuel opportunities

When products and packaging are no longer able to be reused and become waste, then we should aim to recycle as much of the component materials as possible. We can also recover energy from the residual waste that cannot be recycled.
Q Which of your investments contribute to circular economy objectives?
A In the Netherlands, we have Attero and in Italy, Herambiente. They recover recyclable materials from waste, produce granulates from used plastic for use in new products, produce green gas from organic waste, and generate heat and electricity by incinerating residual waste that would otherwise go to landfill. In the UK we own Infinis, the leading generator of low-carbon power from captured methane, which comes from waste decomposing in landfills and disused coal mines. These activities all reduce the use of oil & gas and greenhouse emissions. Furthermore, all our portfolio companies have sustainability strategies, which include objectives around reducing waste.

Q What are the barriers to delivering on circular economy objectives and how can we overcome them?
A The overall recycling rate in Europe is around 50%, so there is room for improvement. However, materially increasing this rate will require new approaches, new technologies and probably higher costs. Recycling yields have historically been improved by investing in better sorting and cleaning equipment. Innovative new recycling technologies are now being developed that are much better at handling mixed materials and contaminated waste

streams, and our portfolio companies are closely following these developments with a view to investing in the right opportunities. Materially increasing recycling rates is likely to take many decades and achieving recycling rates of 100% may never be feasible. Hence using incineration to recover energy from waste that cannot be recycled will continue to be a key part of the circular economy for the foreseeable future. Carbon capture may be a way of making energy from waste plants even more sustainable and this is something we are exploring with some of our portfolio companies.

Q How will the circular economy evolve as ESG credentials become more important for infrastructure investors?
A Even five years ago, we saw limited infrastructure investor interest in the sector. However, this has changed and there is now growing interest in circular economy companies, particularly in the energy-from-waste sector. Investors who moved early into the circular economy are now increasingly looking at more complicated parts of the sector, such as biogas, recycling plants and waste-to-biofuel opportunities. Looking ahead, we anticipate the continued focus on ESG credentials will increase the number of infrastructure investors interested in the circular economy and contribute to a more sustainable future.

For more information, please visit [3i.com](https://www.3i.com)



REGULATION

Exporters to EU braced for more carbon bureaucracy from Brussels

The transitional phase of a radical new emissions policy will start in 2023, with significant implications for infrastructure inside the single market and beyond

Heidi Vella

Nearly two decades ago, the EU introduced its carbon emissions trading scheme (ETS) in a bid to incentivise heavily polluting industries to decarbonise. While this was considered radical policy-making at the time, so-called carbon leakage – where businesses move overseas to avoid the tax – has reduced its impact.

Legislators in Brussels are preparing to unleash a new framework in early 2023 that’s designed to solve this problem. Known as the carbon

border adjustment mechanism (CBAM), it will apply a carbon price to imports of electricity, iron, steel, cement, aluminium and some fertilisers. It would be equivalent to the ETS: currently about €65 (£55) per tonne of CO₂. The CBAM will also eventually phase out the ‘free allowances’ given to heavy industry under the ETS to deter offshoring.

Firms won’t have to pay any net tax until 2026, but next year they must start measuring the carbon embedded in their trading products.

“The idea is to have an ETS that bites,” explains Yves Melin, a trade lawyer and partner at Reed Smith. “The removal of free allowances and the introduction of CBAM at the border will require everyone to pay for the right to emit carbon, creating a strong incentive to decarbonise industrial processes.”

In practice, this means that firms using imported CBAM products – such as those in the construction, energy and automotive sectors – will need to show how much CO₂ is embedded in them and purchase CBAM certificates accordingly.

This, Melin says, creates a new risk for businesses. “Many firms could be priced out because either they aren’t importing green CBAM products or they are but can’t prove it. There is no time to waste – the future belongs to the prepared.”

Manufactured goods that contain CBAM commodities are also vulnerable to carbon leakage, because raw material costs will probably increase when the tax takes effect in 2026. This is why Melin expects the mechanism to be extended to downstream products “by the end of the decade”.

The overarching ambition of the revolutionary new policy is to reduce greenhouse gas emissions. Steel, for example, is accountable for an estimated 8% of global carbon emissions.

The CBAM can support European users to buy more responsible steel by effectively levelling the price differential between cheaper, higher-emission steel made in China, for example, and carbon-free steel produced in Europe, says Carla Wellens, director of quality, health, safety and the environment at offshore wind fabricator Smulders. Her firm has committed to use, procure or specify 100% net-zero steel

“The removal of free allowances and the introduction of CBAM at the border will require everyone to pay for the right to emit carbon

by 2050 as part of SteelZero, an initiative run by the Climate Group.

It’s expected that several steel manufacturers in Europe will be producing low-carbon steel by the middle of the decade. These are based mostly in Sweden, where about half of the energy generated is from renewable sources.

Without the CBAM, “if clients are looking only at price, not emissions, then the low-carbon steel will find it hard to compete with products coming out of the Middle East or other parts of Asia”, Wellens says. But these mills won’t produce enough steel to meet European demand by 2026, meaning that the cost of building new infrastructure in the EU is still going to rise.

