

FUTURE OF INFRASTRUCTURE

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* Credit Suisse Research on European Fibre Networks, Sept 2021

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ECONOMICS

More GDP, less CO₂ – the global green investment challenge

Governments worldwide are spending massively on infrastructure to help their economies rebound from the Covid crisis. But there is increasing pressure on them to fund only low-carbon projects

Peter Archer

Public investment in infrastructure, widely acknowledged as a key stimulant of economic growth, is at the heart of many nations’ plans to recover from the Covid crisis. In the UK, for instance, the chancellor has pledged £100bn of capital expenditure for this year, on top of the so-called levelling-up fund of £4.8bn for local regeneration projects.

The new UK Infrastructure Bank, based in Leeds, opened for business in June. Its main goals are to tackle climate change and to support local developments, especially in more deprived parts of the country. Eyes are on the bank’s potential to back substantial investments in projects covering areas such as housing, transport, renewable energy, digital telecoms and waste management.

According to the Treasury, the bank has “an initial £12bn of capital to deploy and will be able to issue £10bn of government guarantees, helping to unlock private-sector funding and more than £40bn of overall investment”.

Dr Jennifer Schooling, director of the Centre for Smart Infrastructure and Construction at the University of Cambridge, agrees that infrastructure investment has a key role to play, but stresses that “we have to be spending on the right things”.

She explains that, although “new assets have to be designed, built, managed and maintained to give us whole-life value”, the government also needs to focus on “getting more out of the existing infrastructure and using smarter technology – machine learning and digital twins, for instance – in an informed way.”

The labour shortage in the UK construction industry is not only a result of Brexit and the Covid crisis, according to Schooling.

“It has an ageing workforce, with many workers due to retire in the next 10 to 15 years,” she says. “We need to move the perception of its work away from ‘shovels, mud and concrete’ by using the best available technology in the most appropriate way. We need smarter methods – more automation, for instance – so that the work is less physically taxing. This should make the industry more appealing to younger people.”



“Even as the Chinese are clamping down on coal-fired power stations at home because of air pollution, they are still exporting such plants to developing nations

Sir John Armitt chairs the National Infrastructure Commission, which advises the government on the UK’s long-term infrastructure challenges. He says that reaching for shovel-ready projects is an understandable instinct for any government looking to kick-start the economy, noting that Westminster has not been alone in this respect.

“Only weeks into the pandemic, the UAE set up a £3bn package that included measures to accelerate its major infrastructure plans, while Australia planned a series of fast-track programmes worth more than £2bn,” Armitt observes. “The problem is that there aren’t all that many truly shovel-ready projects sitting

around waiting to get started. Major infrastructure works take time to plan and design for good reason – and they cost a lot.”

The US’s recently announced \$1tn (£760bn) package, which has allotted at least \$110bn to physical infrastructure projects, is a testament to his last point.

“Every large economy will be looking at investing in infrastructure,” Armitt says. “But the question that I hope everyone involved will be asking is: ‘How can we make this investment support a low-carbon future as well as GDP growth?’”

Jim Hall is professor of climate and environmental risks at the University of Oxford and a member of

the Council for Science and Technology, which advises the prime minister. He agrees that “the problem is going to be ensuring that infrastructure is green, especially in nations facing intense short-term pressures of a growing population and high unemployment”.

Described as the 21st-century Silk Road, Beijing’s multitrillion-pound Belt and Road Initiative (BRI) is one of the world’s biggest infrastructure programmes. Its objective is to better connect Asia, Africa and Europe, while extending China’s influence.

Although the BRI predates the pandemic, it will be central to the nation’s recovery from the Covid crisis. China is planning construction or already building in more than 100 countries, having signed agreements to cooperate on infrastructure projects including highways, railways and ports.

The G7 countries have countered the BRI with their Build Back Better World initiative. This US-led programme has been designed as a transparent partnership to provide the £29tn of infrastructure required by the developing world by 2035, according to the White House. ●

Successful infrastructure projects in developing countries can have a significant socioeconomic impact. Recent research by the International Monetary Fund (IMF) indicates that investments in railways in Ghana and Kenya, for instance, can “produce long-term gains by reducing trade costs and integrating markets, potentially transforming the economic landscape in poor remote regions with high trade costs”.

Many nations in the developing world have been pouring public money into infrastructure, while participation from the private sector has also increased, according to the IMF. But it adds that the cost of the pandemic may limit planned expenditure in some countries.

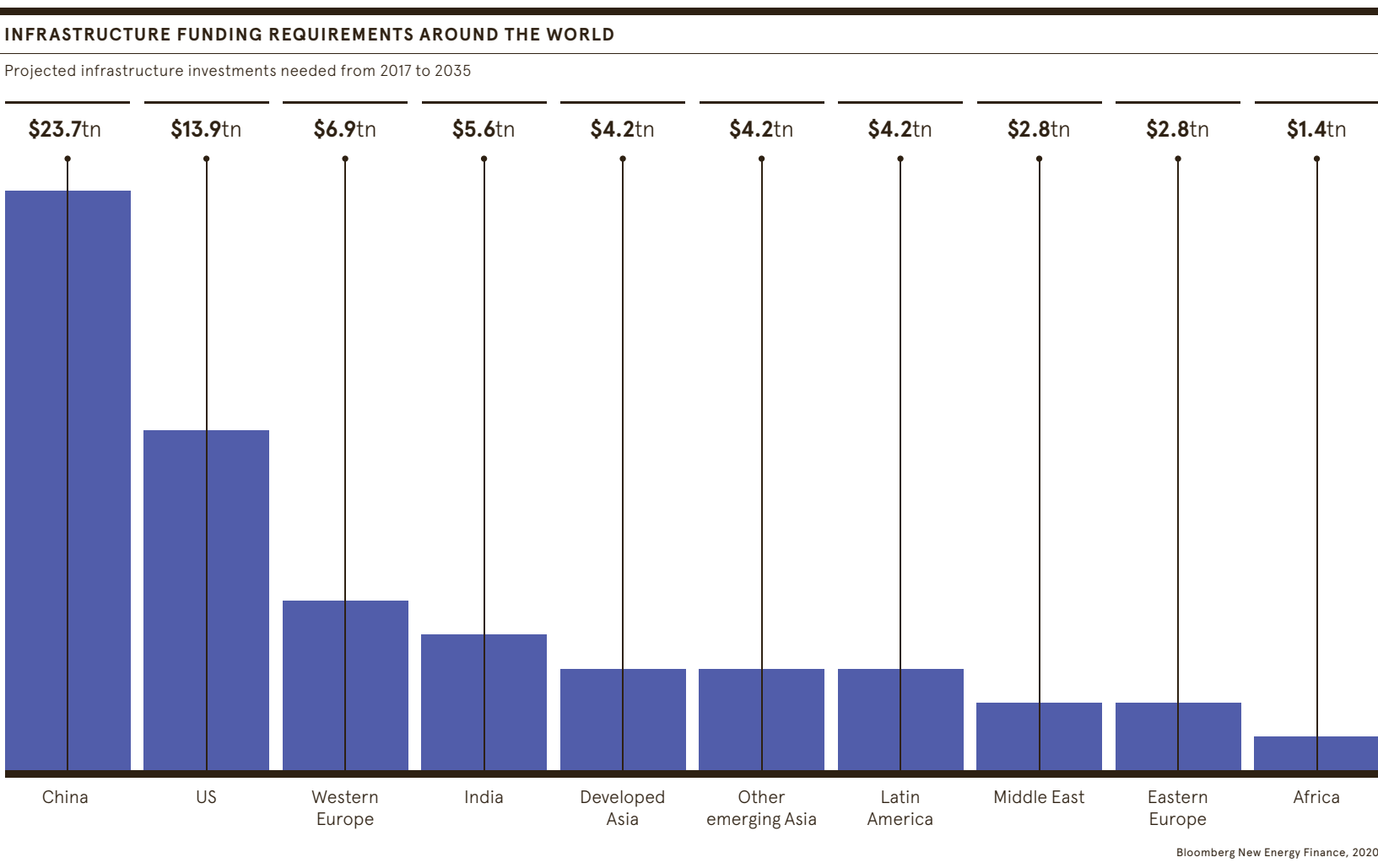
Armitt says: “The UK’s big institutional investors, including the government, can play a role in funding worthwhile programmes overseas. Traditional infrastructure projects are a relatively safe bet, albeit not always with the biggest returns.”

The challenge here, he adds, is to de-risk and attract private investment for more innovative engineering projects that could help to deliver a lower-carbon economy.

“Developing countries have secured considerable private finance for telecommunications and energy projects,” Armitt reports. “But they need to look to other sources of finance, including the World Bank or aid funding, in other sectors, including transport.”

Approaches to infrastructure development vary considerably around the world. Singapore, for example, has an infrastructure authority that takes a 50-year strategic overview, which is then broken down into 10-year plans. Senior civil servants are rotated between the planning and delivery functions.

Australia, on the other hand, created an infrastructure commission



in 2008, taking a federal view on what is needed and then disbursing the funds under its control to support state-level projects that align with its assessments.

China, meanwhile, has funded its key infrastructure projects centrally over the past 30 years. Its national infrastructure plan for 2020-25 is worth £1.4tn, according to Beijing, although some regions also have multibillion-pound programmes of

their own. In addition, the government has recently introduced a Covid-19 relief package to revamp the country’s digital infrastructure. This includes the installation of a 5G mobile network, the construction of high-speed inter-city rail links and the development of the internet of things.

“Whatever model of governance it operates, every country shares the challenge of how to build resilience

and adaptation to climate change,” Armitt says.

Hall believes that China – the biggest national producer of greenhouse gases, according to US research institute the Rhodium Group – is committed to addressing climate change through low-carbon infrastructure projects.

“Yet, even as the Chinese are clamping down on coal-fired power stations at home because of air

pollution, they are still exporting such plants to developing nations – Pakistan for instance,” he says.

On the other side of the world, Colombia serves as an example of how things can go wrong. Its government has been trumpeting its infrastructure projects, in packages described as “a new generation”, since the 1990s. The fourth and most recent of these, which began in 2014, was the biggest investment programme of its kind in the country’s history: 29 projects to build or upgrade 3,000 miles of highway, 775 bridges and 41 tunnels at a cost of about £9.5bn. The programme was scheduled to end in 2022 but has encountered serious delays, owing partly to flaws in contract design and partly to a corruption scandal in which a Brazilian construction firm called Odebrecht bribed officials to win contracts.

The nationwide 4G network roll-out is more than 40% complete. This represents significant progress since the election of Iván Duque Márquez as Colombia’s president in 2018, yet there is clearly still much work left to do, offering foreign investors potentially lucrative opportunities.

George Monbiot, the bestselling author, columnist and environmental campaigner, argues that foreign infrastructure investments in developing nations are the answer only if they are ecologically sustainable.

He says that any such investment would be desirable “only if it does not expand industrial frontiers into wildlife habitats; only if it replaces, rather than supplements, damaging infrastructure; and only if the new infrastructure is appropriate, has the consent of those it affects and meets the needs of the poor as well as the rich.” ●



The sustainability imperative

In the run-up to the UN’s COP26 summit on climate change in Glasgow in November, the UK is seeking to lead by example, but just how green is its infrastructure programme?

Environmental campaigners argue that the state’s infrastructure spending must combat climate change through carbon-neutral construction and/or the decarbonisation of equipment and networks.

“Infrastructure sectors account for about two-thirds of the UK’s total greenhouse gas emissions,” says Sir John Armitt. “Decarbonising energy, heating and transport is therefore crucial.”

On a global scale, without re-engineering networks for these services to be compatible with a low-carbon future, net-zero carbon emissions will be impossible.

But infrastructure can also offer engineered solutions for absorbing carbon from the atmosphere to offset the impact of the hardest sectors to abate, such as aviation and agriculture, while other methods are found.

Carbon capture and storage technology is another essential infrastructure innovation required to achieve net zero. It can take carbon dioxide emitted by heavy industries, such as steel and cement production, and store it under the seabed.

“COP26 is a key moment for galvanising action at home and abroad, and has already been seen to encourage the UK government to set some ambitious targets,” Armitt says. “But we should beware of loading too much expectation on to a single event, when in infrastructure terms we need to see consistent targeting of carbon reduction over the long term, at every stage of decision-making about the nature and design of projects.”

George Monbiot believes that as much hinges on the amount of old infrastructure that’s shut down as it does on the amount of new infrastructure commissioned.

“In transport, for instance, you need a two-pronged approach: increasing road space for buses and bikes while also decreasing the space for cars,” he explains. “We have a surfeit of fossil-fuel-dependent infrastructure – and

much of it urgently needs to be retired if we are to meet our climate goals. Similarly, we need more renewable and nuclear power. But we also need a simultaneous programme for shutting down thermal power plants.”

Dr Jennifer Schooling stresses that infrastructure must be built with as close to zero carbon emissions as possible. “Nothing we’re currently doing is green enough; the scale of ambition is not big enough,” she argues. “We’re in the middle of a climate crisis, but we’re not doing enough about it. It’s time to stop moving the deckchairs around on the ship and to see the iceberg dead ahead. This crisis will be solved only by major concerted action globally.”

