Powering the UK's Green Revolution

The foundation for the UK's future growth

G | Smart Campus

Fast-track to the future, naturally

The UK must make itself the global blueprint for a green economy

If the climate crisis could be solved by target setting alone, there would not be an issue. Both the US and the UK have recently pledged to slash emissions even further. With COP26 set to be held in Britain this November, it is good to see world leaders are once again uniting on this especially given Trump's presidency meant the US spent four years away from occupying its vital role as the Western world's leader.

But, while the proposed cuts to emissions are good targets to have, we need to see less rhetoric and more concrete action taken both by governments and the private sector.

Frankly, the action currently being taken is not swift or decisive enough. The International Energy Agency reported emissions were higher in December 2020 than in 2019, even with lockdowns. If we are to reverse climate change and leave our children a future, we need to change course immediately. Fundamentally that means more tax incentives for innovative firms investigating new technologies for clean industry and power, and a framework for green financing to help build the pool of capital necessary to finance these projects.

Post-Brexit and pandemic, the UK will need to reinvent itself as our competition for trade and business will be truly international given our departure from the EU. Now is a golden chance to become the blueprint for pivoting away from our industrialised economies towards a greener and cleaner future.

And immediate actions are not that hard to take.

Given the country is facing 1980s style unemployment once the Chancellor ends the furlough scheme, now, more than ever, is when we should be committing to a green stimulus. The economic multiplier for the economy is estimated to be as large as 8x. For every pound spent on green infrastructure, workers in a variety of different sectors across the country will feel an extra pound in their pocket too. With this and government borrowing costs at an all-time low, it is not far-fetched to see how such a stimulus could pay for itself.

There also needs to be serious attention paid to investing properly in the UK's regional connectivity across road, rail, and air - and this investment must be made throughout the entire country if the Government is to achieve its aim of levelling up the country.

It's not just about connecting the whole country at a macro-level. We also need to focus on creating local infrastructure to support local jobs in sustainable, clean industries near where people live to ensure they don't have to travel vast distances in fossil fuel reliant cars or on outdated and unreliable rail infrastructure. Suppose business and Government can come together to create more smart, clean campuses and clusters that can host innovative companies at scale and create thousands of local jobs - we could start to pivot the UK's economy towards a cleaner one.

As this report spells out, there are a raft of innovative industries waiting to be scaled-up - and they will need modernised hubs and facilities, like Gravity, to cater for low carbon technologies and workforce demands. This would create thousands of local jobs and kickstart a greener UK economy that the rest of the world will eventually have to mimic.

Over the last two decades or so, since former vice president Al Gore released an Inconvenient Truth, climate change has slowly crept up the agenda. It's now essential enough that major investors and governments all say it is a priority.

But the time for talk must now stop. It's time for action.

By Martin Bellamy, CEO, This is Gravity

Recommendations

Pivoting the UK's economy to a cleaner and greener one is a commitment that will require dedication from both the Government and the private sector. However, while there has been a good deal of rhetoric from both public and private spheres, there has been little concrete action or planning taken.

The case for moving the UK economy onto a greener footing is ubiquitous; rarely a week goes by without new research championing the cause. What resonated for us was: according to the Stern Review, the global costs of climate change could be between 5% and 20% of GDP per annum if we fail to act, dwarfing the costs of effective international action, estimated at around 1% of GDP in 2050. In addition, the net costs of mitigation in the short to medium term will be higher if global action is delayed or if there is uncertainty about the investment and changes in behaviour needed to make the transition.

However, to reach these goals, the UK will need to pivot away from being a service economy towards once again becoming a country rife with manufacturing.

We must draw up plans to concretely shift the UK - and the world- to an economy underpinned by clean growth, creating both jobs and sustainable businesses.

This report has set out eight recommendations, that if subscribed to on their own or as a whole, could help the UK become a world leader for a clean and green growth economy.

1. Make the super deduction tax a tool for green growth:

The Problem: Currently, the super deduction tax, aimed to help spur investment into manufacturing, has no green component

The Solution: Firms must be encouraged to invest in green and clean industries. Making the super deduction more favorable to firms investing in green and clean machinery would help achieve this.

2. End greenwashing:

The Problem: To finance a green industrial revolution, investors must be confident their monies are going into suitable projects. However, greenwashing - where funds are not directed into sustainable and clean projects - still happens. This dents investor confidence and results in less capital available, making financing more expensive.

The Solution: It should be mandated that any green financing vehicle found to be greenwashing should be subject to a hefty fine. We recommend a higher fine value than the UK GDPR and DPA 2018 set in 2019 regarding a data breach, where a maximum fine was imposed at £17.5 million or 4% of annual global turnover.

3. R&D tax credits for innovative scale-ups:

The Problem: To support investment in areas that encourage growth and innovation, R&D is crucial. However, the Government is still in the midst of a third consultation and little progress is being made on implementing anything tangible.

