PwC Net Zero Future50

Showcasing 50 UK climate tech start-ups that are driving the decarbonisation of key sectors

Foreword

While 2024 was marked by bold ambition in the UK, with the new Government stepping up its climate commitments, global developments are testing our collective ability to decarbonise at pace. Against this backdrop, the role of innovation has never been more important.

Climate action is gaining momentum in the UK. The Government's climate policies, investments, and incentives aim to accelerate the transition and strengthen climate resilience, while a new phase of ESG is pushing businesses beyond compliance and towards data-driven targets, AI-powered insights, and greater integration of sustainability into core business strategies.

But despite these encouraging trends, the urgency of the climate crisis has only intensified. Global temperatures surpassed the Paris Agreement's 1.5°C threshold for the first time in 2024,[1] while three of the UK's four warmest years have occurred since 2022.[2] At the same time, policy changes in the US may slow the transition to clean energy.

To limit further warming, the United Nations has called for a staggering 42% reduction of annual greenhouse gases by 2030.[3] Inger Anderson, Executive Director of the United Nations Environment Programme, warns that achieving this will require "global mobilisation on a scale and pace never seen before, starting right now." Governments, companies, investors and consumers all have a role to play. And at the centre of this transformation lies innovation and emerging technologies that can reshape industries.

We have been tracking the UK's climate tech ecosystem for years. In 2022, we screened thousands of UK-headquartered climate tech start-ups to curate the PwC Net Zero Future50 – a selection of fifty nascent companies, each offering innovative solutions for our journey to net zero. Although commercialising and scaling new technologies is challenging, some have succeeded against the odds, securing funding and bringing their products to market. For an update on a selection of our 2022 Future50, go to the 'where they are now' section at the end of this report.

We have now repeated this exercise using our AI-powered net zero accelerator to enhance the breadth and depth of our search for innovative start-ups. The new cohort showcases the UK's climate tech ecosystem and features a remarkably diverse range of solutions – from lithium-free batteries and oil-free plastics to motor optimisation and grid efficiency. Some solutions are just emerging from the lab and taking their initial steps into the real world, while others are experiencing rapid roll-out to paying customers.

While technology alone isn't enough, it remains one of the most critical building blocks. The innovations spotlighted in this report reveal the immense potential of the UK's climate tech sector, and the shared vision of a more sustainable and resilient future.

1. World Meteorological Organization, "WMO Confirms 2024 Warmest Year on Record, About 1.55°C Above Pre-Industrial Level."
2. Met Office, "2024 Provisionally the Fourth Warmest Year on Record for the UK."
3. UNEP 2024 Emissions Report

Net Zero Future50

Our Net Zero Future50 showcases some of the UK's most innovative climate tech start-ups, each accelerating progress towards a more sustainable and resilient future.

This selection of companies illustrate the opportunity to decarbonise across all sectors, but is neither exclusive nor exhaustive. The company information has been derived from publicly available sources and discussions with management. PwC has not independently verified any of the company information. This publication has been prepared for general guidance on matters of interest only, and does not constitute professional or investment advice. You should not act upon the information contained in this publication without obtaining specific professional advice. No representation or warranty (express or implied) is given as to the accuracy or completeness of the information contained in this publication, and, to the extent permitted by law, PricewaterhouseCoopers LLP, its members, employees and agents do not accept or assume any liability, responsibility or duty of care for any consequences of you or anyone else acting, or refraining to act, in reliance on the information contained in this publication or for any decision based on it.

Select a logo below to explore each company's innovative solution.

ULEMCo
piclo
Recycleye
BIOHM
UrbanChain
SEABOUND
neutreeno
ADDIONICS
QIO
azotic
hyran
Biozeroc
Qflow
Xampla
EARTHSENSE
HVS
Superdielectrics
OUTFIELD
kelpi
Grid Edge
zero
straw INNOVATIONS
EARTH BLOX
ilika
ev.energy
RARE EARTH
altilium clean technology
switchee
QPT
BLACK BULL BIOCHAR
concrete 4change
Sustineri Fuels
Naked Energy.
FUTURE GREENS
Tetronics
SERATECH
FIREFLY
Seafields
LiNa Energy
HutanBio
ICEOTOPE
SUSTAINABLE PLANET
EVA BIOSYSTEMS
etopia
MissionZero
monumo reinventing electric motors
tepeo
Circulor
CCU INTERNATIONAL

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01 Market context

The tech gap to net zero

PwC's 2024 Net Zero Economy Index reveals that the world must decarbonise at a rate twenty times faster to limit global warming to 1.5°C above pre-industrial levels. Even achieving the 2°C, at the lower end of the Paris Agreement's target, demands a sevenfold increase in the current decarbonisation rate.

Such a rapid shift will require significant advancements in climate tech. In the UK, 56% of decarbonisation will need to be delivered by technologies or solutions that are not yet commercially mature.[3] This presents a once-in-a-generation investment opportunity, which is already unfolding. A decade ago, climate tech accounted for just 1% of global venture capital (VC) and private equity (PE) investment, but has since risen to 8-10%, reflecting its critical role in the transition to net zero.[4]

56%

of the UK's decarbonisation needs to be delivered by technologies or solutions that are not yet commercially mature.

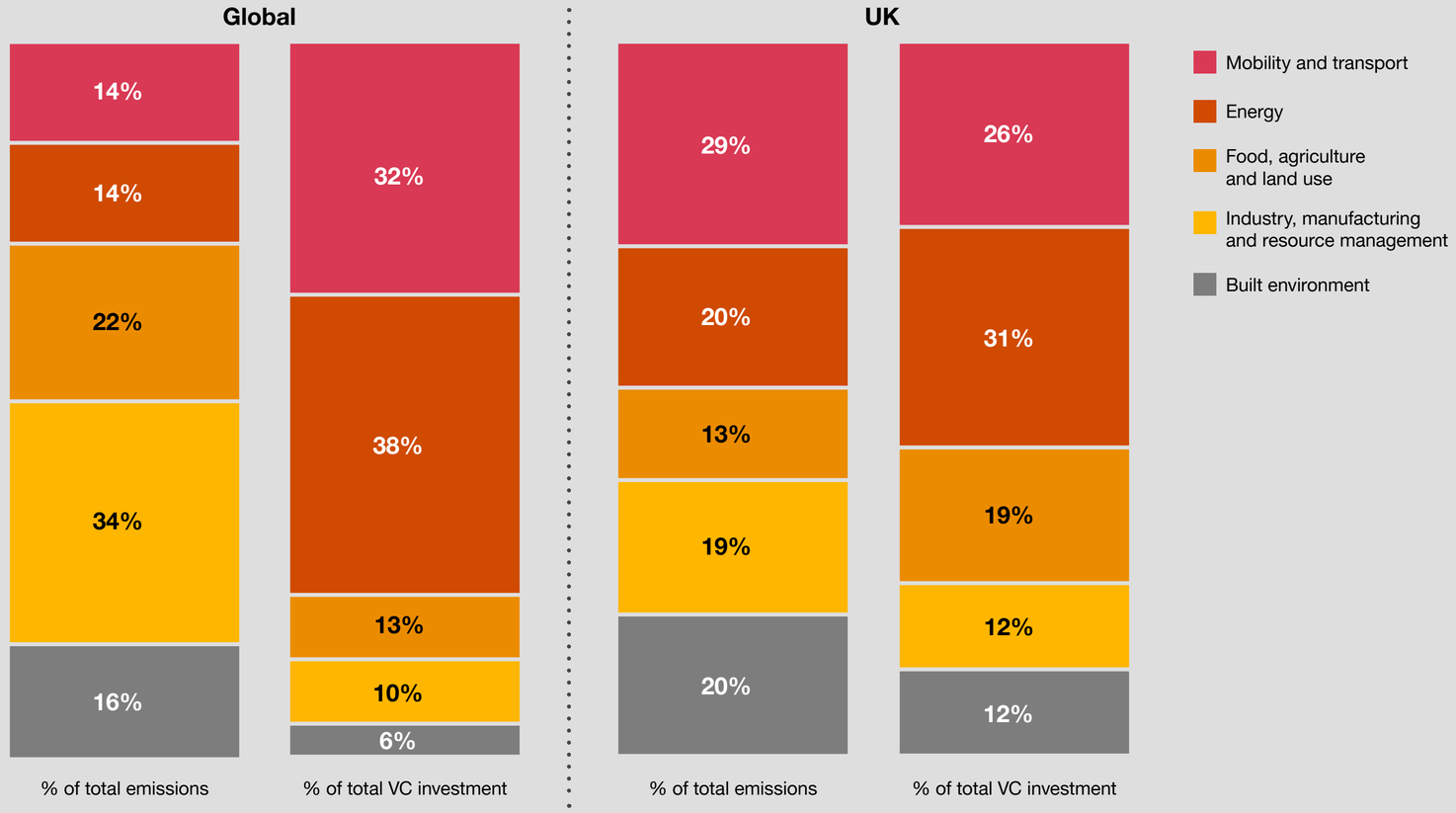
3. PwC, "De-risking the Energy Transition in Europe."
4. PwC, "State of Climate Tech 2024: Seeking an edge as deal-making slows".

The mismatch between emissions and investment

Early-stage investments are heavily weighted towards sectors that are easier to decarbonise, resulting in a significant funding gap in other areas. The vast majority (70-80%) of global climate-related venture funding currently goes into the energy and mobility sectors, where the transition is well underway.[5] In contrast, sectors like buildings, food, agriculture and heavy industry, which have disproportionately high emissions compared to their level of funding, receive far less attention.

It's now vital to expand the focus beyond energy and mobility, and identify solutions across a much broader range of sectors that require greater government support and investor attention.

Global and UK emissions versus investment by sector



* UK GHG emissions 2023

**Removed mobility mega deal valued at £0.8bn

Note: Emissions are 2023 and VC investment is 12 months to Sept-24. All other numbers, aside from UK emissions, are taken from PwC State of Climate Tech report. Figures have been rounded and may not total 100%.

5. PwC, "State of Climate Tech 2024: Seeking an edge as deal-making slows."

Catalysing net zero through investment

Driving investment is essential for achieving net zero, particularly given the steep risk and cost of capital curve associated with net zero solutions. Successfully moving technologies up this curve unlocks larger pools of capital at lower costs, delivering strong returns for early backers and attracting investors with deeper pockets to scale the technology.

Most early-stage climate tech investors are angel investors or venture capitalists with a high-risk high-return appetite, but private equity and infrastructure investors are increasingly entering the space.

Large corporates are also playing a crucial role in scaling climate tech solutions by adopting technologies, forming partnerships, and financing or acquiring start-ups. Around 25-30% of recent climate tech deals have involved large corporates,[6] and 72% of business leaders say they are likely to use transactions to cut emissions and achieve net zero goals.[7]

Despite these encouraging trends, securing investment remains a challenge. While many founders are given a strong start through government funding, the start-up and scale-up funding ecosystem is weaker in the UK than other countries, such as the US. We are frequently approached by early-stage companies who tell us that US investors have the scale and risk appetite needed to back companies in this space. The complexity of the decarbonisation agenda and the fragmentation of the climate tech market in the UK also makes it difficult for start-ups to find the right investors and strategic partners.

72%

of business leaders say they are likely to use transactions to cut emissions and achieve net zero goals.

