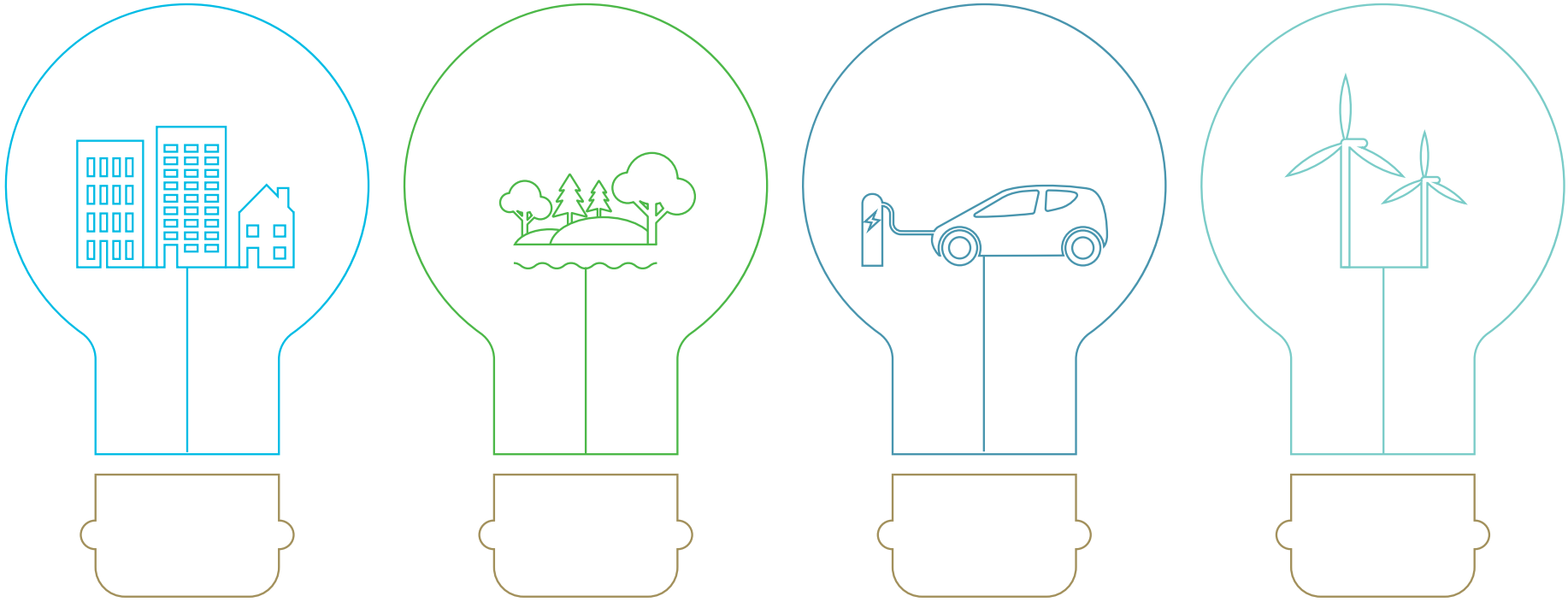
How to fast track innovation for a green industrial revolution

green alliance...



GREEN INNOVATION POLICY COMMISSION

Summary

"Green innovation will play a vital role in economic recovery, leading to higher productivity and jobs."

As the UK responds to the Covid-19 crisis, the government must lay the foundations for a more resilient, competitive economy. Already, before the pandemic, UK productivity was lagging behind that of other nations. Government decarbonisation policies were also not cutting emissions fast enough to meet legally binding targets. The plans needed for economic recovery are an opportunity to build an economy that is more fit for a net zero future, that protects against the impacts of climate change and looks after the natural capital we depend on.

Green innovation will play a vital role in economic recovery, leading to higher productivity and jobs in new low carbon industries across the country, supporting the government in its ambition to position the UK "at the forefront of the green industrial revolution", as set out in the recently published ten point plan.[1] Most economic sectors still have a large environmental footprint, so greater innovation in green technologies and business models is necessary across all parts of the economy. This will help businesses reduce their negative environmental impacts locally and globally, and remain competitive in the low carbon transition.

Over the past two years, the Green Innovation Policy Commission (GIPC), chaired by business leader John Cridland and directed by Professor Paul Ekins at UCL, has been looking into what it will take to translate this ambition into reality and ensure green innovation drives the UK's future economic development. The commission brought businesses together with academics and other experts to inform its investigation.

“Policies for low carbon energy innovation over the past decade have turned UK research excellence into a world leading renewables industry.”

In this report we summarise the GIPC’s main messages to policy makers. One clear conclusion is that innovation cannot only happen in a lab. Real world trials and the large scale adoption of novel solutions are needed to test their viability, and these depend on the right resources and infrastructure, policy and regulatory landscape, and market development.

While investment in R&D is still essential, policies that promote learning by doing and deployment are required to bring about a resilient economic recovery in the 2020s.

However, as the commission identifies, a green industrial revolution will only be possible once the barriers and policy gaps holding back innovation are overcome. These include limited incentives to invest in clean technology, unambitious regulation and a failure to link innovation efforts along value chains and across sectors.

Addressing these limitations is necessary to attract more business investment. Past experience shows it can be done. Well designed and appropriately funded policies for low carbon energy innovation over the past decade have turned UK research excellence into a world leading renewables industry. With similar drive, this could be replicated across other sectors of the economy.

The commission recommends six ways that the government should promote green innovation:

- **Set an overarching strategic framework,** ensuring policy coherence across government and greater collaboration with business and civil society.
- **Create demand**, including through fiscal incentives and public procurement, to accelerate the transition of novel solutions from niche to global markets.
- **Boost investment**, by ensuring net zero and environmental goals are central to the remit of the new National Infrastructure Bank, establishing a new National Green Innovation Fund within it to provide a more comprehensive and systemic approach to funding green innovation and by rebalancing public investments, away from R&D and towards experimentation and the commercialisation of new green solutions.
- **Change the rules of the game**, using progressive and performance based regulation to drive innovation, leveraging the UK's strong track record in pioneering regulatory 'sandboxes' to establish new 'green innovation sandboxes'.[2]
- **Nurture innovation partnerships**, by fostering cross sectoral and place based collaborations, supported by a government review of the capabilities and skills needed for green transformation.
- **Make infrastructure work for a green economy**, by ensuring that all infrastructure decisions align with net zero and wider environmental goals, and through greater emphasis on natural and digital infrastructure.

“The Green Innovation Policy Commission is clear that progress cannot be achieved by the government alone.”

These recommendations are not aimed at a single government department. The commission proposes a new Green Innovation and Sustainability Transformation Council, chaired by the prime minister, to bring together ministers and high level representatives from business, academia and civil society, to ensure cross departmental co-ordination and promote a whole government approach. The recommendations are discussed in more detail in the commission’s full report, *Innovation for a green recovery: business and government in partnership* (GIPC, January 2020).

The GIPC is clear that progress cannot be achieved by the government alone. With its significant business leader membership, it calls for a new partnership between the public and private sectors to achieve a green transition. Its report makes further,specific recommendations to businesses which, together with direction and coherent policy from government, will unlock green innovation across the economy.

