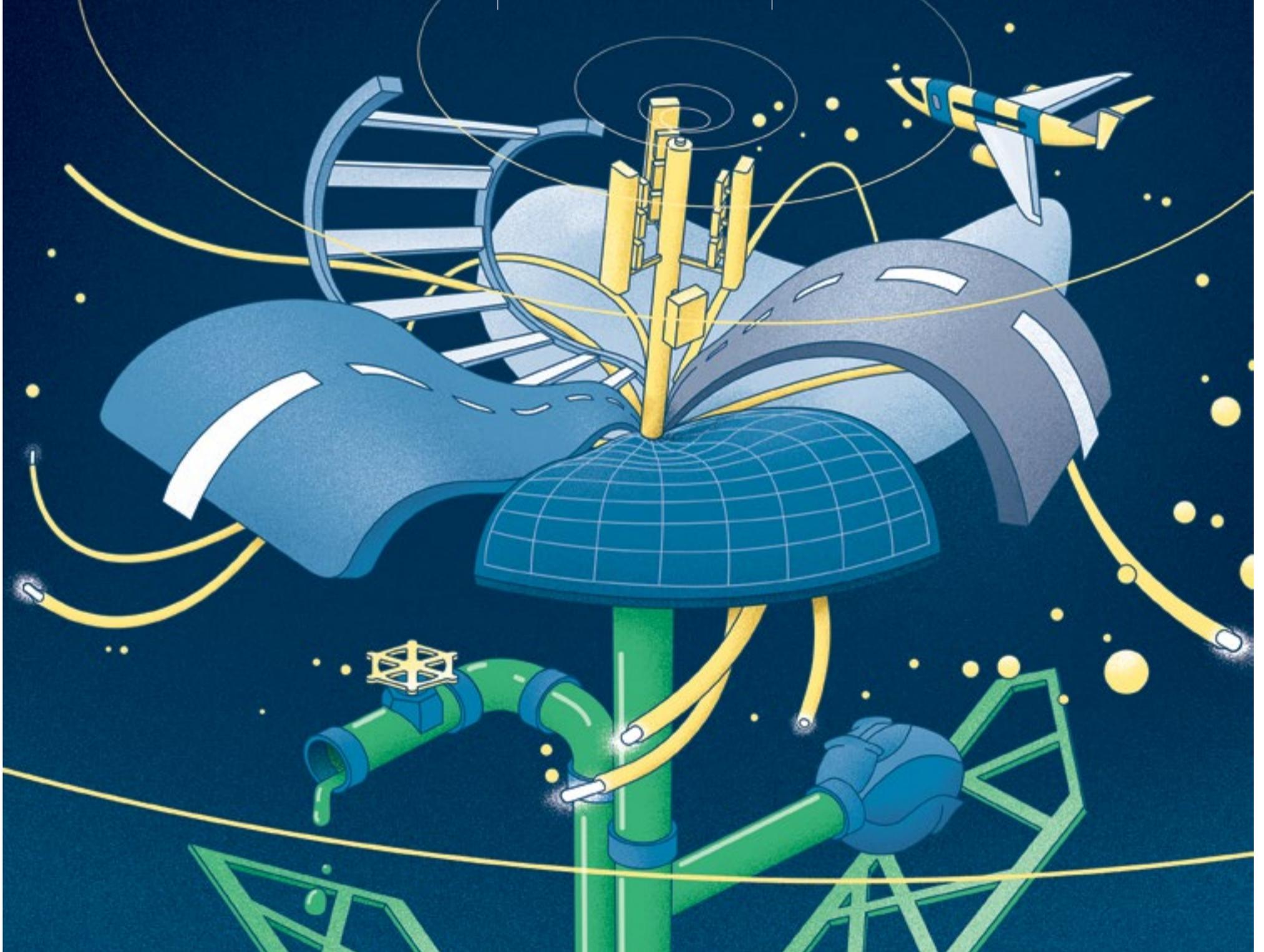


FUTURE OF INFRASTRUCTURE

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FUTURE OF INFRASTRUCTURE

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GREEN ENERGY

Why UK renewables require a power boost from the state

Experts in green energy believe that Westminster can and should act quickly to help the sector as it faces increasingly stiff competition from the US, the EU and beyond

Sam Haddad

The UK has long been seen as a world leader in renewable energy infrastructure. But, with several rivals ramping up their efforts, industry experts fear that this country is losing ground at a crucial time.

The UK is arguably a pioneer in this sector, which covers technologies ranging from wind and solar to marine sources such as tidal streams, but other players are catching up quickly. The Inflation Reduction Act 2022 is turbocharging the development of renewables in the US, for instance, while the EU is planning to match that initiative with its own proposed legislation, the Net-Zero Industry Act. Meanwhile, competition is growing from China and India.

Adam Berman, deputy director of policy at trade association Energy UK, reports that the conditions for investment in clean energy in this country have deteriorated dramatically in recent months.

"It's a perfect storm of challenges coming together at the same time," he says.

On the domestic side, Berman points to rising interest rates, which have pushed up the cost of finance; commodity price increases, which have caused a supply chain crunch; a "poorly designed windfall tax", which is hurting renewables in particular (see graph, below); and broader regulatory uncertainty.

All these factors have been amplified by international events. "Since Russia's invasion of Ukraine, most western countries have doubled down on their clean energy targets because they see this as a way out of the energy crisis," he says.

That has in turn led to an increase in competition for talent, materials, components and investment. As if those problems weren't enough, the legislative initiatives that the US and EU have taken present another challenge, according to Berman.

"We have no equivalent in the UK at the moment. When you combine all those factors, you can see that it's a troubling time for clean energy investment," he says.

By the time that definitive evidence of an investment hiatus becomes clear, it will be too late to do anything about it, Berman fears. The UK will have lost between six months and a year of investment. The indirect impact on supply chains will be even worse, leaving us two or three years behind the



Orbital Marine Power's O2 turbine, which is supplying tidal electricity to Orkney, was awarded £3.4m of state funding by the Scottish government

wind and solar, as they're already cost-competitive with fossil fuels.

"They need an industrial road map and specific deployment targets, just as offshore wind has had for some time," Serin says. "The government has to work with industry to understand what's feasible and then put a supply chain strategy together with a skills strategy to get that going."

Deploying the technology is one thing, but Serin thinks the UK should also focus on manufacturing it, so that the economic benefits are created and retained at home.

"The UK is a science superpower, but we haven't been good at keeping the innovation, commercialising it here and building the factories to produce our inventions," she says.

This is partly because China dominates the production of cheap tech ranging from photovoltaic cells to batteries. But Serin thinks that the UK could lead on emerging infrastructure such as floating offshore wind and tidal-stream energy.

"The global market is so small and nascent, but the UK needs to be investing in it right now and building a domestic supply chain. When there is global demand for that technology in five to 10 years' time, the UK can then export it," she says.

How can Westminster help if direct investment isn't always possible? "By providing siting and long-term purchasing agreements," Serin explains. "Even just promising that the sector will still exist in the UK, with clear deployment targets, would help to underpin it."

The government could also do more when it comes to streamlining planning regulations and awarding environmental permits, she adds. "There has definitely been a bottleneck for many of these projects. It can take five years for an offshore wind farm to secure approval, for instance. These kinds of timelines are too long if we want a net-zero electricity system by 2025."

Serin hopes that the government will not overthink the politics of renewables, which she believes are not nearly as controversial as ministers might imagine.

"Political thinking has been stuck at a point 10 years ago. Where local opposition exists, there are many ways in which you can make things work, such as offering cheaper electricity to communities that are willing to host a solar or wind farm," she argues. "There is broad support for renewables generally from the UK population."

pack. This jeopardises not only our energy security but also our net-zero targets.

Berman is not calling for direct state investment, because that wouldn't be the most effective use of public funds. But he does want the government to establish some advanced incentives to attract private money, including de-risking investment in renewables and removing some of the obstacles. These include resolving planning problems, ensuring that new projects can connect to the grid and reforming the Energy (Oil and Gas) Profits Levy Act 2022.

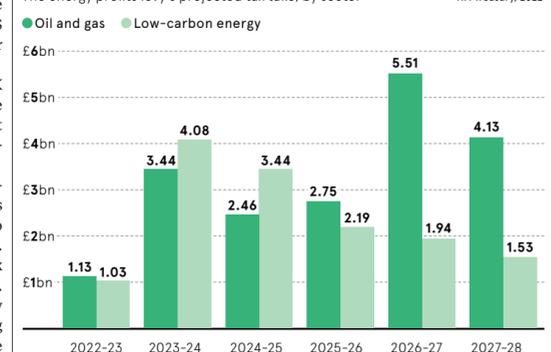
"What's making the US Inflation Reduction Act so successful is the

fact that it's not just an unlimited set of tax credits; it also has lots of local content obligations. This reassures local supply chains," Berman argues. "It has 10 to 20 years of certainty built in, which allows for long-term corporate investment. Companies can start to really invest in supply chains, jobs and skills."

Esin Serin is a policy analyst at the London School of Economics' Grantham Research Institute on Climate Change and the Environment. She agrees that the government must provide more long-term certainty for investment in renewables. This already exists in the case of offshore wind, she says, but it also needs to happen with onshore

THE UK WINDFALL TAX WILL HIT THE LOW-CARBON ENERGY SECTOR HARDER IN THE MEDIUM TERM

The energy profits levy's projected tax take, by sector HM Treasury, 2022





“Electric planes and urban air mobility are a complementary service. It’s all about the intermodal connectivity of one’s journey

including operators, vehicle manufacturers and technology developers. Each will have an important role in achieving the objective of commercial UAM services. With the completion of the terminal, we’ll start the comprehensive testing of procedures and technologies in a realistic aviation environment.”

Pontoise will be a blueprint for a planned vertiport network serving Paris when it hosts the 2024 Summer Olympics. A fleet of VoloCity EVTOLs is being prepared to carry people between five further locations in and around the city.

Elsewhere, Airbus and Munich Airport International (MAI) signed an agreement in June 2022 to market themselves to cities and regions interested in implementing UAM services. The deal combines the aircraft manufacturer’s CityAirbus NextGen EVTOL with the airport’s infrastructure expertise, because it’s “crucial for airports to be actively involved in paving the way for this new form of transport”, says Ivonne Kuger, MAI’s executive VP of corporate development.

Japan Airlines recently revealed plans to procure 50 Vertical Aerospace VA-X4 EVTOLs from Irish leasing company Avolon. This “represents an important step towards the implementation of air taxis at Osaka Kansai Expo in 2025”, says the company’s managing executive officer, Tomohiro Nishihata. The agreement, he adds, “lays out the pathway towards achieving the air mobility revolution in Japan”.

Beyond these specialised showcases, big airlines see electric plane

infrastructure as a way to extend their regional reach. In September 2022, United Airlines announced a \$15m (£12.5m) investment in Eve Air Mobility, an EVTOL producer backed by Brazilian manufacturer Embraer, and made a conditional purchase agreement for 200 planes.

Delta Air Lines, meanwhile, has invested \$60m in air-taxi startup Joby Aviation. It’s part of a deal to offer home-to-airport services using Joby’s all-electric 200mph aircraft, starting in Los Angeles and New York. The aim, says Allison Ausband, Delta’s executive VP and chief customer experience officer, is to “make the experience of travel more seamless, enjoyable and wait-free”.

Another approach is to embed electric UAM into the infrastructure of planned urban developments. Neom, a city in north-western Saudi Arabia being built from the ground up as a living laboratory for innovative tech firms, recently invested \$175m in Volocopter. The aim is to operate electric air taxi services in Neom to connect with three other planned developments in the area: The Line, Oxagon and Trojena

“This is the first time that EVTOLs, with their unique characteristics, are being factored into the design of a region that is being built from scratch,” says Volocopter’s CEO, Dirk Hoke. “This offers a whole new approach to how UAM can increase the quality of life in cities.”