Professor Jim Hall is optimistic that the UK can at least move to a zero-carbon energy mix in the near future. “The last of our coal-fired power plants are being decommissioned and it’s possible, with some combination of wind, solar, nuclear and power-storage infrastructure, to have a completely carbon-free energy network,” he says.

Armitt observes that greening the world’s infrastructure and economy is a huge long-term challenge, but it’s one that all countries must face up to together.

“Ultimately,” he says, “the costs of inaction are too great for governments around the world to ignore.”

Infrastructure’s united realisation: responsible business is good business

The future of infrastructure needs to be based on ethical consideration and a collaborative approach. Crucially, it needs to be built on the recognition that responsible business is good business

Over the past two decades, infrastructure, like many other industries, has been engulfed by ideas and concepts that would allegedly usher it in to being a more progressive and attractive sector – corporate social responsibility, ESG, digitisation, decarbonisation, sustainability, inclusion and diversity. Initially, while many talked the talk about how they were addressing these concepts, very few broke into more than a crawl, let alone a walk. Few believed that these early attempts did much to change the long-term status quo, or to transform the appearance of the sector.

Fast forward to 2021, however, and we’re not exactly strutting, but the gait is widening, and the pace is finally picking up.

Infrastructure as a sector is at long last beginning to meet these ethical challenges with a sense of purpose – embedding these into long-term visions.

And now that the walk is being walked, the next obstacle to overcome is to ensure that businesses are working even more collaboratively to share knowledge. The industry needs to make sure that positive behaviours transcend respective supply chains so that this apparent momentum isn’t just a false start.

Purpose is key

Morgan Sindall Infrastructure, part of the Morgan Sindall Group, was one of very few companies in the sector to take a more holistic and sustainable approach to implementing this vision of the responsible future of

infrastructure early on. From the outset, the company looked to tackle these issues under the overarching umbrella of culture. And as such, the rewards of this early pragmatism are now a positive template for others to follow today.

“It’s all about how you choose to do business – not because legislation dictates it, but because ethics and behaving responsibly is embedded in our culture,” says Morgan Sindall Infrastructure’s managing director, Simon Smith.

“For all stakeholders to benefit we must deliver sustainable progress and treat culture and business as one and the same, not as tokenistic initiatives. Being a responsible business provides confidence that we’ll always do the right thing – for the people who work for us, for those who live around our projects and for those who do business with us.”

A new best practice template

Now that the situation is improving, however, a different issue is arising and one that Morgan Sindall Infrastructure also needs to address.

“This is one that we may be guilty of to an extent as well,” Smith explains. “Companies are taking more considered steps in these areas but aren’t always talking enough about them. They’re not promoting and sharing their own genuinely positive steps forward.”

“And I don’t mean in a competitive way, but in terms of creating and leaving a lasting legacy, and sharing knowledge and experiences that can be of value to others.”

In Morgan Sindall Infrastructure’s case, this includes enhancing the communities in which they work and ensuring they deliver long-term social value for everyone. This means committing to employing locally on their projects, for example, as well as forming relationships with local schools and colleges as part of some ambitious social value targets.

It aims to create 70 pence per pound spent in added social value for the communities where it works. Already, the company creates 58 pence of social value per pound spent by its customers and continues to drive social value creation in the delivery of all its projects.

Additionally, the business is aligning itself with the likes of National Highways (formerly Highways England), Sellafield, National Grid, Welsh Water, Network Rail, Transport for London, Scottish and Southern Electricity Networks and other peers to explore more sustainable material use and to learn from their



“It’s our responsibility to leave the sector in a position where progress will happen organically, over time, because we’ve created an environment where it can

legacy projects. It aims to accelerate progress across the sector, although it recognises there is still some way to go.

“So many of us are now part of similar associations or programmes geared towards collaboration, or innovation, or more sustainable material use,” Smith continues.

“There is now a more developed structure and ecosystem where we can learn from each other and pull together our collective might. And it’s important we use these collaborative platforms to share and speak about the good progress being made, to create a new best practice template for the whole industry.”

Collective responsibility

What many organisations are realising from these efforts, activities and approaches, is that responsible and ethical operations aren’t an aside from the bottom line. Good business and responsible business are, in fact, one and the same.

Green efficiencies, a sense of purpose, diversity of thought and a commitment to the greater good not only drive cost effectiveness but aid customer and employee retention.

And, when considering the overall future of infrastructure, these positive assets will encourage the next generation of young people – for whom ethics and purpose is key when seeking work – into the sector.

“Infrastructure has had to get better at marketing itself as an attractive industry by improving how it is viewed – as connected, collaborative, diverse and purposeful,” says Smith. “Now we are on the crest of a wave, the opportunity is huge right now to make the sector more desirable, to showcase the abundance of career opportunities, and to create a lasting legacy.”

Responsible and ethical infrastructure is now a long-term pursuit, rather than a short-term competition. Morgan Sindall Infrastructure is already ahead

of many of its peers because it embedded a more sustainable and collaborative approach years ago.

“However, we can all still do more,” Smith concludes. “That ‘collective might of the industry’ still doesn’t have the breadth of representation required to present the best path forward at this time. And just like we are, businesses always need to be open to new understanding, learning and development.

“We won’t always get it right, and it won’t all be fixed in my lifetime. But it’s our responsibility to leave the sector in a position where progress will happen organically, over time, because we’ve created an environment where it can. It’s an environment where people feel safe, accepted, fulfilled and that they are contributing to a more responsible future for infrastructure.”

For more information please visit morgansindallinfrastructure.com

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ENERGY

The high cost of low carbon

The transition to greener energy is gathering pace, with renewables proving particularly attractive to investors. But are enough billions flowing in yet to make a meaningful difference?

Heidi Vella

Driven by the urgent need to combat climate change, the world committed more than \$500bn (£363bn) to decarbonisation projects for the first time last year, according to BloombergNEF. Well over half of this was invested in renewable energy generation, but significant sums were also put into domestic heat pumps, electric vehicles, hydrogen technology and systems enabling carbon capture and storage (CCS).

While this news appears encouraging, the numbers are still a long way below what is required, according to the International Energy Agency's *World Energy Investment 2021* report. It notes that, although \$750bn is expected to be allocated to clean energy projects in 2021,

"investment would need to double in the 2020s to maintain temperatures well below a 2°C rise and more than triple in order to keep the door open for a 1.5°C stabilisation".

Part of the problem is that all the capital being allocated cannot be deployed quickly enough, according to Seb Henbest, BloombergNEF's chief economist and lead author of its *New Energy Outlook 2021* report.

"There is a rate-of-change problem," he explains. "Getting the technology cheap is one thing, but then you have to deploy it through the global economy to displace the existing carbon-intensive generation infrastructure. That takes time."

The report argues that investment in wind and solar generation alone needs to increase to between \$760bn

and \$1.8tn annually between 2021 and 2030 to get on track for net zero.

Price uncertainty is also holding back the renewable energy market. Energy prices are typically dictated by the marginal costs of operation, which are very small for renewables.

"In other words, there's a missing-money problem," Henbest says. "As the level of renewables in the system increases over time, the wholesale power price falls and revenues start to look less good. To mobilise capital, there needs to be more certainty about future price signals."

Thanks to falling costs and rising demand for electricity, renewable energy is the low-hanging fruit for investors. Other low-carbon technologies, such as hydrogen, CCS, heat pumps and large-scale battery storage, are much further away from maturity and commercialisation.

"Just as renewables have had over the past 10 to 15 years, these markets will need robust policy and support mechanisms, as well as collaboration between the public and private sectors," says Dr Edurne Zoco, executive director for clean technology and renewables at IHS Markit.

This is starting to happen. Take hydrogen, for instance: the European Commission and six European countries published strategies for it in 2020, followed by the UK this year. Through various funding mechanisms, \$44bn has been made available for hydrogen projects in France, Germany, Italy, Spain and Portugal up to 2030, according to IHS Markit.

Zoco believes that these initiatives, along with policy measures such as Canada's clean fuel standard, are incentivising and de-risking investment, but she adds that there are still likely to be winners and losers as the technology develops.

"Although the overall market may boom, there will also be a number of spectacular busts," she predicts. "We expect to see joint ventures and strategic partnerships forming to defray those risks."

Hydrogen technology alone will require a total investment of almost \$15tn between now and 2050, argues the Energy Transitions Commission, a think-tank funded by a range of stakeholders, including oil and gas companies. It estimates that 85% of this total would need to be allocated to electricity generation. The rest would need to be spent on aspects such as hydrogen production, storage and transport.

Alongside hydrogen, electric heat pumps will play a big role in decarbonising heating. According to *New Energy Outlook 2021*, an average of 18 million new heat pumps need to be installed each year to 2030.

Along with financial incentives, customer education is crucial in achieving this rate of uptake, says Ben Hertz-Shargel, global head of grid edge at the Wood Mackenzie energy consultancy.

"A lack of understanding about the total cost of ownership and the importance of clean heating, along with insufficiently trained contractors, is holding back deployment," he reports.

Each technology in the low-carbon field has its own barriers to overcome. For instance, to support the development of large-scale battery storage, there are plans to introduce 500GWh (equivalent to the energy used by 133,000 UK homes a year) of new cell manufacturing capacity across Europe and North America, according to IHS Markit, but limited access to raw materials is creating nervousness in this sector.

For technologies such as CCS, which is needed to offset emissions from the fossil fuels that remain in the mix, governments are trying to bring down costs through regional hubs. IHS Markit estimates that annual investments in CCS would need to double every five years for the technology to hit its CO₂ reduction targets.

David Elmes is professor of management practice and head of the

"We must talk about consumption with the same emphasis we place on supply. We need serious discussions about building standards and local energy systems"

Global Energy Research Network at Warwick Business School. He thinks that an increase in investment in energy efficiency for buildings and transport, which in recent years has been flat, would go some way to bridging the funding gap.

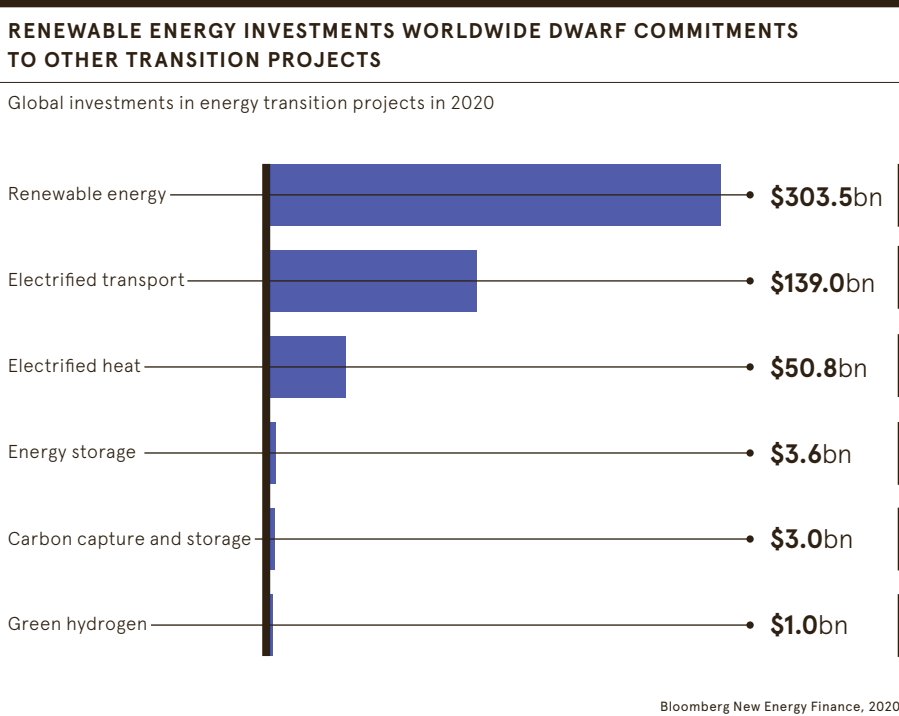
"We must talk about consumption with the same emphasis we place on supply," he says. "We need serious discussions about building standards and local energy systems."

Part of the energy transition challenge is that governments aren't sure what the market will look like and are yet to make firm decisions on its technological composition. It's also unclear how they plan to manage, measure and regulate reporting on emissions, as well as whether there will be opportunities to trade them (as is outlined in article 6 of the UN's Paris accord on climate change).

"More clarity on these issues can lead to a pretty profound growth in market opportunities, but mistiming this could also mean some pretty heavy losses," Zoco warns.

Despite the risks and uncertainties, Henbest believes that all players in the energy economy reckon that the transition will happen and all are betting in the global marketplace in the hope that they have a winning strategy.

"They know that this huge shift is creating a big market opportunity," he says. "This is simply a matter of how fast it's going to happen." ●



Q&A

How infrastructure investment is driving Europe's decarbonisation agenda

Q&A with **Ed Clarke**, co-founder and chief investment officer at Infracapital



Q Are you seeing an impact from the decarbonisation agenda on investment opportunities in Europe?