The impact will also be felt elsewhere. Exporters from European Economic Area countries that participate in the ETS – Switzerland, for instance – will be exempt from the measures. Other countries can negotiate to have their carbon trading systems recognised in this way. But the UK is particularly exposed to the CBAM, because Westminster decided not to link its ETS to the EU’s version. Initially, the CBAM will add yet another layer of paperwork for UK exporters already grappling with a post-Brexit increase in bureaucracy.

Firms could also experience a double whammy in carbon taxes, says Professor David Bailey at the Birmingham Business School, who is a senior fellow of the Economic and Social Research Council’s UK in a Changing Europe programme.

“UK firms are already paying for carbon locally and could then face a tax to export to the EU. Some sort of alignment will be necessary. Otherwise, pretty soon we’ll be put at a competitive disadvantage,” he says.

British Steel’s environment and sustainability director, Lee Adcock,

has called for the UK to establish its own mechanism, which the government is considering. If the EU is establishing its mechanism, there’s no alternative but to set up a UK version or retain regulatory alignment with the bloc, he argues. Such a measure “would protect domestic steel manufacturing from high-carbon imports as we invest and decarbonise our processes”.

The CBAM is expected to fall within the remit of the Northern Ireland protocol, although this is yet to be confirmed.

Some believe the upcoming legislation has encouraged others beyond Europe, such as China, to move on carbon pricing. China introduced a national carbon trading system last year.

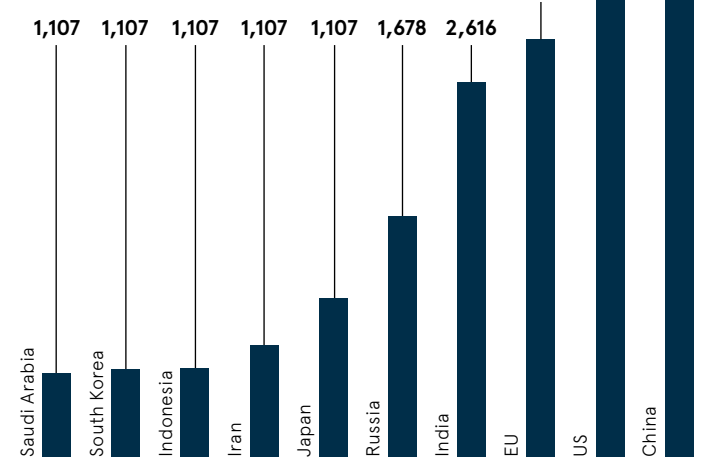
But there is a criticism that the framework could have a negative impact on the developing countries that are trading with the EU, as they may be unable to do the complex carbon accounting required. There have been suggestions of a ‘developing-country mechanism’ that could see the reinvestment of CBAM funds via aid or another system.

Such details are yet to be decided as the European Commission, Parliament and Council prepare to produce the final draft by as early as June. But, given the increasing costs and supply chain problems that have been dumped on businesses as a result of the pandemic and Russia’s war on Ukraine, might the legislators water it down?

Melin doesn’t think so. “There is a very important policy objective in the ETS and the CBAM: it is not only to reduce greenhouse gas emissions but also to help the EU become less dependent on imported gas and oil,” he says. “The ongoing crisis has made this even more of a priority. There is energy sovereignty in it for the EU – nothing is more crucial than that right now.” ●

CHINA IS THE WORLD’S TOP CO₂ EMITTER BY FAR

CO₂ output of the biggest 10 global emitters in 2019 (millions of tonnes)



United Nations Conference on Trade and Development, 2021

Nicolas Schmit, EU commissioner for jobs and social rights, is one of several Brussels legislators set to be involved in drafting the final version of the Carbon Border Adjustment Mechanism



REUTERS / Alamy Stock Photo

Commercial feature

Investing in infrastructure to solve societal challenges

Energy efficiency and digital inequality are very different challenges, but they both present an investment opportunity to create sustainable income while contributing to a better society for all

The pace of societal change is faster than ever, yet it’s not currently fast enough to overcome the major barriers standing in the way of creating a cleaner, greener and more equal planet and economy. Technology is powering widespread progress, but better infrastructure is required to accelerate the transition to a zero-carbon digital economy, while closing a damaging digital divide. Fortunately, investors today are as conscientious as they are savvy to the opportunities.

The government’s ambition to cut emissions to net zero by 2050 is well understood, but the challenges are less so. Demand for solutions and systems to decarbonise the UK power system continues to surpass supply, and renewable energy is limited by intimacy and curtailment. The wind doesn’t always blow, which creates volatility in the grid; even when it does blow, sometimes renewable energy has to be switched off due to a lack of demand at that moment.

Improving energy efficiency is key. Along with wind and solar power, it will provide half the emissions savings in the next decade and without those gains renewables will struggle to displace fossil fuels in electricity generation, according to the International Energy Agency.

A symbiotic relationship is needed between renewables and battery storage to deal with any instabilities that arise within the grid. Carbon renewable sources accounted for 22% of the UK energy supply in 2020 and this is predicted to grow significantly over the next two decades. The UK’s battery storage capacity, meanwhile, is expected to double by 2027 and then again by 2035, driving an exponential increase in the amount of battery storage required.