The momentum behind electric planes and airports, then, is significant. But it’s worth remembering that it takes a lot more than that to get a big idea off the ground. ●

TRANSPORT

All hail the flying taxis?

Several consortia are poised to offer emission-free urban air travel, but they have some significant infrastructure challenges to overcome before they can realise their electric dreams

Paul Sillers

Why sit miserably behind the wheel in a urban gridlock when you could be soaring above the traffic in a flying taxi? Nearly silent and emission-free, these electric vertical-take-off-and-landing aircraft (EVTOLs) could eventually become a familiar sight in cities around the world. In theory, they can help to join the dots between air, rail and road transport.

But, although the concept of so-called urban air mobility (UAM) may sound enticing, turning that into reality is far from straightforward. For one thing, the specialist infrastructure required would be mind-boggling: high-voltage electricity networks and safe charging points are merely the basics. Safe segregation from the flight paths of mainstream civil aircraft and autonomous delivery drones would have to be factored in too.

Despite such complexities, a brave new world of electrified UAM seems to be taking shape. The McKinsey Center for Future Mobility has found

that, of the 25 largest mainstream aerospace manufacturers and suppliers, 72% and 64% respectively are working on future air mobility technologies. Over the past five years 16,000 VTOL orders, worth about £85bn, have been placed.

Moreover, a report published recently by the Société Internationale de Télécommunications Aéronautiques (Sita), an airline-owned provider of aviation IT services, has predicted that flying taxis will be ubiquitous at international airports by 2032. It suggests that they will be providing auxiliary services and extra revenue streams for airports and airlines.

Sita’s head of strategy and growth enablement, Ilkka Kivelä, points out that “airports and airlines are scrambling to provide the seamless travel experience that passengers expect, often with slashed workforces and squeezed budgets”.

Agile infrastructure solutions will therefore be key. In April 2022, UK firm Urban-Air Port demonstrated

Air One, a prototype vertiport in Coventry. The installation featured all the elements of a conventional airport – check-in, security, retail and food areas, along with operational infrastructure for air-traffic control, charging and maintenance – within a tiny footprint.

“Our approach has been to provide something compact, which can be purchased and assembled easily,” says Urban-Air Port’s CEO, Andrea Wu. She adds that specialist airports for electric aircraft are “not an alternative – and I don’t think that many people in this industry would describe them as such. Electric planes and UAM are a complementary service. It’s all about the intermodal connectivity of one’s journey.”

Urban-Air Port is working towards delivering one of its vertiports in North America by the end of the year. Wu confirms that this will be “inaugurated as a proof of concept but then be utilised as a proper testing facility”.

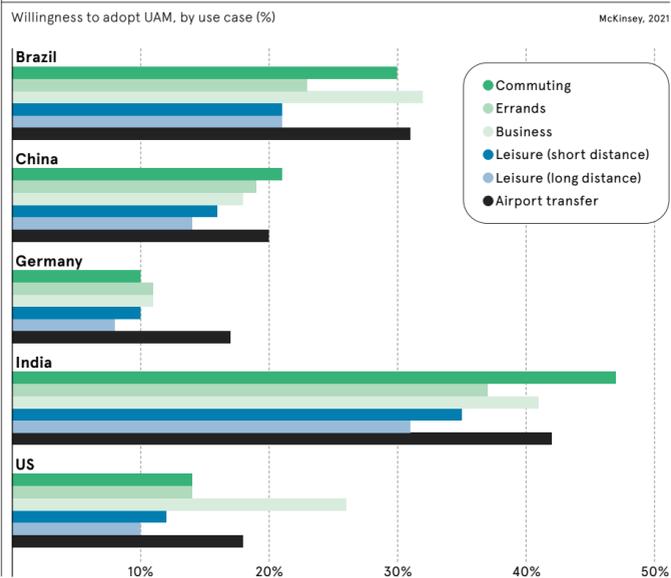
A key factor influencing demand for EVTOL operations, according to a recent research report by Deloitte, is the “optimal placement of ground infrastructure, considering prime locations such as business areas, airports and areas with limited transportation options”.

Apropos of that, the testing of critical EVTOL technology and passenger processing infrastructure is under way at Pontoise Aerodrome, some 25 miles north-west of Paris. The initiative involves France’s civil aviation authority, airport operator Groupe ADP, German EVTOL manufacturer Volocopter and Sita, which is providing biometric infrastructure designed to smooth the check-in, security and boarding processes.

Another key partner in the project is UK firm Skyports, which designs, builds and operates take-off and landing infrastructure. Its founder and CEO, Duncan Walker, observes that “innovation requires collaboration from a multitude of experts,

In November 2022, Europe’s first fully integrated vertiport terminal for the UAM sector was commissioned at Pontoise Aerodrome on the north-western outskirts of Paris

ATTITUDES TO THE VARIOUS USE CASES FOR URBAN AIR MOBILITY DIFFER CONSIDERABLY FROM COUNTRY TO COUNTRY



Retailers future-proof with rapid EV charging

Given the growth in electric vehicle sales, coffee chains, motorway stops, out-of-town shopping centres and hotels are all taking the chance to protect future revenues by installing ultrafast charging hubs

The notion that drivers of electric vehicles (EVs) might struggle to find charging points on long drives is increasingly outdated. Mirroring the immense growth in EV driving is the rapid proliferation of charging points, which is good news not just for drivers but also for the broad array of retailers on their route.

The very latest electric vehicle chargers from IONITY are rapid and powerful, providing substantial capacity for long-distance driving within just 24 minutes of being plugged in. They are found along major A-roads and motorways across the UK and continental Europe, helping drivers charge while also significantly boosting local trade.

“Some chargers are designed to be used at home or work, or at locations such as supermarkets, cinemas or gyms,” explains Andreas Atkins, UK and Ireland manager at IONITY, the rapid charging hub provider. “But ultrafast chargers can also be located at any useful point along people’s journeys, enabling them to quickly plug in before covering long distances.”

Increasingly, charging points work rapidly enough for EV drivers to have a short coffee or lunch break and get

back on the road. This opens up huge opportunities for businesses that can benefit massively from new customers and the boost to footfall.

Securing new retail revenues

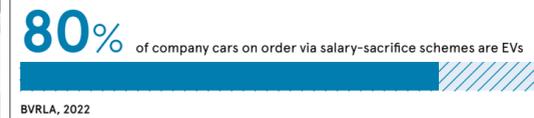
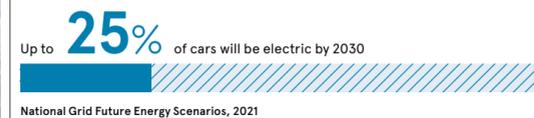
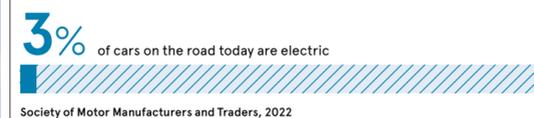
Wherever charging points are located, there is a significant impact on the site’s overall trade levels. Coffee chains and food sellers are among the businesses that can take immediate advantage.

“Businesses such as a Starbucks drive-through franchise or a food stop along a major road can install ultrafast charging and attract customers who would not otherwise have stopped,” explains Atkins. “Typically these sites might see around 100 to 200 more drivers on any given day, the impact of which quickly mounts up.”

For out-of-town retail sites, the potential benefits of having ultrafast charging hubs are equally clear. Locations such as the Metro Centre near Newcastle, for example, can gain from drivers stopping by to charge their vehicles because those people might well be tempted to venture in for some food or to consider spending more money at other retail outlets. Much the same applies to hotels,

Commercial feature

STATE OF THE EV MARKET IN THE UK



retail sites within two or three minutes of motorways and major A-roads,” Atkins says. “And we work as tenants or owners of the land our hubs are on.”

“First, as tenants, IONITY leases land from retailers based on deals lasting up to 25 years, covering all costs end-to-end and establishing on-site charging points for those businesses and the public. Second, we also purchase land, either from retailers or from sites adjacent to them.”

Charging hubs in action

Hub locations typically cover around 800 to 3,000 square metres, featuring between six and 24 charger units, with 12 units the current average. The speed at which the technology can charge up vehicles’ batteries affects the price for drivers and is chosen based on how long patrons are likely to stop. This varies greatly between a quick coffee stop on the motorway and an out-of-town shopping centre or a hotel for an overnight stay.

Currently, IONITY has charging hubs in 19 locations across the UK, stretching from the south coast of England to Perth in Scotland. Following an additional €700m (£620m) of backing from shareholders including investment giant BlackRock, the company expects to quadruple the number of UK hubs to between 80 and 100 sites within three years, moving to 7,000 chargers across Europe in the same timeframe.

“Our aim is to have charging hubs around every 60 to 80 miles along major roads, which will give drivers plenty of confidence given that new EVs can typically cover several hundred miles on one charge,” Atkins notes.

David Hatherell is managing director of Chippenham Pit Stop, where EV drivers have become a new, consistent source of custom. “IONITY has helped to boost our sales figures and bring in new, loyal customers,” he says. “Prior to IONITY charging stations being here,

the Pit Stop was not ‘on the map’ for most non-commercial drivers.”

JJ O’Hara is managing director at OCO Westend, the Starbucks franchise with IONITY ultrafast charging points. He expects to see continued “real traction in EV drivers visiting our stores by 2025” as ever more electric vehicles are driven on UK roads.

Looking ahead to net zero

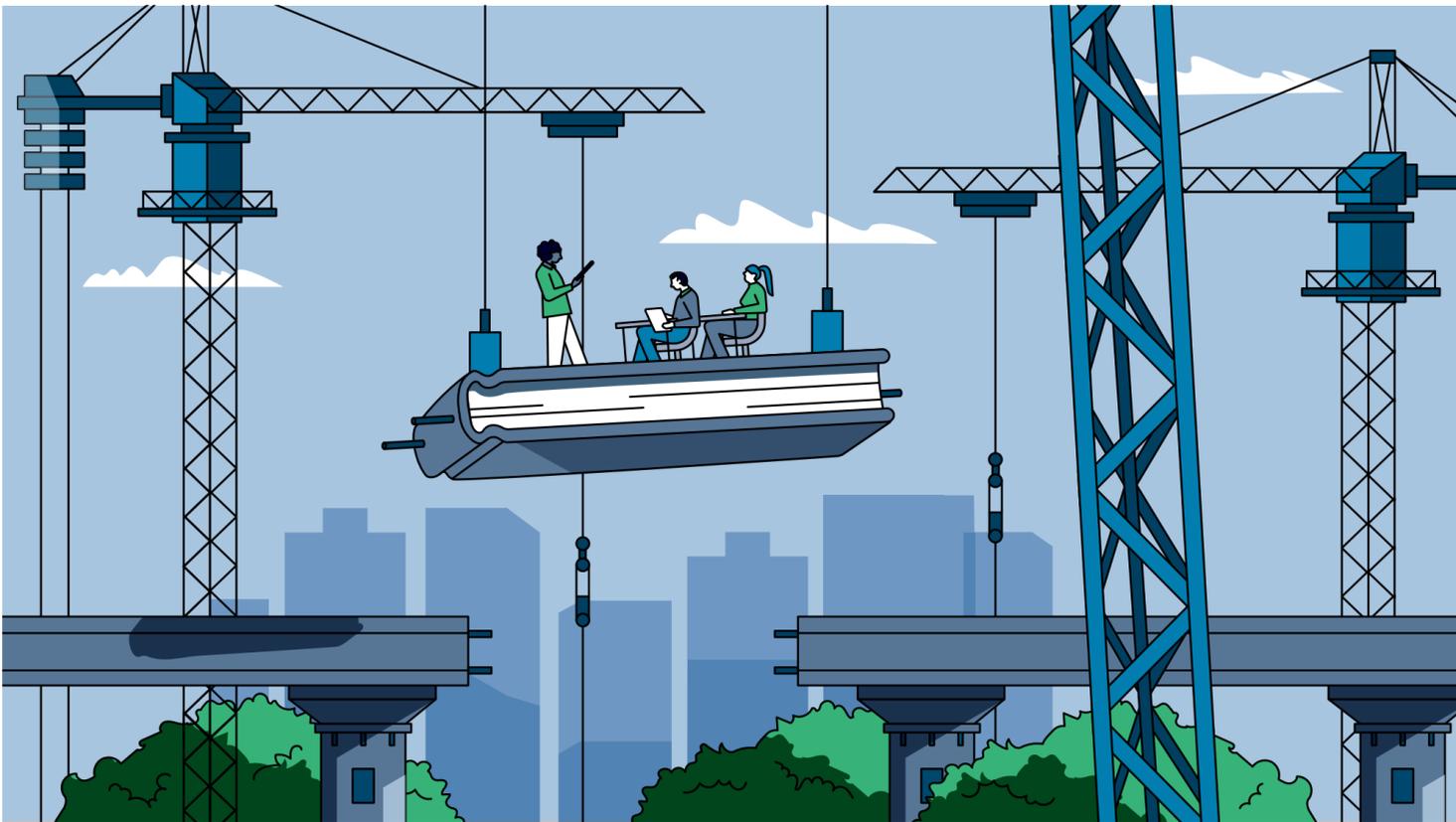
In the future, Atkins expects IONITY’s charging hubs rollout to contribute significantly as the UK and other European countries move towards net-zero carbon emissions. “When I started working with electric vehicles in 2012, there were only hundreds of EVs on the road in the UK, but now there are well over half a million. Looking ahead, within just a few years there could be close to 10 million EVs on British roads. With all our hubs supplied by green, renewable energy, IONITY will play its part in the UK moving to net zero by 2050.”