Why green innovation is needed for economic recovery

Increasing competitiveness and growth

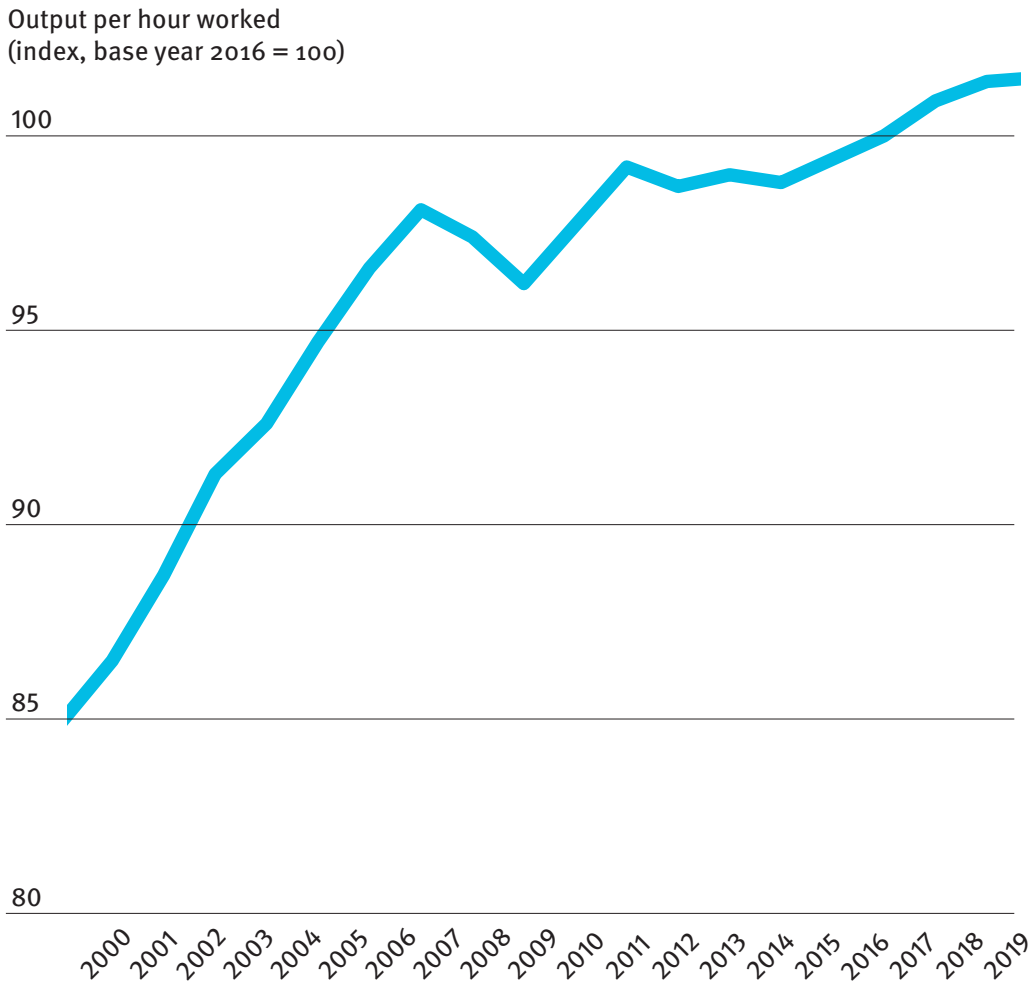
"Innovation was an important driver during the most recent phase of strong UK productivity growth"

Innovation investment yields strong economic benefits for businesses and wider society.[3] Private sector returns on R&D spending are generally between 20 and 30 per cent. The social return, ie the economic benefit to wider society, tends to be higher still, with rates of return typically two to three times higher.[4,5] Innovation was an important driver during the most recent phase of strong UK productivity growth, contributing to more than half of the increase that occurred between 2000 and 2008.[6]

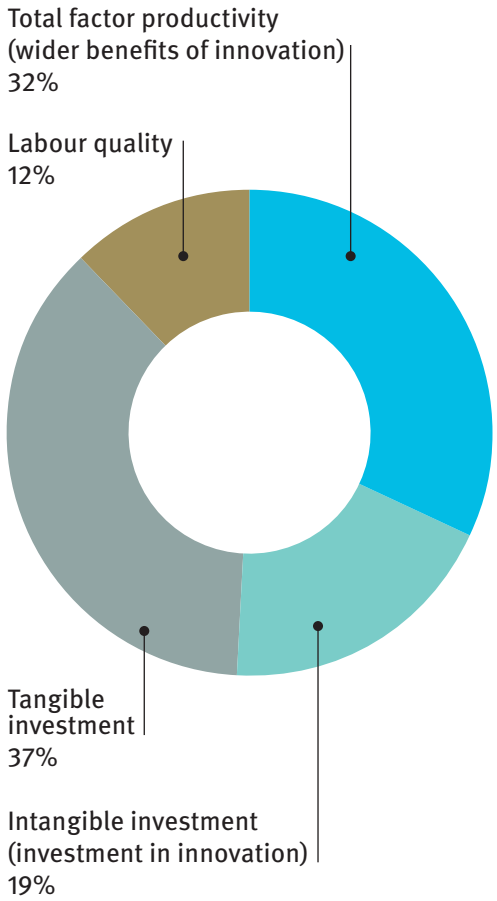
Accelerating innovation as part of the UK's recovery from the coronavirus pandemic will help businesses to compete in the global market, through higher productivity and by developing the novel products and services that will be in high demand as the world's economies decarbonise.[7,8]

Innovation has been an important factor in UK productivity growth[9,10]