The capital investments needed to create this infrastructure are not only crucial to meeting net-zero goals but also present an opportunity for strong long-term income. Triple Point Energy Efficiency Infrastructure Company plc (TEEC), an investment trust that focuses on energy efficiency assets in

the UK covering generation, distribution and consumption, has secured under exclusivity a near-term pipeline of £108m of grid-scale battery energy storage assets.

“This will greatly improve the efficiency of the UK electricity system while creating jobs, driving innovation and saving consumers, businesses and governments money,” says Jonathan Parr, partner and head of energy at Triple Point. “Amid all of that, we can generate sustainable income for our investors and contribute to a solid portfolio amongst our other investments.”

“The UK urgently needs to upgrade its energy infrastructure and the government has a big part to play through funding projects and policy mechanisms such as the Public Sector Decarbonisation Scheme and Green Heat Network Fund, which Triple Point was appointed to deliver in March 2022. However, private capital is also absolutely key to a cleaner, greener future. Energy efficiency projects offer an exciting way for investors to be part of that important purpose, while also benefiting financially from very profitable outcomes.”

Technology is not only transforming energy generation, distribution and consumption, but every other industry too. The internet is the window to opportunities, knowledge and skills in this increasingly digital world, driving economic growth and development globally. As such, a fast and reliable internet connection is now more than just a luxury – it’s a 21st century human right.

Yet more than a third of the world’s population has no ready access to the internet, risking the crass formation of a two-tier society divided by the haves and have-nots of digital connectivity. This digital divide is most pronounced in developing countries, where only 35% of people have access to the internet. Increasing this to 75% would add as much as \$2tn to the collective GDP of these nations, creating more than 140 million jobs, according to the UN.

That’s not to say the problem isn’t also brewing closer to home. Children from lower income families are already



disadvantaged, with those eligible for free school meals or who had been in care half as likely to achieve a sufficient pass grade in GCSE English and Maths in 2019. The internet has the power to level playing fields, but only if access is there. ONS research found that only 51% of households earning between £6,000 and £10,000 had home internet access.

Divisions were amplified during the Covid-19 lockdowns, when the government tried to distribute laptops and 4G routers to low-income families so their children could keep up with online lessons. With education systems, and even healthcare organisations, on their own digitisation journey towards more virtual modes of delivery, the knock-on impacts of the pandemic offered a worrisome glimpse into future inequality issues should the digital connectivity gap not be closed.

In 2020, almost \$400bn was spent on new digital infrastructure across fibre, data centres and wireless networks. But this kind of annual capital investment will need to increase in order to better prepare the digital infrastructure for the future. This is where Triple Point is seeking to move the dial with Digital 9 Infrastructure plc (DGI9), an investment trust that invests in infrastructure assets that will help to deliver, among other things, a reliable and functioning internet.

“There is a significant societal need to improve connectivity globally by investing in a portfolio of critical digital infrastructure assets in subsea and terrestrial fibre, wireless networks and data centres,” says Thor Johnsen, head of digital infrastructure at Triple Point, which is participating in building a network from Europe to India, among other projects. “Investing in our digital infrastructure is vital to driving economic growth and equality in an interconnected world.”

Once again, however, participating in advancing this social imperative can also achieve the dual investment benefit of delivering sustainable, long-term income. “Like energy efficiency, the government is relying on private capital to continue to deliver a reliable functioning internet. Given the increasing importance and vital role digital infrastructure is playing for industry and

\$400bn

was spent in 2020 on new digital infrastructure across fibre, data centres and wireless networks

society as a whole, infrastructure projects can provide a highly predictable cash flow return,” Johnsen adds.

As well as offering investors access to exciting sustainable asset classes with long-term capital return and income, investment trusts can also contribute to a diversified and robust investment portfolio. This is best illustrated by their 17.8% return in 2020, when stock markets were tumbling due to Covid volatility. And with more than 300 trusts focused on asset opportunities across more than 30 different sectors now trading on the UK stock market, there’s an abundance of choice.

For more information, visit triplepoint.co.uk



Triple Point

Private capital is also absolutely key to a cleaner, greener future



Like MacGregor/Bombardier via Getty Images

FUNDING

The UK faces tough choices to bankroll its infrastructure ambitions

There’s an urgent need to spend more on critical infrastructure such as power stations and hospitals. But, with public finances under pressure, the government requires new ways to raise the money

Martin Barrow

The UK government’s latest *National Infrastructure and Construction Pipeline* policy paper promises £650bn-worth of infrastructure programmes over the next decade. You cannot fault its ambition, but where will all that money come from?

World-class infrastructure will be the foundation to “build back better, uniting and levelling up the country as we recover from the pandemic”, the government says. Roads, railways, airports, schools, hospitals, digital networks – the list is long and the aims are high.

The UK is not alone in its vision for a golden era of infrastructure spending that will bring jobs and prosperity. The US, for instance, is planning to spend \$1.2tn (£900bn) over what President Biden has called “the decade of infrastructure.” The European Commission has unveiled an infrastructure investment strategy designed to mobilise up to €300bn (£250bn) of investments in global development by 2027. And infrastructure spending has had a huge role to play in

China’s meteoric economic rise over the past three decades. As its GDP growth rate decreases, it is turning once again to such investments as a stimulant.