Today, for retailers, coffee shops and food stops, as well as hotels and out-of-town shopping centres, adding electric vehicle charging hubs to their locations is becoming ever more essential to future-proofing their business. Retailers along major roads across the UK are acting already on this opportunity to attract the consumers of the future.

IONITY is actively seeking retail partners of all sizes near motorways and major A-roads across the UK and Europe. To find out more, visit ionity.eu



“With all our hubs supplied by green, renewable energy, IONITY will play its part in the UK moving to net zero by 2050



TRAINING

Infrastructure providers scramble to bridge the low-carbon skills chasm

The transition to greener operations is having an impact on every part of the sector. Can dedicated upskilling and reskilling schemes equip the UK's engineering workforce for change quickly enough?

Alison Coleman

The UK's ambitious net-zero goals loom large over the infrastructure sector, affecting everything from design to delivery. They have also created a skills crisis.

That is because infrastructure projects based on net-zero goals are very different from those of the past. They demand a different set of competencies, ranging from a basic knowledge of data analytics and computer programming through to advanced technical skills, such as 3D modelling.

Apprenticeships and further education technical training routes are bringing some new talent into the engineering sector, but employers are also having to redouble their

efforts to both upskill their established workers and reskill those recently brought in from other sectors – quickly and on a large scale.

For instance, the Engineering Construction Industry Training Board – which forecasts a need for an additional 25,000 workers for major projects by 2026 – is calling for more government support to enable the reskilling of oil and gas workers for jobs in related sectors. After all, that workforce should be cut loose by the transition away from fossil fuels.

Upskilling and reskilling are key to achieving a just energy transition, ideally one that delivers high-quality jobs and career progression for those in the energy sector. BP,

for example, is focused on providing opportunities for its workers to apply their skills to new challenges in low-carbon technologies.

"We see high levels of skills transferability into lower-carbon tech," reports Kerry Dryburgh, BP's executive vice-president of people and culture. "In a skills-constrained environment, more collective efforts are needed to help people move across sectors. This could mean more access to technical and vocational training; more flexibility in how that is funded; and more modular approaches to development, including top-up training, to help people bridge skills gaps."

To realise this goal, BP is giving its employees access to a personalised

learning portal and company-wide 'growth weeks' focused on learning, alongside a range of other programmes designed to help them acquire new skills for the future.

The company already has many examples of engineers and other specialists applying their skills to low-carbon projects to help the transition from oil and gas. It recently ran recruitment campaigns for some of its fastest-growing clean energy segments, including hydrogen, offshore wind and electric vehicle charging. Applications from other parts of the business were highly competitive, with internal candidates filling half of the vacancies in areas such as hydrogen.

"Getting this right not only helps to create green jobs in the UK but also helps to level up the country," Dryburgh says. "It can ensure that those in social mobility 'cold spots' can access opportunities in the sector, including in places such as Teesside, where we operate."

And it's not just about energy. Big transport projects such as the HS2 rail link and the Stonehenge road tunnel are also set to rely on a similar transition of engineering skills.

For example, the rail industry has a relatively old workforce, with more than 28% of its employees aged 50-plus, according to research from City & Guilds and the National Skills Academy for Rail. This means that the focus has so far been on securing the talent pipeline, with apprenticeships forming an essential route for young people seeking to start a career in the sector.

But work is also ongoing to help existing employees embrace digitisation as a path to more efficient, safe and sustainable practices. Specialist engineering and technical recruitment firm the Morson Group supports clients with this skills challenge through its training delivery arm. This has been heavily involved in HS2 and other big railway construction projects, often upskilling contractors in the use of technology that didn't exist when they started their careers.

"HS2 is a game-changer because of the massive investment in tech, which is advancing at such a pace that how it will look over the life of the project is unknown," says the group's training director, Matthew Leavis. "We must incentivise people to adopt new ways of working and become champions of tech."

Through its Pathfinder Academy, the company works with companies to retrain their employees; people who have left the sector; and those from more diverse talent pools, through digital engineering boot camps. By the end of April, Morson Group's training arm will have trained 175 new entrants and retrained 50 existing workers in north-west England, with plans to roll this model out nationally.



In a skills-constrained environment, more collective efforts are needed to help people move across sectors

The Morson Group is also running 'train the trainer' boot camps, helping people in didactic roles to incorporate tech such as virtual reality and digital twins in their courses.

This initiative is likely to be particularly important, because it should help to free up entry-level roles for people coming into the sector. What's more, ongoing training opportunities should make transport more appealing for people at all stages of their careers.

"Part of that is about training", Leavis says, "but it also relies on employee value propositions that highlight the positive impact the industry will have on greener and more efficient journeys, for example, along with the opportunities for a sustainable career with potential for progression."

Among the biggest obstacles to upskilling are a lack of time, funding and strategic coordination. Employees could also resist change, often prompted by concerns about a return to training after what may for some people have been a considerable number of years.

Any of these factors has the power to derail an upskilling initiative, says Raconteur columnist Bernard Marr, a strategic adviser to business and government and the author of *Future Skills: the 20 skills and competencies everyone needs to succeed in a digital world*.

"Overcoming these challenges requires a mindset shift to prioritise learning," he says. "Best practices for organisations include providing flexible learning options, offering incentives and aligning upskilling with career advancement to encourage employees to take ownership of their development."

Over at the National Grid, for example, the upskilling and reskilling strategy is a vital part of the organisation's role in the UK's transition to clean energy sources. Resistance to change among staff has not been

“Overcoming these challenges requires a mindset shift to prioritise learning

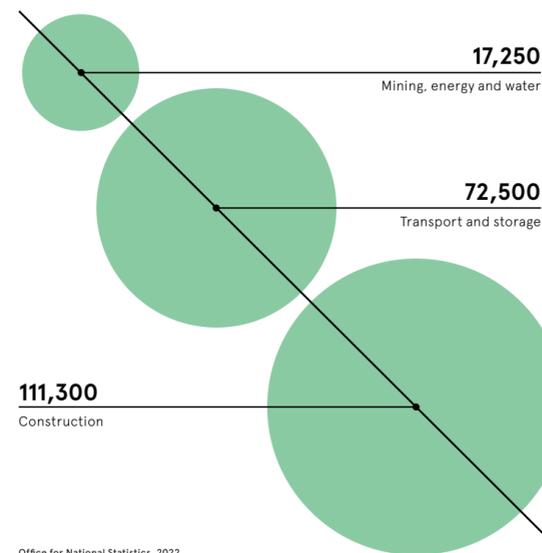
a significant problem, reports Lee Wallace, director of safety, health and environment training and engineering policy. That's because the organisation has focused on encouraging staff to see change as an opportunity. To help this process, it has provided training programmes tailored to the skills gaps of workers who have been out of education for a long time.

National Grid also makes clear the distinction between 'new' skills and the upskilling and reskilling of current employees. "We are clear on that difference and ensure that our new training and refresher programmes cover technology changes," Wallace explains. "We also undertake assurance and competency checks, including any refresher training of staff in existing roles."

Crucially, it's not only technical skills that matter, Marr stresses. Emotionally intelligent people with strong interpersonal skills "can take advantage of different career opportunities, such as working with clients. And those who can adapt quickly to new technologies and processes, and be creative in their problem-solving, will be more prepared to match the changing demands of the industry," he says. "Organisations that invest in upskilling and reskilling programmes that address both technical and soft skills will be better positioned to succeed in the high-tech engineering landscape." ●

INFRASTRUCTURE-ADJACENT SECTORS IN THE UK EMPLOY MANY OLDER WORKERS

People aged 65 years and over in employment, by sector, April to June 2022



Office for National Statistics, 2022

How the circular economy can transform the built environment

If we want to achieve net zero, it's high time we applied circular economy principles to infrastructure and reimagined our buildings and spaces

Every year, our built environment consumes nearly half the materials extracted globally. Such activities are a massive contributor to greenhouse gas emissions. That means the way we design, construct and eventually demolish our infrastructure matters. While many projects are still entrenched in a linear take-make-waste economy, modular design offers great potential to move away from this model.

Modular construction isn't a new concept, but the market is experiencing significant growth as businesses drill down on their carbon footprint and commit to ESG goals. Built off-site, units are more sustainable, since the components are put together in a controlled environment, allowing for greater efficiencies, less waste and the reuse of materials. There's also less transport to the site.

"We're seeing more large businesses demand infrastructure that is low-carbon by design since it will help them reach net zero more quickly. Circular economic principles can help in this process," says Inder Poonaji, director of ESG and sustainability at Modulaire Group, a leading global specialist in modular spaces, with over 290,000 modular units in operation in 23 countries.

"This is where resources are kept in use at their highest value for as long as possible," Poonaji explains. "With modular units, you can control the use of raw materials more easily and minimise the energy used." Operating as Algeco in the UK and Europe, Modulaire is the region's leading modular building company.

Modular buildings have traditionally been deployed for temporary site accommodation, but they're increasingly being used for permanent structures by hospitals, schools and for businesses creating smart offices for up to 1,000 people. Units can be disassembled, relocated or refurbished. They can be reused up to 20 times over 30 years. This approach also generates 70% fewer emissions than traditional construction.

"The units we create are now 96% recyclable and generate 65% less embodied carbon than a normal building," details Poonaji. "By deploying a



circular 'loops within loops' model, this ensures that most of the materials used in the assembly of our units have an ongoing life with little waste. And by leasing modular units, we're also able to unlock the most amount of value from our assets, keeping resources and building materials circulating in the economy."

The space-as-a-service (SPaaS) model is a paradigm shift in the way the infrastructure industry works. And it's gaining traction, partly because it allows occupiers to demand buildings which are aligned to their ESG and sustainability commitments. The same is true of investors, who want to ensure that their assets are future-proofed against tightening sustainability regulations and the changing climate.

"Technology is also changing when it comes to infrastructure, especially on the sustainability front, whether it is to do with EV chargers installed on site, the latest solar PV panels on roofs, or internet of things devices measuring air quality. A leasing SPaaS business model ensures that we can act fast and offer the most up-to-date solutions to clients," says Modulaire's Poonaji.