A "We've certainly seen a deepening and broadening of investment opportunities in the last few years. When we talk about the decarbonisation agenda people usually think of wind farms and solar parks. Over the years we have made investments into those sectors, but they are well trodden markets now and the pricing really reflects that, so we're looking at other emerging energy transition sectors which potentially offer better returns. A good example of that is the battery sector where we're invested in a business called Zenobe, a market leader in the UK for both grid-scale batteries and electric buses. We've also recently invested in a business called EnergyNest, which captures surplus heat generated from industrial processes and recycles the heat or its used to generate renewable electricity. If countries are to meet their net zero targets it's vital we see capital funding sustainable infrastructure businesses across all sectors, not just energy generation."

"Sustainable infrastructure projects are a win-win for the environment, economy, and the communities they serve"

which is critical to us. At the moment it feels like a very exciting phase as the market searches for new greener solutions to meet societal needs. Where we can be most effective is helping those businesses and developers who have a well-defined business to reach commercial scale. That said, we invest in a diverse mixture of assets, including mature operating businesses. For instance, we've invested relatively recently in GB Railfreight, one of the leading rail freight businesses in the UK. GB Railfreight supports the energy transition through taking container haulage off the roads and onto rail which is a much more environmentally-friendly solution, and we're working with the team to invest in reducing the carbon footprint of their fleet further."

Q How do you assess which new technologies or sectors could pay off in the long term?

A "The technologies in which we invest are not typically new, but what is often newer is the application of that technology. Take the battery business—battery technology is well established, but it's how you use it and how it performs in those new use scenarios

Q Has Covid-19 impacted your approach to investing in and managing your infrastructure assets?

A "At the beginning of the pandemic, we had a heightened focus on liquidity and making sure that all of our businesses could withstand this sudden shock. As time has gone on, we are pleased to see the pandemic has proved out our basic investment thesis, whereby genuine infrastructure investments that are providing essential services remain resilient even during turbulent markets. Some sectors may even see a positive longer term impact, such as our businesses in the broadband space where we've seen a greater demand for full fibre

connectivity over the last 18 months. We are also seeing leaders around the world point to infrastructure investment as a key route to recovery from the Covid-19 shock. If we can ensure those funds are channelled into sustainable projects it's a win-win for the environment, economy and the communities they serve."

Q What risks does the energy transition pose to existing infrastructure assets?

A "There is clearly the risk of stranded assets and we've seen that through the rapid decline of coal in the UK over the last 20 years. There is now a debate about the role of natural gas as we transition to alternative approaches to domestic heating or electricity generation, and that's a challenge for investors who hold investments in the sector. But this could present an opportunity too, for instance if gas pipelines can be used in the future for hydrogen. Likewise, we see significant scope for the electrification of our transport assets. We consider our role as delivering positive impact not just through funding new green infrastructure, but converting established businesses into sustainable leaders in their respective sectors."

Q What role should governments be playing to incentivise additional investment in this area?

A "In the UK, the government has made high level policy commitments to the 2050 net zero agenda, which provides a very supportive backdrop to the investments we make. But there's more policy work to be done within specific asset classes to ensure that they are attractive for institutional capital to invest today. It's important that governments and regulators embrace the new technologies in a way which allows them to scale quickly and fairly share risk between the public and private sector. There's no time to waste because 2050 will be here before you have time to blink in the context of

major infrastructure projects. The government has developed effective models in the past to pump prime investment in new sectors like wind. Today we are seeing a similar focus being applied to fibre, battery storage, electric vehicles and hydrogen, but there is more to do."

For more information please visit infracapital.co.uk



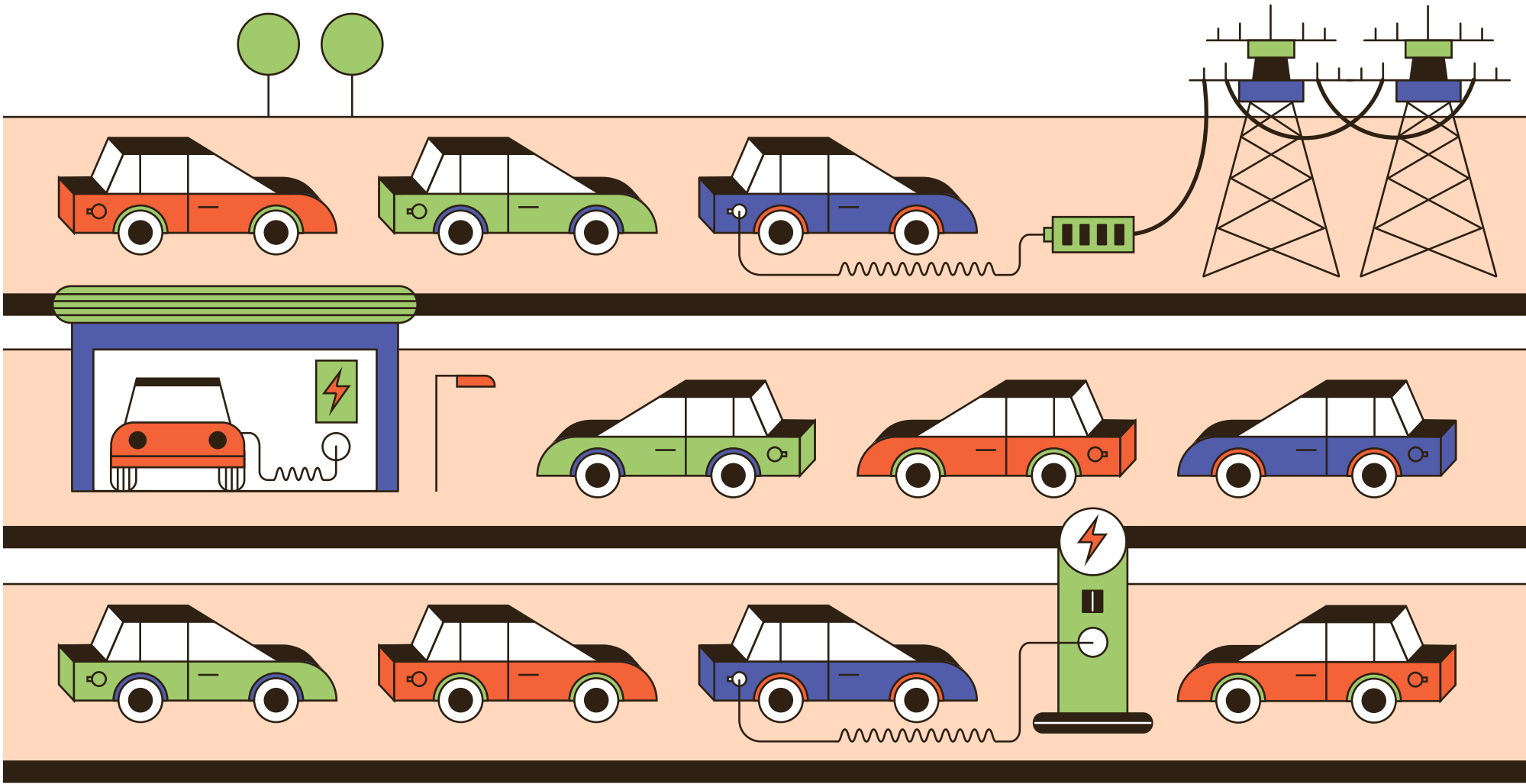
Zenobe: leading the charge in the UK's energy transition

Infracapital has committed £150m to Zenobe, one of the UK's leading independent owners and operators of battery storage and electric vehicle (EV) services. Zenobe is spearheading the shift to a zero-carbon UK economy through its innovative, emission-free energy and transport solutions.

Zenobe is the first company to provide a full EV fleet solution for bus operators, serving around 20% of the EV bus market in the UK, including blue-chip operators such as Stagecoach, First Group and Abellio. The business currently services more than 160 electric buses, with a further 230 electric vehicles in the pipeline for 2021.

Additionally, Zenobe owns and operates 175MW of contracted grid-scale batteries which provide a range of services including balancing and reactive power services. This includes the 100MW Capenhurst project currently under construction, which will be Europe's largest grid-connected battery. By ensuring stability of energy supply, these battery services are playing a vital role in facilitating the growth of renewable energy in the UK.

Further, Zenobe seeks opportunities to optimise batteries after their initial use case and recently partnered with Extreme E, the electric motor-racing series, providing second-life batteries to power its onsite broadcasting, media and control centre.



Grid locked? The UK’s e-mobility conundrum

The transition to electric vehicles is proving complex in the UK, as the public and private sectors struggle to reconcile the demand for greener motoring against the infrastructural constraints

Georgia Lewis

Governments worldwide are making ambitious policies to enforce the replacement of conventionally powered vehicles with electric vehicles (EVs). Many have enacted legislation imposing tight deadlines for this. In the UK, for instance, sales of new petrol- and diesel-powered cars and vans must end by 2030. But will that leave enough time to develop sufficient infrastructure to ensure a smooth transition – and who should pay for it? A chicken-and-egg challenge is emerging. The nation’s EV infrastructure is far from ready to support a mass roll-out. Private investors

and companies remain reluctant to fund infrastructure while demand is low, but consumers, businesses and public-sector purchasers will be wary of buying EVs as long as the infrastructure stays in its infancy. The government’s key EV investments include £1.3bn in charging points over the next four years, £500m in battery development and £525m in nuclear power, partly to help meet the additional demands that the electrification of transport will impose on the grid. Nonetheless, consumers will also be expected to play their part in preparing the country for the EV revolution. The creation of home

charging infrastructure is already a shared responsibility, for instance. The government’s Electric Vehicle Homecharge Scheme, which offers grants up to £500 to help motorists install charge points in their homes, is continuing alongside private residential developments offering such facilities. There are about 300,000 domestic charge points in the UK, whereas there are only 42,000 public ones, according to Zap-Map, an app that pinpoints the latter for EV drivers. More public charge points are needed, given that about 40% of households in the UK have no off-street parking.

The provision of workplace-based EV charging facilities varies nationwide and doesn’t necessarily match regional EV uptake. For instance, research by Knight Frank has found that, while there are about 78,000 ultra-low-emission vehicles registered in south-east England – the highest regional total in the UK – 44% of business parks located inside the M25 have no charge points. Professor Nick Reed is the founder and director of Reed Mobility, a consultancy specialising in environmentally sustainable transport. He observes that the EV market requires “vehicles that meet the expectations and desires of consumers” and “decent infrastructure to support remote charging”.

Reed believes that, if most motorists have access to home chargers and buy vehicles with a long enough range for most journeys, they will be “mostly satisfied with the experience”. But he acknowledges the infrastructure problem in towns and cities where access to off-street charging facilities can be limited. New models of charging may be required, including concierge services, whereby EV owners pay for

“EVs have the potential to turn today’s models of supply and demand on their head. They offer a way for consumers to charge for the energy they supply to the grid in much the same way that they currently pay for what they use

he says. But more needs to be done – and quickly. “The UK requires more battery manufacturing facilities – more gigafactories in the pipeline – and its supply chain needs to be vastly enhanced for crucial ingredients, such as lithium,” Myersdorf argues. “These are not easy tasks and the clock is ticking, so it will require a huge government-led initiative to make things happen in time.”

As EVs increase their market share globally, the car industry will go where batteries are being produced. China is leading the world in this respect. In 2020, it accounted for 77% of global battery manufacturing capacity, with the US coming in a distant second at 9%, followed by the rest of Asia (8%) and Europe (also 8%), according to research by S&P Global Marketing Intelligence. This highlights the urgent need for the UK to boost its battery manufacturing capacity in tandem with its growing EV output, establish robust supply chains and attract appropriately skilled people.

Energy storage tech will be essential in meeting the power demands created by the EV revolution. Households are likely to play a role in this. David Hall is vice-president of power systems in the UK and Ireland at Schneider Electric, a French company specialising in smart energy management systems. He says: “The good news is that, as more and more households invest in EVs, more and more of them will have a large electricity storage device in their garage that’s capable of powering the average home for several days.” Hall notes that second-generation smart meters can measure both consumption and generation. The provision of pricing visibility will enable motorists to store and resell

unused energy back to the grid, using their EVs’ batteries as mobile storage systems.

“EVs have the potential to turn today’s models of supply and demand on their head,” he says. “They offer a way for consumers to charge for the energy they supply to the grid in much the same way that they currently pay for what they use.”

Bernard Magee, director of EV charging at Siemens, agrees. “The battery will take from the grid when it’s charging – often during periods when energy is cheapest – and, potentially, feed energy back to the grid when the demand is there,” he says. “These storage systems can also draw power from the grid for later use. If it becomes inaccessible, off-grid green energy supplies can be used.”

As the 2030 deadline approaches, calls for more state spending on EV infrastructure and a coherent transition plan will become louder. In May this year, the Commons Public Accounts Committee said there was a “mountain to climb” to meet the transition target, stating that it was unconvinced that the government had “sufficiently thought through” its EV roll-out plans.

Moreover, public transport’s role in the transition has to be addressed from the consumer’s perspective. If train fares are uncompetitive, say, and consumer confidence is lacking in EVs for longer journeys, this will add to the government’s policy and funding headaches.