6. PwC, "State of Climate Tech 2024: Seeking an edge as deal-making slows."
7. PwC, "Fast-Tracking Green Growth."

Disclaimer – The company information presented in the results section has been derived from publicly available sources and discussions with management. Any metrics presented, including Technology Readiness Level (TRL), emissions reductions or cost savings, have been provided by the company but not independently verified by PwC.

02 Methodology

1. Search

We used our AI-powered net zero accelerator to scan the UK market by sector. This process helped us identify a long list of thousands of innovative solutions and companies that are driving decarbonisation.

2. Screen

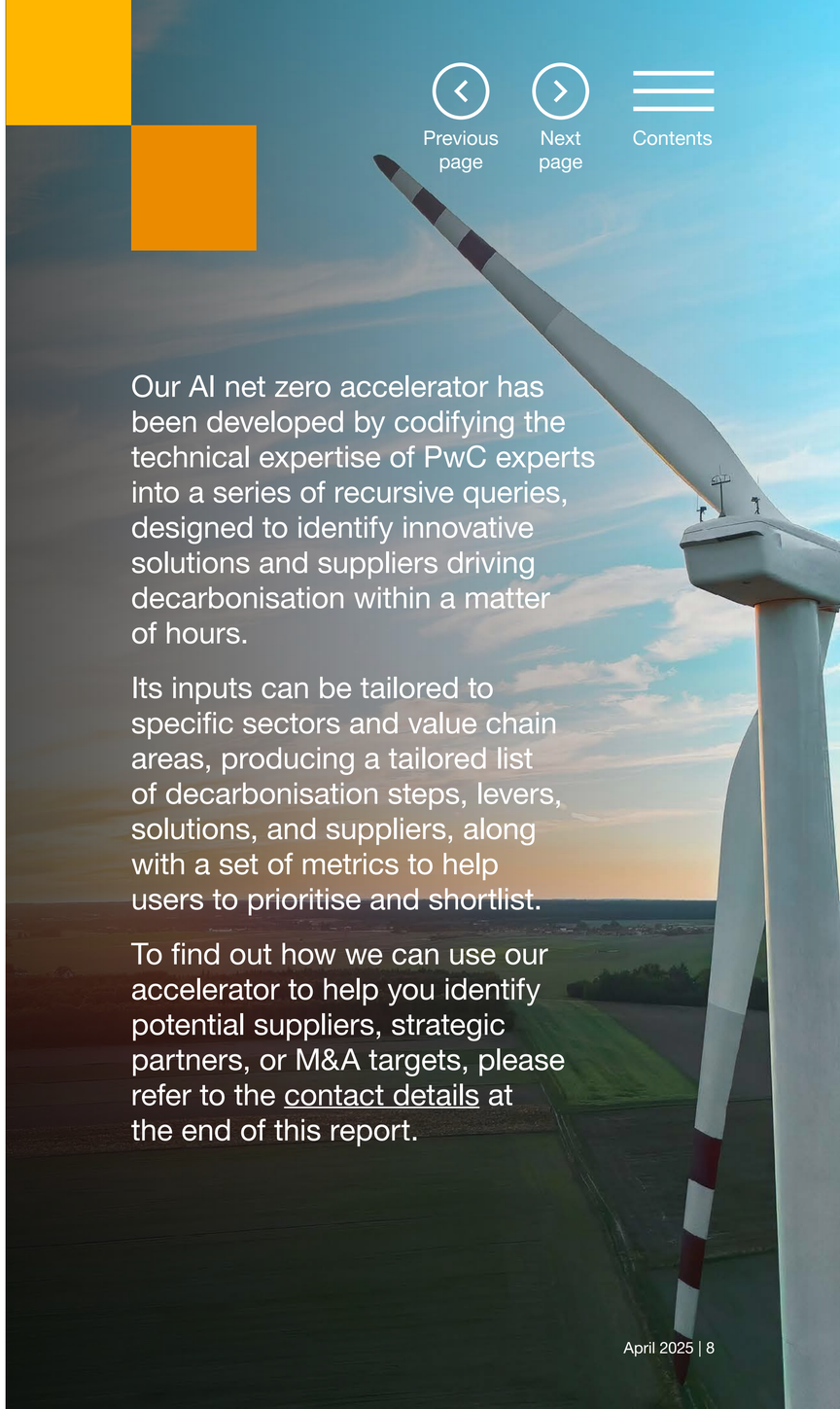
We used CO_2 emissions reduction potential and technology readiness level (TRL) metrics provided by our AI net zero accelerator, along with insights from PwC subject matter experts across each sector, to assess the long list of solutions and create a shortlist.

We then evaluated the companies using maturity and scalability metrics and further oversight from PwC UK specialists. This narrowed the shortlist down to approximately 150 companies.

3. Select

We conducted surveys and interviews with the shortlisted companies and selected 50 innovators for inclusion in our Net Zero Future50, seeking a broad range of solutions across sectors, regions, themes, maturity and founder background. Our list is neither exhaustive nor exclusive but intended to showcase the breadth and variety of innovation taking place.

We would like to thank all the companies we interviewed. This report could have been filled three times over with innovative technologies and solutions, and the exclusion of any company on this list does not reflect our view on its potential.



Our AI net zero accelerator has been developed by codifying the technical expertise of PwC experts into a series of recursive queries, designed to identify innovative solutions and suppliers driving decarbonisation within a matter of hours.

Its inputs can be tailored to specific sectors and value chain areas, producing a tailored list of decarbonisation steps, levers, solutions, and suppliers, along with a set of metrics to help users to prioritise and shortlist.

To find out how we can use our accelerator to help you identify potential suppliers, strategic partners, or M&A targets, please refer to the contact details at the end of this report.

03

Results: Net Zero Future50

Our Net Zero Future50 reflects the diversity of the UK climate tech ecosystem. In selecting these companies, we considered factors such as underinvested areas, geographical spread, technological maturity, and founder backgrounds to ensure broad and impactful representation.

Emissions and investments

We have featured more start-ups in under-invested sectors relative to their emissions contribution. With the mobility and transport and energy sectors accounting for almost half of UK greenhouse gas (GHG) emissions, a large proportion of UK VC in climate tech investment has focused on these areas. While further investment is needed to fully decarbonise them, the carbon funding gap is smaller than in other carbon-intensive sectors such as industry and built environment.

We also recognise the need for significant investment in GHG capture, removal and storage and climate change management and reporting, and included start-ups driving innovation in these areas.

Sector	UK GHG emissions*		UK VC Investment**		Number of start-ups in our Future50
	Mt CO_2e	% of total emissions	Funding raised (£m)	% of total	
Mobility and transport	112	29%	203***	22%	9
Energy	75	20%	245	27%	7
Food, agriculture and land use	49	13%	145	16%	6
Industry, manufacturing and resource management	71	19%	96	11%	9
Built environment	78	20%	93	10%	9
GHG capture, removal and storage	n.a.	n.a	57	6%	5
Climate change management and reporting	n.a.	n.a	69	8%	3

* UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

***Removed mobility mega deal valued at £0.8bn

Geographical distribution

All our climate tech start-ups are headquartered in the UK, although many have operations overseas.

Promising climate tech start-ups are springing up across the country but, as expected, there is a notable concentration in London. The Cambridge area also boasts a significant number of start-ups due to spin-offs and incubation by Cambridge University, while other universities are similarly collaborating with founders to advance research.

Climate tech is key to the government's industrialisation strategy, particularly in the regions. To support this, regional innovation hubs and clusters have been established. They are focused on developing and commercialising new technologies, promoting green job creation, and ensuring the transition to a green economy that benefits all parts of the UK.

London

- Seafields Solutions
- Rare Earth Global
- Sustainable planet
- Switchee
- QFlow (Qualis Flow)
- Biohm
- Etopia
- Seratech
- Black Bull Biochar
- Mission Zero Technologies
- ev.energy
- Piclo
- Zero Petroleum
- Addionics
- Seabound
- Recycleye
- Circulor
- Naked Energy

Edinburgh

- CCU International
- E.V.A. Biosystems
- Earth Blox

Cambridge

- Outfield Technologies
- Lambda Agri
- Biozeroc
- Hyran Technologies
- Monumo
- Xampla
- QPT (Quantum Power Transformation)
- HutanBio
- Neutreeno

Sheffield

- Future Greens
- Iceotope

York

- Azotic Technologies

Bristol

- Firefly Green Fuels
- Kelpi (Kelp Industries LTD)

Nottingham

- Concrete4Change

Hertfordshire

- Straw Innovations

Essex

- Superdielectrics Group

Egham

- QiO Technologies

Lancashire

- LiNa Energy

Manchester

- UrbanChain

Plymouth

- Altilium Clean Technology

Swindon

- Tetronics Technologies

Birmingham

- Grid Edge

Berkshire

- tepeo

Glasgow

- HVS (Hydrogen Vehicle Systems)