UK economy labour productivity



Factors contributing to UK average labour productivity growth between 2000-2008



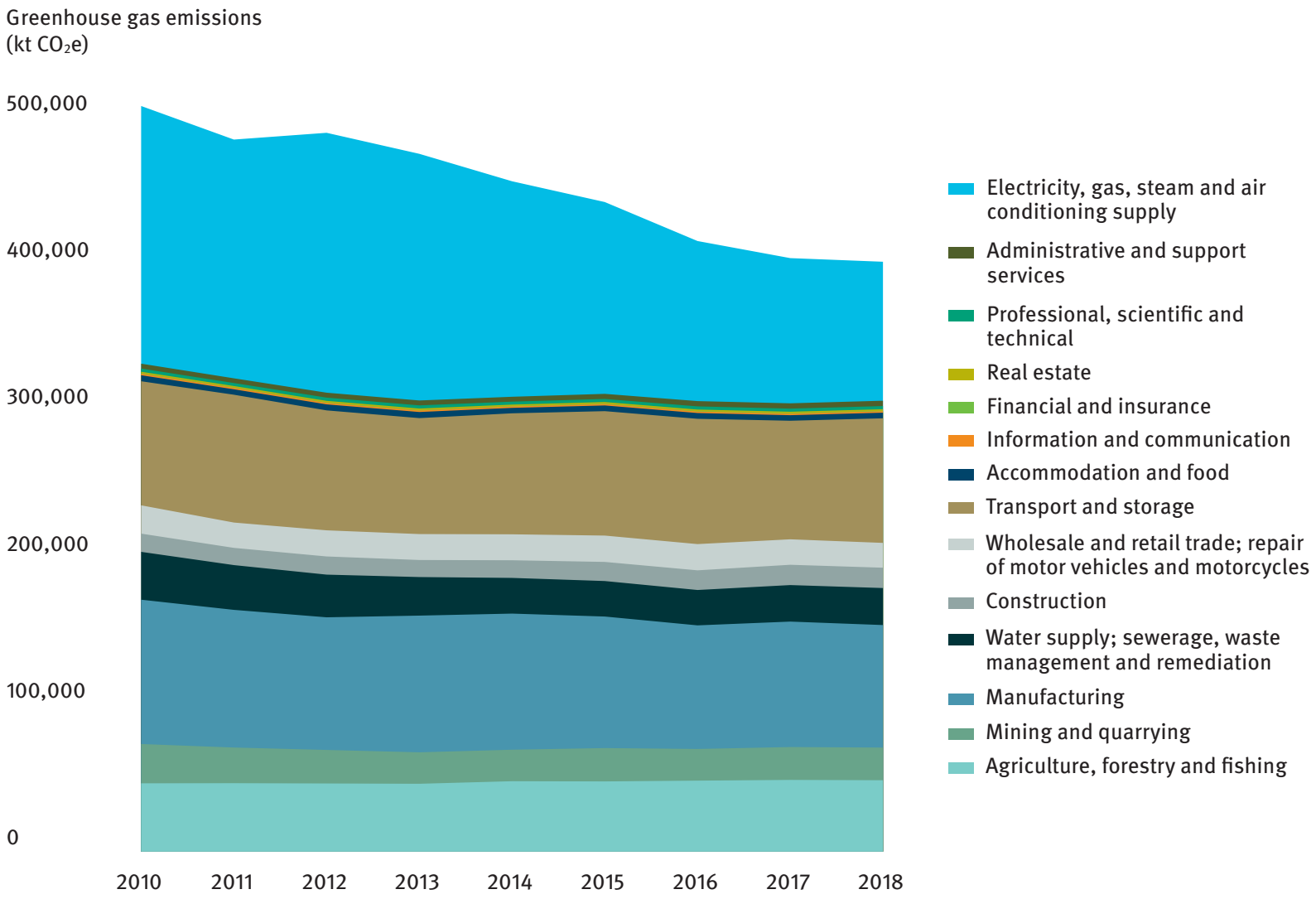
Promoting business resilience

"There has been little progress on decarbonisation across most industries, apart from the power sector."

As global economies increasingly face the need to respond to climate change, industries that invest in novel environmental solutions can limit their exposure to supply chain disruption, reputational damage and regulatory changes. A survey of 125 large corporate buyers and their supply chains estimates US$1 trillion of financial impact if they do not adjust their operations to address environmental risks.[11]

UK businesses still have a large environmental footprint. For example, there has been little progress on decarbonisation across most industries, apart from the power sector.[12] The average annual overseas land area required to meet UK demand for just seven commodities between 2016 and 2018 has increased by 15 per cent compared to demand during 2011-2015.[13] And, despite overall reductions since the early 2000s, many sectors still have high material intensity, with sectors like construction actually increasing in recent years.[14] This exposes UK businesses to future risks.

Most UK industries have not significantly reduced their emissions[15]



Supporting new low carbon jobs

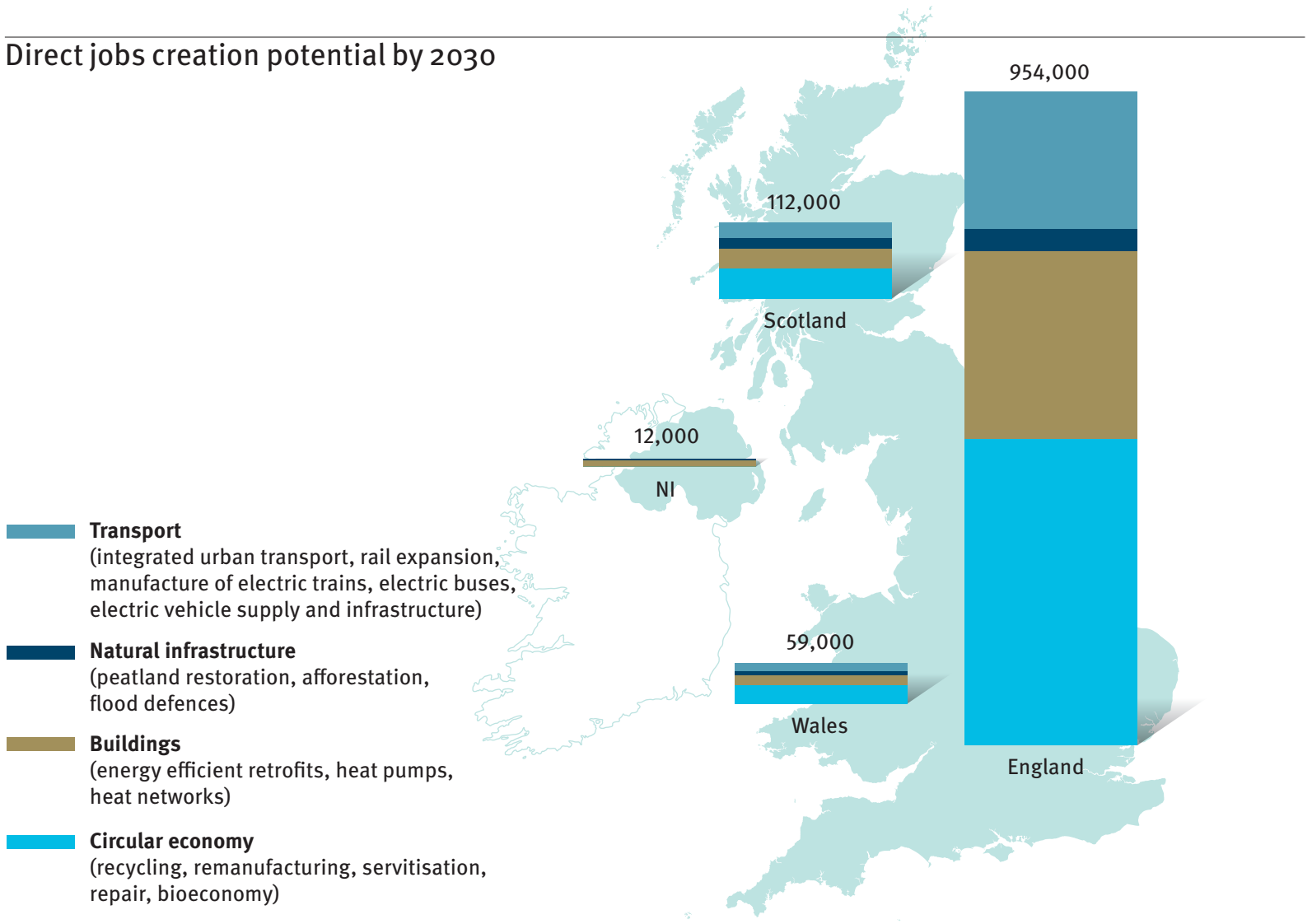
“Innovative climate and nature solutions have the potential to create thousands of new jobs over the next decade.”

Innovative climate and nature solutions have the potential to create thousands of new jobs over the next decade. From scaling up clean energy, switching to low carbon vehicles and public transport, and upgrading the energy performance of UK buildings, to making products more durable and repairable, growth in these new sectors offers significant employment opportunities.