The Solution: Widen the scope of eligibility for the R&D tax credit to ensure it keeps pace with modern R&D practices, such as clean growth technology; review the availability of data on R&D expenditure to ensure the R&D tax credit's effectiveness continues to be monitored appropriately; The Government must ensure the R&D tax credit is internationally recognised as world-class by regularly benchmarking the UK's regime against international peers

4. A green project pipeline:

The Problem: Despite plans to launch the UK's first Green sovereign bond later this year, there is currently no list of green projects earmarked by he Government. Investors will need to have confidence their money is going into sustainable projects; otherwise, they may shy away from investing due to greenwashing fears.

The Solution: To help the UK become a beacon for green investors, the UK needs to have a rolling list of green projects that it will finance via institutional/retail bonds.

5. Stop penalising the consumer:

The Problem: We urgently need to develop zero-carbon technologies to make them cheaper and deployable at scale so that the end-user - often the ordinary person on the street - does not find themselves having to pay a green premium.

The solution: Green-inspired regulations, such as the ban on sales of petrol cars after 2020, should not penalise the end-consumer. Instead, companies who commit to reducing emissions should be handed either grants or tax breaks to encourage them to develop green and clean products that can be sold at no extra cost to the consumer.

6. The UK should establish clear transparency rules:

The Problem: Currently, how companies report green projects is not clear or consistent.

The Solution: The UK government should work closely with companies to define a set of metrics to measure green investment/ decarbonisation. From our research, we know companies are very willing to work with the Government on this.

7. Support entrepreneurs and SMEs:

The Problem: Innovation is likely to come from start-ups. Silicon Valley has proved this time and time again across the pond. While in this country, entrepreneurs like Sir James Dyson and Sir Richard Branson have created countless thousands of jobs through their enterprise.

The next generation will need support to be able to compete in an ever more globalised market.

The Solution: SMEs and entrepreneurs will be the driving force behind many green innovations. The UK should ensure these are supported by the Government considering raising funds to build incubators up and down the breadth of the country. Where possible, these funds should be given to universities that already operate these incubators and take a long-term view.

8. Stop top-down policies that throttle innovation:

The Problem: Government is currently mandating solutions through legislation. For example, moves to ban sales of petrol or diesel cars from 2030 or ban boilers may on the face of it sound like good ideas. However, in many sense these types of policies are restraining solutions to the climate crisis.

The Solution: Government policy should look to encourage innovation from the private sector. For example, it's impossible right now to really predict if electric vehicles are the panacea to the climate crisis. Hydrogen power may turn out to be the solution. But if the market is only encouraged to go down one path, then it is unlikely any backing will be given to truly innovative technologies.

Executive Summary

Britain was the first nation to embrace industrialisation. It should now be the first to evolve it into a green and clean economy and set the example focused on innovative companies making planet-friendly products powered by clean energy.

It was Boris Johnson, PM that said,

> *"We will use Britain's powers of invention to repair the pandemic's damage and fight climate change."*

Are We?

Despite both Brexit and Covid-19 in some ways handing Britain the perfect chance to take a clean sheet and reimagine how and why we do business and create jobs, much of the so-called Green Industrial Revolution has so far amounted to little more than rhetoric and grandstanding.

Little tangible progress has been made since 2019, when the UK became the first major economy to pass net-zero emissions into law by committing to becoming a net-zero economy by 2050. So far, not enough concrete actions have been taken to achieve this. The Government has recently been robustly criticised by the Public Accounts Committee for not publishing a clear strategy for decarbonisation.

Furthermore, the Chancellor's recent budget had very little in the way of any green policies. The Bank of England may now have a mandate to change its approach to buying corporate bonds after the Government said environmental and climate goals should be explicitly considered part of monetary policy and plans for retail Green Bonds to be offered alongside the UK's debut Green Gilt were also announced.

But with the country in its worst recession for nearly 300 years, not to mention that traditional employers like retail and hospitality look to have been decimated by pandemic lockdowns, the March 2021 budget must be noted as a missed opportunity to reboot the economy in a cleaner and greener way.

Why we must act now

Going forward, the planned capital investment must be directed to every corner of the UK to level up the country. Covid-19 has laid bare the dangers posed by an over-reliance on global supply chains.

To truly power a green industrial revolution, there is an urgent need to reinforce domestic supply chains by creating jobs in clean industries.

The economic multiplier for the economy at large is estimated to be as large as eight. For every pound spent on green infrastructure, workers in a variety of different sectors across the country will feel an extra pound in their pocket too. With this and government borrowing costs at an all-time low, it is not far-fetched to see how such a stimulus could pay for itself.

The case for a green stimulus is well made usually on the environmental benefits one would yield — such as a real step toward the UK's 2050 net-zero carbon target. While these benefits are undeniable, it is scarcely recognised that forthe economy as a whole, the benefits would be far higher than from a regular stimulus.

Much the same is true for jobs. Amid the Silicon Valley tech boom in the States, Enrico Moretti, a prominent labour market economist, calculated the 'skilled job multiplier' to be equal to five. While we would be swapping silicon for solar, it is certainly plausible that the same would ring true here: the jobs directly created through a green industrial revolution would support thousands more throughout the economy. The key driver for this to be a success is for the Government to invest in infrastructure that will produce short-term gains and in sectors that will continue to support and create jobs.

Green and clean industries of the future must underpin this; the electric vehicle (EV) industry is one such area.