Clitheroe

- Sustineri

Hampshire

- Ilika

Liverpool

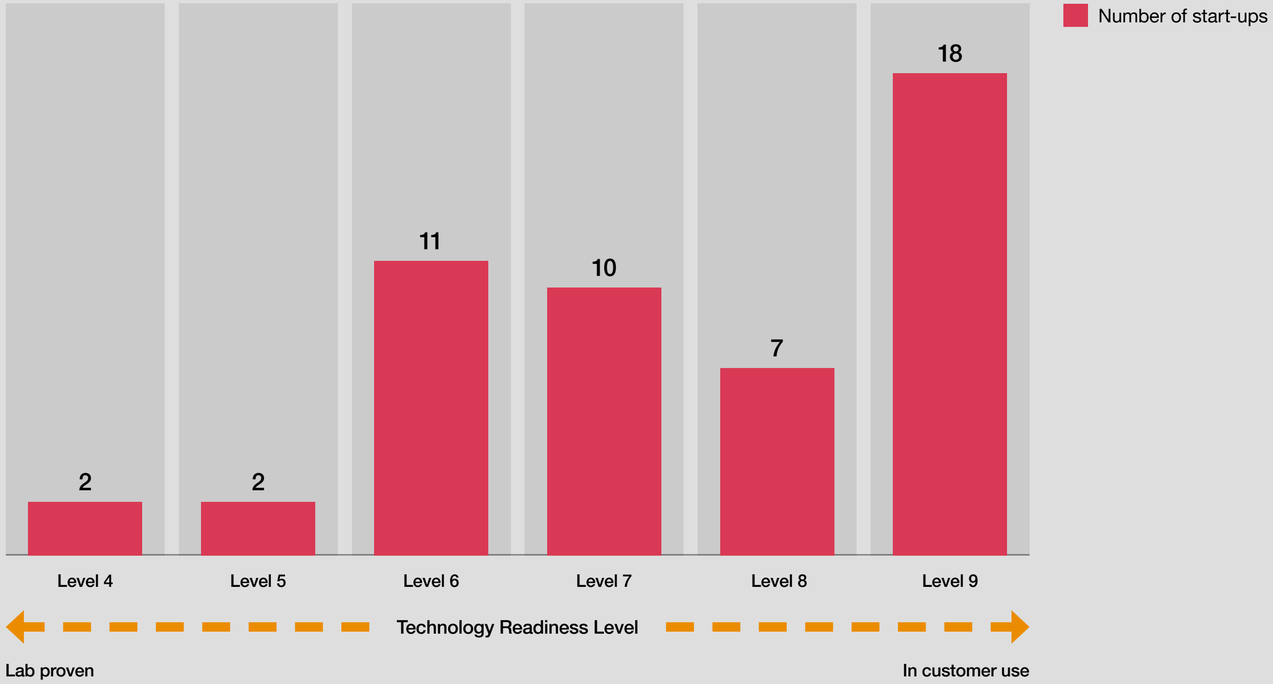
- Ulemco

Leicester

- EarthSense

Technical maturity

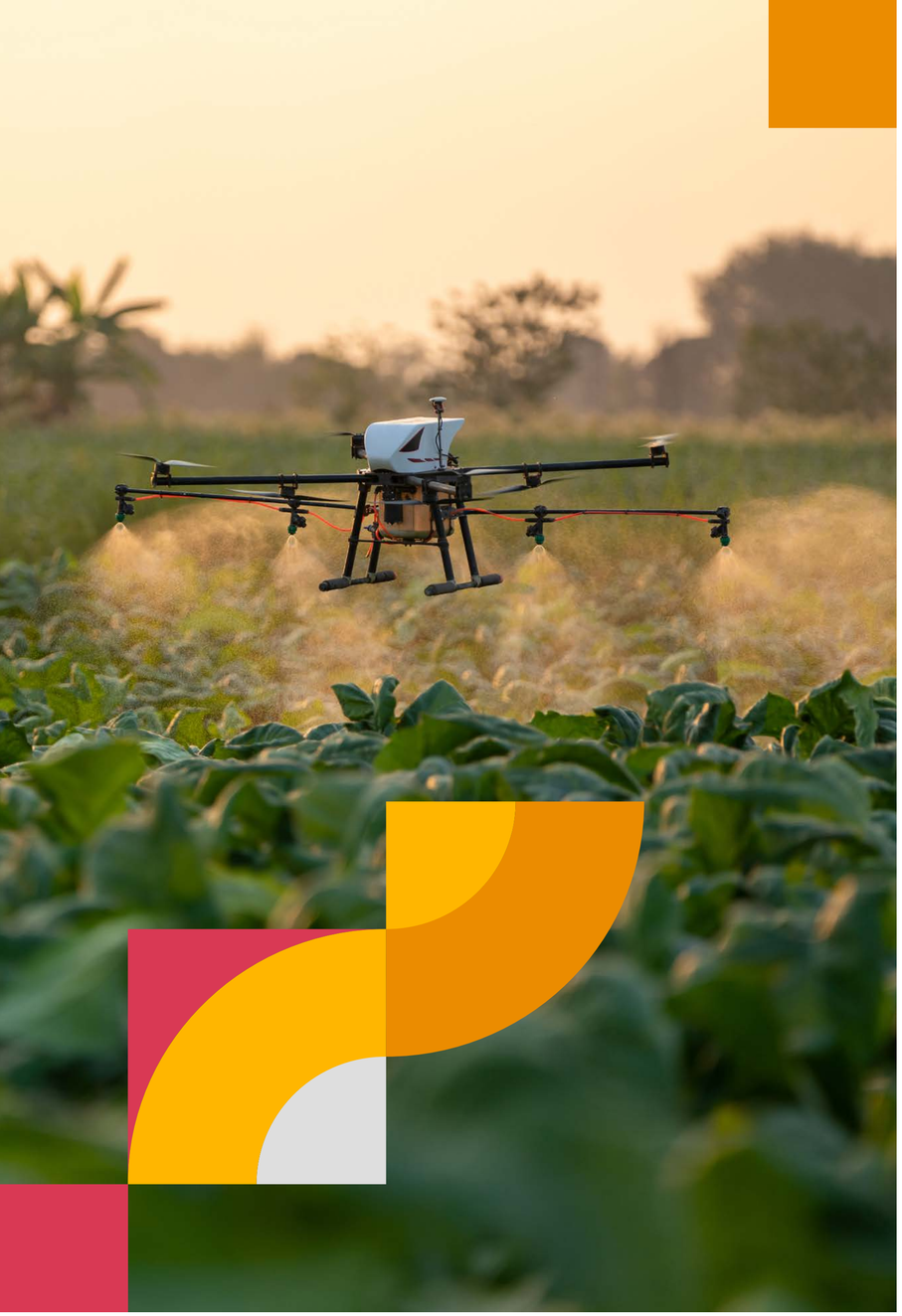
We have selected technologies at various stages of maturity, guided by their technology readiness level. Some are lab-proven, others have been successfully demonstrated in real-world settings, and a few are scaling commercially with paying customers.



Our research indicated that the mobility and energy sectors have a higher proportion of more mature start-ups compared to other sectors, which aligns with the significant investment these sectors have already received. The technical maturity of our 50 innovators, categorised by sector, also reflects this.

Founder diversity

Behind these innovations are the Future50 founders, who come from a diverse range of backgrounds – from young academics to seasoned entrepreneurs. The cohort reflects the richness and depth of the UK climate tech talent pool, and this diversity is essential for fostering innovation and breakthrough solutions.



Decarbonisation themes

In every sector, reaching net zero requires challenging the way we do things. We have tagged each of our start-ups to decarbonisation themes that cut across sectors and reflect how the technology reduces carbon emissions.

Demand reduction through efficiency: These solutions increase efficiency, thereby cutting the overall need for energy and the emissions that come with it. Examples include energy-saving technologies for buildings, fuel efficiency improvements in vehicles, and the use of waste heat boilers for industrials.

Cost out, carbon out: These innovations reduce operating costs while simultaneously cutting carbon emissions. Examples include optimising electric vehicle (EV) charging to match times when electricity is greener and cheaper, or using less fertiliser in agriculture.

Waste reduction and circularity: Waste materials, from non-degradable plastics to agricultural run-off, present an opportunity for a more sustainable solution. These innovations use waste as a feedstock, reduce problematic waste, or produce long-life, recyclable or easily biodegradable materials. Biodegradable packaging, battery recycling, and converting waste into fuel all fall into this category.

Digitalisation: More accurate and insightful data enables better decision-making. These solutions harness the power of AI, machine learning and Internet of Things (IoT) technologies to gather and use data and analytics to power decarbonisation, whether through supply chain analysis, building monitoring, or predictive modelling.

Nature-based solutions: Working with nature, not against it, is essential. These solutions harness natural processes in the pursuit of net zero by replacing or augmenting traditional solutions to become more nature-positive, often generating carbon credits in the process. Examples include seaweed feedstocks and agritech innovations.

Resource transition: Decarbonisation goes beyond the energy transition and the shift from fossil fuels to renewables. Achieving net zero also depends on the development and use of cleaner raw materials across industry, manufacturing, and the built environment. Examples include bio-based plastics, non-lithium batteries, and alternatives to cement.

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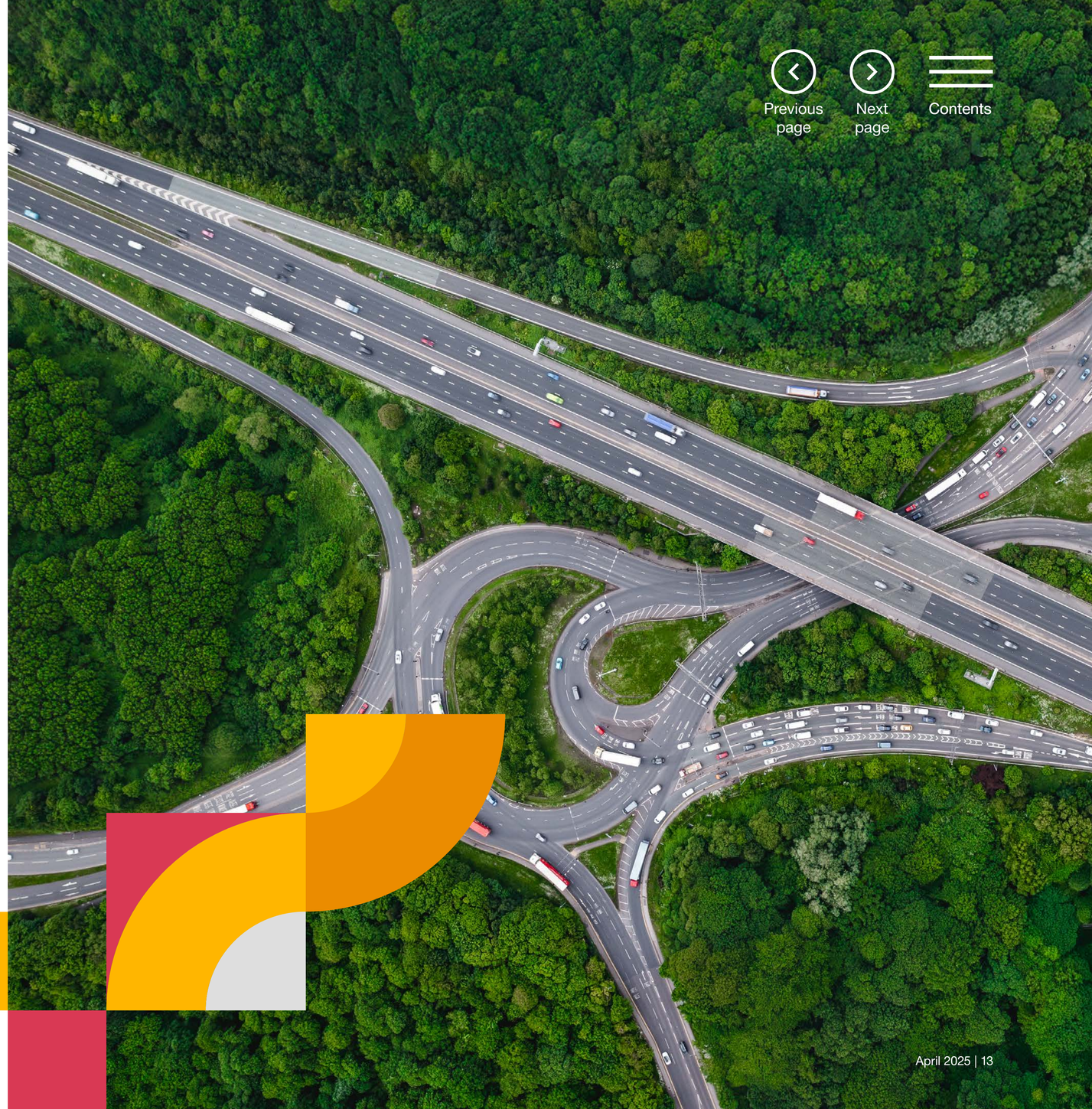
Mobility and transport

Future50 companies

ULEMCo
Addionics
HVS
Ilika
Sustineri Fuels
HutanBio
Firefly Green Fuels
Zero Petroleum
Seabound



3.1 Mobility and transport

% of UK GHG emissions*

29%

UK climate-related VC investment**

£203m

No of start-ups in NZF50

9

Mobility and transport accounted for 29% of UK GHG emissions* and attracted 22% (£203 million***) of UK climate-related VC investment** in the 12 months leading up to September 2024. Despite heavy investment, greater funding is needed to address the sector's high emissions.

Although there have been some twists and turns on the road to mainstream adoption of EVs and their associated infrastructure – largely due to changing government targets – the path forward for passenger cars is clear. The focus is now on other forms of transport such as heavy goods vehicles (HGVs), rail, shipping, and aviation, which are harder to abate.

Accelerators

EV maturation: The growing adoption of EVs has led to more funding and infrastructure investment. This maturation is driving market competition, involving both traditional automakers and new entrants, with significant R&D expenditures as companies strive to become market leaders.