The firm has already worked on major projects in both the public and private sectors and has raised €3 billion in sustainability-linked financing.

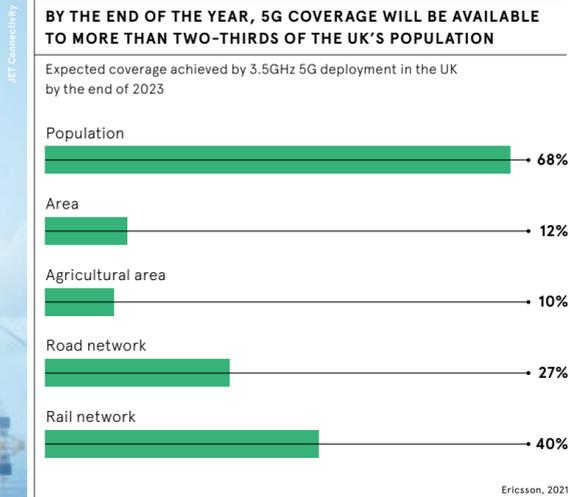
"Urbanisation is also a mega-trend, and it is set to continue," Poonaji adds. "It means the demands on future infrastructure will be huge. Spaces to work, learn and live will therefore be an increasingly valuable commodity, and so will sustainable infrastructure that deploys the latest tech. Climate adaptation will also be important. Meeting all these demands requires new business models."

Answering to six stakeholders – employees, suppliers, investors, as well as society more widely, the planet and customers – is becoming a more prominent business strategy. Modulaire endorses this approach. It could shift the dial in the infrastructure sector, which is ripe for disruption.

"We need to redesign the sector using circular economic principles," concludes Poonaji. "Every modular unit deployed is a step closer. It's the only way to drive economic and social prosperity for society and enhance environmental responsibility."

Find out more at [modulairegroup.com](https://www.modulairegroup.com)





CONNECTIVITY

Keeping Britain connected, from the sea to space

In the race to secure 5G connectivity, buoys, drones and high-altitude platforms are being used to eliminate dead spots and support the construction of other forms of infrastructure

Heidi Vella

As the roll-out of 5G networks gets started on the ground in the UK, another dimension of the cellular network is also gathering momentum: non-fixed 5G. This is the term that's used to refer to non-terrestrial technology that can expand mobile coverage into parts of the country where it isn't viable to lay fibre-optic cables or construct cellular base stations. The implementation of non-fixed 5G promises to put an end to mobile dead zones and usher in the age of 'connectivity absolutely everywhere'. It should also enable businesses to reap the benefits of the network in some novel and unexpected places.

The government, which has had problems with the terrestrial 5G roll-out, is getting behind the technology too. In January, the UK Space Agency announced £50m for projects to "supercharge the UK's satellite communications industry". The following month, the secretary of state for energy security and net zero, Grant Shapps, announced the allocation of public funding for various projects to encourage new green tech, one of which is to develop a 5G network at sea. The company building the offshore 5G network, JET Connectivity, is developing buoy platforms that are equipped with 5G comms and

An artist's rendering of the 5G buoy platforms being developed by JET Connectivity

can withstand waves of up to almost 18m. A dozen strategically placed platforms could enable a 5G network to cover wind farms located several hundred miles apart.

Such a capability would be particularly useful for construction projects in the UK's fast-growing offshore wind sector. Anyone working at these remote sites would have connectivity for high-speed communications instead of having to rely on the accompanying vessel, which typically uses satellite systems.

Beyond this, JET Connectivity hopes to be able to offer real-time data profiling on metrics such as wind speeds, as well as site feasibility studies – for which it already has a contract with Scottish Power. A floating 5G network could even support smart blades capable of predicting parts fatigue before faults develop, says Sam Strivens, senior manager of the floating offshore wind team at the Carbon Trust.

The concept of a non-terrestrial comms network is piquing the interest of other companies too, reports Dr Derek Long, head of telecoms and mobile at Cambridge Consultants. He explains that the focus so far has been mainly on low-Earth-orbit (LEO) satellites, inspired by Elon

Musk's Starlink service. One of the barriers to uptake has been that standard mobile phones mostly cannot receive LEO satellite comms, which require another device with a bigger antenna. But this is a problem that US-based AST SpaceMobile claims to have solved. The company has a specially designed satellite in low Earth orbit – the largest communications array deployed commercially, it says – that can provide 4G or 5G to smartphones with no modifications. It plans to demonstrate the capability this year.

The satellite works like a mobile phone tower, dropping traffic back down to a central hub. It collects solar power on one side and on the other it has more than 100,000 individual antenna elements to ping signals back to Earth. One satellite can transmit from 430 miles away to an area the size of Spain. Only 100 would be needed to cover the globe.

AST's CTO and treasurer, Scott Wisniewski, says that the company, which has agreements with more than 30 big mobile network providers worldwide, including Vodafone and AT&T, wants to tap into the trillion-dollar mobile market.

"Mobile operators can use it to extend their coverage where it might not make sense to put a tower because it's too costly or the terrain is difficult or distant," he says.

AST's offering may therefore have more use in regions such as Latin America, where numerous communities are cut off by natural barriers including forests and mountains. That said, operators aren't ruling out the idea of extending non-terrestrial operations to Europe. At the recent Mobile World Congress trade show in Barcelona, for instance, a Vodafone executive said that AST's technology would enable his company to increase its coverage in Spain from 75% to 95%.

Starlink is also making moves in this direction. It has revealed plans to partner with T-Mobile to offer US mobile customers SMS capability where there's currently no connectivity, by the end of this year.

And satellites aren't the only solution. Other technologies emerging to target mobile dead zones – which

account for roughly 16% of the UK's landmass as far as 4G coverage is concerned – include balloons, drones and high-altitude platforms.

Cambridge company Stratospheric Platforms, which recently raised £70m from investors, has developed a hydrogen-powered drone for this purpose. With the wingspan of a Boeing 787 Dreamliner, the drone can circulate the stratosphere – the second layer up of Earth's atmosphere – to beam internet services down to remote areas. The company claims that one drone could replace 450 traditional phone masts.

Long believes that these technologies could be useful for covering large areas that have a high-capacity need, such as at ports where thousands of containers are all relaying data about their identity, location and status. Equally, these solutions could help at rural music festivals, which require high-capacity connectivity for short periods.

"Instead of needing to spend several weeks establishing a connection on the ground, you could have a high-altitude system flown to the location to provide temporary coverage," Long explains.

Smaller drones could do similar things, although they would probably cover a much smaller area. Virgin Media is running 5G drone trials in Snowdonia, for example, to explore how provide support the mountain rescue services there.

Telecoms and media consultancy Altman Solon believes that there could be a complementary role for non-fixed 5G technologies, possibly acting as redundancy to terrestrial solutions for critical applications. But it adds that developers will need to act quickly to roll them out before mobile network operators.

On this front, the relatively small scale of the UK market could prove prohibitive, according to Long. "American and European companies exist in markets significantly larger than the UK, meaning that any investment there will instantly get a higher return," he says.

That will certainly be something for both Westminster and investors in this sector to bear in mind as the technology develops. ●

“Mobile operators can use it to extend their coverage where it might not make sense to put a tower because it's too costly or the terrain is difficult



Commercial feature

The UK is on the cusp of a green mobility revolution

By 2030, the sale of new diesel and petrol vehicles will be banned, and the number of electric vehicles (EVs) is predicted to have boomed. But that means we also need to develop a public charging network which meets the daily needs of EV drivers unable to charge at home

Many people's perception of an EV charger is a large unit at a motorway service station, offering an ultra-fast service to allow EV drivers to continue their journeys. But these units are just one part of the picture, says Chris Pateman-Jones, chief executive of charging infrastructure specialists Connected Kerb.

Pateman-Jones believes that in the current system, with drivers more often than not having to seek out a charging point, the user experience is being forgotten. "We don't think the model should be driving to a rapid charger and then sitting there waiting while your car charges. In our view, that's the slowest way you can possibly charge. We think the fastest way is to turn up, plug in and then go and do something else."

Through its work with local authorities, Connected Kerb has installed thousands of charging points on residential streets across the UK. Now it's looking to bring more charging to workplaces, car parks and other long-term parking places, such as those outside train stations.

The reality is that the vast majority of charging takes place on people's driveways, says Pateman-Jones. According to Connected Kerb's own research, when considering the switch to an EV, 80% of drivers say that reliable, affordable charging where their car is parked at home is essential.

Yet according to the 2016 English Housing Survey, 34% of people don't have a space such as a driveway where they can install a private charger. And while a further 28% have access to off-road parking, such as a space at a block of flats, they don't have the authority to install a charger. This makes on-street charging crucial.

"If we're really serious about the EV transition and the shift to green mobility, we have to find a way of providing the same level of affordability, convenience and reliability you would get if you

had a driveway," says Pateman-Jones. "Driving to find a charging point and then paying for more expensive energy than you have at home means that the transition isn't going to happen at the pace we need it to."

To solve exactly this sort of problem, Connected Kerb is installing 700 charging points in Coventry, where much of the city's housing stock is made up of Victorian terraced houses, without off-street parking.

The design and appearance of on-street charging is also crucial. In Coventry, the local authority

specified compact, bollard-style charging points, which have two sockets so that more than one vehicle can charge at the same time. "People don't want big petrol pump-style units on their streets," says Pateman-Jones. "They need to be visually discreet, and councils want to avoid yet more street clutter."

The company has also worked at Regent's Park Terrace in London, installing four dual charging points. The discreet design helped to preserve the appearance of the area, and also solved the problem that they couldn't be installed on the outside of the grade two listed building.

Connected Kerb's chargers are all made from recycled materials wherever possible, and a modular design means that the electric can be installed underground in one go, and then more charging points can be activated as and when they're needed.

Charging infrastructure that encompasses a mix of fast, rapid and ultra-fast charging also supports the grid. Charging overnight, or at your workplace during the day, can reduce costs and also ensure more efficient charging, taking power from the grid when it's available rather than being constrained during peak times.

But the UK needs to act fast. By 2030, when the ban on combustion engines comes into force, it's estimated that up to 700,000 charging points will be needed. Fast forward 20 years to 2050, and it will need to be closer to 3 million. Currently, there are just 30,000.

Planning is crucial. The Office for Zero Emission Vehicles and the Department for Transport are overseeing the creation of the network, and in turn issue guidance to local authorities around regulations and procurement. Then, says Pateman-Jones, it should be left to the private

sector to build the infrastructure. But it's not just about putting chargers in the ground. Residents and local people need to become partners in the whole process, he says, so that charging points are sited where they're really needed. This local buy-in also helps to ensure that the charging points will be used once they're operational, which gives investors a greater degree of certainty.

However, Pateman-Jones is quick to stress this doesn't mean a rush to flood more affluent city boroughs with chargers, and avoid poorer or rural areas. Often it's these outlying districts which lack good public transport, or where peoples' jobs don't allow them to work from home. These are the people who need the infrastructure most, he says, and where demand is guaranteed.

This new roadside infrastructure also needs to factor in commercial vans that are increasingly parked at home by their drivers overnight, rather than going back to a central depot. Bays need to be big enough to accommodate them too, otherwise these fleets won't be able to transition to electricity.

"The quicker we can deploy the infrastructure, the quicker the transition will come," adds Pateman-Jones. "But to give people the confidence to switch to an EV, that infrastructure needs to be robust, in the right place and with the mix of charging options that they need."