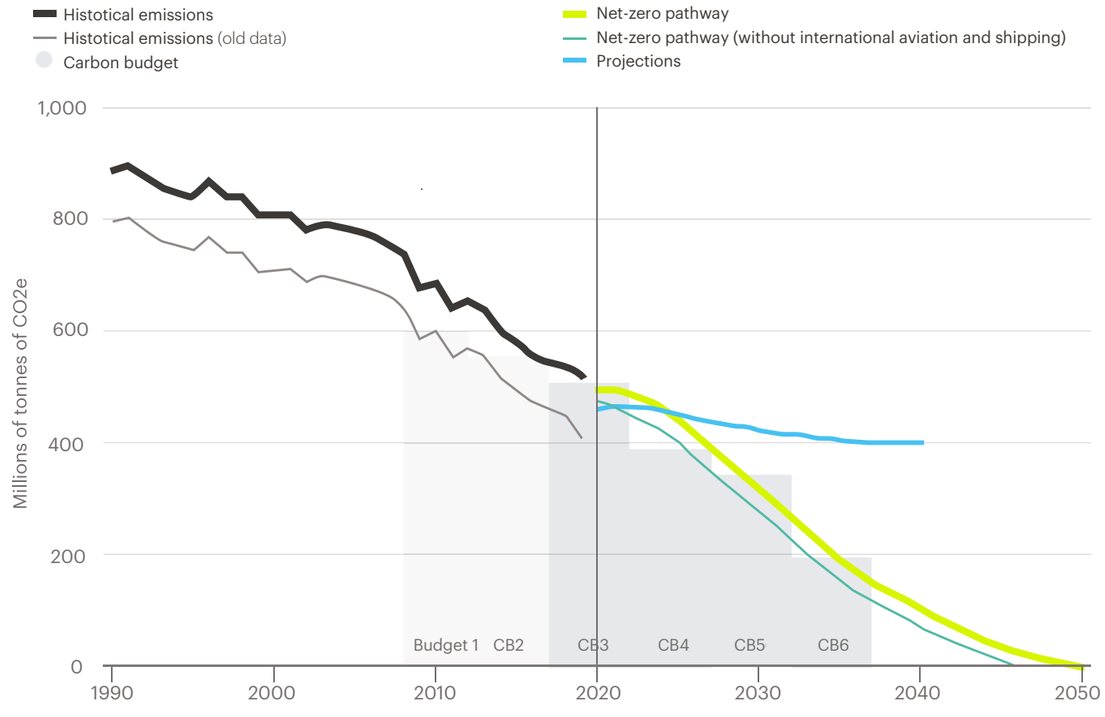
Already supporting over 100,000 jobs, there is real potential for Britain to become a market leader.

This provides the Government with the perfect avenue to achieve their levelling up agenda. Through strategically driving new industry, the Government can help overcome the discontent of 'left-behind' areas that had previously seen such dynamism pass them by. For example, Hull and Humber, one of the country's most deprived areas, offers a prime location for the extension of Britain's world-leading offshore wind industry and would benefit enormously from a green stimulus.

The UK is set to host COP26 in November this year, which represents a huge opportunity for this country to put itself at the forefront of the green agenda. The UK may have been the first country in the world to commit to being a net-zero economy by 2050, but now concrete plans must be unveiled to show the roadmap towards this.

COP26 is the perfect time for all involved to stop talking in green platitudes and commit.

The gap between UK emmisions and a net zero patway is expected to grow



Source: Department for Business, Energy and Industrial Strategy (BEIS) emissions data and projections, CCC figures and Carbon Brief analysis.

Chapter 1:

Shifting to a green economy

Smart Campus

Why COP 26 matters

The first 12 days of November should prove crucial for the UK's green future. It is hoped the Government will unveil a joined-up strategy over that time.

From an optics point of view, hosting the 26th United Nations Climate Change conference provides the UK with the perfect chance to once again take the lead in addressing the climate challenge.

But it is vital that COP26 does not just turn into another talking shop. Instead, concrete points of action need to be taken away. We canvassed the following green leaders for their thoughts

What do you think COP 26 could do to transform the way we approach sustainable energy and sustainable growth?

HELP SMEs

Chris Melhuish BSc MSc PhD C.Eng FBCS FIET
Assistant Vice Chancellor: Technology Partnerships University of the West of England, Bristol

One of the issues with the Government is that they tend to look at the existing portfolio of UK industries, but emerging sectors and technologies are often driven by SMEs. And so, one of the big questions that needs to be answered is: what can we do for those SMEs?

What do we do in the UK to make people want to engage in entrepreneurial activity and to support them through their journey of growth, all the while keeping them in the UK?

If you're going to make physical systems, then you need hardware incubation - and that's a different ball game to regular software incubation as it involves longer timeframes and needs a lot more investment.

There's a strategic need to address how you support and grow emerging sectors – and clean energy is one of them.

BALANCE RISK

David Lennard
Head of Business and Operations
Bristol Robotics Laboratory

Innovation requires risk taking and an acceptance of failure, particularly in new and emerging sectors.

Investment in new sectors also needs to be encouraged, as funding tends to be channeled towards mature sectors, which are viewed as less risky and offer more predictable ROI.