Alternative revenue streams, such as road-user charging, especially with reduced revenues from fuel duty, may be expanded. Reed says that such a move would need to be

220% Increase in the number of public EV chargers in the UK from 2016 to 2020

Zap-Map, 2021

4.6GW

Projected battery storage capacity in the UK by the end of 2022

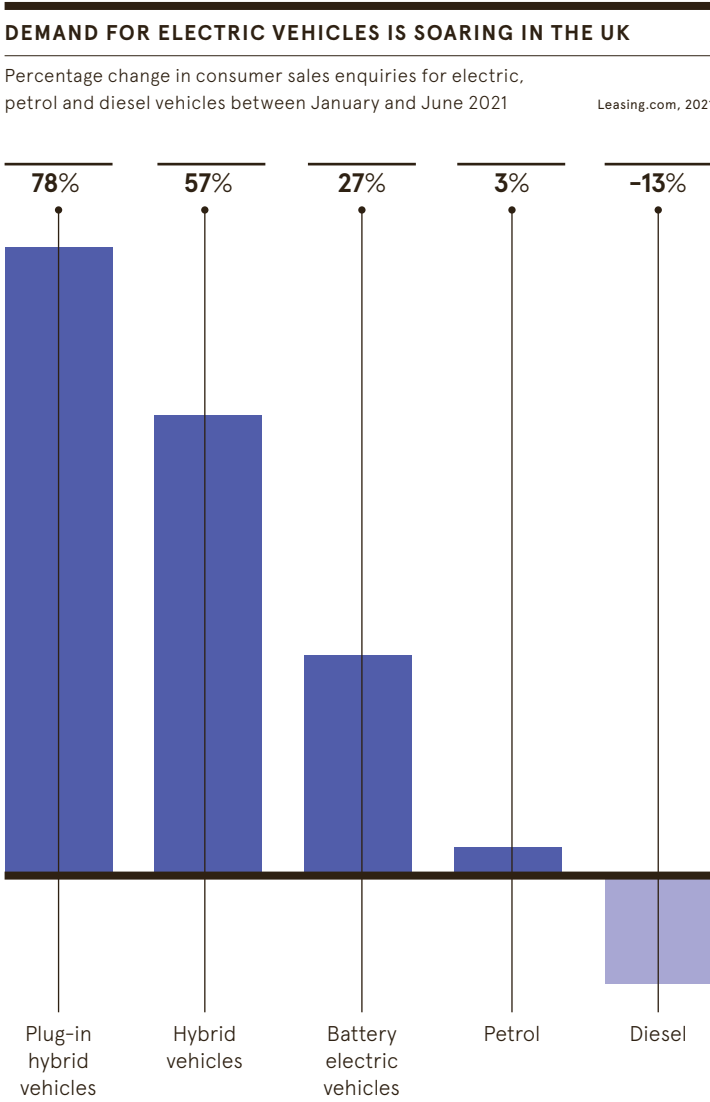
Solar & Storage Research, 2021

“designed equitably”, such that it would not harm groups such as low-income families. But a system that charges users based on a combination of factors, such as the vehicle’s size, the times it’s being driven and the roads it’s using, “could be powerful in reducing the carbon emissions of the transport system”.

Utility companies will have a role to play in the EV roll-out, as the market’s growth increases the pressure on the nation’s power generation and delivery infrastructure.

“These companies need to invest in upgrading their networks without creating upward pressure on the cost of electricity for consumers and businesses,” Hall says.

It’s clear that, even as EV usage starts to pick up over the coming years, significant public and private investment, industry innovation and consumer engagement will all be crucial in producing the infrastructure required to make the UK’s net-zero goals a reality. ●



Q&A Taking a long view on digital infrastructure investments

Matt Barker, partner at 3i Infrastructure, talks digital connectivity and investment



Q The need for digital connectivity has been accelerated by Covid—how has that impacted the sector from an investment perspective?

A Pre-Covid we already had a big focus on digital infrastructure across both wireless and fixed connectivity, it’s one of the sectors where we see hugely positive underlying demand growth. People are increasingly demanding high-bandwidth and low-latency connectivity across a variety of use cases such as streaming and online gaming, both of which were present pre-Covid. But some of the trends we’ve seen accelerate during the pandemic have been things such as video conferencing and remote working, which require high-quality and consistent connectivity.

Q What investments have you made in the digital connectivity space and what attracted you to those assets?

A Our most recent investment is a company called DNS:NET, which is rolling out fibre-to-the-home connectivity in the Berlin area. It’s a well-established business founded more than 20 years ago by the current CEO, who we are investing alongside. There are particularly attractive dynamics in the German market where fibre-to-home coverage is relatively low and it really is the only technology capable of future proofing demand requirements.

Another of our investments is in a company called Tampnet, which owns offshore fibre networks in the North Sea and the Gulf of Mexico, providing connectivity to users including offshore energy platforms and wind farms. Those industries are looking to improve efficiency and safety, so having low-latency and high-bandwidth connections is crucial for the digitalisation of their operations, for instance with remote monitoring and robotics.

Q What are the biggest challenges you face when developing digital infrastructure projects?

A There are two relevant aspects—one is helping our customers understand the advantages our networks can bring. This is particularly relevant for a company like Tampnet, which is right at the frontier of the industry and facilitating new and innovative ways of working. Then there is also a practical element. These are big engineering tasks, be it offshore where you’re laying cables on the seabed or onshore with DNS:NET where we’re building new fibre networks all the way to the home, taking into account a range of stakeholders from construction partners, local authorities and our customers. We work closely with our portfolio company management teams to support them in overcoming these challenges.

Q Given how quickly the digital landscape can change, how do you factor that in when taking a long-term view as an infrastructure investor?

A It’s important to differentiate between the technology as opposed to the infrastructure. The fibre networks that DNS:NET and Tampnet are building are future-proofed, since they are the fastest, lowest latency way of connecting and highly reliable once built. The view we take is that these networks provide the infrastructure that will be required for a host of technologies, even as those technologies evolve over time. This allows us to be somewhat agnostic to changes in technology, provided the demand for connectivity continues to grow.

Q How has the increased competition for digital infrastructure assets impacted your investment approach?

A We’re certainly not alone in seeing the attractive market fundamentals. Against that backdrop

“Some of the trends we’ve seen accelerate during the pandemic have been things such as video conferencing and remote working, which require high-quality and consistent connectivity

we have to find opportunities that are suited to us and where we can add the most value. We invest to support management teams, so for us it’s about finding the companies that are looking to build a partnership with us as an investor, and where the particular strengths that we bring to support it through both capital and expertise, to help take it to the next stage of its development and accelerate its fibre-to-the-home rollout over the coming years.

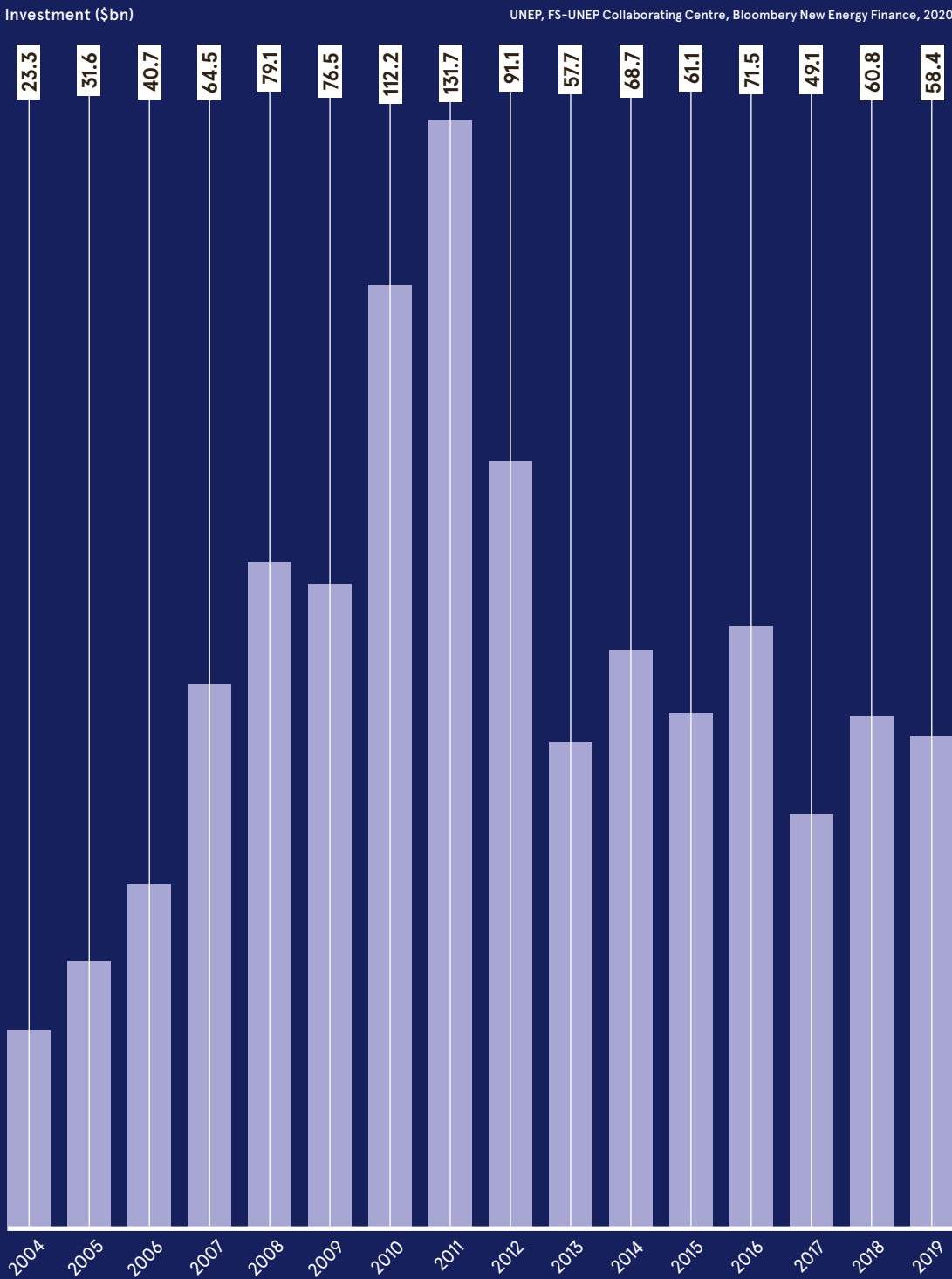
For more information please visit 3i.com

3i Infrastructure plc 3i

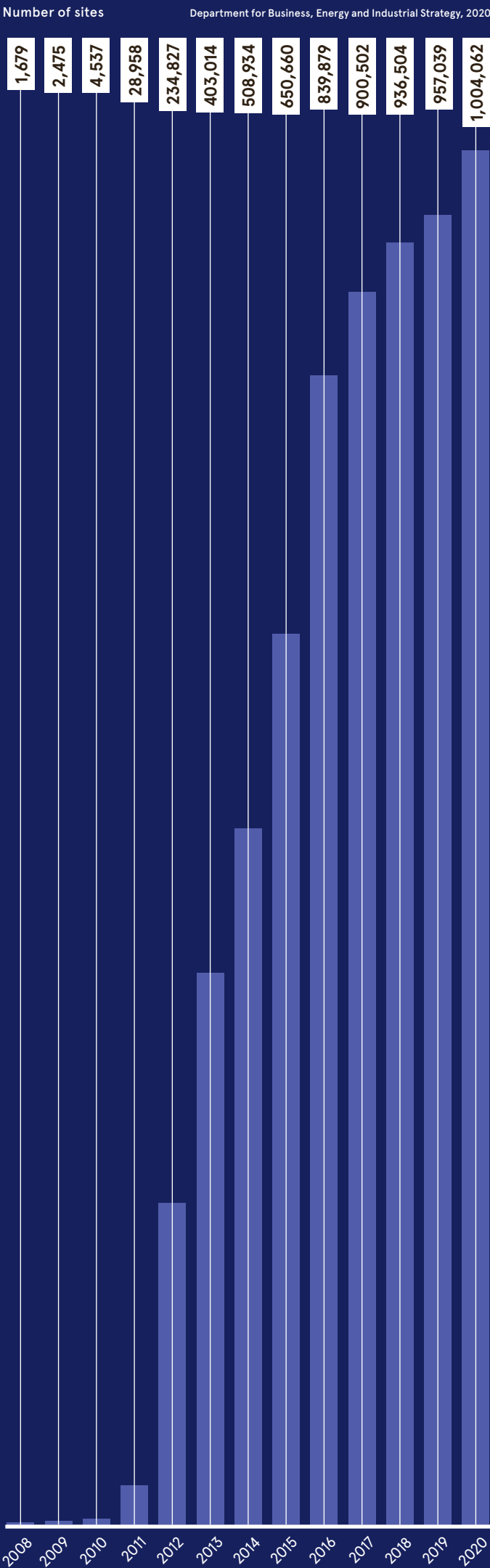
THE ROLE OF RENEWABLES

A new report from the UN’s Intergovernmental Panel on Climate Change has laid bare the challenges facing the world if serious action is not taken now to tackle climate change by reducing global greenhouse gas emissions. A move to renewable energy sources, while under way, has hitherto been relatively slow and there are warnings that current efforts won’t be enough to stop the planet heating by more than 1.5°C above pre-industrial levels. As we look ahead to COP26, where is the world on its energy transition?