Economic incentives: The rising cost and volatility of fossil fuels can make sustainable transport options more economically attractive, especially when coupled with tax breaks, rebates and grants.

Mobilisation of government funds: Governments play a crucial role in greening the transport sector by setting emissions standards and educating the public. Significant government funding has also been directed to this sector in the form of subsidies for sustainable transport and investments in transportation infrastructure.

Barriers

Supply chain challenges: The increasing demand for precious metals for vehicle componentry, particularly for EVs, has created bottlenecks in the supply chain. Further electrification could result in ore depletion, and there are concerns about the pollution and environmental damage caused by extracting these materials, as well as the social concerns around child labour and poor working conditions for miners.

Safety regulations impacting innovation: While safety regulations are important in this sector, they can slow down the implementation of new technologies due to the time-consuming and costly testing and approval process. The regulations themselves are not always appropriate for new technologies and regulatory bodies can take time to adapt. Greater collaboration between regulatory bodies and technology developers is required.

Infrastructure inertia: Building new infrastructure, such as electric charging and hydrogen facilities, requires significant investment. For these assets to be attractive to the private sector, investors need to have confidence in the long-term outlook. Many factors can dent this confidence, such as changes in government policy or consumer sentiment.

*UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

***Removed mobility mega deal valued at £0.8bn

Growth areas

Battery technology: There are ongoing efforts to enhance the range and performance of batteries, particularly for heavier vehicles, while also focusing on using more sustainable and less hazardous materials, improving lifespans, and advancing recycling processes. With increasing demand for EVs and other transport electrification, this provides a range of opportunities for both investors and start-ups.

Greening HGVs: Approximately 80% of freight transport distance is conducted by trucks in the UK, and 20% of all UK domestic transport CO_2 emissions is attributed to HGVs. The weight of HGVs creates performance challenges for electric batteries, resulting in range concerns for drivers.[8] However, other methods are being explored such as hydrogen fuel cell vehicles (HFCVs), bio-fuel engines, and more. In 2023, the UK Government announced its £200m Zero Emission HGV and Infrastructure Demonstrator programme.[9] While this is a promising start, with the rollout of 370 zero emission vehicles[10] and the establishment of road freight infrastructure, substantial further investments will be required to fully transition the 550,000 or so HGVs across the UK.

Sustainable Aviation Fuels (SAF): The UK government has introduced a SAF mandate, which commenced in January 2025, requiring that 2% of total UK jet fuel demand be met by SAF in 2025, increasing to 10% by 2030 and 22% by 2040.[11] This intent signals opportunities for investors to develop and scale SAF technologies. SAF is typically a biofuel that can be made from organic feedstock or non-hydrocarbon feedstock such as hydrogen. While bio-based SAF will have an important role to play, there is a particular need for further investment in non-bio alternatives which are not constrained by the availability of feedstocks.

Shipping: The sheer magnitude of operations make shipping a large contributor of GHG emissions. In the UK, maritime accounts for 20% of the country's transport GHG emissions. The UK Chamber of Shipping has outlined a roadmap that includes a proposed £700 million investment to make the UK a hub for clean shipping.[12]

8. PwC, "State of Climate Tech 2024: Seeking an edge as deal-making slows."
9. PwC, "State of Climate Tech 2024: Seeking an edge as deal-making slows."
10. UK Government, "Government Invests £200 Million to Drive Innovation and Get More Zero-Emission Trucks on Our Roads."
11. UK Government, "Sustainable Aviation Fuel Initiatives."
12. UK Chamber of Shipping, "Shipping Sets Out £700m Net Zero Investment Priorities."

ULEMCo

ultra low emission mileage company limited

Company: ULEMCo
Founder: Amanda Lyne
HQ: Liverpool
Operating regions: UK
TRL: 9
Funding: Seed funding, government grants

Resource transition

ULEMCo retrofits existing diesel HGVs, other large vehicles and off-road machinery and equipment with hydrogen dual-fuel technology. This technology allows hydrogen to be mixed with diesel directly in a conventional combustion engine, supplied via onboard gas tanks, without altering the existing diesel engine.

With ULEMCo's system, vehicles can run with a mix of hydrogen and diesel or revert to switch back to diesel when necessary, significantly reducing CO_2 emissions while preserving full utility and productivity. This offers a cost-effective way to reduce emissions without a complete fleet or asset overhaul and can be adopted quickly.

Impact

- ULEMCo estimates that for every kilogram of hydrogen used, approximately three litres of diesel-equivalent CO_2 emissions are saved.
- Upgrading 30 vehicles in back-to-base fleets could save at least 250 tonnes of CO_2 emissions per year.
- The prototype facility has capacity to retrofit over 100 vehicles annually.

Highlights

- ULEMCo secured a contract with Aberdeen City Council for hydrogen conversion of 35 vehicles, including refuse collection vehicles and road sweepers.
- The technology has been successfully demonstrated in the construction sector.
- ULEMCo holds patents for leak detection systems and intellectual property related to controlling hydrogen injections into engines.

ADDIONICS

Company: Addionics

Founders: Moshiel Biton

HQ: London

Operating regions: UK, US, Germany, Israel

TRL: 8

Funding: Series B, various grants

Cost out, carbon out

Resource transition

Addionics has designed a porous 3D current collector, using recycled copper, for use in automotive battery manufacturing. This design serves as a direct replacement for traditional flat copper and aluminium collectors, reducing raw material required per battery, increasing the energy density, and producing a longer-lasting cell.

The 3D collector works with existing battery manufacturing equipment, minimising the need for expensive redesigns. It is chemistry-agnostic, making it equally applicable to lithium-ion, solid-state, and other battery chemistries.

Addionics' porous 3D current collector manufacturing facility operates at a 0.5 GWh scale and is already delivering products to industry-leading companies.

Impact

- Addionics' modelling indicates a potential CO_2 saving of 6 tonnes over the lifetime of an EV with 77kWh of batteries.
- Addionics expects a reduction in copper and aluminium in batteries by up to 50%, which also decreases the space required per cell and the amount of casing and supporting infrastructure.
- By extending battery lifetimes, Addionics also reduces embodied carbon.
- Addionics says its technology accelerates the adoption of dry coating, significantly reducing time, energy, and emissions in the battery production cost by eliminating the drying and priming processes.

Highlights

- Addionics is already collaborating with top automotive OEM's and battery makers.
- Recognised as a BloombergNEF Pioneer in 2022.
- Raised a total of $80 million, with the B round led by GM.

Company: HVS
Founder: Abdul Waheed
HQ: Glasgow
Operating regions: UK, Europe
TRL: 6
Funding: Non-series equity raise, various grants

Resource transition

Demand reduction through efficiency

HVS (Hydrogen Vehicle Systems) offers two solutions to target emissions from HGVs: a guidance system to help operators improve their driving efficiency and emissions (AI-SEMAS™), and a hydrogen-powered zero emission electric truck.

AI-SEMAS™ can be easily installed in existing vehicle fleets, including diesel trucks. It uses in-built sensors to dynamically measure road topography, cargo weight and fuel weight. On pre-known fixed delivery routes, the system anticipates the road segment ahead and displays the scientifically optimal speed and approach.

Unlike proof-of-concept hydrogen trucks built with a converted diesel chassis, HVS's vehicle is designed from the ground up for hydrogen and is therefore better optimised for hydrogen storage and electric drivetrain.

Impact

- HVS claims its AI-SEMAS™ system can save up to 14% on hydrogen, 10% on battery, and 5% on diesel, equating to approximately 5 tonnes of CO_2 saved per year per truck.
- The hydrogen-powered zero-emission electric truck replaces diesel trucks, eliminating associated emissions.

Highlights

- Multiple patents have been granted for its AI-enabled emissions reduction technology.
- Accolades include the Greenly Gold Medal.
- Key strategic partners include Asda, Tesco and UPS.

Company: Ilika

Founders: Graeme Purdy, Prof Brian Hayden

HQ: Hampshire

Operating regions: UK

TRL: 6

Funding: Various grants

Resource transition

Ilika has been a publicly traded company on the AIM stock market since it was founded in 2004. However, it only started developing its larger ‘Goliath’ solid-state batteries for EVs in 2018. Ilika markets these batteries, which are composed of an oxide solid electrolyte and a silicon anode, as safer, more efficient and more environmentally friendly alternative to traditional lithium-ion batteries.

Solid-state batteries can operate safely at higher temperatures than lithium-ion, which can spontaneously ignite when damaged. This allows for simpler safety systems, such as cooling and fire suppression. When used in EVs, solid-state batteries provide higher energy and power density, allowing for faster charging and lighter vehicles with an equivalent range.

Ilika’s solid-state miniature battery technology has also been proven and commercialised as the Stereax product line for medical devices.

Impact

- Ilika says its solid-state batteries are easier to recycle and reduce embodied carbon by 20% compared to lithium-ion batteries.
- They also enable a 20% weight reduction, which is particularly beneficial in EVs, where the battery is a significant amount of the vehicle weight.

Highlights

- Development partners for Ilika’s Goliath EV battery include Agratas, BMW, and Fortescue.
- A pilot facility is under development in collaboration with APC’s Automotive Transformation Fund.
- The technology is patented.

Sustineri Fuels

Company: Sustineri Fuels

Founders: Karl Hylands, Steve Baker, Neil Bruce OBE, Mike Read, Richard Neale

HQ: Clitheroe

Operating regions: UK

TRL: 9

Funding: Infrastructure capex committed

Resource transition

Sustineri Fuels is developing a major new facility to convert biomethanol to sustainable aviation fuel (SAF), avoiding the complex gasification of solid waste typically required in traditional SAF projects. The process uses established components arranged in a custom configuration to produce a drop-in replacement fuel.

Sustineri explains that biomethanol offers a practical and scalable alternative to current feedstocks such as crop-based or hydrotreated esters and fatty acid (HEFA) SAFs,which often face supply and demand challenges.

Sustineri Fuels take a circular approach. Heat generated in the process is used to self-power the plant, with excess energy sent to the grid. Unreacted gases are recycled through the system to be used again, and excess water is stored to be repurposed later.

With the technology proven, the company is focused on process efficiency and commercialisation to ensure the SAF is viable at scale. Sustineri Fuels notes that they do not rely on solid waste gasification technology, which has proven challenging to scale economically.

Impact

- Sustineri Fuels aim to produce over 250 million litres of SAF per annum by 2030, which could result in carbon intensity savings of approximately 80% versus fossil-based aviation fuel, equating to around 450k tonnes of CO_2 saved.
- There is potential to use e-methanol in the future, which could deliver further carbon savings and support the UK SAF Mandate's separate Power to Liquids (PtL) quota.

Highlights

- Significant infrastructure finance has been secured for project construction.
- Sustineri Fuels, with its technology partner, is hoping to gain industry approval for its SAF in the coming months.

HutanBio

Company: HutanBio

Founders: John Archer, Noor Azlin Mokhtar, Suhaiza Jamhor, Paul Beastall

HQ: Cambridge

Operating regions: UK, Malaysia

TRL: 6

Funding: Seed

Resource transition

Nature-based solution

HutanBio produces a zero-carbon biofuel for long-distance transportation using a recently discovered, oil-producing family of marine microalgae cultivated through automated agriculture techniques. The extracted bio-oil can be used as a direct drop-in replacement for marine fuel and as a feedstock for sustainable road diesel (HGVs) and aviation fuel (SAF).