Robotics in the early days provided investors with the dilemma of, you know it is going to be valuable but don't quite know where it is heading and where it is going to end up. In Bristol Robotics Laboratory's Hardware Incubator, we aim to de-risk ideas and limit uncertainty through intelligent experimentation as we translate scientific achievements into commercial gain. Since inception, we've supported about 30 start-ups and they've generated in excess of £20 million of revenue. We provide:

+ *A rent-free period to assist with cash flow at start-up*
+ *Subsidised rental for the first six months and a rental escalator thereafter*
+ *Easy-in/easy-out flexible license agreements*

To accelerate innovation journeys and build strong, agile enterprises.

SUPPORT THE INNOVATORS

Benjamin Bell
Head of Public Policy for Northern Europe, TIER Mobility

Our fingers are crossed that COP26 can be an opportunity for the world to come together in a physical sense after the pandemic.

The forum can help ensure that climate change, and the future of energy and transport, are at the forefront of the global agenda.

Speaking from the TIER and wider mobility perspectives, I think a lot of the solutions need to come from innovators, with the private sector working in lockstep with city partners.

LEADERSHIP AND PLANNING IS VITAL

Mark Cavill
Head of City Energy Solutions,
EON UK

I think COP26 really needs to continue, we saw a slight dip in tackling the climate crisis after the US left the Paris Agreement but thankfully they are back at the table now and recent announcements from the White House and from other governments show greater commitment and a return to a faster pace again.

There really needs to be a significant amount of leadership from some of the major nations who are taking part.

Discussions need to be focused on leadership, policy and planning and investment, and how that can flow to the right areas: decarbonising heat at a city scale for example, inspiring millions of homeowners to improve their homes and invest in smart, sustainable technologies.

It's about how we can continue that debate, how we can give a platform for certain countries to really take leadership and to follow up the investment into the more emerging economies that are perhaps underfunded

UN CLIMATE CHANGE CONFERENCE UK 2021

Chapter 2:

Funding

BlackRock boss Larry Fink used his annual letter in 2020 addressed to the company's global executives to urge them to "get a grip" and put sustainability at the heart of their future investment decisions. This intervention has proved significant.

BlackRock, the world's largest asset manager, had been under pressure to reallocate funds away from sinful assets such as coal, with climate change climbing back up the news agenda following natural disasters such as the horrific wildfires in Australia.

Beyond the reputational risk posed from being too involved in 'dirty' industries such as mining, there are business reasons for investors like BlackRock to increasingly look towards backing green projects.

One, it reduces the risk of being exposed to stranded assets as the UK and global economy shifts towards clean and green assets being the norm. Rather than there being a 'green premium' for sustainable buildings, we are more likely to see a 'brown discount' for assets that perform poorly on key metrics.

Two, an increasing number of investors are making it clear they will not invest money into vehicles backing projects that are harmful to our environment. This is becoming more than just a fashion for a minority, as the growing number of conferences on Environmental, Social, Governance (ESG) investing prove. It's a clear - and growing - trend, especially among institutional investors such as pension funds, who can't afford to think short-term.

But how does this become mainstream?

As Gravity Director, Lord David Triesman notes, a culture change in how investors view projects may be needed.

> *"One of the things that struck me being in government and then in finance, in the period from 2008 through for at least five years beyond that, was when people talked about investment, there was a crucial mistake that was made time and time again - duration mismatch," says Lord Triesman.*

> *"We had a banking system, which operated as though it was like a joint venture capital system, and most of the banks had become American style investment banks. And those are entirely inappropriate for the kinds of change that we're talking about"*

Green bonds

In the recent March 2021 budget, Chancellor Rishi Sunak announced a plan to launch green bonds for retail investors, which will sit alongside the planned first Greene Gilt set to be launched later this year.

Why does this matter? Simply put, getting both sets of green bonds right would help the UK raise significant financing for green projects itself plus help build confidence in a private green funding market

+ Around $250bn (£189bn) of green bonds were sold last year, amounting to approximately 3.5 percent of bond issuance globally
+ According to research by global law firm Linklaters, more than 680 green bond issuances have been launched globally in 2020. Green bonds finance environmentally friendly projects, including energy, efficiency, pollution prevention, clean transportation, and new green technologies

Why issue green bonds?

Most green bonds currently in the market bear similar financial characteristics to regular bonds from the same issuer since repayment is tied to the issuer. Green bonds, however, offer some potential benefits to issuers:

+ Investor diversification and demand
+ Closer engagement with investors
+ Corporate reputation and awareness
+ Improved internal awareness of sustainability
+ Government support and incentives

Countries leading the way in green finance

Germany and Sweden top green bond proceeds and issuances

+ Sweden (92), Japan (77) and Germany (69) were the top three green bond issuers in 2020
+ Germany raised $37bn (£27bn) followed by US and France at $30.7bn (£22bn) and $25.3bn (£18bn)
+ UK - Data from Bloomberg shows there are currently 42 issuances of green bonds in sterling - mainly corporate bonds - with a total value of around £11bn (very small market) (City A.M.)
+ The trend is set to continue as we begin to see more evolved variations of the product with the emergence of sustainability-linked bonds beyond the traditional use of the proceeds model

Huge demand

The huge demand for these bonds is coming from a range of investors. Some examples include:

+ Mainstream institutions investors: Amundi, Aviva, AXA, BlackRock, State Street
+ Specialist ESG and Responsible Investors: Natixis, Mirova, ACTIUM
+ Corporate Treasury: Barclays, Apple
+ Sovereign and municipal governments: Central Bank of Peru, California State Treasurer
+ Retail investors: World Bank issuances for retail investors through Merrill Lynch Wealth Managers. IFC and SolarCity issuances for retail investors through capital

But, little has been done to ensure the success of the UK's nascent green bond market.