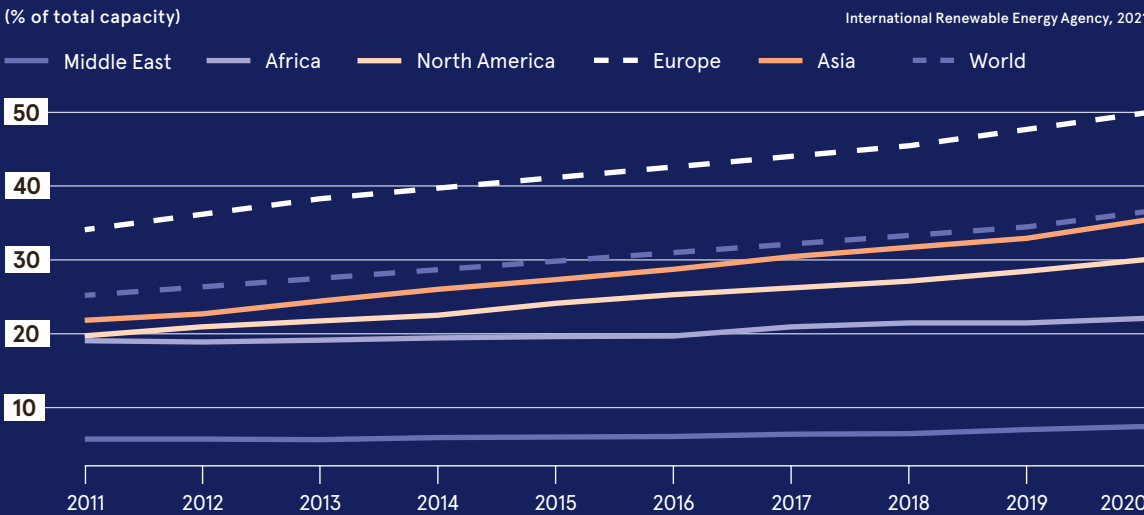
INVESTMENTS IN RENEWABLE ENERGY HAVE BEEN TRENDING DOWNWARDS IN EUROPE



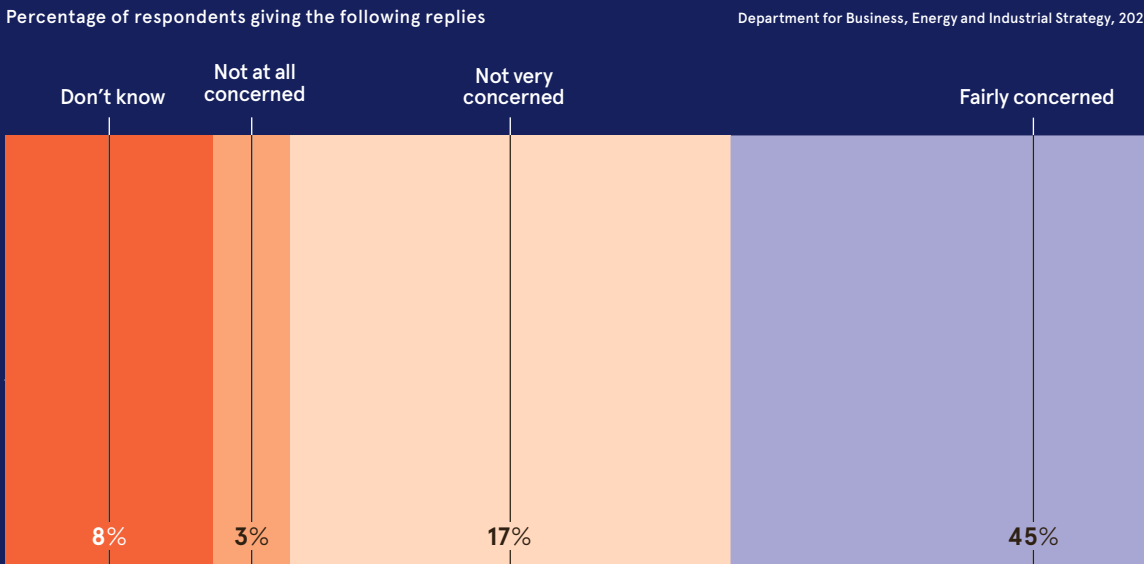
GROWTH IN THE NUMBER OF SITES GENERATING SOLAR PHOTOVOLTAIC ELECTRICITY IS SLOWING



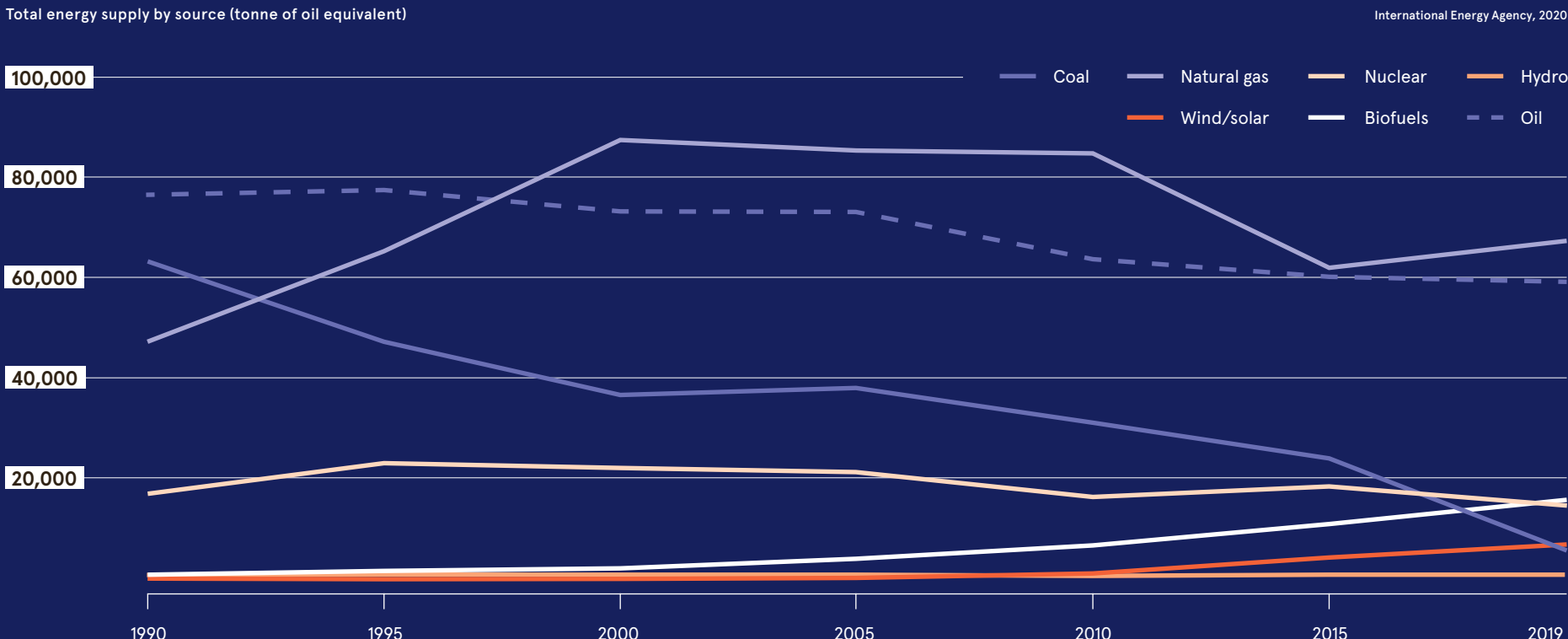
THE WORLD’S CONSUMPTION OF RENEWABLE ENERGY IS RISING, BUT RENEWABLES STILL ACCOUNT FOR ONLY ONE-THIRD OF ITS ELECTRICITY GENERATION CAPACITY



HOW CONCERNED ARE BRITISH CONSUMERS THAT THE UK IS NOT INVESTING QUICKLY ENOUGH IN ALTERNATIVE SOURCES OF ENERGY?



THE UK REMAINS HEAVILY RELIANT ON NON-RENEWABLE ENERGY SOURCES, PARTICULARLY OIL AND GAS



Very concerned 27%



Close to the wind

With severe weather events striking ever more often, many organisations are at long last realising that they need effective plans to protect critical infrastructure against climate risks

Tamlin Magee

From the Arctic storm that blasted Texas in February to the 50°C heatwave that seared the Mediterranean all summer, extreme meteorological events are undeniably increasing in both frequency and intensity.

The conversation about technology and climate has so far been dominated by talk of carbon footprints. We have heard much about the CO₂ emissions of data centres and the fact that bitcoin mining requires more energy each year than the total consumed by the whole of Argentina. While extreme weather is becoming hard to ignore, what tends to be discussed less in the ICT industry is that climate-driven events run both ways.

In July, for instance, flooding after extreme rainfall not only caused hundreds of deaths across Europe. It also brought down Germany's three main mobile networks, disabling 130 base stations in the country's western states of North Rhine-Westphalia and Rhineland-Palatinate.

Back in 2005, a heroic effort by a team led by special forces veteran

Michael Barnett to keep a data centre operational during and after Hurricane Katrina meant that New Orleans kept a line to the outside world, even as cell towers were being destroyed by wind and water. In that case, maintaining communications was literally a matter of life and death. Telecoms providers learnt several key lessons from Katrina, with those affected having since reduced their reliance on physical locations. Many now have their own crisis teams, for instance, which can be deployed to disaster zones to establish emergency comms.

Nonetheless, a report from the UN's Intergovernmental Panel on Climate Change in August about the extent of climate risk suggests that potentially devastating weather-related incidents will become ever more common.

From an infrastructural perspective, this is particularly worrying because essential systems are so closely connected, according to Chris Cartwright, chair of the digital panel at the Institution of Engineering and Technology. "A power outage could

bring down both a transport network and a communications system, for instance. It could also affect local hospitals and schools," he explains. "This is the real concern: to what extent do you create interoperability, knowing that a single point of failure could knock out many services?"

Luis Neves is CEO of the Global Enabling Sustainability Initiative (GESI), which collaborates with multinational ICT firms and other large organisations to offer impartial guidance and resources aimed at "achieving integrated social and environmental sustainability through ICT-enabled transformation". He believes that most businesses aren't

“For change to happen, you need a shock. That’s what Covid has provided: a reality check on the way that we do things

adequately prepared for the climate-related risks they are facing.

Extreme weather events, Neves observes, "are happening more frequently, but they are unpredictable. We do not know when or where they will happen. Even with one month's notice, you cannot create the kind of infrastructure necessary to avoid the risk."

In 2014, the GESI and the International Telecommunications Union published a joint assessment of climate risks and suggested several mitigation measures in a research report entitled *Resilient Pathways*. They recommended creating redundant backbone networks for service areas that would be resilient to all extreme weather; relocating central offices away from coastal regions and potential future floodplains; developing alternative telecoms technologies that promise to increase reliability; and reassessing standards and industry-wide regulation. Progress since then has been slow, according to Neves. To his knowledge, no single company has ticked all of these boxes.

Yet there is a growing acknowledgment, given Europe's recent run of extreme weather, that such matters are overdue for consideration. At the end of July, the European Commission published a "climate-proofing" checklist for new infrastructure projects, which needs to be followed by organisations seeking a slice of the €17.5bn (£15bn) that the EU holds in its so-called just transition fund for more sustainable development.

Another European Commission work in progress is the EU taxonomy for sustainable activities. This classification system will set out the conditions that infrastructure projects, among other investment programmes, will have to meet in order to be defined as sustainable. Investors are keeping a close eye on this development, reports Raffaele Della Croce, senior economist at the Organisation for Economic Co-operation and Development (OECD).

The OECD is set to publish its own report on infrastructure at the UN's COP26 conference on climate change in November. The document, which will complement G20 recommendations regarding maintenance, will suggest that organisations adopt a radical new approach to creating, maintaining and operating infrastructure. Among other things, this will entail the creation of infrastructure with end-to-end integration and the use of smart maintenance techniques to manage potential problems proactively.

"For change to happen, you need a shock. That's what Covid has provided: a reality check on the way that we do things," Della Croce says. "Infrastructure has not changed and was clearly not functioning, but now there is a recognition of having to catch up to face reality. The change needs to be radical. If we're only doing it at the margins, it won't be enough."

Cara Labuschagne is senior analyst for adaptation at the Climate Change Committee, an independent

body that publishes a yearly assessment of UK climate risk. She notes that the national adaptation programmes of the UK's devolved nations acknowledge the risks facing the digital sector. But she adds: "In general, there is still a lack of evidence, certainly in the public realm, of specific actions that are taking place that will manage climate risks."

The committee's latest *Independent Assessment of UK Climate Risk* report, published in June, notes that "alarmingly... the gap between the level of risk we face and the level of adaptation under way has widened. Adaptation action has failed to keep pace with the worsening reality."

Labuschagne says: "We aren't seeing a plan or process to manage the long-term risks. There's a need for a set of resilience standards for the ICT sector covering climate change risks and adaptation actions. It would include requirements for providers to assess their climate risks under a region and to think about interdependencies with other critical infrastructure, and the actions to take to reduce and monitor risk."

Abhijit Sunil, analyst for infrastructure and operations at the Forrester consultancy, says that he has heard very little from the ICT sector addressing climate threats directly, although sustainability has become a consideration for many organisations. But he adds that climate preparedness is likely to move up the industry's agenda after COP26.