The algae grows in saltwater contained in photobioreactors, developed by HutanBio and engineered for performance and cost. The algae feed on CO_2 and nitrogen, storing oil as a fat reserve. After the saltwater is drained, the oil is extracted, leaving behind a nutrient-rich biomass high in protein and carbohydrates which provides an excellent resource for animal feed.

HutanBio is targeting deployment at scale in coastal desert regions where sunlight and sea water are readily available for high efficiency algae growth. This creates value from land that is not suitable for agriculture and creates green jobs in these areas.

Impact

- HutanBio has found that its algae captures 1.83 tonnes of CO_2 for each tonne of algal material grown and can replace fossil-based fuels across multiple transport applications.
- Unlike many forms of biofuel production, HutanBio uses saltwater instead of freshwater and does not contribute to deforestation.
- HutanBio algae captures CO_2 directly from the atmosphere, but grows more quickly with higher densities of CO_2, so it could be used with heavy emitters such as cement works.

Highlights

- The core intellectual property is a family of microalgae discovered through extensive sampling and stress testing of marine colonies.
- Accolades include the Cambridge Independent Innovation Awards (2024), the 21-to-Watch Awards (2023), and Startups 100 Index Top 100 (2025).

Company: Firefly Green Fuels

Founders: James Hygate, Paul Hilditch

HQ: Bristol

Operating regions: UK, US, Brazil

TRL: Biocrude Hydrotreatment – 8, Hydrothermal Liquefaction of biosolids – 7

Funding: Series A, government grants

Resource transition

Waste reduction and circularity

Firefly has developed a pathway to convert sewage into sustainable aviation fuel (SAF). Sewage biosolids, typically used as low-grade agricultural fertiliser, face increasing challenges due to PFAS contamination, leading to more being landfilled or incinerated. Firefly offers an alternative by using these biosolids as a feedstock for SAF.

The SAF is produced through hydrothermal liquefaction (HTL), which uses high pressures and relatively low-energy heat to convert sewage into biochar and crude oil. The crude oil is refined through hydrotreating and fractionation using conventional methods.

Firefly, in partnership with Chevron Lummus Global, has developed a new catalyst system to make this process energy-efficient, cost-effective, and scalable for SAF production. Firefly have noted that independent analysis suggests that the properties of the resulting SAF are almost identical to conventional A1 jet fuel.

Impact

- Firefly's process claims a 92% reduction in life cycle carbon compared to traditional fossil-based jet fuel, potentially saving 3.6MT of CO_2e per year with feedstock volumes already secured from partners.

Highlights

- The first commercial-scale HTL facility is expected to be operational by the end of 2025, with plans for a full commercial-scale refinery by 2029.
- An offtake agreement has been signed with Wizz Air, which has committed to purchasing 525k tonnes of fuel over 15 years.
- Agreements are in place with UK water companies, as well as strategic partnerships with Synagro in the US and Sanepar in Brazil to supply feedstock.
- Accolades include Aviation Innovation of the Year (2024), Aviation Strategic Investment of the Year (2024), and Waste Water Innovation of the Year (2024).

Company: Zero Petroleum

Founders: Paddy Lowe, Professor Nilay Shah OBE, Anna Danshina, Doug McKiernan

HQ: London

Operating regions: UK, US

TRL: 6

Funding: Equity, revenue and government grants

Resource transition

Zero Petroleum uses its proprietary chemistry DirectFT® to manufacture synthetic fuel, known as efuel, from green hydrogen (sourced from water) and non-fossil carbon (sourced from CO_2 in the air or biogenic sources). The CO_2 released when burning Zero Petroleum's fuel matches the CO_2 captured in its production, creating a sustainable cycle when powered by renewable energy.

Zero Petroleum states that these synthetic fossil-free fuels enable all forms of mobility to operate at 100% sustainably without requiring changes to vehicles or infrastructure distributions. Critically, they retain the energy density of liquid fuels, which is imperative for most mobility sectors, including aviation, agriculture, and road, rail, and sea freight. Zero Petroleum's technology can produce all types of fuels, as well as carbon-neutral equivalents of fossil fuel based chemicals, such as plastics.

Impact

- Zero Petroleum anticipates that synthetic fuel manufacture will scale to meet global demand at levels comparable to the current fossil fuel industry, and could achieve cost parity with fossil fuels within the next decade.

Highlights

- Zero Petroleum is the official partner of the Formula 1 team Stake F1 Kick Sauber. Other notable partnerships include Airbus, Boeing, the Royal Air Force, Rolls-Royce, Qantas, ADNOC, Toshiba and Intertek.
- Accolades include the Low Carbon Transport Award at the British Renewable Energy Awards in 2023 and the Guinness World Records® title of 'first aircraft powered by synthetic fuel' in 2021.

SEABOUND

Company: Seabound

Founders: Alisha Fredriksson and Roujia Wen

HQ: London

Operating regions: Global

TRL: 7/8

Funding: Seed

Resource transition

Shipping has traditionally been difficult to decarbonise, as large diesel engines using inexpensive, ‘dirty’ fuels are ubiquitous. However, Seabound has developed carbon capture systems for cargo ships. The technology uses calcium looping, where calcium hydroxide reacts with CO_2 to form calcium carbonate. This inert solid is then offloaded in port, where it can be processed to remove the CO_2 for either sequestration or use in electro-fuel production.

Seabound’s system is designed for easy retrofit and is supplied in the form of modified 20 ft shipping containers. Seabound intends to set up secondary processing facilities near key ports to ensure it can offer a full service to its customers.

Impact

- Seabound states that its system can capture up to 95% of the CO_2 from ship exhausts.
- Sulfur emissions are also captured through the Seabound system.

Highlights

- The 2023/4 pilot saw the technology fitted to a container ship and successfully capture CO_2 emissions at 80% efficiency during normal operations.
- The founders were listed on the Forbes’ 2023 30 under 30 Europe list for Social Impact, the MIT Tech Review Innovators Under 35 Europe and the company won Maritime UK Startup of the Year Award 2024.
- Other accolades include the Keeling Curve Prize (2024), and Riviera Tanker Entrepreneur of the Year (2023).

Energy

Future50 companies

Piclo
Superdielectrics
ev.energy
Naked Energy
Iceotope Technologies
LiNa Energy
UrbanChain
Circulor

3.2 Energy

% of UK GHG emissions*

20%

UK climate-related VC investment**

£245m

No of start-ups in NZF50

7

The UK has made good progress in decarbonising its energy sector. It generated 20% of total UK emissions* but energy-based start-ups attracted 27% (£245m) of UK climate-related VC investment** in the 12 months leading to September 2024. This reflects the demand for renewable energy and increased electrification of applications, as well as the maturity of technologies in this sector.

Accelerators

Energy security: Global conflicts have highlighted the vulnerability of energy supply to external shocks, prompting nations to seek greater self-sufficiency and control over their energy sources. In response, the UK has increased its use of renewables and is targeting 95% clean energy supply by 2030. Renewables – including wind, solar, biomass, and hydro – accounted for over 50% of the country's energy generation in 2024[13], while coal has been eliminated for the first time since 1882.[14]

Government push: The UK Government has set new interim emissions reductions targets to ensure the country remains on track to reach net zero by 2050 and has set out a detailed action plan for reducing emissions in the energy sector. They have pledged substantial funding for offshore wind and solar projects and are encouraging community and local renewable energy projects through grants and subsidies.

Demand for clean energy: Growing public awareness and advocacy for climate action, along with government-set targets and financial incentives, are driving increased consumer and corporate demand for clean and renewable energy sources. In addition, factors such as population growth, the electrification of transport and heating, and the rise of AI technologies are further increasing energy demand. It is essential that the development of efficient climate technologies outpace this growth to meet future needs.

Barriers

High costs: Many technologies within the energy sector are capital-intensive, with substantial upfront costs and long payback periods that can deter investment. This challenge is often compounded by immature commercial models. For example, a recent PwC survey found that high capital cost was the biggest barrier for large energy users to invest in behind-the-meter energy efficiency or energy management technologies.[15]

Reform bottlenecks: Delays in planning consents, grid connection backlogs, and slow progress in grid reforms and upgrades are hindering the deployment of innovative technologies and delaying the transition to a sustainable energy system. Policy support and reforms are essential to unlock investment and the Government is seeking to improve on this as part of Clean Power 2030.

Skills shortage: A lack of skilled labour is slowing the build-out of critical infrastructure and the deployment of innovative climate technologies. Without a sufficient workforce to meet industry demands, the scalability of new projects becomes uncertain, deterring investors and delaying progress. Addressing this requires a focused effort to scale-up education and training programs to bridge the skills gap.

13. UK Government, "Energy Trends: September 2024."
14. BBC News, "Electricity and Gas Prices Will Remain High for Years, Business Group Warns."
15. PwC, "Powering the UK's path to growth: PwC UK Energy Survey 2025."

*UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Growth areas

Smart grids: The rise of renewable energy generation has led to increased intermittency of electricity supply. Smart grids, including grid aggregators, use data analytics, the IoT and AI to help optimise the energy use. They are crucial to help effectively integrate renewable energy, efficiently matching supply and demand to enhance grid stability, and create a more stable energy system.

Energy storage: Both grid-scale and local energy storage is essential for maximising the benefits of intermittent energy sources and maintaining a consistent, resilient energy supply. Energy storage also helps integrate a higher percentage of renewable energy into the grid and can reduce the need for expensive infrastructure investments. By storing energy when it is cheap (during low demand periods) and using it when it is expensive (during high demand periods), significant cost savings can be achieved.

Sector coupling: Heat and energy are wasted in many processes. In the UK, around 50% of primary energy used to generate electricity is lost in conversion, transmission and distribution.[16] There is growing research into synergies between sectors and new technologies to facilitate the redirection and repurposing of wasted energy to optimise energy use.

AI and data centre demand: The National Energy System Operator (NESO) anticipates that electricity demand from UK data centres will quadruple from 2025 to 2030, driven by advancements in AI and off-site computation needs.[17] Plans are underway to develop the largest data centre in Europe in the North East of England.[18] This will put significant pressure on the grid. Considering this, the development and adoption of new technologies to improve the energy efficiency of data centres, including advanced cooling technologies, are crucial.

16. Department for Business, Energy & Industrial Strategy, DUKES 2024 Chapter 5: Renewable Energy, UK Government, 2024.
17. BBC News, "The Boss of National Grid Warns of Increasing Energy Demand."
18. UK Government, "PM Tells US Investors Britain Is Open for Business as He Secured Major £10 Billion Deal to Drive Growth and Create Jobs."

Company: Piclo

Founders: James Johnston, Alice Tyler, Andy Kilner

HQ: London

Operating regions: UK, Europe, US, Australia

TRL: 9

Funding: Series B

Cost out, carbon out

Piclo is a software company with a mission to decarbonise the grid by making energy networks smarter, more flexible, and more sustainable.

Piclo has established a marketplace for Distributed Energy Resources (DER), to match buyers – typically grid companies and distribution/transmission system operators – with flexible sellers, such as EV fleet and battery owners.