For instance, a list of earmarked projects to receive funding from these issuances has not yet been released.

According to Lord Triesman, that may, in effect, limit how much money the Government will be able to raise through these notes

> *"The Government and regulators need to create an environment where investors and lenders are rewarded for taking the long-term view. What will ultimately bring down green financing costs are longevity and pipeline security. Given the UK is planning on launching its first Green Gilt to institutional investors later this year, the Government should earmark the projects, businesses, and technologies that this bond will fund. Otherwise, investors may shy away due to concerns over potential greenwashing issues. And, the Government will certainly have to engage the expertise of the specialist financial businesses capable of structuring investment to achieve the best possible results"*

Ending Greenwashing

There are still numerous cases of greenwashing, which is when a company or organisation spends more time and money on marketing themselves as environmentally friendly than on minimising their environmental impact.

Such activity is tremendously harmful when it comes to building up a financing base for green projects. Investors who are not certain their monies will be used for sustainable projects are less likely to invest. The net effect of this will be to reduce the pool of capital available, raising the pricing of funding. Ultimately, this will make it more expensive for firms to get the financing they need, potentially stifling innovation.

This report asked a number of experts how we could potentially end greenwashing and help companies report their green credentials more transparently.

Q Do you feel companies should be required to publish data in their annual reports?

PUBLIC AND PRIVATE PARTNERSHIP

Iain Percy, OBE
CEO: Artemis Technologies

> *Big wind farms funded around the world, which are purely private, are working quite efficiently. But I think where governments have a role to play is where there's more risk involved, such as a start-up.*
>
> *I think the public/private partnership of financing new technology will be how the UK can really lead the way, if we're nimble. There needs to be a push for efficiency around reporting transparently. The Government could lead that, and there's definitely an argument for being more systematic and prescribed from the top-down.*

Marrying the public and private

The climate challenge is currently being tackled at both a governmental and a private sector level. But joined-up thinking between both sectors will be required to help spur innovation and support companies. This report asked a number of experts and firms with skin in the game for their thoughts on:

Q How should the government and the investment world look at these opportunities and what metrics should they use to consider deploying investments?

OPPORTUNITIES THROUGH BONDS

Chris Melhuish BSc MSc PhD C.Eng FBCS FIET
Assistant Vice Chancellor: Technology Partnerships University of the West of England, Bristol

But where do those ideas come from? And where does the money come from to support this?

Could there be an opportunity for the government to set up bonds, so that people can invest in them so they're guaranteed by the government and then funding can then be given out to the sector in order to support new ideas and businesses and de-risk the takeout?

The question is how do you unlock this funding to take us forward?

PUSH TOWARDS EFFICIENCY

Iain Percy, OBE
CEO: Artemis Technologies

I've seen a massive change from financial institutions around the need to fund and change their portfolios.

But there needs to be a push for efficiency around reporting transparently. The Government could lead that, and there's definitely an argument for being more systematic and prescribed from the top-down.

Chapter 3:

A green revolution?

What types of industries does Britain need to have?

There are a number of developing industries in the UK, with a large majority driven by the knowledge economy. The combination of Brexit and Covid-19 will also reprioritise certain industries over others. These include, but are not limited to:

+ AI
+ Immersive technology
+ FinTech and other intersections of tech with more traditional industries such as PropTech, and other knowledge-driven industries, like life sciences

In the last decade, AI has increased by 145 percent. In 2010, there were 1070 companies in the UK before increasing to 2619 in 2018. Based on this growth, the Government created the Office of Artificial Intelligence (part of the Department of Digital, Culture, Media & Sport and the Department for Business, Energy & Industrial Strategy) and identified AI as a sector that can put the UK at the forefront of the industries of the future.

From computational and data science to analytics, the merge of technology with other industries is changing businesses' operations on a day-to-day basis. It will continue to revolutionise the UK economy in the digital age.

The Government's industrial strategy sets out five key foundations: Ideas, People, Infrastructure, Business Environment, and Places.

Current Government targets aim to raise total research and development (R&D) investment to 2.4 percent of GDP by 2027 and increase the rate of R&D tax credit to 12 percent. This shows how vital the knowledge economy will be for future industry, ensuring the growth and strength of UK businesses, and how driving investment into innovation and improving technical capabilities will be instrumental in positioning the UK as a global leader going forwards.