Crucially, these opportunities will be distributed right across the country. For example, building retrofit jobs are expected to follow regional patterns where homes need energy efficiency upgrades. Previous Green Alliance analysis found significant potential for new circular economy jobs in all regions, with jobs in the remanufacturing sector likely to be clustered around existing manufacturing sites, while reuse and repair activities would be dispersed throughout the country. Importantly, these new jobs will offer roles at a range of different skill levels too.

Growing low carbon and resource efficient industries will create new jobs across the country[16]

Direct jobs creation potential by 2030



Innovation doesn’t just happen in the lab

Commercialising and scaling up environmental solutions

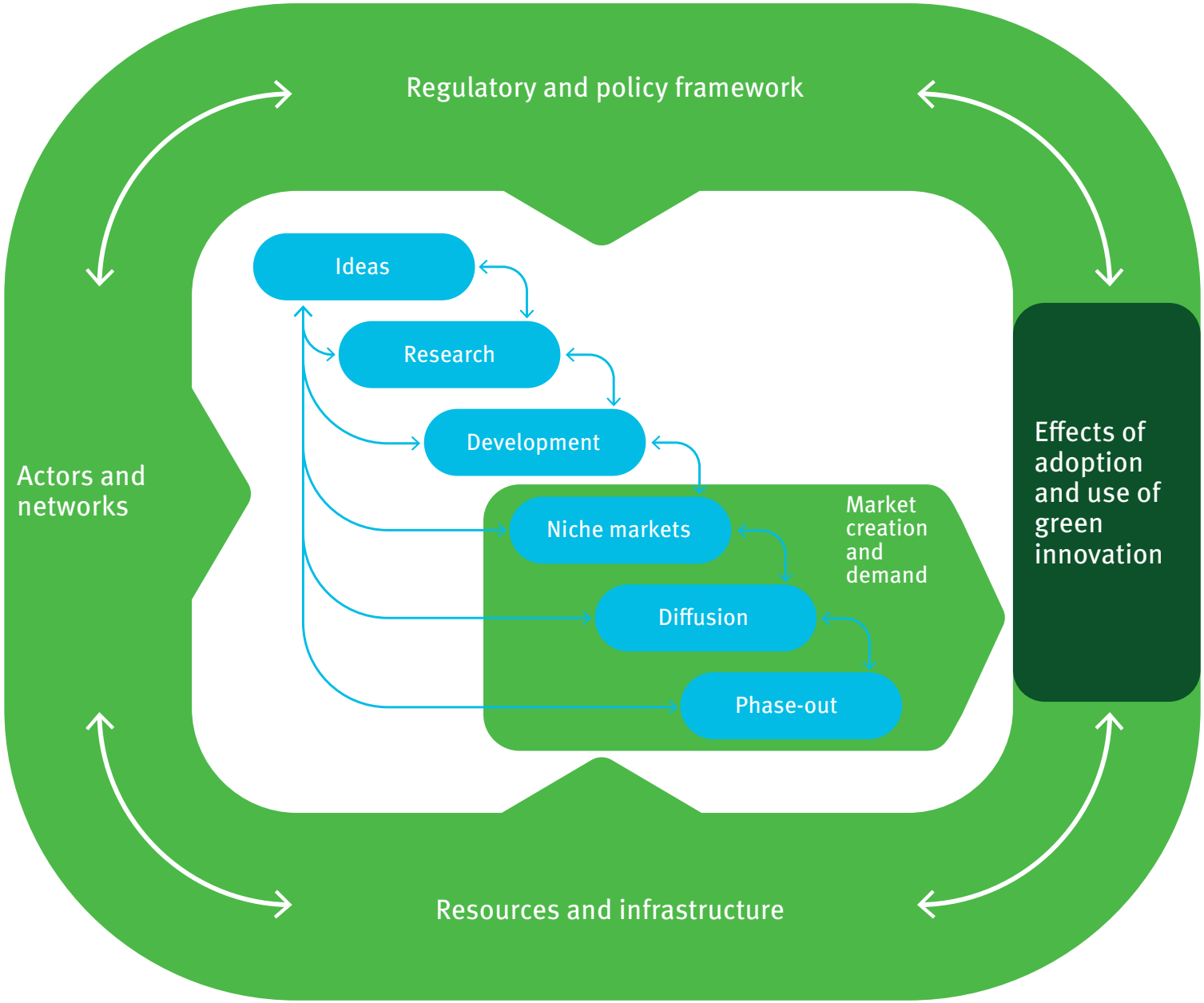
"To promote rapid progress in the near term, proven technologies and solutions that are close to market must be expanded."

Innovation takes many different forms. It can involve changes in production processes, such as the development of an industrial process to reduce material use, avoid waste or use renewable electricity. It could be linked to new products or design changes, so that products last longer or have less environmentally harmful components. It may also involve new business models, such as selling services rather than products. Or it may be linked to new ways of supporting sustainable lifestyles, for example improving consumer information about environmental impact or providing access to more sustainable options.

It involves multiple iterations and interactions within and between firms and other actors, such as public sector agencies, academic institutions and consumers. And the rate and how it happens depends on many factors, such as the type of resources and infrastructure businesses can access, the policy and regulatory landscape and the extent to which markets for novel solutions are developed.

In the UK, there has been a renewed focus on R&D and innovation policy, with a new industrial strategy white paper, an R&D roadmap and the launch of a funding agency similar to the US innovation agency ARPA, all in the space of three years. These place great emphasis on R&D and the early stages of innovation. The government's recently published ten point plan for a green industrial revolution, while recognising the need to commercialise and test new ideas at scale, is still strongly biased towards new technologies. But, to promote rapid progress in the near term and ensure the UK meets its net zero target, proven technologies and solutions that are close to market must be expanded. This is why policy that addresses the later stages of innovation is so important.

What it takes to get new green solutions to market[17]



R&D funding alone isn’t enough

Market and system failures hold back innovation

Getting innovative green ideas from the lab to large scale adoption has been challenging. This is because there are many barriers which prevent businesses from capitalising on them. These include:[18]

- **Market failures**. Market prices do not reflect the social and environmental costs of unsustainable products and services. This is compounded by the tendency of the private sector to underinvest in innovation in general, as it is risky and the benefits can accrue to others, rather than the investor.
- **System failures.** These include collaboration failures, between firms from different sectors or between science and industry; infrastructure failures, such as ageing technical infrastructures; capability failures, for example a limited ability to deploy new technologies due to a lack of relevant skills and knowledge; and institutional failures, like regulatory barriers.

Innovation policy will not succeed by only focusing on R&D funding, it must also address these barriers.

Maximising the benefits of innovation

"Government policy should set the vision and foster efforts to innovate."

In addition to addressing market and system failures, government policy should set the vision and foster efforts to innovate, focused around important transition pathways to achieve environmental goals. This vision is needed because strong and coherent innovation policy brings a wealth of benefits.