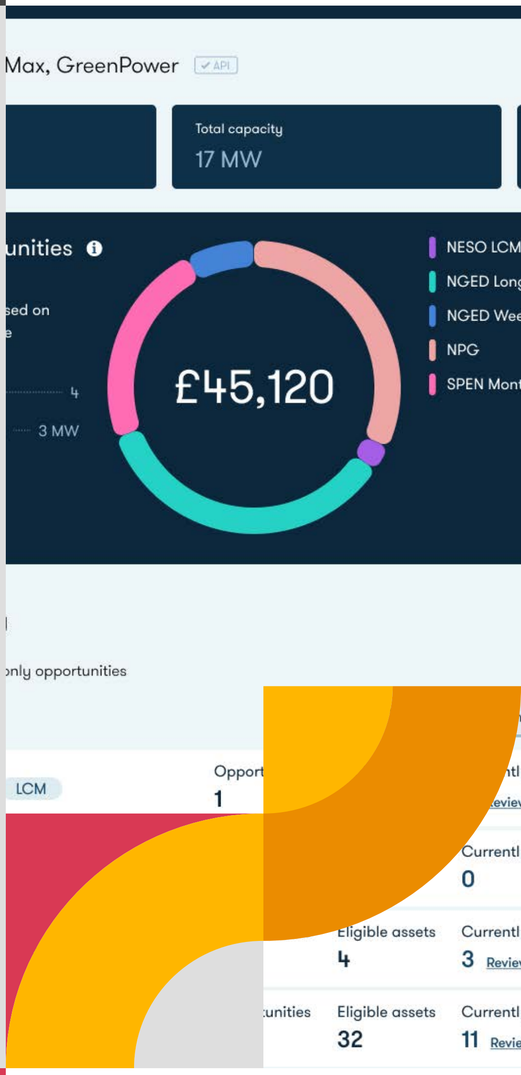
Beyond the UK, Piclo has a growing presence in Europe, USA, and the Asia-Pacific.

Impact

- Piclo has over 350,000 registered flexible assets, representing more than 26 gigawatts (GW) of flexible energy capacity.
- Piclo reports saving over 9,000 tonnes of carbon to date by enabling grid operators to call on low-carbon sources for flexibility.

Highlights

- High profile partners include National Grid in the UK and EDP in Portugal.
- Accolades include the 2024 Global Cleantech 100 and Top Impact Startups on Norrsken Impact/100 (2023) lists.



Superdielectrics

Company: Superdielectrics

Founders: Jim Heathcote, Dr Donald Highgate, Nigel Spence

HQ: Essex

Operating regions: UK

TRL: 6/7

Funding: Series B

Resource transition

Digitalisation

Superdielectrics has developed an energy storage device that uses aqueous polymer technology, similar to that used in contact lenses, with enhanced electrochemical properties. This innovation creates a hybrid between a battery and a supercapacitor. The materials used are recyclable and free from critical metals, reducing the environmental impact and strain on scarce resources.

Key features of the product include fast charging and discharging, scalability, improved safety, high recyclability, and lower costs compared to traditional battery technologies.

Research and development is ongoing, but proposed applications include small lightweight vehicles such as e-bikes, various stationary home appliances and home energy storage, with hopes to expand to EVs, aviation, and vertical farming in future.

Impact

- Superdielectrics says it has improved the energy density of its product by over nine times in two years.
- The device can charge faster than lead-acid and many lithium-ion batteries, and can effectively charge from intermittent sources.
- Superdielectics estimates that 93% of the material in its products can be recycled.

Highlights

- Superdielectrics were named as a WIRED Trailblazer in 2024.
- It launched its ‘Faraday 1’ energy storage technology at the Institute of Energy and Technology in London in 2024.
- Partnerships are being established with large multinational companies to propel business growth.

Company: ev.energy

Founder: Nick Woolley

HQ: London

Operating regions: US, UK, Europe, Australia

TRL: 9

Funding: Series B, various grants

Cost out, carbon out

Digitalisation

ev.energy offers a smart charging platform and app to bridge the gap between energy providers and EV users. The platform uses advanced algorithms and real-time data to manage and optimise the charging process, making it more efficient, cost-effective and environmentally friendly. By optimising EV charging times and taking advantage of off-peak electricity, ev.energy reduces grid demand, carbon-intensive energy use, and user charging costs.

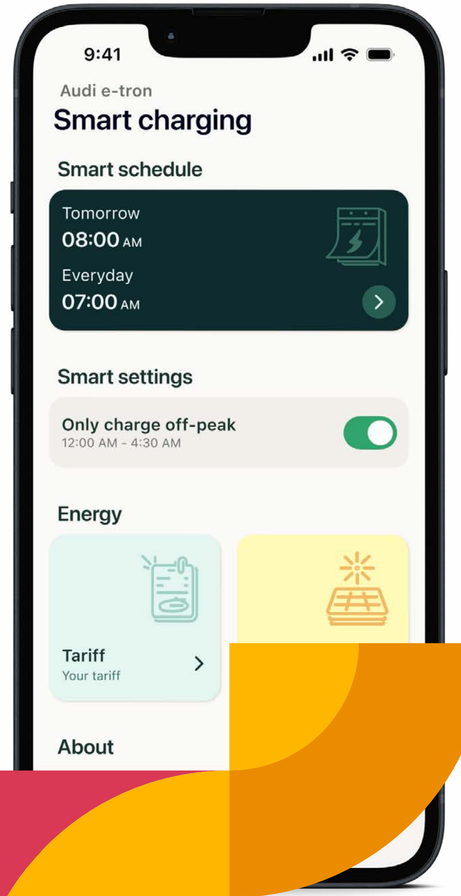
ev.energy has three main products. ev.insight helps energy providers understand and plan for the EV roll-out, including impacts on the grid. ev.engage bridges the gap between energy providers and EV charging, enabling energy companies to incentivise drivers to charge at the right time. ev.flex facilitates the creation of virtual power plants (VPPs), using EV batteries to temporarily top up the grid.

Impact

- By optimising charging and renewable energy integration, ev.energy estimates carbon emissions can be reduced by up to 70% while saving users 30% on their charging costs.
- In 2024, the ev.energy platform saved over 780 tonnes of carbon.

Highlights

- The ev.energy platform is available to 80-90% of EVs currently registered in the UK.
- ev.energy is B-Corp certified.
- Accolades include Utility Week Flex Awards Finalists (2024), CleanTech 100 (2023 and 2024), S&P Platts Global Energy Awards (2022), Volkswagen Future Mobility Incubator (2020) and EDF Energy Bluelab Pulse Innovation Challenge Winner (2019).



Naked Energy.

Company: Naked Energy
Founder: Christophe Williams
HQ: Crawley/London
Operating regions: UK, Europe, US
TRL: 9
Funding: Series B

Resource transition

Naked Energy's 'Virtu' solar heat and power collectors are designed for commercial and industrial applications. According to Solar Keymark data, they offer the highest energy density for flat roofs. The 'VirtuHOT' model heats water up to 120°C, while 'VirtuPVT' combines solar photovoltaics (PV) with solar thermal technology, generating electricity and heat up to 75°C.

Virtu products require less space than standard solar PV and solar thermal products. They have lower installation and maintenance costs due to their modular design and durability in extreme weather. They also efficiently pre-heat existing systems, like heat pumps, thus reducing carbon emissions.

The target customers include businesses with a constant heat demand, such as hospitals, residential developments, leisure centres, hospitality as well as various forms of manufacturing including food and beverage.

Naked Energy also offers 'Clarity24-7', a platform providing performance data and remote monitoring capabilities.

Impact

- Naked Energy has completed 100+ Virtu projects in 11 countries, displacing fossil fuels and saving 1500 tonnes of CO_2.
- Naked Energy states that VirtuPVT achieves 4 times the CO_2 savings per m_2 of available roof space compared with standard solar PV panels.

Highlights

- Virtu uses patented technology.
- VirtuPVT is the world's first hybrid evacuated tube collector to receive TÜV Rheinland certification.
- Accolades include Innovation Zero Award (2024) for the ‘Built Environment, Mature Solutions’ category and Green Product Award (2023) in the Building Components category.
- The British Library commissioned the largest solar thermal installation in the UK, spanning 712.5 m_2, using Naked Energy's VirtuHOT and VirtuPVT collectors.
- In a strategic partnership with E.ON Energy Infrastructure Solutions, Naked Energy provides renewable heat solutions for commercial and industrial decarbonisation projects.

ICEOTOPE

Company: Iceotope Technologies

Founder: Peter Hopton

HQ: Sheffield

Operating regions: United States, Europe, UK, Asia Pacific, Middle East

TRL: 8

Funding: Series B, government grants

Demand reduction through efficiency

Iceotope specialises in liquid cooling AI data centres. It provides innovative direct-to-chip and chassis-level immersion cooling technologies designed to improve compute density and utilisation, enhance energy efficiency, reduce water consumption, and lower the total cost of ownership for data centre operators.

Iceotope's technology is particularly well-suited for AI workloads, high-density computing, and applications requiring maximum thermal efficiency, making it a key player in the shift towards energy-efficient data centres.

Its liquid cooling solutions use dielectric coolants to remove heat directly at the source, eliminating the need for traditional air-cooling infrastructure. By using fully sealed, rack mounted systems, Iceotope says that its technology eliminates operational noise, improves component reliability, and allows data centres to operate efficiently.

Impact

- Iceotope states that its liquid cooling technology can reduce total data centre energy consumption by up to 40% compared to traditional air cooling systems.
- The solution also reduces water consumption by up to 96%, addressing critical environmental concerns.
- Iceotope explains that 100% of the heat recaptured from cooling electronics can be repurposed within the building ecosystem for applications such as central and water heating.

Highlights

- Iceotope holds a robust intellectual property portfolio with nearly 150 granted and pending patents.
- A full launch of the product portfolio is planned for 2025, aiming to meet the escalating demands of modern AI workloads from the cloud to the edge.
- The company collaborates with major OEMs (e.g., Dell, HPE, Gigabyte), component manufacturers (e.g., Intel, AMD, NVIDIA), and fluid manufacturers (e.g., BP, Valvoline, Castrol, Exxon Mobil, Shell) to deliver cutting-edge cooling solutions.
- Iceotope has received numerous awards, including CRN Data Center 50: The Hottest Data Center Companies of 2025, Environmental Product of the Year and SDC Awards: Digital Transformation Company of the Year.

LiNa Energy

Company: LiNa Energy
CEO: Will Tope
HQ: Lancashire
Operating regions: UK
TRL: 7
Funding: Seed, government grants

Resource transition

LiNa Energy is developing and commercialising a low-cost, solid-state sodium battery used for renewable energy storage. LiNa's innovative intellectual property enhances the performance of sodium batteries made from salt. The use of abundant raw materials, coupled with inherent safety features, enables LiNa to simplify the design of its energy storage systems, offering significant cost savings and improved performance compared to lithium-ion systems.

LiNa's advanced technology platform allows the customisation of extended charge and discharge times within the battery cells. This capability enables LiNa to address the growing demand for long-duration energy storage solutions needed to tackle the 'duck curve,' i.e., storing many hours of low-cost solar energy to replace hydrocarbon use when the sun is not shining.

LiNa is prioritising emerging markets, where resilient, long-duration energy storage is crucial to harness the solar potential of the Global South and avoiding continued reliance on the worst emitting current fuels, such as coal.

Impact

- LiNa suggests its system can reach over 92% round-trip efficiency (including heat losses from maintaining the cells at operating temperature), approximately 10% better than a lithium battery of similar size.
- The absence of lithium and cobalt in the batteries minimises environmental and social impacts associated with mining these critical materials.
- Testing with ACWA Power confirmed that LiNa systems can maintain over 90% efficiency, even under extreme temperature conditions ranging from -20°C to +55°C.