Case Study: TIER Mobility

TIER Mobility is Europe's leading provider of micro-mobility and on a mission to change mobility for good. Founded in 2018 with its leadership team based in Berlin and London, TIER serves 95 cities in 11 countries across Europe and the Middle East. As part of its drive to make it easier for people to live without a private car, TIER offers e-scooters, e-bikes, and e-mopeds among its growing suite of multimodal options and integrates with 30 different public transport providers.

TIER is climate-neutral, a UN 50 Climate Leader, and its CEO / co-founder has pledged to donate his entire stake in the business to sustainability causes from which he will not financially benefit. TIER is already profitable and recently secured significant external funding to expand its unique Energy Network - which utilises British battery technology manufactured in Oxfordshire - into cities seeking to benefit from the air quality, high street, and consumer benefits of rider-swappable batteries

According to The International Energy Agency (IEA), lockdown resulted in the largest-ever drop in global emissions. For instance, a fall in car journeys accounted for 50% of the decline in global oil demand and the slump in the aviation sector for around 35%. Meanwhile, low-carbon fuels and

technologies, particularly solar PV and wind reached their highest ever annual share of the global energy mix, increasing it by more than one percentage point to over 20%.

But this trend has not continued. As lockdown has eased, cars have returned.

Indeed, the IEA also reported that emissions were higher in December 2020 than they were in 2019.

Ailin Huang, Head of Sustainability, TIER talks about the importance of mobility and connectivity in achieving sustainability.

How micro-mobility can help make cities sustainable.

The pandemic has led to many changes in our day-to-day lives with lockdowns around the world forcing us to work from home and changing our mobility patterns.

One of the side effects of this was a reduction in traffic in our cities around the world. Another being a change of preferences (social distancing rules and avoiding potential risk of infection) towards individual modes of transport instead of public transport - such as bikes, scooters, and cars.

If we are to reverse climate change, we need to change course now and use the lessons learned from the crisis for the better. Fundamentally that means examining every facet of how we do things.

Changing the way we travel, especially in our cities, plays a pivotal role. Micro-mobility, whether e-scooter or e-bikes, have a key role to play. Swapping car journeys to the supermarket or work for the convenience and green speed of a scooter is one thing that could help, especially if it slashes emissions.

Not only would this make it easier for everyone regardless of age, fitness level, or income to choose a convenient, accessible, and sustainable form of transport to get to where they need to be, micro-mobility firms also have the potential to create jobs within the green economy.

But, tackling climate change and pivoting to a greener economy will need a joined-up effort across business, Government and consumers. Electric micromobility is here to stay - as a low carbon transport option, it has and will play an increasing role in the sustainable urban transport mix.

Advanced Manufacturing

In its broadest sense, advanced manufacturing uses innovative technologies to create existing products and the creation of new products. The sector includes production activities that depend on the information, automation, computation, software, sensing, and networking.

In the context of today's world, the most relevant product being delivered using advanced manufacturing is vaccines to the coronavirus.

For the last year, newspapers across the UK have splashed stories in which the European Commission has lambasted the efficacy of the AstraZeneca-Oxford vaccine or threatened to halt exports of the jab to the UK.

This has forced the UK Government to innovate and quickly by creating a British vaccine industry. In what some commentators have called the "Ursula dividend", policymakers have quickly realised that the UK can not be reliant on supplies from overseas and, therefore, strengthen domestic supply chains.

Although the UK had a world-class life sciences sector pre-Covid, we were not focused on developing vaccines. India, China, and of course the United States were far more significant on the global stage, while in Europe, France and Belgium were much bigger players.

AstraZeneca was not in the industry at all, and while GlaxoSmithKline was in the big three, alongside Merck and Sanofi, it was hardly dominant. That is now about to change.

Faced with threats from the EU to block exports of Covid vaccines, the UK is quite rightly enhancing its own capacity. There are already a couple of plants making the Oxford-AstraZeneca vaccine and a bottling operation in Wrexham. Novavax will make its vaccine – very effective in trials and expected to be authorised soon – in Stockton-on-Tees, while GSK will bottle it in the North East.

AI & Robotics

In the leafy suburb of Andover, Hampshire, you will find robots working round the clock to pack shopping for millions of UK residents.

The pandemic has been kind to Ocado Retail. As a series of lockdowns forced vast numbers of people to shield, the online grocery business – whose website and app went offline amid the panic buying of March 2020 – reported a 35 percent increase in revenue to £2.2bn in the year to November.

The company's state-of-the-art 'shelf picking technology' enabled the company to operate at near full capacity throughout the Covid-19 crisis as robotics could work away 24 hours a day without the worry of social distancing.

AI is driving advancement in robotics and automation. It is perhaps impossible in practice to draw a clear line between AI and physical functions that AI can now manage. In the last ten years (2010-2019), industrial robots' annual installations more than tripled, reaching 381 thousand units in factories worldwide.

Globally and in the UK, AI has gone through periods of development and periods of relative stagnation. However, in the longer run, the advances in symbolic programming enabled a greater understanding of high-level problem-solving intelligence, with special progress in tools and techniques to stimulate or support complex expert reasoning in relatively well-structured domains – ideal for applications in the workplace.