It is good for the economy

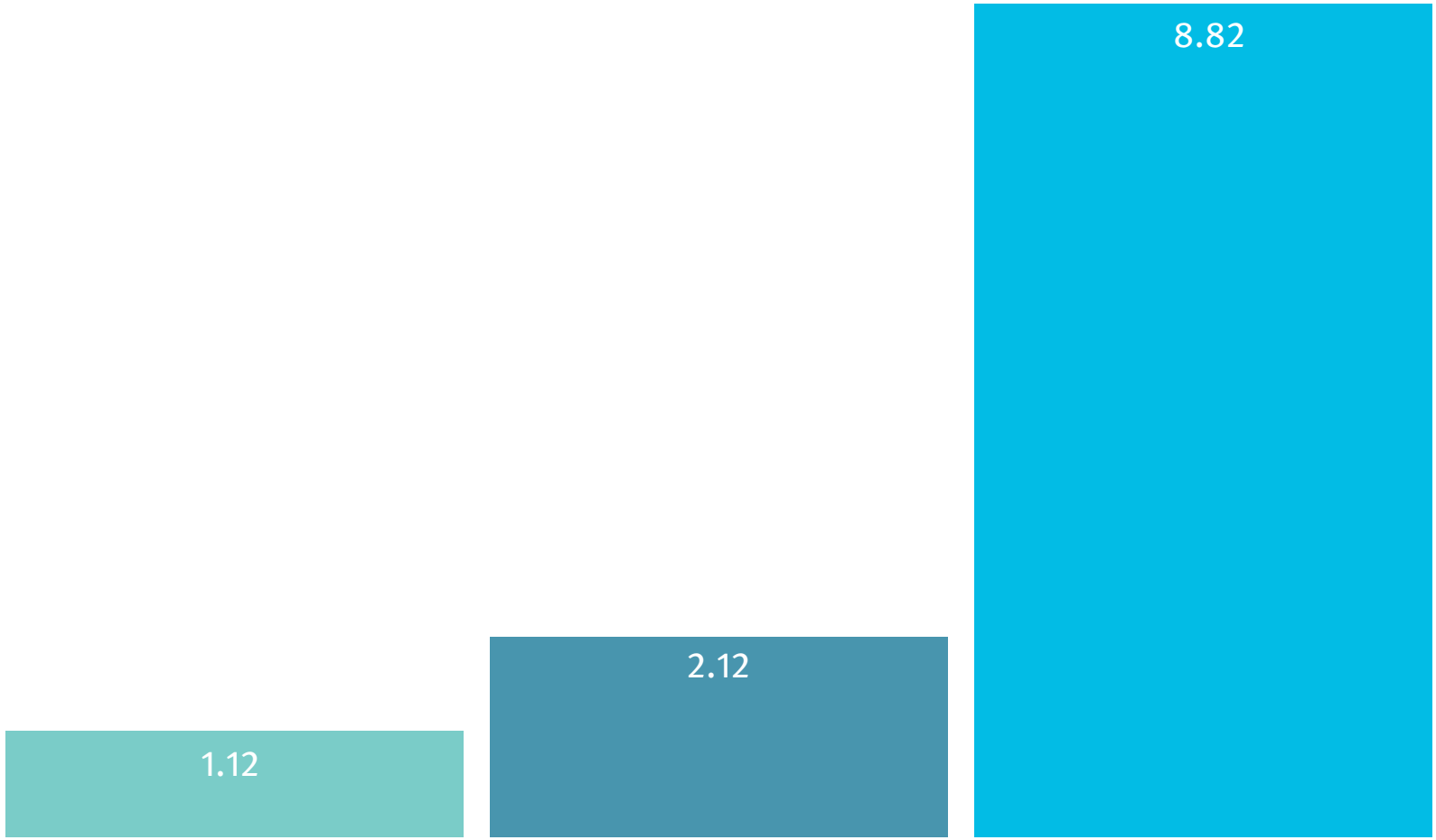
Policy that provides significant long term expectations of future growth, by creating and shaping new markets, stimulates private sector investment and results in a higher GDP multiplier, ie it boosts economic growth.

It strengthens leadership in emerging industries

Countries that lead in new industries are not simply those that spend most on R&D but the ones that enable early deployment and market formation. For example, when the era of modern wind energy began during the late 1970s and early 1980s, Denmark spent less than half as much on R&D as the UK, but it set policy to create early markets. This enabled real world deployment and generated private R&D investment. As a result, Denmark now has leading global wind energy companies and a thriving export business. Despite its overall success in the offshore wind sector, the UK missed the opportunity to develop a stronger position in offshore wind manufacturing and is only now catching up.[19]

Innovation policy focused on structural transformation leads to higher national output[20]

GDP multiplier per £1 of public spending (£)



It cuts timescales for technology diffusion

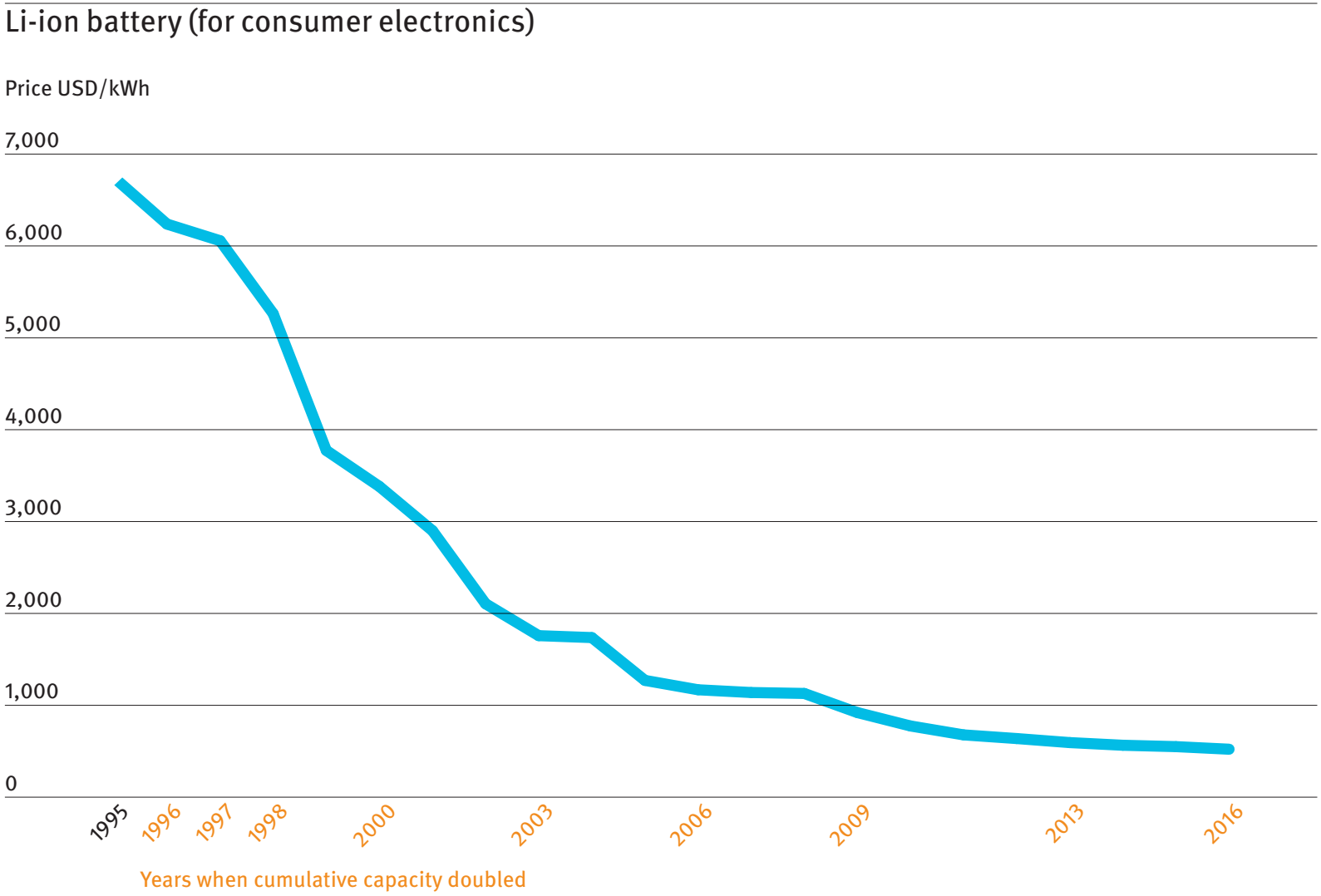
Timescales can be long to develop and diffuse radical new technologies widely, in some cases it can take many decades, but effective policy can speed up the process.[21] For example, LED lighting has rapidly moved from prototype to large scale adoption, thanks to the government setting more ambitious standards and regulations for lighting efficiency.[22]