Highlights

- LiNa Energy delivered its first energy storage systems to India's largest integrated power company, Tata Power.
- LiNa Energy has secured agreements to develop a commercial pipeline exceeding 100 MWh in projects throughout the UK, Europe, Asia, and the Middle East.
- LiNa Energy's technology is patented.

UrbanChain

Company: UrbanChain
Founder: Somayeh Taheri
HQ: Manchester
Operating regions: UK
TRL: 9
Funding: Series A, government grants

Cost out, carbon out

UrbanChain believes the energy market was not built for today's energy needs. It was designed for large fossil fuel assets, benefiting major companies with power purchase agreements (PPAs), and restricts broader renewable adoption.

UrbanChain's solution is its blockchain-based system, 'eChain', which connects renewable energy generators with local users, supporting the transition to a decentralised renewable energy market. By promoting, generating and consuming locally, investors save on transmission losses and costs, and improve the viability of investing in renewable energy.

The platform enables direct trading between consumers and producers, bypassing traditional suppliers to offer higher returns for generators and savings for consumers, while reducing reliance on the volatile wholesale market.

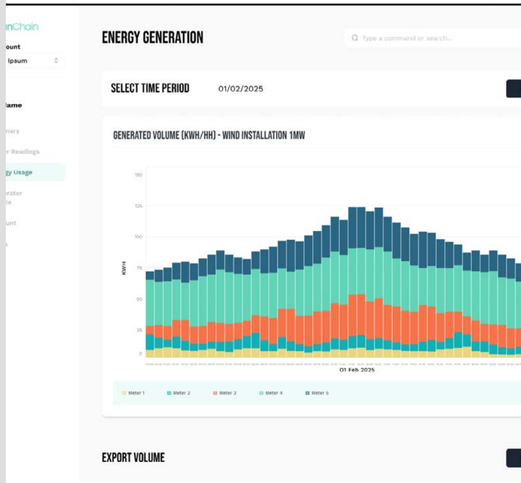
While UrbanChain cannot currently sell directly to residential customers, it is working on pilots with local authorities and housing associations to address fuel poverty.

Impact

- UrbanChain says its founder has helped steer UK policy, including the legislation change in February 2025 that will reduce costs for smaller-scale renewable generators by up to 16%.
- UrbanChain states it has enabled over 230GW of renewable power sales since 2022, saving about 475k tonnes of CO_2 vs non-renewable energy sources.
- UrbanChain helps generators get long-term stable prices for energy, encouraging renewable investment.

Highlights

- UrbanChain achieved 10x revenue growth in FY 2024, earning recognition as the third fastest-growing tech company in the UK by The Times.
- UrbanChain has partnered with Equans to deliver a Virtual Power Plant (VPP) in Dudley, UK, to create the country's first net zero neighbourhood. It has also partnered with Together Housing to deliver green energy to social housing.
- UrbanChain is part of the UK's Power Network SHIELD project to support low-income districts and the award-winning net zero terraced streets project to enable community heat solutions.
- Plan to launch in the US in 2025.



Company: Circulor

Founder: Douglas Johnson-Poensgen, Veera Johnson

HQ: London

Operating regions: UK, Europe, US, Singapore

TRL: 9

Funding: Series B

Digitalisation

Waste reduction and circularity

Circulor is a supply chain traceability company that uses distributed ledger and AI to track where materials originate, how they move through production, and their final use in products.

The platform offers end-to-end visibility by tracking the physical flow of materials as they change state from source to manufacturer. It connects all supply chain participants and provides reliable, granular data all the way to Tier N (the deepest level of the supply chain). Companies work with Circulor to gain full visibility of their inherited upstream activity, mitigate risks, improve responsible sourcing, protect their brands, and prove compliance with growing global regulations.

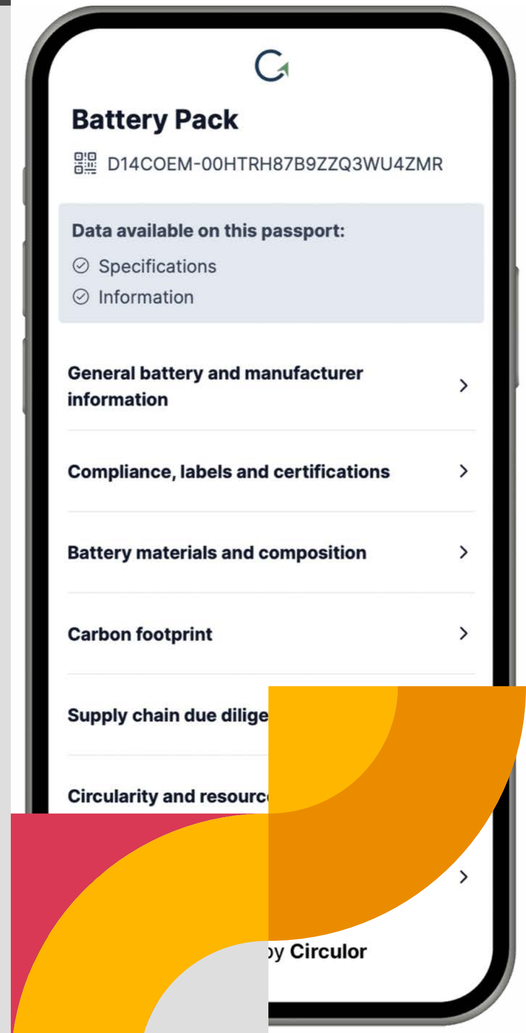
To date, the majority of Circulor's work has focused on batteries and critical minerals, where Circulor's traceability helps downstream manufacturers create more responsible, sustainable, and circular battery value chains.

Impact

- Circulor reports that approximately 77% of global cell manufacturers, by capacity, provide data through their platform.
- More than 159 million battery modules have traceability provided by Circulor.
- By the end of 2025, Circulor estimates that it will have helped manufacturers avoid over 1 million metric tons of CO_2e from their supply chains.

Highlights

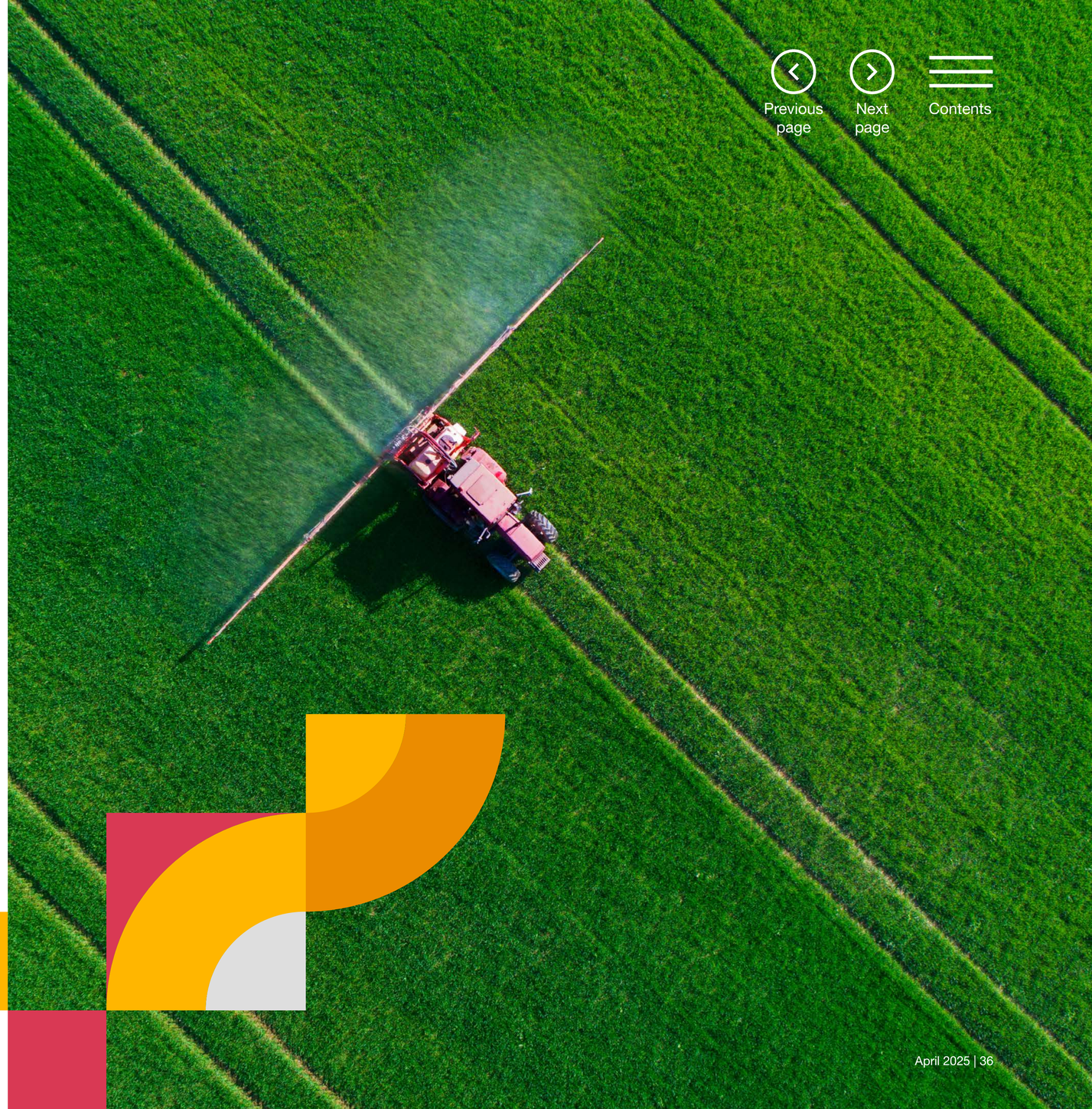
- Circulor is the battery traceability partner for eight major automotive brands, including Volvo, which launched the world's first battery passport for its customers with Circulor.
- The company has strategic partnerships with Accenture and Rockwell.
- Circulor has been named in the Global Cleantech 100 for three consecutive years.



Food, agriculture and land use

Future50 companies

Lambda Agri
Azotic Technologies
Outfield Technologies
Rare Earth Global
Future Greens
Sustainable Planet



3.3 Food, agriculture and land use

% of UK GHG emissions*

13%

UK climate-related VC investment**

£145m

No of start-ups in NZF50

6

The food, agriculture and land use (FALU) sector accounts for 12% of the UK's GHG emissions* and received 13% (£145m) of UK climate-related VC investment** in the 12 months leading to September 2024. Notably, technology for climate Adaptation and Resilience (A&R) is a prominent theme in the FALU sector. In the first three quarters of the year, 45% of the total UK A&R deals were concentrated in this sector, more than in any other sector.

Accelerators

Climate risk: Climate risks pose a significant threat to food security, as temperature changes and extreme weather events can drastically affect crop yields and disrupt the export and import of goods. This vulnerability highlights the urgent need for substantial investment in adaptation and resilience (A&R) agricultural practices and technologies. Addressing climate risks through strategic investments in this sector is essential to ensure a stable and sustainable food supply for the future.

Environmentally oriented consumers: By sourcing green and ethically farmed products, which utilise by-products and waste, a number of agriculture-dependent businesses such as restaurants and supermarkets can meet consumer demands for more sustainable products while meeting their own net zero goals. However, this can be expensive, at least in the short term, which can be challenging when consumers are already battling high food costs.