For more information visit connectedkerb.com

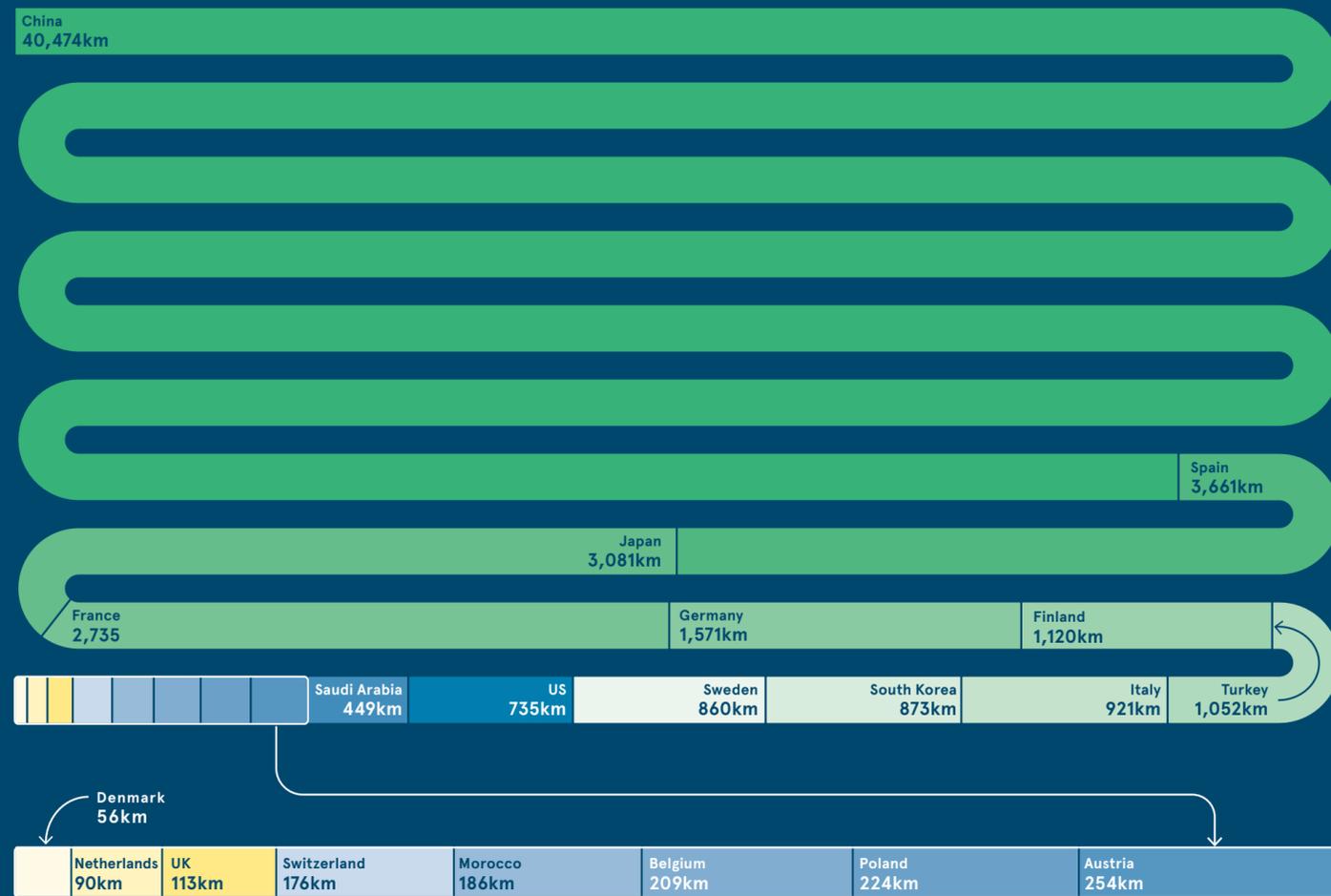


HIGH-SPEED RAIL NETWORKS

It has been 14 years since HS2 was first proposed. After much indecision and many delays, completion is not due until 2029 at the earliest. With costs ballooning, the project's scope has been much reduced too. In that time, the UK has fallen a long way behind the rest of the world, particularly China. It's a telling indicator of the nation's diminishing ability to deliver on big infrastructure plans

CHINA HAS STORMED AHEAD WITH BUILDING ITS HIGH-SPEED RAIL NETWORK

Length of national high-speed network in commercial operation by country



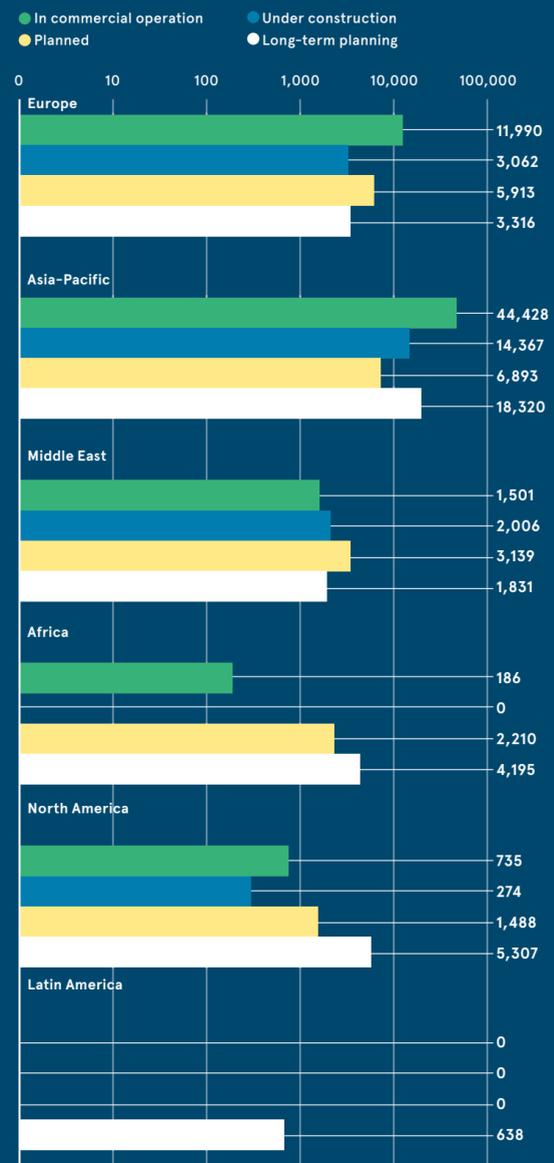
THE PAST DECADE HAS WITNESSED A BOOM IN HIGH-SPEED RAIL CONSTRUCTION

Cumulative length of high-speed rail networks in commercial operation worldwide (km)



THE ASIA-PACIFIC REGION LOOKS SET TO EXTEND ITS GLOBAL LEAD ON THE PLANNING FRONT

Length of existing and planned high-speed networks (km, log scale)



CHINA LEADS ON SPEED AS WELL AS DISTANCE COVERED

Maximum speed achievable on railway network by country in 2021





Ariana Dumitru via Getty

STRATEGY

Why low-carbon clusters are well set for success

As we move to a low-carbon, digitalised society, successful hubs will have many new forms of infrastructure, from solar-powered data centres to transport systems fuelled by green hydrogen

Nick Easen

People have always been drawn to the places offering the largest mass of resources, from water and timber to coal and crops. That same law of commercial gravity seems to be applying increasingly to low-carbon energy and data.

The commercial, residential and infrastructure hubs of the future are likely to feature office districts using renewable energy. They will have solar-powered data centres; green hydrogen transport systems; airports with a ready supply of sustainable aviation fuel; ports with access to green ammonia; and water infrastructure based on circular systems.

Why? Because the priorities of businesses, investors and consumers are changing, which in turn means that the clustering of sustainable and digital infrastructure

could end up becoming more competitive. Climate mitigation and adaptation, as well as digital transformation, are drifting up the agenda. That's prompting a re-evaluation of the infrastructure we're likely to need in the 2040s.

Because it takes decades to build out the infrastructure for urban centres, that process is starting now.

“In the future, carbon will have value, so low-carbon zones will be financially efficient and increase their gravitational pull

“It's clear that we have to create low-carbon infrastructure ecosystems,” says Andrew Stanford, director of infrastructure at engineering consultancy Walsh. “In the future, carbon will have value, so low-carbon zones will be financially efficient and so increase their gravitational pull.”

We are only at the start of our renewable energy, digital and data-led transitions, so are yet to fully determine how these new infrastructure hubs could look. But our big urban centres have proved resilient over the centuries, thanks largely to their ability to rebuild and transform their infrastructure.

For instance, the Great Stink of 1858 spurred London to upgrade its sewerage system. Today, much of the fibre-optic data network runs along the roofs of these old sewer pipes, while parts of the capital's electricity supply are connected via cables that run along the towpath of the Grand Union Canal.

If we in the UK want a net-zero, data-fed future that doesn't harm the nation's prospects for economic growth, various elements of our new infrastructure will need to complement and service each other in precisely this manner. Achieving this will involve new levels of collaboration and urban planning within an 'ecosystem' approach. But how can businesses and governments (central and local) get to such a point?

“Investment is a catalyst,” says Laurence Johnson, head of the utility and energy infrastructure group at engineering consultancy Hoare Lea. “Infrastructure requires long-term investment that is traditionally connected and guaranteed with strike prices, say, in the case of electricity. Doing this speculatively without the customer yet in place will need some guarantees that only government can offer.”

If the right hubs can be created, providing low-cost low-carbon infrastructure with plenty of renewable energy digital connectivity and access to water, the prize could be huge. Such centres will have a new gravitational pull.

And it's already starting. There isn't a day that goes by without a headline about another new green hydrogen hub, whether it be in the UK or on the other side of the world.

“These types of hubs will draw in industries by providing the most economic locations for them to meet their needs,” Johnson predicts. “As engineers, we need to value our resources differently. It's capacity, carbon and cost – the three Cs. This allows us to create a market around a cluster that can be measured and valued against competing traditional locations in cities.”

China is ahead of the curve on this. It already has green special economic zones, with the specific aim of attracting green finance. The UK, meanwhile, has pushed freeports as a post-Brexit policy, offering tax incentives to draw in businesses. Two freeports in Scotland are also being touted as green. They'll be powered by offshore wind and aim to develop green hydrogen.

“Special economic zones have huge potential,” says Gavin Watson, an energy and sustainable finance specialist at law firm Pillsbury. “We are talking about anything from 'green clusters' and 'energy transition hubs' to 'sustainable innovation zones.’”

Watson believes that the development of low-carbon infrastructure and ecosystems “should mirror the

approach taken by economic free zones, whereby complementary infrastructure is developed side by side. This not only improves the potential for the practical application of energy sources; it also encourages resource-sharing and innovation.”

A more localised approach to infrastructure planning could also generate its own gravity. Businesses, employees and investors will be attracted by cheaper renewable energy generated on their doorstep, super-fast digital connectivity or affordable transport networks.

“Their proximity would offer a range of benefits, including greater value chain integration and reduced costs and environmental impacts,” says Jonathan Moseley, executive director and head of infrastructure and defence at real-estate giant CBRE. “This could represent a complementary range of interdependent, colocated infrastructure assets.”

New hubs could also draw in innovative pilots or new applications of infrastructure technology. This has been seen in Seoul, Masdar City (the UAE) and Kalundborg (Denmark), which has taken industrial symbiosis to the next level.