Ambitions are one thing but financing them is quite another. As the world seeks to shake off the Covid crisis, state spending and government borrowing are already at record levels. Taxation is high and, after many years of cheap money, the cost of borrowing is rising. Inflation has returned with a vengeance: high energy prices and a shortage of resources are pushing up the cost of projects. The need to future-proof infrastructure against climate change and meet the UK’s commitments arising from the United Nations’ sustainable development goals adds many billions to the cost of construction.

Nonetheless, investment in infrastructure is critical and cannot be delayed. Essential infrastructure has been starved of investment over the past decade as a result of the global financial crisis of 2008. In the UK, for example, the backlog

After a decade of wrangling, Westminster approved Electricité de France’s bid to build what’s set to become the most costly nuclear power station built to date, Hinkley Point C in Somerset (see page 26)

of spending on NHS buildings is estimated at more than £9bn – simply to address crumbling clinics and hospitals. The repair bill for schools in England is put at £11bn.

Against this inauspicious backdrop, loftier ambitions have been scaled back already. Projects such as High Speed 2 and Crossrail 2 have been clipped as spending priorities have shifted. Again, the UK isn’t alone: the US infrastructure programme, while still huge, has been reduced from the original proposal because of a backlash against tax rises.

The UK government has indicated that it hopes at least half of the targeted £650bn infrastructure funding will come from the private sector. The new UK Infrastructure Bank (UKIB), set up after Brexit to replicate part of the role traditionally played by the European Investment Bank (EIB) in the UK, will play an important role in building bridges with business.

The government believes that the UKIB will be more aligned with its policy aims than the EIB and be more targeted. The objective is for the UKIB to assume the startup risk of a given project before attracting traditional investors once the works have started.

The bank is due to publish its first strategic plan in June, including investment priorities. It has an initial £12bn of capital to deploy and £10bn in government guarantees.

It made its first investment in February when the Tees Valley Combined Authority agreed a 50-year loan of £107m to fund its South Bank Quay project. This would transform part of a former steelworks into a facility to service the offshore wind sector.

“It’s not only renewable energy projects that could be considered for such loans,” says Mark Casey, a specialist in banking and finance and legal director at Womble Bond Dickinson. “Transport infrastructure – which has always been a hard sell in terms of attracting private sector investment – is an essential part of the road to net zero. If authorities get their pitch right, whether it’s for local bus services or other transport links, they might be able to kick off projects with UKIB-backed funding.”

The UKIB will have to meet subsidy rules, although its proposed offering of 60 basis points above gilts is considerably cheaper than the commercial market.

Previous governments have leant heavily on schemes such as the private finance initiative (PFI) and its successor, PF2, to form private sector partnerships for infrastructure

“Greater alignment between users and payers will need to be found if governments are to deliver on their infrastructure agendas

projects. But such arrangements have fallen out of favour, mainly because of their legacy costs to the public sector, which are widely considered excessive. For example, PFI deals that financed £11.8bn of hospital building across England will cost the NHS £79bn in repayments over 30 years.

Although reviving PFI/PF2 would be politically difficult, experts believe that some form of public-private partnership would be vital to secure the infrastructure investment required. Daniel Woolf is a principal consultant at infrastructure consultancy Aecom and a former senior policy adviser at the Confederation of British Industry. He believes that championing private finance delivery models should be given priority to fill the void left by PFI’s demise.

“Public-private partnerships can be an effective mechanism to raise investments in infrastructure,” he says. “They are still used widely in countries such as Norway, the Netherlands and Australia. Unfortunately, PFI became synonymous in the UK with a small number of high-profile failures. This detracted from its many strengths.”

Woolf says it would be helpful for the next *National Infrastructure and Construction Pipeline* to state the infrastructure projects that will seek private finance and the private finance delivery models to be used in every case. This would restore confidence in the government’s appetite to support private sector investment and finance in UK infrastructure and provide a clear pathway to participation for businesses. This paper could also be showcased globally to publicise projects that the UK is backing.

“The solution needs to be multifaceted,” Woolf argues. “There are numerous options, depending on what type of project and timeframe is involved.”

For example, the Thames Tideway Tunnel sewer construction programme was funded using an innovative regulated asset base model, which resulted in a lower cost of capital and an increase in Londoners’ annual water bills of £13 to £25 – considerably lower than the £70 to £80 originally estimated. This model might not be appropriate for other programmes, of course.

Richard Threlfall is KPMG’s global head of infrastructure and a former adviser to the secretary of state for transport and the deputy prime minister. He says that it’s time for “political honesty” about the state’s ability to fund infrastructure investment. Users should be expected to directly bear more of the cost.

“Governments everywhere are under pressure to pass more of the cost of infrastructure to users, but they are worried about the political backlash,” Threlfall says. He notes that in the UK, the energy regulator has been supported by the government in its refusal to lift the energy price cap, even as dozens of utility companies face collapse.

“No one wants to pay more for things they regard as essential, like

“The private finance initiative became synonymous in the UK with a small number of high-profile failures. This detracted from its many strengths

power, water or the drive to work. But greater alignment between users and payers will need to be found if governments are to deliver on their infrastructure agendas and their net-zero commitments.”