If we look at the subsequent developments in the UK, researchers are building autonomous robots that will use AI to identify and fix potholes in UK roads. Further, a £22.4 million

worth National Robotarium will open in Edinburgh in 2022. In a move to revolutionise the food and hospitality industry, London-based start-up Karakuri also has ambitious goals to bring robots and AI to the food industry with their robot chef canteen.

The majority view for the industry is that its impact will be positive, large, and widely spread across sectors, with uneven uptake rates. The UK must hone in on its expertise in the sector, as patented technology, such as that deployed by Ocado, can contribute significantly to job creation and the UK's gross domestic product. One way to achieve this would be to prioritise grants towards university students on courses directly related to AI.

Electric Vehicles (EV)

As part of Boris Johnson's 10-point plan to tackle climate change, the prime minister announced in November 2020 that the UK would ban the sale of new combustion-engine vehicles by 2030. The Government is also banning the sale of new hybrid cars by 2035.

The UK was once a battery pioneer. Scientists at Oxford University made a breakthrough on the lithium-ion battery in 1980. It was not so long ago that Britain was Europe's biggest producer of electric cars, thanks to the battery factory opened up by Nissan next to its car plant in Sunderland in 2013.

Unfortunately, that is no longer the case.

The UK's access to batteries to power these next-gen cars remains a stumbling block. Last year, Jaguar Land Rover's award-winning I-Pace electric car hit a roadblock that typified the challenges facing the automotive industry: the supply of batteries ran out.

While countries worldwide have been building the gigafactories where they are made, Britain has appeared stuck in the slow lane. Governments on the Continent, car-makers, and investors have been pouring cash into gigafactories in recent years to play catch-up with the battery giants of China, South Korea and Japan. In Germany, for example, work is progressing well at "Giga Berlin" - Tesla's new and first gigafactory in Europe, which has received $1bn in state-backed subsidies.

Brexit has given the construction of gigafactories added importance for the UK. Under the trade deal with the EU, the country has six years to establish domestic production of batteries and parts if it wants to export electric cars tariff-free to the Continent. If batteries are not sourced from the EU and the UK by the end of 2026, punitive tariffs could cripple the UK automotive industry.

A deal struck between the EU and Japan will eventually allow the likes of Nissan, Toyota, and Honda to export cars tariff-free to the Continent, bypassing the UK and the production plants they set up here in the 1980s and 1990s to supply the market across the Channel.

The car industry, which employs more than 800,000 people, directly and indirectly, has potentially devastating consequences. Without battery factories near their plants, foreign-owned car-makers will build models elsewhere, probably on the Continent. Vauxhall's Ellesmere Port plant on Merseyside and Toyota's site in Derbyshire are vulnerable.

Failure to build gigafactories could cost 105,000 jobs by 2040, according to the Faraday Institution, a government-funded battery research body. It calculates that seven gigafactories of 20-gigawatt hours capacity each will be needed here by 2040, producing enough batteries to power 300,000 to 400,000 cars. To date, there is only just one planned in the UK. Given the pace of change in the global economy, the simple fact is that we are not acting fast.

Life sciences

For the most part, Britain is already a world leader in life sciences, although the sector has a critical mass in the Oxford-Cambridge Arc knowledge economy.

The pandemic has put life sciences, and its researchers under the spotlight - both for healthcare and economic reasons – and will result in more capital coming into this space. The higher levels of fundraising also show investors are growing more comfortable with life sciences as a sector. This is especially true post-pandemic, with investors seeking sectors that are less vulnerable to disruption.

Life sciences rely on a three-way partnership between academics (custodians of ideas and innovations); governments (as funders and customers); and industry (who invest, commercialise and acquire).

This triple helix is vital in creating thriving life science ecosystems and is a common characteristic of core markets on both sides of the Atlantic, including San Francisco and Boston in the US, and Cambridge in the UK.

However, for the UK's life sciences sector to reach the heights of its cousins across the pond, delivering more space to attract venture capital funding is vital.

In the UK alone, there has been £20bn of life sciences capital raising during 2020. However, in the US, the figure eclipsed this, with venture capital investment reaching £305bn.

There is enormous capacity in the market not just for more high-quality incubator space but for a broader range of specialist life sciences real estate that can support Britain's growth. The UK, now the third-largest life sciences market after UK-based biotech companies, raised £1bn in direct venture capital funding alone in 2020 and is on track for a record-breaking year. We are beginning to close the gap on North America's life sciences clusters, but there is some way to go.

Aerospace

The UK is at the forefront of cleaning up the aerospace and aviation industries.

In September 2020, the world's first flight of a hydrogen-powered, commercial-grade aircraft was completed in Bedford. The ground-breaking event came while UK ministers faced fresh calls to help scale up the domestic market for hydrogen produced using renewables.

Conducted by Zero Avia on 24 September, the flight saw a six-seater plane using hydrogen as its primary power source completing taxi, takeoff, a full pattern circuit, and landing.

Inside the Piper M-class plane, compressed hydrogen gas is fed into hydrogen fuel cells, where it is combined with oxygen from the air in a process that produces water as well as electricity. The hydrogen is supplied by green gas producer EMEC Hydrogen.

The successful test flight brings the model one step closer to commercial viability for short-haul journeys such as London to Edinburgh. In December, the UK Government invested £12.3 million into the company, as ministers began scaling up their ambitions to decarbonise aviation.