Some straightforward opportunities exist for business leaders to make more sustainable choices, Sunil says, suggesting that enterprises associate sustainability with efficiency by, for instance, signing long-term energy contracts with utility companies to create price certainty. He adds that firms with many physical assets should consider how their data centres can be built around natural cooling mechanisms, or use machine learning to optimise energy consumption.

To mitigate risk, cloud computing company PagerDuty has designed its systems so that they are sufficiently dispersed to enable a failover (the facility to switch to back-up systems with minimal disruption) to be tested and automated easily, according to its senior director of infrastructure, Paula Thrasher.

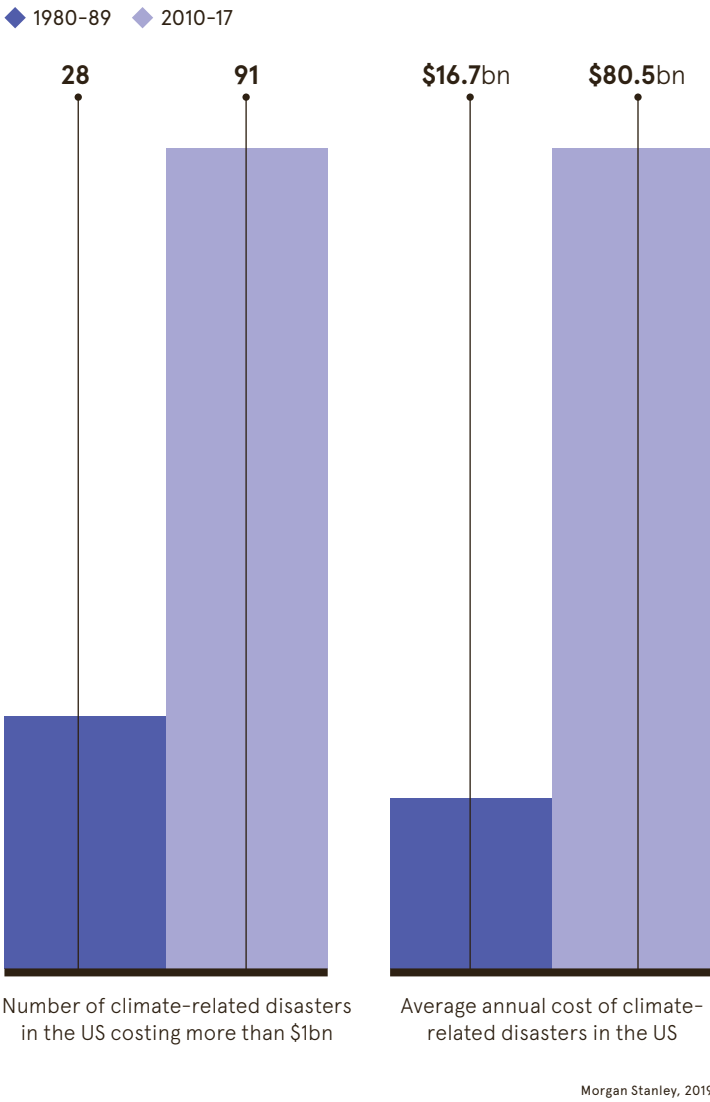
The company's engineering function is designed to ensure continuity in the case of natural disasters. It isn't tied to a specific data centre or network point of presence, so it can use its 'work anywhere' practice to its advantage.

All things considered, climate risk is becoming clearer for businesses, investors and customers alike. And, while it would have been better to have taken adaptation measures at least a decade ago, things are at least heading in the right direction, according to Della Croce.

"It's not the right speed. Progress should be faster, we all agree," he says. "But it is definitely moving." ●

THE INCREASING IMPACT OF CLIMATE CATASTROPHES

Number of major climate disasters and their average annual costs owing to property and infrastructure damage (adjusted for inflation)



How Sisk is transforming the infrastructure industry

To move forward, the infrastructure sector needs to focus on people, technology and sustainability and Sisk is doing just that

Sisk is an innovative, international construction and engineering company paving the way for the future of infrastructure. We are experienced in delivering high-quality projects across the UK, Ireland and Europe. With a group turnover of £1.5bn and an industry leading balance sheet, we have the strong financial platform, track record and capacity to be a total solutions provider. In the delivery of complex projects, we work collaboratively with our clients and stakeholders to understand key project drivers, enabling the development of solutions that fulfil these needs and provide best value.

With a 160-year history, our family business has stayed true to our founder John Sisk's vision of providing exceptionally high levels of construction expertise and customer service by employing, training and motivating capable staff, while constantly striving for innovation.

Our people, technology and modern methods of construction capabilities sit at the core of our offering and are true enablers for our clients in achieving their sustainability agenda.

Our ability to deliver the future of construction and infrastructure across the public sector is highlighted by our recent partnership with SCAPE, one of the UK's leading public sector procurement authorities. Sisk secured a place on its new £12bn Net Zero ready construction framework throughout England, Wales & Northern Ireland, where we will work collaboratively with SCAPE, our clients and our delivery partners to deliver the best value solutions from project concept through to whole life cycle usage, through the promotion of performance-based design and digital twin technology. Sisk has also been appointed to Highways England's £218m framework to revitalise ageing roads, where we will work to lead engineering and construction to repair the concrete surfaces of the Strategic Roads Network.

We are committed to delivering exemplary projects across a range of ever-expanding sectors to help build the future of infrastructure, from transport to commercial, healthcare and life sciences and data centres. We are acutely aware of the impact construction projects have on the local environment and we engage with all stakeholders including the local community, clients, end-user groups, regulatory and professional bodies at an early stage as part of project design and throughout construction.

Building today, caring for tomorrow
At Sisk, we believe that building the infrastructure of the future means doing so



sustainably. Having launched our 2030 Sustainability Roadmap - Building today, Caring for tomorrow - we have already started meeting our key milestones in this journey to reducing our carbon. Our 2030 Roadmap outlines an ambitious set of targets and actions, aligned with UN Sustainable Development Goals.

Our ambition is to lead the industry with the sustainable management of our operations throughout their entire life cycle, tackling climate change and air pollution, care for the environment, enhance communities, lead on responsible business practices, and embrace innovation and digital technology.

We have already achieved our Carbon Zero certification under the Achilles Carbon Reduction Programme. We have trialled the use of Hydrotreated Vegetable Oil (HVO) since 2019 on our Northstowe site, a project to build infrastructure for the new 10,000-home town outside Cambridge, and have recently announced our plan to roll this out across all new projects throughout the UK from September this year.

Steve Bowcott, chief executive at John Sisk & Son, says: "In our 2030 Sustainability Roadmap we set ambitious targets and I am delighted that we have achieved our first goal, achieving carbon neutral status by offsetting the emissions from our operations through internationally accredited offsetting schemes within 12 months of setting the target."

"We continue to actively work to drive down the carbon emissions which we produce as a business, and my hope is that through engagement with our clients and supply chain we can affect a paradigm shift in the industry, to help us achieve our overall target of becoming a carbon neutral business without offsetting by 2030."

The future of the built environment
We see the need for rapid mindset and behavioural change in relation to the adoption of more sustainable methods of working and digital technologies. At

Sisk, we already have the systems, tools and technology to digitally transform operations and upskill project teams.

With our own off-site manufacturing capability via Vision Built, we can offer a new range of products and services to meet an increasing appetite for more sustainable modern methods of construction. Our MMC capabilities are helping to tackle some of the critical resource and skilled labour challenges our industry faces, and promotes a wider spread of investment between urban and regional settings.

In association with our facilities management joint venture business, Sensori FM, we are creating digital twins of the assets we build, enabling real-time predictive facilities management to be deployed and future proofing every aspect of facilities management. Sensori has invested in intelligent building solutions, which can be customised to suit each client and their individual requirements, delivering real-time data to enhance the user experience and allow for more efficient management of buildings and assets.

These investments are imperative for the future of infrastructure, providing more innovation while helping to reduce time and money spent on projects.

The future of construction needs transformational leadership as we change the way we all operate. At Sisk, we are proud to be at the heart of that journey and continue to push the boundaries of what is possible. The future of our industry depends on it.

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CYBERSECURITY

Clear and present danger

A crippling ransomware attack on one of North America's largest fuel distribution networks has brought into sharp focus the cyber threats facing infrastructure of national significance

Oliver Pickup

In 2020, the Cybersecurity and Infrastructure Security Agency alerted the US to the threat of a devastating cyber attack on a nationally important system. On 7 May this year, the UK National Cyber Security Centre (NCSC) issued a stark warning along similar lines. By coincidence, it was the same day that hackers would cripple one of the largest fuel distribution networks in North America.

The taking of the Colonial Pipeline realised the authorities' worst fears. The 5,500-mile network was disabled by a ransomware attack that caused fuel shortages throughout the south-eastern US states and even prompted the Biden administration to declare a state of emergency. The Colonial Pipeline Company's CEO, Joseph Blount, made a ransom payment of \$4.4m (£3.2m), but the network was still down for nearly a week.

This case was "not shocking" to Sarah Lyons, the NCSC's deputy director for economy and society. There had been warnings aplenty. Only three months previously, for instance, a hacker unsuccessfully attempted to poison the water supply of Oldsmar, a city in Florida.

"The pandemic has exacerbated cyber attacks targeting organisations, including providers of critical national infrastructure, which will always be an attractive target," she says. "The Colonial Pipeline case confirmed our belief that any such attack could have wide-ranging societal ramifications. It also gave us a glimpse at the kind of attack with a physical impact that could materialise in future if connected places providing critical public services are compromised."

The way that critical national infrastructure has evolved to use interconnected digital networks makes it far more vulnerable than it used to be, according to Lyons, who believes that the threats could become even greater when 5G is more widely adopted.

"Regulated industries such as telecoms and energy are being connected to unregulated services and suppliers," she explains. "These industries, which we all rely on daily, are an attractive target for a range of threat actors, unfortunately. A successful attack could cause significant disruptions to key public services and compromise citizens' sensitive data."

Lyons stresses to operators that "it's vital to ensure that these networks are resilient to cyber attacks.

The Colonial Pipeline was hit by a ransomware attack that disabled the 5,500-mile fuel distribution network for nearly a week in May



Bloomberg via Getty Images

In a worst-case scenario, a successful one could endanger lives."

George Patsis, president and CEO of Obrela Security Industries, concurs, warning that "the sky is the limit" when it comes to the extent of the damage that cyber attacks on critical infrastructure could wreak. "These have the potential to be cyber physical, putting many people's lives at risk," he says.

Patsis cites the London Underground as an example. "Computers control the timing of when trains arrive at junctions. If someone were to infiltrate the network and alter their synchronisation by only a few seconds, it could cause multiple fatal crashes," he says.

Most worrying is a lack of robustness in operational technology (OT) security, which Gartner defines as "practices and technologies used to protect people, assets, and information; monitor and/or control physical devices, processes and events; and initiate state changes to enterprise OT systems".

Patsis says: "As OT increasingly becomes internet-enabled, it creates new attack avenues. There is now a big focus on securing OT in the same way as we do the IT estate."

While he notes that the Colonial Pipeline attack has been a "huge driver" for improving OT security, Patsis stresses that there is much work to do in this area.

Theresa Lanowitz, head of evangelism at AT&T Cybersecurity, takes much the same view. "With the convergence of IT and OT systems, there has been an exponential growth in internet-of-things devices that has heightened concerns about the digital security of these systems," she says.

Lanowitz calls for a "mindset shift" in how OT assets are safeguarded. "Legacy infrastructure has been in place for decades and is now being combined as part of the convergence of IT and OT," she says. "This can be challenging for organisations that previously used separate security tools for each environment and now require holistic asset visibility to prevent blind spots. Attacks are coming from all sides and are creeping across from IT to OT and vice versa. Organisations should adopt a risk-based

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Transparency and trust are key to having robust and executable action plans. Everyone has a role to play in security

approach that recognises that there is no perfect security solution. Enterprises that strategically balance security, scalability, access, usability and cost can provide the best long-term protection."

Has the Colonial Pipeline attack encouraged infrastructure providers to take more effective defensive measures? "Frankly, not enough," argues Rob Carew, chief product officer at Arcadis Gen, the digital arm of Arcadis, a Dutch engineering consultancy. "There is still a disconnect between cybersecurity and critical infrastructure."

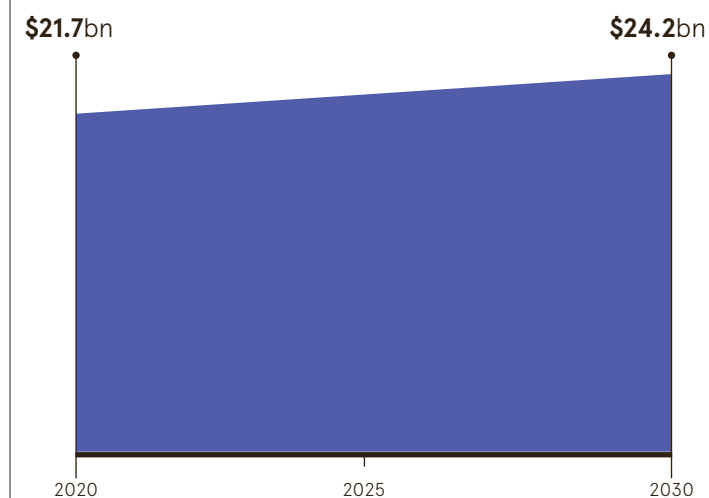
He suggests that cybersecurity is widely seen in the sector as an "addon", rather than intrinsic, when it comes to monitoring the health of critical infrastructure.