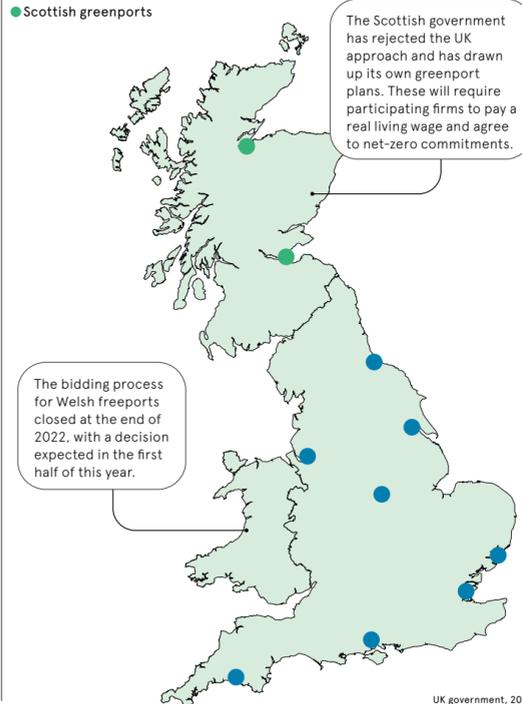
As Dave Cole, programme director of project solutions at engineering consultancy KBR, notes: “Clustering enables the development of highly skilled resources, especially when connected to universities and research institutes.”

The opportunity is ripe, then. But, as ever, it will take that magic mixture of commitment, funding and long-term vision for these nascent infrastructure clusters to reach their full potential. ●

THE UK'S NASCENT FREEPORTS ARE ONE EXAMPLE OF CLUSTERING IN ACTION

Location and status of proposed freeports

- UK government freeports
- Scottish greenports



UK government, 2023

INSIGHT

‘Words must be matched by action’

As the government sets out its spending priorities, it's time for it to deliver on the promise of reform, says **Jon Phillips**, acting CEO of the Global Infrastructure Investor Association

“We are not hanging around on this,” Jeremy Hunt promised business leaders at the end of last month, responding to questions about the successful implementation of investment incentives in the US under the Inflation Reduction Act 2023.

“We recognise that it is creating challenges,” Hunt said of the Biden government's sweeping legislation. “We don't agree with every aspect of it, but nor do we have any doubt at all in our ability to compete.”

As the chancellor and his team rehearse for his spring statement today, they'll be conscious that it's not only across the pond where competition for the infrastructure investment required to achieve net zero is intensifying. The EU is developing a green deal industrial plan. This involves accelerating permissions processes for sustainable projects, streamlining access to finance and developing incentives for investors in green projects.

Given that context, it's encouraging to hear a UK minister pledging to take action. There is certainly work to do.

Every six months, we test investor sentiment among our members, which have a combined £1.1tn in infrastructure assets under management globally, to gauge their appetite for investing in different markets. Over the course of last year, the UK went from being the most appealing destination in western Europe to the least.

The rankings came in at around the same time that major forecasters were predicting growth for all the world's big economies apart from the UK. One significant contributor to the gloom was the lack of infrastructure investment.

What a difference six months makes, at least where the forecasts are concerned. The sense now is that the UK could narrowly avoid a recession this year; inflation could fall to near 2% before 2024 (bringing down project delivery costs significantly); and the public finances are healthier than expected, to the tune of £30bn.

Those shifts, along with the government's commitments to reform, could push the UK back up the investor sentiment league. But only if words are matched by actions.

Hunt is right to say that hanging around is not an option when it comes to reforming this country's infrastructure regulations and investment incentives. Only by doing

so can we hope to attract the finance required to modernise our transport networks, digitally connect our communities and hit our renewable energy targets.

The chancellor has also promised to respond to Chris Skidmore MP's *Net Zero Review* over the coming months. This comprehensive study is a treasure trove of recommendations that, if enacted, would accelerate inward investment. Skidmore leaves no stone unturned when considering all the interventions needed to make our net-zero goals attainable. He covers aspects ranging from streamlining our planning processes to increase solar and onshore wind delivery to developing a cross-sectoral infrastructure strategy, even homing in on the importance of biodiversity.

While the study suggests several helpful new measures that could improve investor sentiment towards the UK, addressing existing measures that disincentivise investment is also a must. These include the 45% tax on renewable electricity generators – a levy that is far more punitive in practice than the so-called windfall tax on fossil-fuel companies.

At a more fundamental level, as Andrew Jones MP, chair of the all-party parliamentary group on infrastructure, set out on our podcast recently, we need to develop a far more sophisticated and long-term approach to combining private and public finance to deliver infrastructure, for the benefit of communities and savers alike.

We look forward to a strong statement of intent from the government. Then what we truly need, to get the economy back on course, is the turning of kind words on infrastructure investment into action. ●



Jon Phillips
Acting CEO, Global Infrastructure Investor Association

Q&A

An innovative approach to network infrastructure



Accelerating digital transformation is critical for business but how can this be achieved without compromising security or sustainability? The answer lies in applying technology in three key areas, explains **Stephan Robineau**, Alcatel-Lucent Enterprise's executive vice-president, network business division

Q How can Alcatel-Lucent Enterprise help companies in their digital transformation goals?

A Corporations are increasingly dependent on network infrastructure, with the reliance on digitised work making it mission critical. However, we see this increasing reliance happening at a time when IT teams are static, so the pressure to deliver a high quality of service is paramount.

This is why ALE is delivering on its digital age networking (DAN) vision in order to support the needs of both IT and the companies' operations, delivering solutions that address the needs of healthcare, hospitality, education, transport, energy and utilities, and government providers.

Q What is digital age networking?

A Autonomous networks, IoT and business innovation are the three pillars of DAN and they can all speed up digital transformation when the latest technology is applied and optimised.

An autonomous network will support the most demanding applications, while minimising the workload of daily IT operations thanks to its high-performance handling of mission-critical network operations.

“Leveraging artificial intelligence in network operations can significantly reduce the time needed to identify an issue

And with corporations adding hundreds or even thousands of sensors and smart devices that require connectivity to their operations, ALE offers technology to automate connectivity – from wired to wireless – and ensure their security.

Finally, we look to business innovation, accelerating transformation and performance with automated workflows. DAN draws on technology capable of bringing together valuable information in real time and delivering it to the individuals that need it.

Q How can ALE help enterprises protect their infrastructure from cyber vulnerabilities?

A All our network solutions have cybersecurity built into their DNA because we know attacks aren't limited to the external world, they can also come from compromised IoT devices.

We reduce exposure by using very restrictive security rules, defined by customer need, to automatically identify, classify and connect each device and deliver a zero-trust defence architecture that makes connectivity simple but secure.

Additionally, we open our source code to an independent security company to verify we are following the best security practices and help ensure there are no backdoors to be exploited. On top of all this, we also recently introduced ALE's Network Advisor, an AI-based bot that watches a customer's network 24/7.

Q What benefits will AI have on network operations in the coming years?

A Leveraging artificial intelligence in the management of network operations can significantly reduce the time needed to identify an issue occurring in the network and solve the problem. Our network advisor tool again gives administrators full control to apply the

fix and decide whether it should be carried out automatically in the future.

From analysing telemetry data to pattern recognition, these AIOps applications are invaluable because they free up administrators and allow them to focus on other activities more important to the transformation of the enterprise.

AI models trained using the database of known customer problems, product documentation and product release notes can also deliver support portals with natural language interfaces to help customers resolve any issues they may be having.

Q Is ALE's technology compatible with sustainability?

A The message at our Connex23 event this year was 'technology for good' and, from the beginning, ALE has used technology to enable enterprise sustainability through design. We want to continue to support our customers in their digital transformation objectives, while minimising the impact on the planet.

ALE's environmental policy is in place to ensure our technologies meet with local, national, and international environmental legislation, as well as tracing hazardous materials and eliminating banned substances from our products.

By providing low-consumption equipment, energy-efficient architectures, and low-carbon footprint solutions, Alcatel-Lucent Enterprise plans to be a significant actor in the path towards a more sustainable business environment.

For more information visit www.al-enterprise.com





WASTE MANAGEMENT

Rise of the superbugs

New technologies for waste treatment are being trialled to tackle the proliferation of antibiotic-resistant bacteria. But is there enough impetus to integrate these into our infrastructure at scale?

Heidi Vella

The impact of environmental degradation on public health is becoming increasingly clear. The latest cause for concern is the apparent link between pollution and the deadly spread of antimicrobial resistance (AMR), according to a new research report from the United Nations Environment Programme (UNEP). The report, *Bracing for Superbugs*, highlights how wastewater pollution into nature from manufacturing, healthcare and utility waste streams is accelerating the problem. The question is whether it's possible to re-engineer our waste-handling infrastructure to avert disaster. The effect of AMR is such that the antibiotics usually given to treat common bacterial infections no longer work, because the bacteria have become immune to them. This

phenomenon is so serious that it amounts to a "silent pandemic", according to the report. It isn't hard to see why. In 2019, AMR was linked to an estimated 5 million fatalities worldwide. Left unchecked, AMR could account for 10 million deaths annually by 2050, with the highest rates in Africa and Asia. It could also cut global economic activity by £2.8tn annually over a decade, the report predicts. One way that AMR occurs is when traces of an antibiotic, from waste produced by manufacturing sites and hospitals or passed from humans via the sewage system, are discharged into the natural environment. Because they reproduce at such a fast rate, the bacteria can evolve and mutate into new strains that are able to resist the once deadly compounds they're being

exposed to. Chemicals such as disinfectants have also been shown to produce adaptive changes in bacteria after a sustained release, even in small quantities. The mutated bacteria can go on to infect humans, animals and plants and even share their resistant traits with other types of bacteria. While AMR is most prevalent in nations with poor sanitation infrastructure, it also seems to be occurring in the UK. Research published by the University of Exeter last September identified a "significant risk" of increasing AMR associated with the nation's wastewater systems. It found that 67 treatment plants had levels of the antibiotic ciprofloxacin that were "likely" to lead to increased resistance. Pollution in rivers from waste treatment facilities has become a

hot topic as reports of its prevalence come to the public's attention. In 2020, for example, there were more than 400,000 sewage discharges into English rivers and coastal waters, according to figures from the Environment Agency. To combat the problem of AMR, the UNEP is calling for a "one health" approach to waste. This recognises the interdependence of our health and that of animals, plants and the environment. Among other things, it states that waste management processes should be re-engineered to minimise effluent streams into the environment. "The bottom line is, we want fewer chemicals entering the environment and fewer resistant bacteria. That's because we know that, once resistance is out there, we can't control it," explains David Graham, professor of ecosystems engineering at Newcastle University and an author of the UNEP report. "It's better to solve the problem at source." This is especially important, given that treatment processes do not actively remove resistant bacteria,

and it's not yet understood what concentrations of antimicrobials in water can be considered safe. Most waste streams are separated, with the liquid being passed through a form of biological treatment. This often features an energy-intensive forced-air system to encourage useful bacteria to consume organic matter. The solids are diverted and treated by a different process, often an anaerobic one. Using different approaches and retrofitting new tech into old facilities could reduce both energy usage and waste volume, Graham says. He worked with L'Oréal to do this at one of its manufacturing sites in Suzhou, China. The facility stopped using a forced-air system that was failing to break down preservatives and detergents, which are added to increase goods' shelf lives. Instead, waste containing these compounds was siphoned out at source, to be treated separately with chemicals. Everything else went through an anaerobic process. This produces biogas, which can then be used for energy generation. "We separated the waste to create a valuable asset," Graham says. "That's what we're promoting; the idea that it can be another resource." Another facility – in Addis Ababa, Ethiopia – is using an anaerobic system followed by an aerobic one. He explains: "Sequencing the wastes through different treatments can ecologically select away aerobic and then anaerobic micro-organisms

A truly green solution? Some treatment facilities use algae to absorb pollutants from wastewater

“Once resistance is out there, we can't control it. It's better to solve the problem at source

from the wastewater, including antibiotic-resistant bacteria." Engineering consultancy Arup worked with food giant Del Monte at the latter's pineapple cannery in the Philippine town of Bugo to achieve something similar, says Dr Bhavik Barochia, a digital consultant. The facility switched from an aerobic process to an anaerobic one with gas recapture. This cut contaminant levels in the wastewater from its pineapple-washing process and enabled the unit to stop using coal-fired power, explains Barochia, who has a background in microbiology. New technologies are also emerging. Barochia highlights Wase, a startup that's developed a modular microbial electrolysis system that takes a variety of wastes and converts these into water, fertilisers and methane using an anaerobic digestion system enhanced by various types of bacteria. "Depending on which compounds are present, the process produces less waste and, potentially, less antimicrobial resistance," he says. Meanwhile, UK-based firm Power & Water has created a modular wastewater treatment solution that uses a chemical-free process. Its CEO, Harry Cowan, explains that the technology can reduce wastewater overflow by adding up to 50% more capacity to a treatment plant. The company is working with facilities in Turkey and Egypt, as well as five out of the 11 water companies in England and Wales. But Cowan observes that businesses in this country are generally "resistant to changing their ways". Investments in waste reduction and sustainable technologies are happening, but it's not known at what scale. Adoption will require significant capital investment and ongoing operational expenditure. At present, there is little incentive to invest in anything other than simply maintaining the existing standards, according to Barochia. "This is despite discoveries of other potentially harmful compounds being released by manufacturing processes," he says. For instance, potentially carcinogenic per- and poly-fluoroalkyl substances were recently recorded at 81 sites on English rivers, prompting calls for further action. The AMR Industry Alliance, which represents one-third of the antibiotics market for human health, is trying to instigate change in its own sector. The alliance is setting up an independent certification scheme to be trialled this year, allowing for independent third-party verification that an antibiotic is made to an established standard, including the responsible disposal of waste. Steve Brooks, an adviser to the alliance, believes that the scheme will help healthcare procurers buying antibiotics to know whether suppliers are meeting certain criteria. He believes that this could encourage generic manufacturers, based mostly in India and China, to adopt it. Additionally, he hopes that it will have a wider influence on the agriculture sector – also highlighted in the UNEP report – which accounts for about 80% of all antibiotics consumed in some countries.