It’s essential to renew long-term public-private partnerships, he adds. “The question of intergenerational fairness is crucial. If we build roads, bridges or airports that last 30, 50 or even 100 years, there’s an argument for defraying some of the payment to future generations.” ●

£8bn has been allocated by the UK Infrastructure Bank to private sector projects

£1 spent on construction activity results in...

£2.92 created in wider economic benefits HM Treasury, 2021

1% of GDP invested in infrastructure results in a... 1.5% growth in GDP over four years Confederation of British Industry, 2020

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The electric road to 2025

Protecting our planet and tackling climate change is a huge task – and one that is becoming increasingly urgent

To meet net-zero targets, drivers are being encouraged to swap their petrol or diesel vehicle for an electric one. It is estimated that around 80% of all newly registered vehicles will be electric by 2030. The European Green Deal is aiming for CO2 emissions from new cars to fall to zero by 2035, effectively banning the sale of new fossil fuel-powered cars.

However, the switch to e-mobility requires a massive expansion of charging infrastructure, especially for long-distance driving. Some drivers have ‘range anxiety’: will the battery last for a long journey? How long

will it take to charge my car? Are there enough charging stations?

Since forming in 2017, IONITY has played a significant role in shaping the future of mobility across Europe. Its vision is to equip the continent with infrastructure to enable everyone to travel in electric cars. It has built the largest, fastest and most sustainable high-power charging network that is open to vehicles of any brand, with more than 1,600 charging points in 24 countries.

With each charging point delivering up to 350 kW of charging capacity, drivers of current or future generations

of electric vehicles will always get the maximum charging speed their vehicles require. IONITY’s goal is to make mobility truly green and therefore all chargers deliver 100% renewable energy for both emission-free and carbon-neutral driving.

IONITY was founded as a joint venture between BMW Group, Ford Motor Company, Mercedes-Benz AG and Volkswagen Group with Audi and Porsche. In 2020, the Hyundai Motor Group, with Hyundai and Kia, joined

as an additional strategic partner and shareholder. Last November, IONITY partnered with the BlackRock Global Renewable Power platform, making BlackRock the first company from outside the automotive sector to become a shareholder.

A recent €700m (£582m) investment from its shareholders will drive IONITY’s growth plans across Europe, while enhancing the customer experience. It plans to quadruple the number of charging points to 7,000 by 2025. As the demand for charging infrastructure continues its dramatic growth, new IONITY sites are planned to offer more chargers per station. In addition to that, existing sites along routes with higher traffic and higher demand for charging will be upgraded with additional charging points.

While the focus of IONITY will remain on motorways and busy trunk roads, the company is open to establishing charging stations closer to metropolitan areas to allow for fast charging stops when leaving or entering cities.

Speaking of charging stops, IONITY has launched an ambitious project rethinking how charging should ideally look. The ‘Oasis’ concept will turn charging

into a more comfortable and convenient experience, with covered charging stations alongside cafés, restaurants and shops. The architecture will reflect the company’s contribution to sustainability, and so the charging stop becomes a place to recharge the batteries of people and vehicles alike.

To achieve this e-mobility transformation, acquiring suitable locations for charging points is key. Whether it is commercial or rural, bought or leased, land is essential for developing the network and meeting the needs of current and future generations of electric vehicle drivers. By reaching IONITY’s 2025 goals, long-distance journeys with an electric car across Europe will become just as easy as with a petrol or diesel vehicle, as well as making a valuable contribution to climate protection.

Find more information here or visit www.ionity.eu



Q&A

Property owners can drive the change

For electric vehicles to reach critical mass the UK needs to increase its charging infrastructure. **Andreas Atkins**, country manager UK & Ireland at IONITY on the benefits of EV charge points for landowners and retailers



A Almost one in five (18.5%) new car registrations in the UK last year were for battery electric vehicles (BEV) or plug-in hybrid electric vehicles (PHEV). There are about 400,000 electric vehicles on British roads today, a figure likely to reach between 8 million and 10 million by 2030.

Electric vehicle charging infrastructure must grow accordingly, but finding suitable locations is difficult. This may present opportunities to commercial and rural landowners through the provision of charge points, or by selling or leasing land to charging station operators.

Q Why should landowners consider installing charging stations?

A Retail sites, corporate estates and plots of land adjacent to motorways and main road networks are ideal for EV charging development. Properties with EV charge points are likely to increase the loyalty of existing customers and attract new tenants. By leasing underused areas for public charging, new lease and revenue contracts can be agreed, all of which increase the value of the entire site for the landowner.

Given the growing numbers of EVs on the street, the time to act is now. In a few years’ time, everybody will drive electric, so landowners who miss this opportunity now could lose business in the future.

Q What are the benefits IONITY can bring to retailers?

A Besides the revenue generated by renting space for the electric charging station itself, IONITY is bringing additional business to commercial landowners. Retailers will profit from the time drivers spend in the shop, restaurant or café: our sites naturally have an increased footfall from customers.

IONITY is not only open for drivers of all car models, it is also the preferred charging stop of customers driving an EV of our shareholder brands, which represent a large part of today and tomorrow’s EV market. Their in-car navigation systems will lead customers to IONITY sites and bring traffic to commercial landowners partnering with us.