It makes the low carbon transition cheaper

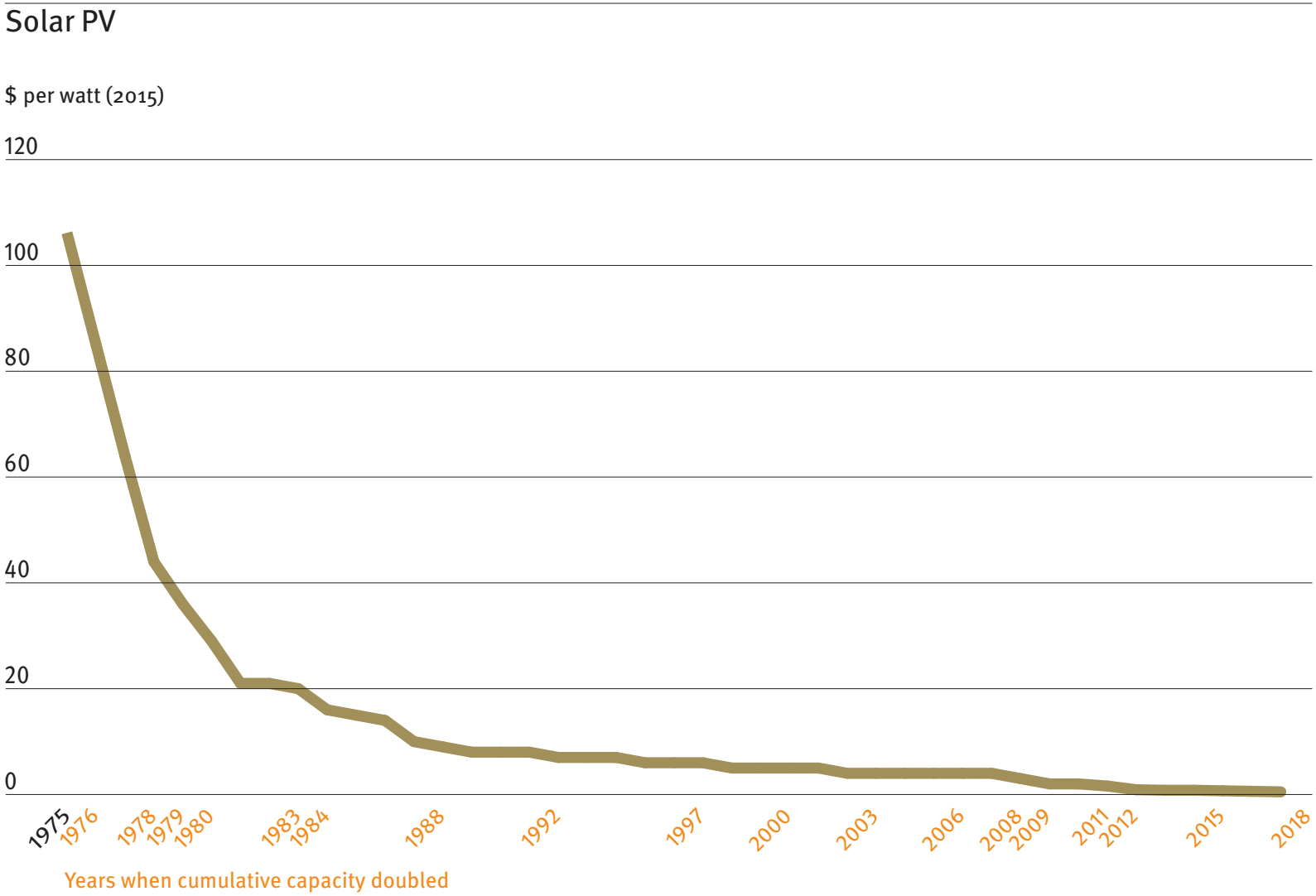
Promoting early deployment helps to position the UK as a market leader and bring down costs, thanks to learning by doing and economies of scale. For example, each time the cumulative amount of solar capacity has doubled worldwide over the past 50 years, unit costs have fallen by around 24 per cent, and up to 30 per cent more recently. Li-ion batteries have followed a similar pattern. A drop in the cost of novel technologies also means more businesses and communities can benefit from them sooner.[23]

And the benefit is not only about individual technologies. A coherent and ambitious policy framework for low carbon innovation will make the overall transition to net zero cheaper.[24] Already, over the past ten years, significant cost reductions have been achieved in the power sector. The Climate Change Committee now estimates that net zero emissions by 2050 could be reached with less investment than that originally estimated for the previous lower ambition of 80 per cent emissions reduction.[25]

Scaling up deployment has brought battery costs down since the 1990s[26]



Solar PV costs have plummeted over the past 40 years[27]