The number of severe antibiotic-resistant infections in England increased year on year in 2021 by



The total equated to an average of



If you're from England's lowest decile of communities by income, you are



UK Health Security Agency, 2022

"The issue will not be resolved without action across the global supply chain," Brooks says. "We are trying to provide a path to that." Experts agree that more routine AMR monitoring and research are needed – for instance, through building wastewater-based epidemiology into the infrastructure. This is when waste streams are routinely tested to monitor public health – something Barochia is doing under the Welsh government's bio-surveillance programme. This can highlight problems as they arise and inform public health decisions. "There should be more focus on the impact of different waste processes on the environment, instead of overlooking it," he stresses. "With modern technologies, it is becoming faster and easier to do that." ●

“This issue will not be resolved without action across the global supply chain. We are trying to provide a path to that

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REGENERATION

Lock and load – the return of freight to the nation’s canals

Efforts to revive the UK’s inland waterways as commercial routes could ease some of the pressure on its creaking road and railway networks. But there is much work yet to do

David Stirling

Think of British canals and your mind may turn to bucolic trips in the sunshine or the waterways’ role in the industrial revolution. But one point is generally agreed: these mammoth pieces of infrastructure are from another age.

That may be changing. Transport experts think that increasing the amount of freight moved on the UK’s inland waterways could help it to rise to the very modern challenge of hitting the government’s net-zero targets on CO₂ emissions.

For instance, at the end of last year, the City of Edinburgh Council floated the idea of reintroducing commercial barges on the Union Canal. These would bring freight into consolidation hubs in the city to reduce the number of lorries contributing to road congestion.

Regular commercial traffic has also recently returned to the 18th-century Aire and Calder Canal. This was made possible by the conversion of a 500-tonne barge called the MMS Off-Roader. Moving

marine aggregate from the Port of Hull to Leeds, this low-emission vessel can take the equivalent of 18 HGV loads off the road.

But water freight traffic remains so minimal that much of this benefit is being missed. According to the Department for Transport, water accounts for about 14% of goods moved in the UK and 6% of goods lifted. This is down from 19% of goods moved in 2010. London is the second-largest handler of water freight in the UK, but even that figure is constrained.

John Spencer is director of GPS Marine, the largest multi-cargo intra-port barge operator on the Thames and Medway. His fleet moves about 1 million tonnes of everyday freight each year but typically works at only half-capacity between major projects.

“We could do so much more,” he says. “Moving cargo on large inland waterways is an easy win for the climate. But the problem is, we’re using 19th-century infrastructure to solve 21st-century problems.”

Bemoaning the relegation of the Thames to “London’s hinterland”, Spencer says that the barriers include a lack of investment in modernising wharves. It wouldn’t be prohibitively expensive to reactivate a wharf – he estimates the cost at around the £500,000 mark. But obtaining planning permission is often a stumbling block.

“Most opportunities have evaporated long before you have planning consent – and that has meant millions of tonnes going on to London roads,” Spencer says. “Outside the capital there are also issues with waterways that have fallen into disrepair. They haven’t been dredged and their locks work only during shop hours. It needs to be 24/7 for a proper freight network.”

A lack of distribution centres or manufacturing plants located near wharves is also hampering development, he adds.

“We need a national organisation whose job it is to keep waterways infrastructure working,” Spencer argues. “It requires a joined-up

approach and a change of mindset from ‘just put it on a truck.’”

Kate Willard, the government-appointed Thames Estuary envoy, acknowledges that landing points are a significant factor holding back the use of waterways for freight.

“Pier and wharf infrastructure is one of the key barriers to the industry’s ability,” she says. “Studies are looking at the necessary adaptations and costings. The government’s subsidy programme – the mode shift revenue support scheme – is designed to support the shift from road into more sustainable forms of transport, including water, but this does not allow for capital investments in infrastructure.”

Tim West, company secretary of Robert Wynn & Sons, a specialist in transporting abnormal loads by water, believes that policy-makers could and should go further.

“There is work to be done to understand the market and what levers can be applied in government to encourage this modal shift,” he says. “The commercial waterways need to be considered like the strategic road and rail network – and funded accordingly. Planning policies need to encourage the movement of freight by water and ensure that waterside developments don’t compromise this.”

Dr Momchil Terziev is a research associate specialising in naval architecture, ocean and marine engineering at the University of Strathclyde. He thinks that the use

of more environmentally friendly and efficient dredging could also bolster the case for water freight.

“If you’re dredging, you can look at what sort of canal geometry is optimal for more energy-efficient transport,” Terziev says. “We are looking at how renewable fuels such as hydrogen and electric-powered boats could reduce emissions too.”

Of course, these fuels will have their own infrastructure needs, such as recharging points throughout the network. There are also issues concerning the lack of supply of hydro-treated vegetable oil. By adopting this biofuel, Spencer’s Thames fleet has cut its greenhouse gas emissions by about 90%.

Despite the progress that’s been made, a wholesale revamp of the UK’s canal infrastructure would be prohibitively costly. That’s the view of Matthew Gore, a partner at HFW, an infrastructure-focused law firm.

“UK inland waters are often narrow, shallow and unable to accommodate much larger vessels. The economics of that means there is a limited amount of scope to develop them,” he says. “On the Manchester Ship Canal and the Thames you can do stuff, but the bigger UK opportunity lies in coastal shipping. That could include more movements between main and feeder ports and using roads just for the final mile.”

There’s certainly scope to focus on larger waterways. The UK’s big conurbations – including London, Birmingham, Manchester and Leeds – are all connected to coastal ports via commercial waterways capable of carrying 300-tonne barges.

Spencer believes that the movement of freight on the Rhine and its tributaries in Germany can be a model for the UK.

“It won’t be cheap, but neither is building a motorway,” he argues. “The sepia-tinted photos of the barge and the horse on the towpath is not where it’s at. We are using bigger vessels with modern kit and fuels. It will deliver results.”

50%

The carbon footprint of a barge is about half that of a lorry

Even the UK’s smallest canals can take barges carrying loads of up to

25 tonnes

But the latest barges can carry up to

550 tonnes

Commercial Boat Operators Association, 2023

“Moving cargo on large inland waterways is an easy win for the climate. But the problem is, we’re using 19th-century infrastructure to solve 21st-century problems

Why gigabit connectivity is critical for companies and the economy

Opening up fibre network provision to alternative suppliers is accelerating deployment rates in the UK. As more businesses access full fibre connectivity, there will be long-lasting economic benefits

The deployment of improved digital infrastructure has been a strong success story for the UK in recent years. While in 2010, there was almost no ultrafast connectivity, more than half of British premises can now be reached by full fibre delivering speeds of over one gigabit per second (Gbps). The government is now aiming to have all premises connected to fibre by 2030, with a growing emphasis on enabling speeds of up to 10Gbps where practicable.

The sudden increase in full fibre has been achieved by opening up the market to alternative network providers, known as altnets. By moving beyond a reliance on the established incumbents Openreach (part of BT) and Virgin Media O2, an ecosystem of nearly 130 altnets has been created, reaching a wide variety of buildings across the country.

Gigabit for business

Much of the fibre rollout so far, and the attention of many altnets, has been focused on consumers. By creating the infrastructure for fibre as close as possible to people’s homes, the belief was that it would be possible to serve businesses next, but the technology has not been sufficiently reliable or capable.

“Companies as a whole are sitting on old networks that do not really serve their demanding requirements,” explains Daren Baythorpe, chief executive at the gigabit connectivity firm ITS Technology Group. “It’s been somewhat naïve to think that the consumer rollout would naturally mean business’ needs can be met. The reality is that companies have faced a real dearth of fibre, harming their productivity, efficiency and scope for innovation.”

As a result, several fibre providers are focusing directly on quickly advancing high quality gigabit connectivity for business premises. They have no copper cables to replace or legacy services to protect, their innovation instead using wireless back-up and direct-to-cloud connectivity.

“The impact for businesses is enormous: as well as the fast speeds, they can have much more confidence in the service levels and bandwidths they are getting, with proper resilience and security built in,” explains Baythorpe. “Over the past five to six years, the altnet sector has played an increasingly important role in ensuring these businesses are reached.”

ITS, which was initially focused in the North West under its Faster Britain

brand, has taken full fibre across 30 towns and cities, with its 58 networks ensuring connectivity is accessible to almost 25% of the UK business market.

For the broader UK economy, the benefits are equally significant. “It became clear during the Covid pandemic just how much we all needed better connectivity,” says Baythorpe. “As gigabit connectivity is rolled out, there are so many benefits: from children being able to do their schoolwork more easily, to businesses fulfilling their potential and employees having better access to cloud-based systems from multiple locations.

“Gigabit connectivity also supports cities’ smart transport developments, flood monitoring systems and the delivery of more intelligent health services to citizens.”

Rising investment

As altnets help drive the fibre rollout, investment in the sector is rising. The increased competition has seen more than £18bn of new investment committed through these alternative providers in recent years. This has also prompted the incumbents Openreach and Virgin Media O2 to step up their own capital plans. The government’s Future Telecoms Infrastructure review in 2018 projected that over £30bn in total would need to be invested for full-fibre coverage in the UK.

However, many of the altnets face challenges. Most have a limited geographic reach and a vertically integrated, narrow business model for reaching core customers. In addition, incumbents’ plans to discount wholesale fibre costs to internet service providers have been problematic because the contracts in place tend to require large usage commitments in return. This acts as a disincentive to service providers to connect through altnets when their customers switch to fibre. While new regulations come into force in April to oblige easier switching, much of the market is yet to develop the processes and systems needed to make it an easy option.

Some of these technological and scale-related challenges are being overcome by altnet mergers and acquisitions. These will bolster the positions of more ambitious providers and unlock faster deployment. “Altnet M&A is likely to accelerate over the next two years, spurred on by the economic pressures many of them face,” Baythorpe notes. “We think it will be a strong positive for the industry and will drive innovation.”



“Just as with copper over the past century, fibre is a technology that will be relied upon by multiple generations

ability to tap the potential capacity of unused ‘dark fibre’ – unused optical fibre – across the country, broadening its footprint.