There are locations within the IONITY network where we drive an average of 100 customers a day to the sites. If each driver spends £5, the additional spend to on-site retailers will be £180,000 a

year. Our UK sites expect to see these volumes as early as 2023.

However, having EV charge points on-site not only increases dwell time and average spend. With IONITY’s high-power chargers providing drivers with 100% renewable energy, the site partners also demonstrate their commitment to preventing climate change and reaching net-zero carbon emissions by 2050.

Q What are you looking for and what are the obstacles you face?

A IONITY is looking for land next to existing service stations, as well as completely new and separate sites starting from 1,000 square metres up to 3,000 square metres, and more, for own-serviced charging stations that will redefine the charging experience of the future.

But it also depends on several factors including grid capacity, accessibility and the traffic on the road, which must be high. If all those criteria are met, we are interested in long-term secure contracts. We will pay and take care of everything: the design, connection, permissions, construction and, of course, the operation of the high-power charging site.

MEGA-PROJECTS

Take five: the UK’s boldest infrastructure programmes

From airport extensions and atomic power stations to multi-use redevelopments, here are some of the nation’s most ambitious mega-projects and their progress to date

Sam Forsdick

1 Crossrail

Completion date: stage one by July, stage two in the autumn and stage three by May 2023
Original budget: £14.8bn
Estimated final cost: £18.9bn

Having been dogged by delays and cost overruns, London’s Crossrail project is at last approaching completion. A test run on the central section of the Elizabeth line this month took about 2,000 passengers the five miles between Paddington and Liverpool Street stations in roughly 10 minutes.

The initial phase of the underground route will open this summer. Once stage three is completed in 2023, it will take travellers from Heathrow Airport and Reading in Berkshire to Shenfield in Essex and Abbey Wood in south-east London. Crossrail will serve 41 stations – 10 of which are new – including Bond Street, Canary Wharf, Farringdon, and Tottenham Court Road.

Crossrail was originally approved in 2007 and construction began in 2009, but the pandemic caused the works to be paused for several months in 2020. The project’s final costs are expected to come in at roughly £18.9bn. That means it’s £4bn over budget, with the first trains running four years later than expected.

Tunnelling progressed at an average pace of 38 metres a day to complete the 42km of new tunnels that make up the Elizabeth line. At the height of the construction works, Crossrail was the largest infrastructure project in Europe. Its chief executive, Mark Wild, claims that it will also be “the most advanced railway” on the continent once it’s finished.

The new British Rail Class 345 Aventura trains for use on the network were built by Bombardier Transportation in Derby. They are twice the length of regular Tube trains and can carry 1,500 passengers at a time. An estimated 200 million passengers will be served by the Elizabeth line each year.

This volume was expected to earn Transport for London a ticket revenue of about £500m a year in

More than **130 million** working hours have been completed on the Crossrail project so far

60 miles

The total length of the completed Elizabeth line

10%

The increase in central London rail capacity created by the line

2022-23 and more than £1bn a year from 2024-25. But the long-term impact of the pandemic on working patterns and commuters’ use of public transport has prompted Transport for London to revise the estimates down to less than 60% of its pre-pandemic forecasts.

Crossrail, 2022

2 Hinkley Point C

Completion date: June 2026
Original budget: £18bn
Current estimated cost: £23bn

One of eight planned atomic power stations announced by the coalition government in 2010, Hinkley Point C remains the only one that's under construction. This means it will be the first nuclear plant to open in the UK in more than two decades.

The project recently gained fresh impetus, with the energy price crisis and Russia's invasion of Ukraine causing the government to review its reliance on imported fossil fuels. The decommissioning of Hinkley Point B, which is set to start in July, adds to the project's importance.

Once it's completed, the 3.2GW power station will generate 7% of the nation's total electricity supply, powering 6 million homes.

The latest phase of construction involved lifting a 347 tonne steel ring on to the reactor, which made the building 17 metres taller. This task was performed by 'Big Carl' – at 250 metres, the world's tallest crane.



3 Thames Tideway

Completion date: H1 2025
Original budget: £3.8bn
Current estimated cost: £4.2bn

Due for completion by mid-2025, London's so-called super-sewer is designed to capture more than 95% of the sewage spills that enter the Thames. The capital's current wastewater treatment system relies heavily on sewers that were built in the late 19th century.

Although the system has expanded alongside London's population, the infrastructure is overloaded, meaning that 40 million cubic metres of raw sewage are dumped into the Thames during a typical year. The project will create an additional 1.6 million cubic metres of storage. The hope is that this will dramatically improve the quality of water in the Thames and make it a healthier environment.

The Covid crisis caused works to be delayed by nine months, incurring additional costs of £233m. The most recent review of the Tideway project, conducted in September 2021, estimated that the upgrade would cost £4.2bn, representing an annual bill increase of between £20 and £25 to be covered by Thames Water customers.

Construction began in 2016 and is taking place at 24 locations across



More than 22,000 people have worked on the erection of the new power station since shovel was first put to soil in September 2016. Work on the project continued throughout the pandemic once social distancing and numerous other additional health and safety measures were put in place.