The UK is not taking advantage of green innovation

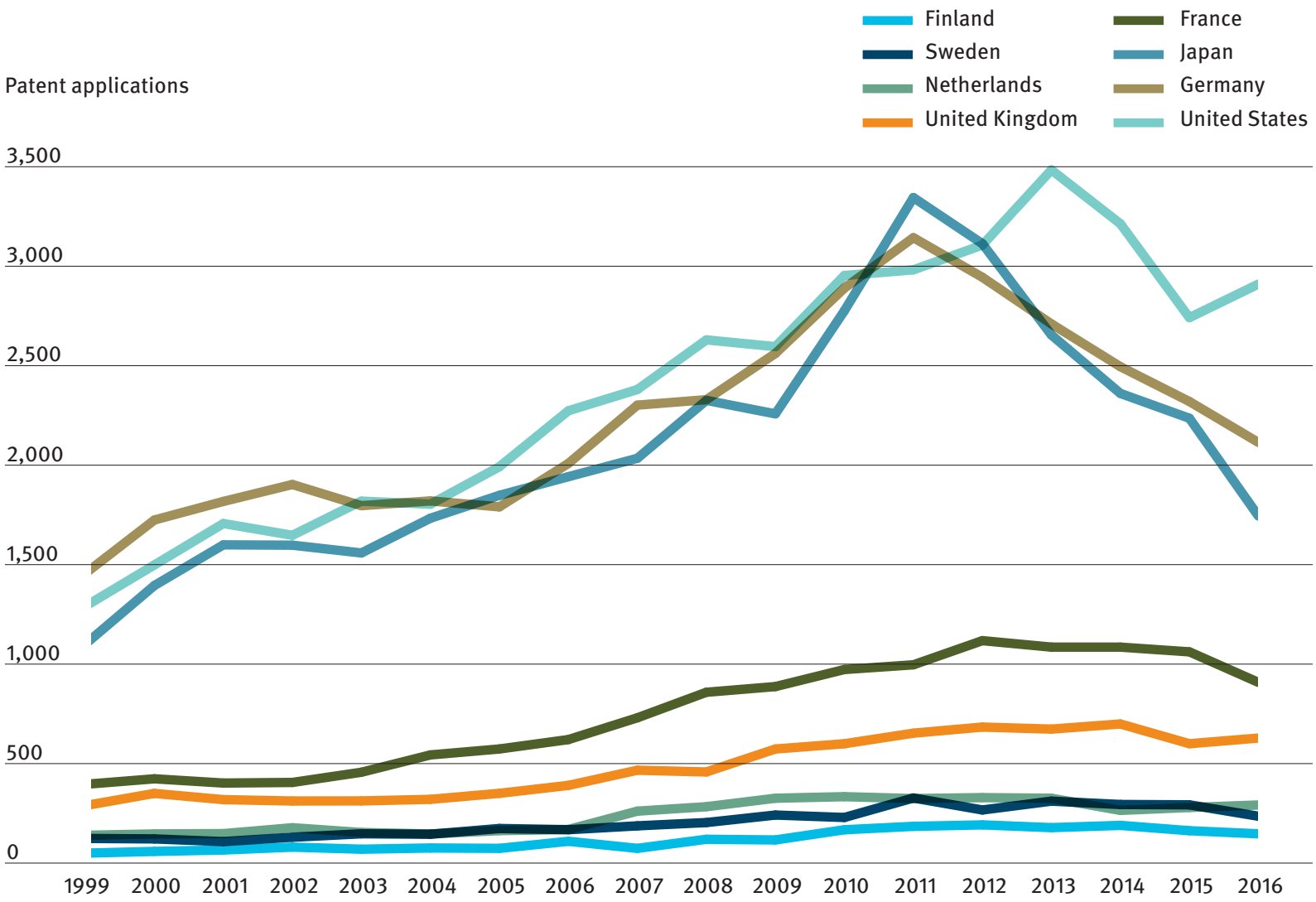
UK innovation strengths aren't being applied to the net zero challenges

"The UK lags behind in important innovations to achieve net zero".

The UK is already among the world's innovation super powers. The Global Innovation Index, which compares 130 economies based on 80 indicators, ranked the UK fourth in the most recent assessment.[28] But the UK is failing to use this strength to address environmental challenges.

For example, while the absolute number of environment-related patent applications submitted by the UK to the European Patent Office has gradually risen since the early 2000s, it is below that of other leading global economies. Furthermore, although the UK has driven up the deployment of low carbon electricity technologies, leading to rapid decarbonisation of the power sector, it lags behind in important innovations that would help to achieve net zero, such as electric vehicles, heat pumps and the energy efficiency of buildings.

The UK is behind other nations in registering green patents[29]



Policy gaps hold back business investment

The GIPC brings together business representatives from a range of sectors. They conclude that a number of sector specific barriers and policy gaps are holding back UK green innovation. Policy is not promoting collaborations across sectors and along value chains, despite the many opportunities for innovation that can emerge at their interface.

Examples of sectoral policy gaps

Food

Limited demand

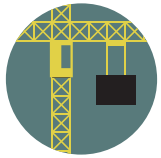
Poor visibility of the environmental impacts of different foods and land use practices, and the fact that fiscal incentives do not factor them in, is hindering uptake of more sustainable foods by both supply chain businesses and consumers.

Transport

Poor policy signals for clean tech investment

While there are net zero technologies for some types of vehicle, it is unclear what the alternatives will be to decarbonise heavy goods transport. Despite this, there is limited policy to direct innovation in alternatives for this sector, or to encourage business adoption.

Construction



Unambitious regulation

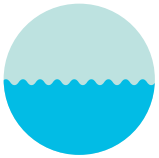
Regulation is not driving best practice in building energy use, since it relies on a rating system based on modelled rather than actual performance. It is also failing to reduce whole life carbon, as developers are not required to address the embodied emissions in construction.

Resources and waste

Failure to join up along value chains

Policy has so far focused on end of life solutions for waste management, rather than promoting collaboration between designers, producers and the waste sector to influence better product design and durability, and reduce resource use generally.

Water



Inadequate infrastructure

Sustainable drainage systems should be prioritised in urban environments to minimise flood risk, but there are few measures to ensure they are considered at the earliest stage of new developments. Similarly, hard infrastructure has been prioritised over ‘green infrastructure’, like ecosystem restoration and river catchment management measures.

Government policy priorities for green innovation

Innovation should be at the heart of plans for a green industrial revolution

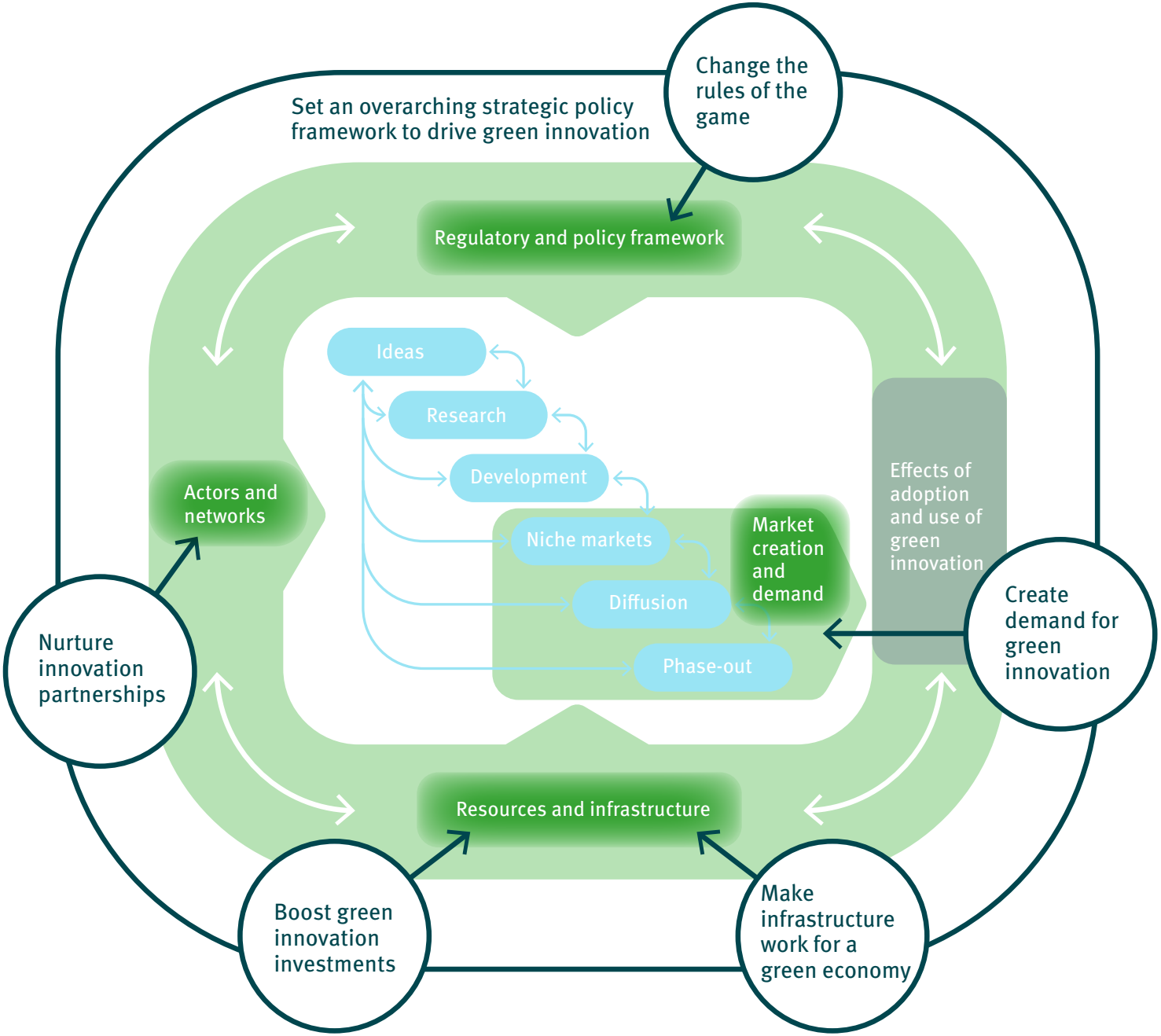
"The government has set out a high level ambition, but a targeted portfolio of policies is now required to make this a reality."