Full fibre partnerships in practice

Throughout the UK, hundreds of internet service providers, network operators and resellers are all partnering with ITS to consistently expand the provision of ultrafast, full-fibre gigabit connectivity. Collaborations between the public and private sectors are also a vital part of ITS’s work, highly tailored to local needs.

One such collaboration is LCR Connect, a £30m joint venture with Liverpool City Region Combined Authority that is on track to transform the digital infrastructure of the six local authorities across the region. Another is Digital Greenwich Connect, a £2m joint investment with the local authority’s innovation unit that aims to make a historic London borough

one of the UK’s most digitally connected areas.

Looking ahead, expectations are that the national rollout of full fibre connectivity will provide profound and long-lasting economic benefits to all parts of the UK. “Just as with copper over the past century, fibre is a technology that will be relied upon by multiple generations,” Baythorpe concludes. “At ITS, we’re excited to be a part of a transformation that will boost the entire economy and provide unprecedented capabilities for businesses across industries.”

To find out about full fibre connectivity to businesses, visit itstechnologygroup.com

its.

CONSTRUCTION

Retrofit for purpose? The challenge for government

Updating the built environment should be a priority in the UK's efforts to hit its 2050 decarbonisation targets, but the sector is worried about a lack of policy coordination from Westminster

Tim Cooper

The built environment accounts for a quarter of all greenhouse gas emissions, according to the UK Green Building Council (UKGBC). Simply retrofitting as many buildings as possible with better insulation or cleaner power would seem like a slam dunk, then, but it's not so straightforward.

The government's net-zero strategy includes measures to support retrofitting, from providing grants for repairs to promoting the use of heat pumps. Unfortunately, many in the property sector believe that such interventions are meagre, myopic and uncoordinated.

The UKGBC which has more than 600 members from across the sector, promotes green building methods. According to its analysis, the government's approach will reduce the built environment's emissions by only 60% by 2050 – missing the net-zero goal by a mile.

In November 2022 the chancellor began to address this problem by pledging new investment aimed at

cutting the UK's energy demand by 15% before 2030.

"This is encouraging, but we still await the strategy and long-term, stable policies and investment behind that," says Louise Hutchins, head of policy and public affairs at the UKGBC. "The government's strategy needs to be more joined-up and commensurate with the scale of the challenge."

Part of the problem has been a lack of big-picture thinking. Lee Fraine, head of building services and sustainability at property consultancy Rapleys, reports that much of the focus so far has been on the necessary building work, with insufficient attention paid to upgrading infrastructure to support these changes. For instance, decarbonising the nation's public sector buildings alone will cost up to £30bn, according to government figures. But Fraine says that accounting for the necessary supporting infrastructure will push the final figure up towards £90bn.

Without those infrastructure upgrades, quick fixes may not work. For instance, a heat-pump system for a large business premises requires a big power source, which may necessitate energy upgrades for the surrounding area. A heat pump might cost a building owner £45,000, but the full cost – including infrastructure – could be £135,000. Some owners may feel that they can't afford their part of the investment, while there's plenty of griping about the cost on the government's own backbenches.

“The government's strategy needs to be more joined up and commensurate with the scale of the challenge

Another problem is that some building owners are yet to appreciate the value of retrofitting, despite research from real-estate services giant JLL showing that sustainable buildings can support higher rents. Even if all building owners do come on board, there aren't enough skilled professionals – including architects, designers and engineers – to deliver large-scale retrofitting. A House of Lords committee recently found that there were fewer than 2,000 heat pump installers in the UK, but more than 130,000 gas engineers.

Gillian Charlesworth is CEO of the Building Research Establishment (BRE), a body that sets sustainability standards for buildings. She acknowledges the recent announcement of £5m in training grants to help 10,000 trainees become experts in low-carbon heating. But she says the government's retrofitting strategy lacks provision for green jobs retraining.

"The government estimates that 50,000 qualified workers will be needed, but the Heating and Hot-water Industry Council suggests that we need 150,000 trained heat-pump installers. Without them, the UK won't meet its 2050 targets," Charlesworth says.

There are yet more barriers to retrofitting. Some owners don't want to alter a building's appearance or character, for example. Building work can bring inconvenience, while there are persistent shortages in the supply chain.

What needs to change? Chris Delaney, managing director of low-carbon energy adviser Green Building Renewables, points to a near neighbour that has been getting things right.

"Ireland offers an excellent illustration of a joined-up strategy," he argues. "It has built an infrastructure of financing, advice, training and quality assurance to deliver retrofits nationwide through approved one-stop shops. Many UK stakeholders are raring to go on retrofitting. Done correctly, it's an incredible opportunity to create thousands of jobs. With our organisations and skills, we could be a world leader. But the government must unlock the potential."

Hutchins believes that the UK needs a comprehensive package of incentives, regulations, standards and planning reforms – for example, removing constraints that might block retrofitting in heritage buildings. The UKGBC would also like to see the monitoring of carbon impacts throughout a building's life, as this transparency can show how much more sustainable retrofitting is than demolition.

The government has several policy levers at its disposal. It could encourage action, for instance, by reforming VAT and business rates or by offering investment rebates to incentivise retrofitting.

There's a critical role for local government too. Manchester City Council is one of only a handful of UK authorities to have led on retrofitting. Elsewhere, cities such as New York, Melbourne and Vancouver are pioneering decarbonisation initiatives for buildings. New York

has incentivised owners to conduct deep retrofits with a finance package offering long-term low interest rates.

The government did not respond in time when asked for a comment for this article, but industry bodies believe that it understands the need for more policies on retrofitting and is working on them.

Meanwhile, proactive property owners are leading with voluntary retrofitting solutions. The UKGBC reports that many of its members are using so-called green contracts to define responsibilities for managing emissions in a building.

Hutchins adds: "Our members are also using technologies to improve energy performance and installing insulation, heat pumps, solar power and measures such as green roofs to capture carbon."

Business leaders are increasingly looking at their options too. For example, the BRE's environmental assessment method enables firms to improve their buildings' energy performance from design through to construction, use and refurbishment. Charlesworth says that such certification can help building owners to attract green investment and avoid compliance failures and reputational risk, while maintaining long-term asset values.

As the government refreshes its energy strategy, the built environment sector is hoping for a strong signal that retrofitting will be an exciting growth area. But, until more coordinated policies arrive, many players will have to go it alone, voluntarily fast-tracking their retrofitting measures. ●

1/3

of all commercial buildings in the UK are more than 100 years old

150k

new tradespeople will be required to work solely on decarbonising the UK's historic buildings in order to meet its 2050 net-zero target

Improving the energy efficiency of the UK's old buildings could reduce yearly CO₂ emissions associated with the built environment by

5%

Grosvenor, Peabody, Historic England, the National Trust, the Crown Estate, 2023



Augean ENRMF Waste Treatment Facility (left) and Hazardous Waste Landfill (right)

Why landfill is not always a dirty word

To support the success of key infrastructure projects, UK plc needs to safely and compliantly dispose of waste that cannot be reused, recycled or recovered

Building for the future will always create waste – from nuclear materials to remnants of precious metals, along with the residues from treating exhaust gases from power stations to prevent air pollution.

As infrastructure grows and develops, UK plc must find ways to manage it all. One of the main ways to do this is through landfill, but the word often conjures up images of dirty dumps covered in seagulls on the edge of towns.

However, according to John Rauch, chief executive at Augean, modern hazardous waste landfills are completely different and highly-engineered. With a range of sustainable waste management sites across the UK, Augean caters for the wide-ranging needs of heavy industry and UK infrastructure. This includes recycling, processing, treatment and disposal.

Tight regulation and traceability

Augean's sector is underpinned by very strict legislation for authorising the management of hazardous waste. The UK is committed to moving towards a more circular economy that will see resources used for as long as possible, extracting maximum value, minimising waste and promoting resource efficiency.

Every effort is made to reuse, recycle or recover but there will always be 'residual' waste leftover. It leaves two options for disposal: landfill or incineration at high temperatures.

"We want to see recycling driven forward," says Rauch. "But even recycling generates small quantities of concentrated materials that are hard-to-handle or for which there is a lack of current technology to make it economical or safe to do anything with it other than disposal."

"We put it into highly engineered landfill sites, which are traceable and mean we know exactly where everything is. We know which landfill cells were filled with which materials." Augean sites represent more than 50% of the UK's hazardous landfill capacity, serving construction, decommissioning and large national infrastructure projects such as HS2 and Crossrail. Augean takes waste from the Canal and River Trust, keeping the waterways open, and services the UK's nuclear estate for disposal of low-level radioactive waste and the renewable energy sector.

Innovative methods are used to recover fuels and other materials for reuse. But certain wastes – such as air pollution control residues from power

stations or asbestos – must be managed safely to prevent harm to human health and the environment.

Metals are in-demand due to increased electric vehicle production and new manufacturing technologies. Extracting them as part of the circular economy to put back into the manufacturing process is important but not always cost effective.

However, this may be possible in the future, explains Rauch, which is where responsible landfill could provide a resource bank.

"Leftover residues containing heavy metals disposed in landfill could be traced and removed in the future, if technology and economics have moved on to make this worthwhile," he adds.

“

We need to change the mindset and show how not all landfill is bad and that it is a crucial part of resource and waste management

A boost for UK plc and nuclear

To reach net-zero targets, the UK needs nuclear power to be part of the solution. This does generate waste, with highly radioactive material dealt with in deep geological storage. However, the majority of waste from nuclear facilities is PPE, wood, stone or concrete, which have low or very low levels of contamination. These can instead be safely dealt with through landfill.

"A thriving economy needs the right waste management infrastructure to deal with all of these things. Our landfills are engineered to be sealed, so there's no risk to health or the environment," says Rauch.

Manufacturing in the UK presents a major growth opportunity for the future of infrastructure and the future of waste management. This in turn delivers an increased need for Augean's industrial services.

Rauch believes the opportunities ahead demonstrate what "an exciting industry" waste management is. But he accepts the company must attract highly experienced and skilled workers, or train new ones, if it is to sustain its own growth and contribute to the UK's economic success too.

He says: "Understanding waste materials and the complexities of managing them is key to our success. We are very proud of our high standards but understand the waste industry isn't a glamorous sector or top of mind for most people. There is also a lack of women and young people in the sector, which Augean wants to change."

"We offer incredible opportunities for all ages and genders, from chemists and engineers to finance specialists, health and safety specialists and environmental advisors. We invest heavily in training and apprenticeships. When people work in our industry, they can be part of a team making a difference to the environment and leaving a positive legacy."

Co-existing with communities

Augean is committed to health and safety, compliance and being a responsible operator – rigorously following guidelines and laws. Most consumers appreciate the importance of producing less waste and while non-recyclable wastes from households are often burned to create energy, this approach is not always appropriate for the waste produced by heavy industry.

Rauch explains: "Rather than hazardous landfill being considered an outdated approach, characterised as 'dumps', they are an important and strategic necessity. We need to change the mindset and show how not all landfill is bad and that it is a crucial part of resource and waste management."

Communities and the environment can also benefit from a responsible approach to landfill. Augean is committed to being a conscientious neighbour in the communities where its sites are located.

For example, Augean's Thornhaugh site includes two hectares of new reserve with well-established wetland, alongside four hectares of grassland and woodland planted with native trees in 2014. Some 20,000 trees were planted on its Marks Quarry site in 2020, while at Port Clarence 13 hectares feature species-rich short turf together with scrub and pond habitats to aid biodiversity.

"It is important to us that we meet our professional obligations in a way that does not have any serious impact on local communities or the environment in which they live," Rauch says. "We continue to deliver the highest level of service to our customers and through keen reinvestment, innovation and sustainable values, we earn trust and create a positive legacy."

For more information augean.co.uk

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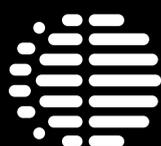
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