Our ability to maintain progress in such tough circumstances is a testament to the commitment of the workforce and our suppliers across Britain and the world," said Hinkley Point C's managing director, Stuart Crooks, at the time. The precision involved in building the reactor units was like "watchmaking on an industrial scale", he added.

The scheme has encountered some delays along the way. Generation from unit one is expected in June 2026 at the earliest, a year later than the date originally planned. This overrun has also increased the estimated cost of the project by £500m, taking the total to £23bn.

Électricité de France remains the majority investor in the project, although the Chinese state-owned China General Nuclear (CGN) paid £6bn for a 33% stake in 2015. CGN is expected to remain a partner in spite of Westminster's subsequent decision to reduce China's involvement in UK infrastructure projects. The deterioration of diplomatic relations between the countries has prompted the government to seek new investors for its other nuclear projects, including Sizewell C.

London. These will eventually be connected by a 25km tunnel below the river stretching from Acton in the west to Stratford in the east. This will be large enough to fit three double-decker buses side by side. These works are expected to be completed this year.

As part of the scheme, seven new embankment areas are being constructed, including at Blackfriars Chelsea and Victoria Embankment. The foreshore structure at Chelsea

will include an area for the public to walk on and view works of art.

"It is hugely exciting to see these pieces of embankment taking shape. We look forward to the time when Londoners and visitors can enjoy all these new spaces and get closer to the Thames," says Andy Mitchell, CEO of Tideway London. "With the project due for completion in 2025, we are also looking forward to the benefits of having a cleaner and healthier river."



4 Heathrow Airport expansion

Completion date: approval has yet to be secured
Original budget: £14bn

The construction of a third runway at Europe's busiest airport before the pandemic has been in limbo since plans were first signed off by Gordon Brown's Labour government in 2009. The economic case for expanding the UK's only hub airport is that the addition of a third runway will generate an estimated £61bn and create up to 77,000 jobs by 2030.

The proposed expansion includes the construction of a new terminal. This would increase Heathrow's capacity by 260,000 flights a year.

But the project has encountered effective opposition from the green lobby. After being cancelled by the coalition government in 2010, it was adopted as central government policy once more in 2016. The proposed third runway was challenged successfully in the Court of Appeal in February 2020 by environmental

campaigners, who argued that the expansion failed to take adequate account of the UK's legally binding climate commitments, made as part of the UN's 2015 Paris agreement, to reach net-zero greenhouse gas emissions by 2050.

This ruling was overturned by the Supreme Court in December 2020, after Heathrow argued that the upgrade would be made in accordance with the government's climate policy. The judgement means that Heathrow can now apply for planning permission.

Amid all the legal challenges and questions over Heathrow's environmental impact, the pandemic presented further problems for the project. Travel restrictions caused passenger numbers to plummet to 19.4 million in 2021 and the airport has incurred losses of £3.8bn over the course of the Covid crisis.

The airline industry is expected to see a significant recovery this year as the number of holidaymakers continues its return to pre-pandemic levels. Heathrow's chief executive, John Holland-Kaye, recently confirmed to the *Financial Times* that this increase in passenger numbers means that the airport's expansion is "back on the table".



5 Battersea Power Station redevelopment

Completion date: summer 2022
Original budget: £9bn

The redevelopment of Battersea's grade II listed power station is nearing completion. Led by a consortium of Malaysian investors, the £9bn construction project began in 2013. Once finished, the 17ha brownfield

site on the south bank of the Thames will have been transformed into homes and commercial units such as offices, shops and restaurants.

A whole host of redevelopment plans have been suggested for the site's redevelopment since the power station was decommissioned in 1983. At one point, an indoor theme park was proposed, while Chelsea Football Club also contemplated building a new stadium there.

The first phase of the redevelopment, the Circus West Village, was completed in 2017. This features leisure facilities such as a cinema and a theatre. An extension of the Northern line connected Battersea Power Station to the Tube network when it opened last September.

In the next phase of the regeneration, the iconic power station building will be opened to the public. Once finished, it will house Apple's London campus. The US tech giant will occupy six floors, providing space for 1,400 employees.

Beneath the office space, there will be shops and a food hall, while the old turbine halls will be converted into a 2,000-capacity venue for events. The mixed-use development will feature 20,000 new homes, 250 shops, cafés and restaurants, 7.5ha of public space and a panoramic viewing platform at the top of one of the chimneys. ●

The great electric car switchover: matching infrastructure with demand

Shell Recharge Solutions aims to lead the development of electric vehicle infrastructure to go beyond the charge points

Many governments, including the UK, are regulating petrol – and diesel-powered cars to the history books. The future of mobility – whether private cars, commercial vehicles, fleets or public transport – is changing to lower carbon alternatives, including electric. This transition to e-mobility demands more than just extra charging points. Entire infrastructures need to be created to support sweeping changes to the way we move around.

Shell Recharge Solutions, previously NewMotion, plans to be part of a holistic approach to getting more electric vehicles (EVs) on the roads. The business unites NewMotion in Europe and Greenlots in North America and Asia under one brand identity and complements its offering with fast charging via Shell Recharge's public network.