The funding was secured via the Aerospace Technology Institute (ATI). This state-backed organisation works in partnership with the Department for Business, Energy and Industrial Strategy and Innovate UK to offer funding designed to accelerate innovation in the UK to maintain global competitiveness. The ATI Programme comprises of four strands – the Strategic Programme, R&D Funding for Smaller Business, the National Aerospace Technology Exploitation Programme (NATEP), and our International programme.

Chapter 4:

The Future of Work

The impact of the pandemic on the jobs market has been extremely tough. While some industries, especially those in the tertiary sector, have easily transitioned online, others have been decimated.

This has inevitably had a significant impact on the jobs market, with many people turning to Government supported schemes such as Universal Credit and the furlough scheme to protect jobs. According to the Office for National Statistics, unemployment has recently been at its highest rate in 5 years, peaking at 5.1 percent.

Looking to a post-pandemic recovery, there will be a crucial need to create new jobs and the protection of existing roles.

The creation of jobs will need to be targeted in flourishing industries and are already attracting levels of interest and investment. These are primarily within the wider knowledge economy, such as life sciences, technology, and aviation.

Many jobs that are created in the knowledge economy are often centered in specific locations, like science parks. To ensure and attract the right talent, other areas of investment need to be considered, such as the residential market and other infrastructure, while balancing these with the necessity of growing the economy in a sustainable and eco-conscious way.

SMEs

SMEs are the backbone of the UK economy, and the continued growth of small businesses will be a crucial catalyst for its recovery. To achieve this, they must receive the financial support that allows them to invest in R&D, hire staff, and contribute to regional economies and create job opportunities.

In March 2021 The Government announced a £20 million SME Brexit Support Fund to help small businesses with changes to trade rules with the EU. This announcement follows extensive engagement with individual businesses, leading business organisations and trade associations from across all parts of the UK, to address challenges SMEs face.

Going forwards, the UK economy will continue to rely on the strength and growth of SMEs, so it will be of critical importance to support businesses and introduce policies and opportunities to allow them to develop.

Case Study: Bristol Robotics Laboratory

Bristol Robotics Laboratory (BRL) sits at the heart of the region's thriving robotics sector, offering businesses and entrepreneurs a range of start-up, growth, innovation, training, and talent development solutions. Its Hardware Incubator and Robotics Innovation Facility (RIFBristol) have hosted and supported some of Bristol and Bath's most successful tech enterprises.

RIFBristol provides training, consultancy, proof-of-concept, and research solutions to businesses ranging from start-ups to large multinationals. Recognised as a European Digital Innovation Hub, it maintains an array of cutting-edge manufacturing technologies and has expertise spanning robotics, automation, mechanical and electronic engineering, IoT/5G, mechatronics, and simulation. From introductory robotics courses to prototyping and new product validation, its services help clients to overcome innovation challenges and stand out from their competitors.

BRL Hardware Incubator and Robotics Innovation Facility Stats

650+ businesses received training or research assistance

£20m investment secured by Incubator residents

£46M GVA contributed to the UK economy

241 new jobs created by supported enterprises

Chapter 5:

Levelling-up - Local hubs and local jobs

While cities and large towns in the Greater South East of England are among the most productive and prosperous places in Europe, most North and Midlands lag far behind. Among those underperforming cities, if the eight largest closed their output gap, the UK economy would be £47.4 billion larger in total, according to the Centre for Cities.

The Government has set out its intention to address this inequality and 'level up' underperforming and "left-behind" parts of the UK through a programme of infrastructure development, investing in education, skills, and scientific R&D. This will shape the future economy and must be a key consideration of other driving factors, such as developing industries and the importance of the green economy.

The UK's inequalities are not just limited to the North-South divide but exist on a local and regional scale as well. It is not simply a case of London and the rest of the UK, but within greater London, there are economic and social deprivation areas. This is replicated across cities in the UK.

These regional inequalities are deep-rooted and complex, and even well-designed policies could take years or even decades to have meaningful effects. This means that the levelling-up agenda must be considered on a long-term basis and is not limited or constrained to election cycles to ensure economic growth.

Levelling-up will be a crucial part of the economic agenda of the UK in the future, and driving for more even prosperity and opportunities across various UK regions will have enormous benefits for the wider UK economy.

What steps can we take to fix this?

One option includes doubling down on backing the repurposing of suitable and available land into enterprise zones and smart campuses that can attract innovative companies to areas up and down the country.

That in turn will provide jobs and housing for local communities that may have been neglected before, with the ultimate aim of helping the government achieve its ambition of levelling-up Britain

But to help fix regional inequalities, a longer-term vision will be needed.

What should this be?

Our three points are:

1. **Boost funding for education in STEM and other subjects in deprived areas of the country to give poorer children the opportunity to learn the skills needed for the future economy**

2. **Replicate the success of the Oxford-Cambridge-London Golden Triangle by establishing regional networks of universities and business from centres of excellence that will look to bring forward schemes and initiatives that will encourage enterprise in these areas**

3. **Improve connectivity, especially the rail network, so that people can travel to areas of employment**

Gravity

thisisgravity.co.uk