"The problem is compounded by the use of ageing hardware and software, which often have unforeseen vulnerabilities that can be exploited," Carew says. "Transparency and trust are key in having robust and executable action plans. Everyone has a role to play in security. If it becomes a regular topic of conversations among asset owners, operators, managers, maintainers and the supply chain, it will become part of the organisation's DNA."

Actions, though, speak louder than words. The Colonial Pipeline attack has set the alarm bells ringing. Months later, there is still high panic across the infrastructure network, with the cybercriminals seemingly better equipped than ever to expose vulnerabilities and gain handsomely from doing so. ●

SHORING UP CRITICAL INFRASTRUCTURE

Projected growth in the global cybersecurity market for critical infrastructure from 2020 to 2030



Frost & Sullivan, 2021

Q&A

Investing in a sustainable future

With the world gripped by a climate emergency, it is imperative that energy consumption – and more broadly infrastructure – is sustainable. Antin Infrastructure Partners' NextGen senior partners, **Nathalie Kosciusko-Morizet** and **Anand Jagannathan**, explain the firm's vision for a more sustainable and connected future



Q How important is it for infrastructure to be sustainable?

A It is critical. This is the essence of infrastructure; it is meant to be future proof and deliver an essential service to society in the long run. Now, being sustainable has not always meant the same across the history of infrastructure, this has been an evolving concept. The next generation of infrastructure will be smarter, more connected, and occasionally more asset light than previous generations. But most importantly, it will be greener.

N The ecological dimension is paramount: it is a question of physical resilience, of economic resilience and of societal adoption of the infrastructure. Let me expand. Physical resilience is obvious: with climate change, the world is becoming more dangerous. Recent floods and so-called gigafires have been dramatic illustrations. Certain physical infrastructure will be challenged.

Economic resilience is a growing concern: in some sectors, the environmental costs and the resulting constraints are deeply changing the economics. The coronavirus pandemic has only

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The idea that infrastructure is what transforms innovation into progress means that infrastructure investors have a specific role to play

accelerated the trend. Lastly, societal adoption is key, though often underestimated in investment strategies. What does good look like? What will good look like in the future? A desire for more flexibility and independence, more localised production spans across our society. How does infrastructure echo these?

Q What role does private sector investment play?

N At Antin we believe infrastructure is what transforms innovation into progress. And these large transformations happen when four

stars are aligned: technological breakthrough, societal trends, political will, and public and private funding. It looks like these stars are currently aligning. The private sector cannot miss what is both a responsibility and an opportunity.

A The idea that infrastructure is what transforms innovation into progress means that infrastructure investors have a specific role to play. There are numerous technologies around that are ready for commercial deployment and need capital to do so. Some of them will be tomorrow's infrastructure. We can accelerate the transition by funding them today to meet this responsibility and help bridge that gap.

Q What is your team looking for in terms of sustainable infrastructure?

A We invest in the next generation of sustainable infrastructure that will address climate change objectives and will be green. We will also invest in proven technological advances that deliver a better connected and a smarter environment for society. We target companies that will display strong infrastructure characteristics, provide essential services, have strong barriers to entry and are able to generate predictable cash flows, even if those are not all fully actualised. We want to help bring them there, during our holding period. And we will do that across our four verticals – energy and environment, transportation, telecoms and social infrastructure.

N We believe that the business models of tomorrow might not conform to traditional categorisations. They might span across sectors and will need cross-sector capabilities. Autonomous vehicles, for example, are a mix of our four sectors: obviously transportation, but also telecoms in the sense it involves connectivity and data, energy and environment as you want the electricity to be green and the battery life cycle to be taken care of, and social in the sense it allows people who

had lost mobility, because of age or disability, to regain it. It will revolutionise infrastructures, well beyond just cars. This also applies to many other areas we are considering such as the hydrogen economy, which spans energy, mobility and social infrastructure, and zero-carbon homes.

Q How can governments help?

A Governments can help by setting a clear, long-term policy framework backed by legislation and contractual schemes, where needed, to create a stable environment for financing the deployment of new infrastructure. This has been done quite successfully in recent years for the development of renewables and a similar commitment is needed to achieve net-zero objectives. It is also critically important these policies and schemes result in affordable consumer choices.

N Historically, government's role has been central to the development and financing of infrastructure, often through general taxation, as these were the backbone of economies and enablers for growth and expansion. In recent decades, this role has diminished; central planning and financing infrastructure through general taxation is not as fashionable or even considered appropriate and necessary. However, recent environmental crises, as well as the pandemic, have coalesced public

opinion globally that significant, coordinated policy interventions are necessary and appropriate to deal with these serious issues and give governments the leeway to act decisively.

There is then a concomitance here of regulations, economic incentives, public policy tools and purposes, all under review. This is good news, as long as the overall objective that long-term policy stability is key to investing is not lost. Predictability is of the utmost importance: from an investor's standpoint, no matter the nature of the policy tools or the amount of public money committed, the key outcomes are stability and affordability for consumers that result in standalone viable investible propositions.

Q In the run-up to November's United Nations COP 26 climate change summit in Glasgow, what message would you like to send to world leaders?

N Public opinion has shifted and there is acceptance that the frequent, widespread and increasingly acute environmental incidents are related to climate change. There used to be the occasional wake-up call but for a few years now, metaphorically, the telephone has not stopped ringing. 2050 targets can only be met by implementing irreversible measures to curb emissions immediately. While long-term objectives are useful to align efforts in the long run, immediate action is needed now. This is on our generation and this is a joint responsibility, public and private sector together, to catalyse both immediate and long-term change.

For more information please visit www.antin-ip.com

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While long-term objectives are useful to align efforts in the long run, immediate action is needed now



SMART CITIES

The smart continent

With rapid urbanisation threatening to exacerbate the socioeconomic and environmental problems faced by large cities throughout Africa, can digital tech provide some of the solutions?

Finbarr Toesland

Many cities in Africa are edging towards a crossroads. Fundamental demographic changes are reshaping urban spaces across the continent and straining the already overburdened infrastructure of large conurbations.

Smart cities that can embrace the benefits of digital innovation and pass these on to their citizens have long been viewed as a powerful tool to improve the quality of urban lives. But will they live up to this promise or might they further ingrain socioeconomic inequities?

There's no question that smart cities will play a role in the future of urbanisation in Africa. But it's down to local and national government leaders to decide how their concepts are applied.

Robert Versteeg, a consultant at Smart City Consultants, believes that the technology should fit around the ambitions of cities, not the other way around.

"If they merely want a gimmick, I think its role will be limited," he says. "You need to run projects where you have a good understanding of how smart cities can help at the strategic, tactical and operational levels. The effectiveness of an given smart city can be calculated by looking at the value added for the public."

Pursuing innovation for innovation's sake has proved an expensive error for some developers, which have seen their dreams of an advanced smart city fall flat. Take

Modderfontein New City, for example. Announced in 2014 by Chinese development group Zendai, this R84bn (£5.8bn) project within the Johannesburg metropolitan area was hailed by some as the New York of Africa when construction began in 2015.

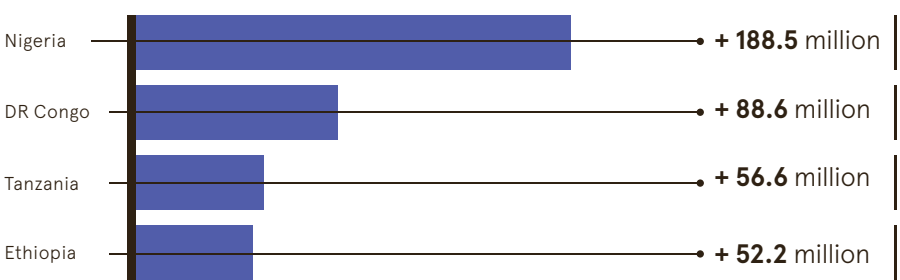
The smart city would have offered cutting-edge technology and jobs for 200,000 people. But Zendai refused to include 5,000 units of social housing that Johannesburg's local authorities had called for. Instead, it pushed for a fully luxury development, significantly drawing out the planning process. With little fanfare, Zendai cut its losses and sold the unfinished development on to another company, which has since begun working to a far less ambitious plan.

Breaking ground on a series of smart cities will not be a panacea that solves all urban problems, of course. But the use of technology can help to tackle specific issues resulting from the growing pains of African cities.

The government of Rwanda is taking one of the most advanced approaches to the challenge. Its comprehensive smart city master plan illustrates how innovative technology can improve the lives of city dwellers. Innovations already being implemented in the nation's capital, Kigali, include smart streetlights, air-quality monitoring equipment and buses offering Wi-Fi and cashless payment facilities.

UPTOWN TOP RANKING

Changes in the urban populations of four of Africa's fastest-urbanising nations between 2018 and 2050



UN Department of Economic and Social Affairs, 2018

Opponents of the Eko Atlantic City project in Lagos claim that years of building works have contributed to coastal erosion and flooding in neighbouring parts of the city



MODJAMO via Shutterstock

You need to run projects where you have a good understanding of how smart cities can help at the strategic, tactical and operational levels

Smart cities that cater to a defined industry may also be able to reduce the brain drain of highly skilled African professionals. Technology specialists have long relocated to Europe and North America in order to advance their careers, but it's hoped that the Konza Technopolis, under construction 40 miles south-east of Nairobi, will draw in hi-tech talent to Kenya from across Africa. Nicknamed Silicon Savannah, this smart city is set to incubate the cutting-edge startups that promise to create the next generation of homegrown innovations.

Finding the right funding structure can be make or break for a smart city. Because the amount of public money available is generally limited, finance models that bring international development organisations together with institutional investors are growing in popularity.

Public-private partnerships are often used to deliver projects. The businesses involved can unlock cost efficiencies and access the wider hi-tech startup ecosystem. Development finance institutions can help to mitigate the relatively high risks involved in these types of projects and also attract private investment from both regional and international organisations.

The Organisation for Economic Co-operation and Development has

forecast that the total population of Africa's cities will increase by 950 million over the next three decades. If managed effectively, urban development can generate economic growth, reducing poverty and improving living standards. Yet, for nations that are unable to overcome the far-reaching problems caused by rapid urbanisation, the danger is that long-standing inequities will be exacerbated.

To realise the potential of smart cities, governments and hi-tech startups are forming partnerships with international organisations to develop technological skills that are essential for building smart cities. For instance, the Rwandan government and a range of partners have established the Smart Cities Innovation Programme. This is a six-month accelerator project, running from June to December 2021, that's supporting African startups operating in fintech, cleantech, smart housing and mobility.

A development enterprise called the German Agency for International Cooperation is implementing this programme. It is bringing together African entrepreneurs and multinational businesses to form local solutions to local problems.

Olaf Seidel is the agency's programme director for digital solutions for sustainable development. He says: "Through this project, 30 African startups are receiving support from companies, such as Volkswagen and Siemens, and public stakeholders, such as Rwanda's green fund and the local ministry of ICT and innovation, to scale up their products."

Some of the startups are working on smart innovations including a digital walking stick for visually impaired people and battery charging hubs for small electric vehicles.

"With this approach, we promote local innovations and allow African

startups to learn from international expertise and the experiences of firms in other countries," Seidel says. "These are key ingredients for growing Africa's smart cities."

Although each smart city project is unique and will require a bespoke plan, much can still be learnt from successful developments around the globe. Countries with highly mature tech ecosystems – Japan, for instance – offer models that can be adapted.

Pilar Conesa, CEO of Anteverti, a consultancy specialising in smart cities, considers these urban spaces to be a response to the key global challenges of the 21st century – namely: the climate emergency and socioeconomic inequality. Taking a collaborative approach to developing smart cities helps to bypass common pitfalls, she says.

"The government of Japan recently realised that, beyond focusing its digitalisation strategy on technology as a means of generating economic growth, it also needs to use the technology as a means of helping to reduce the gaps between urban and rural environments," says Conesa, who also curates the Smart City Expo World Congress.

Several high-profile smart cities, including Eko Atlantic City in Nigeria, have attracted criticism for catering to a wealthy segment of society and leaving behind low-income communities local to it. But, by placing quality of life and inclusivity at the centre of smart city projects, technology can be recast as an enabler of equitable social development, she argues.

"Japan's experience shows that there is no truly sustainable development without promoting territorial cohesion and understanding socioeconomic challenges from a holistic perspective," Conesa says. "That's a fully exportable lesson for the future of Africa's cities."

‘There isn’t a moment to lose to get the right investment frameworks in place for the future’

The Global Infrastructure Investor Association (GIIA) represents 80 of the leading private investors and advisers in global infrastructure – an asset class that has grown continuously and steadily over the past few decades.

GIIA members own and manage nearly \$1tn of infrastructure assets on six continents. It's fair to say that many people reading this report will be doing so only as a result of infrastructure owned by GIIA members, be that energy, transport or digital networks. We conservatively estimate that we have at least £144bn of capital ready to invest in infrastructure at any given time.