Melanie Lane, CEO of Shell Recharge Solutions Europe, describes the company's strategy as "being able to provide the whole ecosystem to help businesses and consumers in their transition to e-mobility. Essentially, customers will have access to EV charging on-the-go, at home and at work". In practical terms, this translates into a global portfolio of charging solutions that will help meet the needs of EV drivers and businesses in different stages of their transition to zero-emission transport.

"We are aiming to operate more than 500,000 charging points worldwide by 2025 and 2.5 million by 2030 – this is part of our energy transition plan," says Lane, referring to Shell's expansion into the EV charging sector. "Our plan to roll out charging points will be market- and consumer-led. Migrating at scale to EVs requires many things to come together – nothing can happen in isolation."

Shell Recharge Solutions is focused on offering EV drivers what they need

for a seamless EV driving experience. That means an ecosystem of charging solutions that is affordable, convenient and globally accessible.

The demand for charging at home and at the workplace is helping Shell Recharge Solutions determine its geographical expansion, with the EU at the forefront.

"It's a combination of consumer and business demand, and government policy – the European market is very fast-paced," says Lane. She explains that, in Asia, the market potential varies between countries, while in the US, president Joe Biden's EV rollout policies are "very encouraging".

In the UK, there is incredible opportunity to further enhance the convenience for the customer, including around residential charging points. For example, the government has set a target of building 300,000 new houses by the mid-2020s with all new homes requiring EV charge points to be installed. This, in conjunction with a £20m investment in installing on-street charge points, demonstrates significant focus on EV-charging infrastructure. Shell Recharge Solutions will be a key provider of products and services as these measures stimulate more demand from customers.

"We plan to work with property developers as home charging is a big area for us," says Lane, adding that home charging is "multi-faceted", with the company having plans for installations in houses and apartments.

Shell Recharge Solution's 2021 EV driver survey found that even though there are now more than 29,000 charging points in the UK, 33.3% of EV drivers are unable to install a charging point at their home and a further 15% have no access to charging at work. Combined with the added inconvenience of needing multiple

Commercial feature



charge cards and subscriptions while on the go, the EV user experience can become complicated. However, customers of Shell Recharge Solutions benefit from a public roaming network of more than 275,000 charge points in Europe and 10,000 in the UK – all of which can be accessed via a single charge card or app.

The survey highlighted that lack of infrastructure is a barrier to more drivers replacing fossil fuel-powered cars with EVs – and it causes so-called 'charge point' anxiety for existing EV drivers. More than half (57%) of UK drivers worry about the lack of available charge points in the near future as EVs become more mainstream.

"This is a logical consequence if drivers cannot be sure they will have access to charge points for their entire trip," says Lane. "That is another reason why it is so important to match charging infrastructure with demand."

Infrastructure development is where Lane says Shell Recharge Solutions' plans go beyond simply installing

charge points, with the company planning to help businesses and consumers go electric. "We can enable smart infrastructure with hardware and software, offering additional services to consumers and businesses," she says. "These range from charging insights, the availability of the nearest available public charge point and energy management services that help manage the increasing demand on the grid."

Shell also has a service station forecourt network, which is an essential part of combating the range anxiety for both private and professional drivers. For business customers, the challenges in switching to an all-electric fleet need to be addressed. We are working at an industry level and a company level to support the energy transition in businesses."

Logistics companies, for example, need to feel reassured that they will be able to keep all EVs charged and that making the transition away from combustion engine vehicles won't affect the bottom line.

"In the long term, logistics providers will be able to enjoy the benefits of owning EVs because of the lower total costs of ownership," says Lane. "They should be worrying about their next delivery, not where they're going to charge their vehicle."

Whether Shell Recharge Solutions is catering to private or business customers, Lane believes the hardware it provides must "balance affordability, quality and capability" to scale up effectively. This innovation-driven approach involves a committed research and

development team, as well as establishing partnerships to improve access to charging infrastructure.

Lane put the time-sensitive nature of the EV rollout challenge into the context of climate change mitigation targets. "Unlike the growth of internal combustion engine car usage, there is a serious urgency to this work – low carbon transport is on top of the agenda for many and driving a low carbon future has never been more important," she says.

"Cleaner transportation is essential to this future, and EV charging infrastructure is as important as EV adoption to making this change."

As governments set deadlines for ending the sale of new internal combustion engine cars, the enormity of how transport is evolving – and the day-to-day practicalities for drivers – cannot be overstated. A ban on the sale of new cars powered purely by fossil fuels comes into effect in 2030 in the UK and 2035 in the EU.

"It is about societal, environmental and political change – and we are at the nexus of it. This industry is evolving daily and it is very exciting," she concludes.

Find out more about Shell Recharge Solutions and start your EV charging journey at uk.shellrecharge.com/public-charging



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Arjun Infrastructure Partners is an independent asset management company dedicated to executing and managing mid-market infrastructure investments. Arjun manages €4 billion of capital on behalf of institutional investors invested in 20 assets and platforms.

Our team has extensive operational and financial experience in the utilities, renewables, digital and transportation sectors. We offer a proven ability to source bilateral investment opportunities and have a strong focus on the ESG framework as part of our long-term, responsible asset management approach.

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