The government has said it will lead a green industrial revolution, with commitments to boost green industries, including offshore wind, building energy efficiency, energy storage and flexibility, and electric vehicles.

Green innovation and investment should be at the heart of this aim, so UK businesses are well placed to take up the challenge, get ahead in the market and increase their competitiveness and resilience. The government has already said it will scale up R&D investment until 2027 and it has set out a high level ambition, in its ten point plan for a green industrial revolution, but a targeted portfolio of policies is now required to make this a reality.

The GIPC has identified six interconnected ways in which the government should accelerate green innovation, addressing all parts of the innovation process.

Six ways to speed up green innovation



The GIPC's recommendations to government

1. Set an overarching strategic framework

Policy to promote green innovation cannot be driven by a single department. Instead, it requires new governance and institutional arrangements across Whitehall. The GIPC proposes a new Green Innovation and Sustainability Transformation Council, chaired by the prime minister, to ensure cross departmental co-ordination and promote a whole government approach. This council could bring together ministers and high level representatives from business, academia and civil society, and develop a green innovation policy roadmap to co-ordinate and build links between key government initiatives. There is also a need for greater engagement by different levels of government, including local government and devolved administrations.

2. Create demand

The government could use a number of measures to increase the market pull for existing and new green solutions. These should include fiscal instruments, like tax incentives, as well as new ways to promote more sustainable consumption, such as dynamic labelling schemes. For example, while regulation in the food sector will be essential to ensure production and land use practices meet environmental standards, labels could be used to provide additional guidance on how products compare environmentally and highlight best practice. The government and businesses could involve the public in co-designing labels to strengthen consumer buy-in. Furthermore, as government procurement accounts for around 14 per cent of the country's GDP, this could be used to raise demand for environmentally beneficial solutions, complemented by pre-commercial procurement to bring innovative green goods and services to market in the first place.

"Regulation is a critical driver of innovation diffusion, acting as a catalyst for experimentation and demonstration."

3. Boost green innovation investments

Public investment in innovation should prioritise green solutions and be rebalanced from R&D to experimentation and commercialisation, to realise the real world advantages of deployment. Public innovation finance plays an important role in promoting new solutions. Countries like Germany and Brazil have been providing such finance through their investment banks: the KfW and the BNDES.[30] Until recently, the UK was unusual amongst developed economies in lacking significant sources of this kind of finance, but the newly formed National Infrastructure Bank (NIB) offers new opportunities. It should provide long term, patient investment that contributes to the UK's environmental goals. The government should also establish a National Green Innovation Fund within the NIB as a source of comprehensive and systemic support for green innovation, beyond infrastructure. Access to finance at every stage of the innovation process is needed, including close to market experimentation and deployment.

4. Change the rules of the game

Business members of the GIPC have made it clear that regulation is a critical driver of innovation diffusion, acting as a catalyst for experimentation and demonstration. The government should align regulations with its environmental targets and goals, building in the ability for continual upward adjustment to increase ambition and stimulate innovation. It should make use of performance based standards, linked to stringent environmental targets, to improve outcomes while avoiding the need to specify an existing technology needed to deliver them. Making the most of the UK's strong track record in pioneering regulatory sandboxes, the government should consider establishing 'green innovation sandboxes', to co-design regulation with regulators, businesses, academia and civil society.[31]

“Capabilities and skills needed for green transformation in important sectors should be reviewed.”

5. Nurture innovation partnerships

Many environmental solutions will require new sectoral and cross sectoral collaborations. Along value chains, these could promote more resource efficiency and across the transport, buildings and energy sectors they can support electrification and the uptake of integrated smart systems. The government should promote these partnerships, including by investing in, and fostering, a network of regional demonstration zones across the country, where solutions are co-created and trialled by local partners and the government working together. The capabilities and skills needed for green transformation in important sectors should be reviewed to support this.

6. Make infrastructure work for a green economy

Infrastructure is the foundation of our economy and society. Decisions taken now will have impacts on how we live for decades to come. Therefore, all infrastructure development, including that delivered by the private sector, should be consistent with environmental objectives. The government should fast forward its strategic investments that crowd-in private investment in clean technologies. For instance, it could speed up the transition to electric vehicles by supporting investment in charging infrastructure where costly grid upgrades might limit deployment. There is also significant scope for innovation in the design, construction and operation of infrastructure to reduce its environmental impacts. A systemic approach to assessing, designing and financing nature-based ‘green infrastructure’ would ensure it is deployed wherever needed. Digital infrastructure which improves environmental outcomes, for instance by increasing resource efficiency and enabling smarter energy use, should also be prioritised.

Endnotes

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2 A regulatory sandbox is a virtual or physical space where selected firms work with regulators to jointly explore, trial and test innovative products, services and business models without having to meet all the usual requirements for compliance. Sandboxes also offer a space to trial new standards in active collaboration with business, consumers and government.

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27 Ibid

28 Cornell University, INSEAD, and the World Intellectual Property Organization, 2020, *The global innovation index 2020: who will finance innovation?*

29 UCL analysis based on data from OECD STAT

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31 See endnote 2 for the explanation of a regulatory sandbox. The Financial Conduct Authority (FCA) ran the world's first regulatory sandbox in 2016. In recent years, other UK regulators have followed suit and introduced similar programmes, including Ofgem and the Civil Aviation Authority.

How to fast track innovation for a green industrial revolution

Author
Caterina Brandmayr

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The UCL Green Innovation Policy Commission
The Green Innovation Policy Commission has brought together progressive businesses, leading academics and others experts for a two year investigation into how policy can best support green innovation across the UK economy and reward the innovators, entrepreneurs and investors who generate value from the solutions to the global environmental challenges.

Green Alliance
Green Alliance is a charity and independent think tank, focused on ambitious leadership for the environment. With a track record of over 35 years, Green Alliance has worked with the most influential leaders from the NGO, business, and political communities. Our work generates new thinking and dialogue, and has increased political action and support for environmental solutions in the UK.

Green Alliance
11 Belgrave Road, London, SW1V 1RB
020 7233 7433
ga@green-alliance.org.uk
www.green-alliance.org.uk
blog: greenallianceblog.org.uk
twitter: @GreenAllianceUK

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