During a very difficult period for people around the world, the infrastructure that supports society has delivered essential services such as water, electricity and gas to communities 24/7. Likewise, fast and ultra-fast broadband has enabled many families to work at home and school their children remotely – something that, only a few years ago, could not have been contemplated with any level of efficiency, let alone with the advances we have seen.

Further afield, seaports and airports have been enabled to operate around the clock (in the latter group's case, while suffering from huge revenue shortfalls). They have continued to help bring in essential supplies and reunite families.

In a great many cases, these assets are owned and operated by private companies and often, ultimately, by pension funds, helping to deliver long-term revenue streams for retirement savers. Infrastructure investors are renowned as long-term stewards, wanting to help nurture and grow their investments, in line with ESG principles, often over decades. During the pandemic, this ownership model also helped to insulate governments from even greater levels of financial stress, as infrastructure investors 'dig in' for the long term and reach out to help the communities they serve.

As we start to emerge from the Covid crisis, many significant challenges remain. Top of the list is, of course, climate change. In the UK alone, a recent GIIA and PwC report suggests that an additional annual investment of between £40bn and £50bn will be required every year for the UK to get on track to net-zero

carbon emissions by 2050. Globally, this number can be multiplied several times over, illustrating the huge task that lies ahead of us all.

We're seeing big policy announcements and spending commitments across key world markets and economies. But, while the context may differ, there is a golden thread that consistently appears: by combining government funds with private capital we can achieve much, much more – and faster.

While it's a big challenge, net zero is not the whole story. Our report with DLA Piper into the global public-private partnership market points out that the world's infrastructure needs trillions of pounds to be invested in it over the coming decades. That level of funding can not be met by governments' already stretched balance sheets alone.

Given this fact, it's essential that both local and national governments have access to multiple sources of funding. As the report also notes, public-private partnerships are delivering investment in critical infrastructure around the world, more often on time and on budget than that held publicly.

This, combined with other funding models in the financing toolbox, gives nations access to hundreds of billions of pounds in private capital that can be deployed quickly and efficiently to deliver the smarter, cleaner infrastructure needed for future generations.

As we look ahead to COP26, it's safe to say that there isn't a moment to lose to get the right frameworks in place to drive the future investment needed to deliver the infrastructure we all require. ●



Lawrence Slade
CEO, the Global Infrastructure Investor Association

Q&A Why solar PV is a stellar investment opportunity

Michael Bonte-Friedheim, founding partner and CEO of NextEnergy Capital, explains why utility scale solar farms offer both great returns and environmental benefits



Q What makes solar PV such an attractive investment opportunity?

A The key reason is that solar is the cheapest form of electricity to generate, which means that it is also the cheapest form of electricity for consumers today. Due to these cost efficiencies, it's also the highest growth electricity generation technology across the globe.

You can build very large solar assets in six months, whereas it will take 20 years to develop and build [nuclear power plant] Hinkley Point C, for example. On top of that, the amount of irradiation that hits certain places on Earth is well known. And because it's stable, you have a precise understanding of how much energy will be generated by a solar plant.

More solar energy hits the Earth in a single hour than the energy being used by the entire human population in a year. As solar irradiation is a free source of power, there's no need for any feedstocks. And of course, there are huge benefits in terms of reducing carbon emissions.

Q Could you tell us a little about NextEnergy Capital and the NextEnergy Solar Fund?

A NextEnergy Capital was founded in 2007 with the aim of becoming the leading investment and operating asset manager in the solar sector. Since its inception, it has been active in the development, construction and ownership of solar assets. To date, we have invested in nearly 300 individual solar plants, with approaching 2GWp of installed capacity.

I describe us as having three business units. The first is asset development, so developing greenfield and brownfield solar projects. And that is everything from finding the land to getting grid access, and building and owning the asset.

The second business unit is what we call fund management. We raise institutional capital in different investment vehicles, with the NextEnergy Solar Fund our listed flagship fund. It provides ordinary shareholders with attractive risk-adjusted returns, principally in the form of regular dividends, by investing in a diversified portfolio of solar energy infrastructure assets, with a focus on the key solar markets.

The third business unit, 'WiseEnergy', is what we call operating asset management, so basically running – in the ownership phase – a solar asset. It's a huge market opportunity for us because our expertise allows us to not only manage our own assets, but also offer our services to other asset owners.

Q How does your investment approach differ from that of other renewable energy funds?

A Our sole focus on solar differentiates us from other renewable energy market participants. We do not subscribe to the idea that you should do biomass one day, wind another, then solar, then hydrogen. Instead, we see ourselves as specialists that achieve better financial, technical and operating outcomes for investors, so we feel we've carved out a very unique market position.

Because we're both an investment manager and an asset manager, we have experience in the global solar sector that is second-to-none. As well as knowing how to achieve better revenues for each power plant, we also know how to manage the risks that all operating assets have.

The NextEnergy Solar Fund is also a very attractive investment proposition for investors that don't have access to private structures. There are several reasons for this. First, it is the largest solar fund in the UK in terms of installed capacity, which provides risk

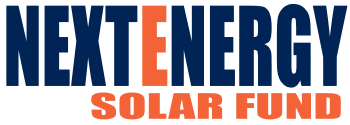
Enough solar energy hits the earth in a single hour to power the worlds electricity needs for an entire year

diversification. Second, the dividend yield of the current share price is the highest in the sector. Third, the performance of the fund's assets has been the best in the sector since our IPO in 2014, so we have a proven track record.

Q How do you plan to expand the fund's portfolio in future?

A Thanks to our track record in solar internationally we have access to opportunities in attractive markets across the globe, so our growth prospects are very exciting. We're also looking at ancillary technology that could be added to our existing assets, such as energy storage – a great addition to our large asset base in the UK.

For more information please visit nextenergysolarfund.com



BROADBAND

Dig for victory

Full-fibre internet connectivity is on its way at last in the UK. But will the easing of regulations on the market lead to ultra-fast services in both town and country?

Mark Hillsdon

A large proportion of the UK's copper telecoms network was installed more than 100 years ago, when the telephone was still a novelty and the internet was well beyond the imagination of even the most visionary of sci-fi writers. Fast-forward a century and the throughput demands on this vintage system are tremendous. No wonder it's creaking under the load.

The installation of a nationwide network that's fit for purpose has been painfully slow and piecemeal. But, in March, industry watchdog Ofcom created the conditions that should bring full-fibre broadband to the whole of the country. In publishing the outcome of its review of the wholesale fixed-telecoms market, it has established regulations that provide the business case for long-term investment.

One of Ofcom's key decisions is that it won't cap the prices that network operators can charge customers for faster fibre products for at least 10 years. This has been a huge fillip for fibre builders, especially Openreach, the BT division that dominates fixed-line broadband in the UK. Safe in the knowledge that it will see a return on its investment, the company has set about connecting more than 20 million homes at a cost of about £25bn.

To level the playing field, Ofcom has also given Openreach's fibre rivals easier access to its underground ducts and telegraph poles, making it significantly easier and

cheaper for them to construct their own networks.

Matthew Howett is the founder and principal analyst of Assembly Research, a consultancy specialising in regulatory matters affecting the digital economy. He says that Ofcom's pronouncement is "a boost to those laying fibre. They can just get on with it, because they know the rules aren't going to change."

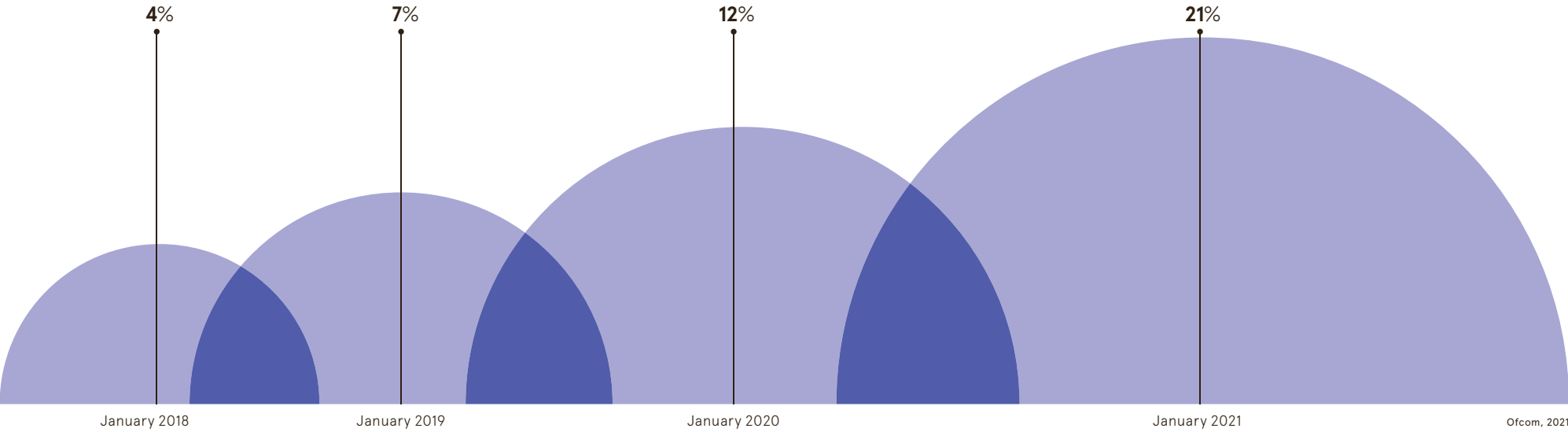
But there are fears that the new regulations could cause a rush to dig up streets to get cables into the ground. And, while cities are likely to be well served with ultra-fast connections, will rural areas continue to be neglected?

Openreach has already done a lot of work to run fibre cabling from telephone exchanges to cabinets on the street, a set-up known as fibre-to-the-cabinet broadband. From this point, millions of buildings are still connected by the old copper cabling, which has been the limiting factor on data transfer rates. Replacing this will make up most of the upgrade work, as the UK moves to fibre-to-the-premises (FTTP) broadband and the promise of standard download speeds of 1Gbit per second.

Openreach's biggest fibre-laying rival is Virgin Media, whose network is based largely on old Cable & Wireless hardware. It has committed to upgrading this and giving 15 million homes ultra-fast broadband by the end of 2021. Then there are about 50 other players, mostly backed by venture capital and private equity.

PUSHING AHEAD WITH THE ROLL-OUT OF FULL-FIBRE BROADBAND

Percentage of UK homes with fibre-to-the-premises internet connectivity



The largest of these, CityFibre, is bankrolled by Goldman Sachs. It's aiming to reach 8 million premises in more than 100 towns and cities.

The race to lay fibre will mean a lot of excavation (digging up roads accounts for about 70% of the cost of building new infrastructure). Howett acknowledges that a period of upheaval seems to be inevitable: "It's getting to the point where you have to ask: 'How many fibre networks do we need in the ground?'"

Genuine competition may be the sign of a healthy industry, yet he

questions whether consumers will benefit from it when so many businesses want to dig up the country's roads. Conscious of this factor, the government is insisting that they use existing Openreach infrastructure wherever possible.

"It's a frenzy at the moment in this market, because everyone is trying to reach out as fast as possible in a land grab," says Paul Stobart, CEO of ISP Zen Internet.

But it isn't only towns and cities, with all their broadband-hungry businesses, that are in these firms'

sights. "If you can find a good rural market and you're the only player, that is a big advantage," Stobart says. It makes others less inclined to follow, "because they know the spoils are going to be divided".

In many rural parts of the UK, the 'final drop' of broadband into the user's premises can be achieved by using overhead cabling, but strict planning regulations, especially in cities, mean that most fibre connections will need to be buried.

In countries such as South Korea, Japan and China, where FTTP has

been extensive for years, huge coils of wire hanging from telegraph poles and sagging across roads are a common sight.

"People in this country are not going to accept that," Stobart says. "We therefore have to go through this much slower, more expensive process of digging up the roads to hide the cabling."

To help limit the number of roadworks, the government is thinking about giving broadband providers access to hundreds of thousands of miles of underground utility ducts. It has already set aside £4m for projects trialling the use of water pipes as conduits for fibre.

And then there's 5G. Historically, fixed-line connections have offered more reliability and speed than wireless networks, which have always been cheaper to install. Stobart thinks it's important to see the two technologies as working together.

"There is going to be a convergence," he says, envisaging a typical set-up featuring a fixed FTTP link to a 5G hub inside a building, which will then deliver an enhanced signal throughout the premises. "They are complementary technologies, so I don't see one beating the other."

Howett agrees. For some people, especially in rural areas, this dual approach needs "to be considered part of the mix and a way of meeting the government's targets for getting everybody in the country on to gigabit-capable broadband", he says.

“It’s a frenzy at the moment in this market, because everyone is trying to reach out as fast as possible in a land grab”

The latest generation of low-Earth-orbit satellites provides another possible solution. They offer the potential for high-speed connectivity, although their cost of usage, at least in the short term, could prove prohibitive.

Down on terra firma, Howett expects that a very high proportion of UK premises will have access to full-fibre broadband within five years. Ultimately, he adds, this upgrade programme is all about future-proofing, because the only limitation with a network of this nature is the speed of light. Other hardware will be responsible for the next advances in communication speed and efficiency.

"This is going to be all about what you plug in at the other end," he says. "That is where the technology will evolve." ●



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