Chemical use: There are increasing restrictions on fertiliser and chemical use in agriculture to protect environmental and human health. Regulations are aimed at reducing synthetic inputs on soils. For example, the Nitrate Pollution Prevention Regulation (2015) restricts the use of nitrate-based fertilisers to reduce nitrate run off. The UK's Agricultural Transition Plan will also introduce the Environmental Land Management (ELM) scheme, which provides financial incentives for sustainable farming practices, including reduced use of chemical inputs in favour of biological alternatives for fertilisers and crop protection.

Barriers

Producer resistance: Farmers are increasingly resistant to pressures from environmental NGOs and regulatory bodies, which are driving policy changes and imposing higher taxes and financial penalties. Currently, sustainable farming practices tend to be either more expensive and/or generate lower yields. This, combined with higher food prices and slower uptake from consumers, results in reduced returns for farmers. Although the government is mandating a transition to greener farming, many farming communities feel that they are not receiving adequate financial support to facilitate this change.

R&D investment: Insufficient investment in R&D limits the availability of new technologies that could help farmers to implement sustainable agricultural practices more easily. This lack of investment also affects their ability to maintain profits and make a return on capital outlays, which are often required in new technologies/equipment.

Education: Traditional farming practices are often deeply rooted, with many communities having a strong attachment to conventional farming methods which, in many cases, currently still generate better yields and financial returns. Farmers need to be supported to take up more sustainable practices and provided with the support and tools to implement these.

*UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Growth areas

Bio-stimulants/crop protection: There have been significant innovations in biological crop protection and stimulants driven by the need to reduce chemical inputs while enhancing crop productivity and resilience. Examples include microbial bio-stimulants and bio-pesticides, such as bacteria and fungi, which target specific pests and diseases. These advancements support the long-term viability of farming systems as well as benefiting the environment.

Food waste: In the UK, 10.7 million tonnes of food waste are generated annually.[19] This presents a significant market opportunity to develop waste management technologies that transform organic waste into resources, such as biofuel or nutrient-rich digestate, enhancing resource efficiency and generating revenues. There is also an opportunity to develop solutions for better storage and transport of food to reduce food waste at the source. These technologies are not only needed in the UK but can be exported to developing markets where most food is lost across the supply chain.

Internet of Things (IoT): The use of sensors, drones, AI and real-time crop and livestock monitoring provides farmers with valuable insights on how to optimise resource use and detect problems early. This enables precision agriculture and enhances supply chain efficiency. IoT technology offers significant benefits that drive increased crop yields, better return on investment, and reduced emissions by measuring precisely what the crop needs.

19. WRAP, "Food Surplus and Waste in the UK: Key Facts," November 2023.

Company: Lambda Agri
Founders: Monica Saavedra
HQ: Cambridge
Operating regions: UK
TRL: 5
Funding: Pre-seed/seed, government grants

Cost out, carbon out

Lambda Agri has developed an active molecular compound which absorbs UV light and re-emits it as photosynthetically active radiation to enhance plant growth, increasing crop yields and reducing energy consumption associated with traditional greenhouse lamps. This compound is added to spray paint and polytunnel films at the point of manufacture.

Lambda Agri explains that its product is the only compound offered as part of spray paint in the market, and it is currently working alongside greenhouse farmers to trial the product.

Impact

- Lambda Agri estimates it could save 55 million tonnes of CO_2e emissions by 2050.
- The company also claims its product could increase revenues by £35,000 and reduce costs by £5,000 per year per acre for farmers.

Highlights

- Lambda Agri has patented the active chemical compound added to the spray paint.
- The company has been recognised by The Royal Society of Chemistry, Tech Nation Rising Stars, Santander X, Greentech Europe, and others.

Company: Azotic Technologies

Founder: No longer with company

HQ: York

Operating regions: UK, Europe, North America and others

TRL: 9

Funding: Seed, various small business grants

Cost out, carbon out

Demand reduction through efficiency

Azotic manufactures a proprietary nitrogen-fixing bacteria that colonises crops and converts atmospheric nitrogen into a form that plants can use. This process supplements conventional crop nutrition practices by enhancing crop yield or allowing for reduced nitrogen fertiliser use while maintaining yield.

Azotic explains that its bacteria are naturally occurring and food-grade. Unlike similar technologies, which are located around plant roots or in intercellular spaces, Azotic's bacteria act directly inside plant cells.

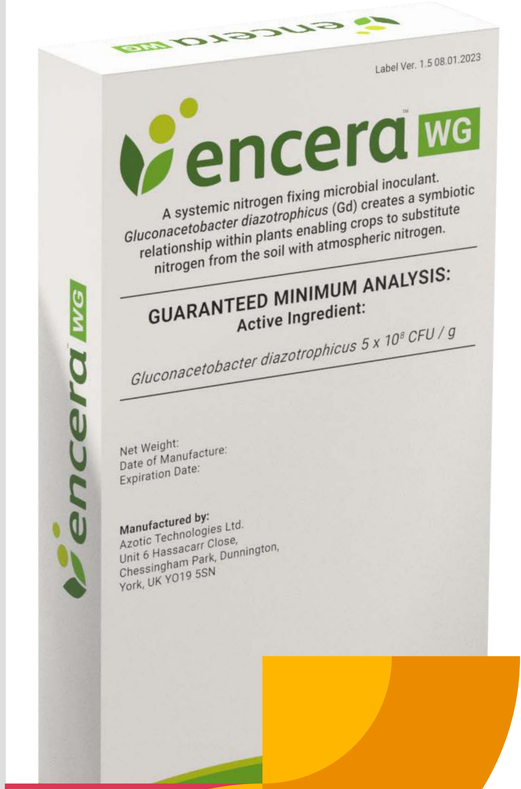
While manufactured in-house to maintain control of the process and its IP, Azotic is working with a variety of agricultural distributors to ensure broad accessibility of its product.

Impact

- Nitrogen fertilisers are energy and carbon intensive to produce and can pollute water ecosystems. Azotic states that its bacteria can reduce the need for nitrogen fertiliser by up to 20% without yield loss.

Highlights

- Azotic's technology is patented.
- Over 2 million acres treated to date, with over 600 trial results on various crops recorded by the company.
- It was initially licensed in North America, where it is predominantly used in the Midwest, but is now available in Europe and growing in markets such as Germany, Poland, Turkey, UK and Southeast Asia.



Company: Outfield Technologies

Founders: Oli Hilbourne, Jim McDougall

HQ: Cambridge

Operating regions: UK, US

TRL: 8

Funding: Seed, grants including Innovate UK

Digitalisation

Demand reduction through efficiency

Outfield Technologies has built a cloud-based platform to help fruit growers, such as those managing orchards or vineyards, improve decision making. Using images from relatively inexpensive off-the-shelf drones and machine learning, Outfield automatically assesses key metrics including tree size, blossom levels and fruit count. This helps farms improve yields while reducing agrichemical and water usage, and primes the onward supply chain in advance of harvest.

Outfield can also directly inform precision farming equipment to target local application of chemical treatments, increasing productivity and reducing overall chemical use.

To enhance user-friendliness, Outfield's platform generates flight plans that enable growers to conduct surveys themselves at the click of a button.

Impact

- In case studies, farmers have been able to reduce the use of fertiliser and diesel by 50% by using Outfield maps to deploy precision spraying.
- In addition to reducing agri-chemical use, the platform also helps to reduce food waste by increasing the proportion of saleable fruit grown.

Highlights

- Outfield Technologies has been conducting trials with some of the largest growers in the UK and US.
- Over 3,800 hectares have been surveyed to date, generating over 1,300 reports.
- The company is involved with various research projects with top horticultural research institutions, including Cornell University, Washington State University and University of Massachusetts in the US, and the National Institute of Agricultural Botany in the UK.

RARE EARTH

Company: Rare Earth Global

Founders: Jamie Lewis, Suneet Shivaprasad, Stephen Wong

HQ: London

Operating regions: UK, Spain, Thailand

TRL: 9

Funding: Pre-seed, equity, grants

Resource transition

Nature-based solution

Rare Earth Global operates a B2B marketplace that connects buyers with sellers of low-carbon products made from industrial hemp. The company aims to support growers to improve crop quality for competitive pricing and product compliance. This localises supply chains and reduces reliance on harmful materials such as soy, which is linked to deforestation, and fossil fuels.

Focusing on the use of hemp seed in fish feed, Rare Earth Global develops intellectual property through joint research with leading institutes. They are currently collaborating with the Neville Centre of Excellence in Cement and Concrete to commercialise structural hemp-based concrete from the stalk.

By adopting Rare Earth Global's hemp products, companies are able to reduce their scope 3 (supply chain) emissions. These customers can also gain access to carbon credits and life cycle data to meet their net zero and broader environmental targets.

Impact

- Rare Earth Global estimates that hemp sequesters approximately 1.5 tonnes of CO_2 per tonne harvested. In applications where this carbon can be 'locked in', such as concrete, hemp products can be carbon negative.
- The use of hemp in aquaculture reduces both the dependence on soy linked to deforestation and fishmeal.

Highlights

- Rare Earth Global is in the process of securing product patents, as well as developing a data-driven crop model to optimise the supply chain.
- Accolades include Aquaculture Award (2023), Argus Startup Award (2024), Greentech Fund Winner (Simmons & Simmons) (2024) and Earthshot nominee (2024 and 2025).

FUTURE GREENS

Company: Future Greens

Founders: David Dixon, Alexander la Fleur, Gabrielė Barteškaitė, Alastair Roper

HQ: Sheffield

Operating regions: UK

TRL: 7

Funding: Pre-seed

Resource transition

Waste reduction and circularity

Future Greens has developed compact, high performance anaerobic digesters that break down waste 8-10 times faster than traditional systems, enabling a significantly smaller and more modular design. Its digesters are small enough to be installed at the site of waste production, such as food manufacturing facilities, thereby reducing transport emissions and providing a local source of green energy.

By developing a novel reactor architecture and focussing on a pre-fabricated, modular design, Future Greens' digestors are easier to deploy and service, and use AI to self-optimise.

Impact

- Future Greens report that the average mid-sized brewery can save 1,100 tonnes of CO_2e per year by processing on-site waste in the novel reactor.
- Additionally, a brewery of this size could save around £200,000 per year due to a combination of waste disposal charges and on-site energy generation.

Highlights

- Future Greens are part of Tech Nation's Climate Programme 2024, and won Tech Nation's Rising Stars regional final.
- Future Greens has been awarded an Innovate UK Farming Innovation grant in collaboration with the University of Sheffield.
- The first full-scale pilot has been successfully deployed in Sheffield, processing spent grain from The Brewery of Saint Mars of the Desert.

Company: Sustainable Planet

Founders: Sven Kaufmann, Susan Payne

HQ: London

Operating regions: UK, UAE, Africa, Asia

TRL: 7

Funding: Seed

Resource transition

Sustainable Planet develops sustainable agricultural models and technology to produce plant proteins using water lentils.

These products do not require any arable land and use 15 times less water to produce than soybeans. This mitigates the broader environmental impact and reduces land-use change in biodiverse, tropical areas.
The cultivated water lentils themselves are also a substantial carbon sink.

Sustainable Planet is committed to supporting local economies in countries where it is trialling water lentils, including Egypt, UAE, Thailand, Indonesia and Mozambique. Water lentils can be used as animal feed, human food, organic fertiliser and biofuel.

Impact

- Sustainable Planet says it has produced 450,000 tonnes of sustainable protein to date, which has reduced carbon emissions by 30 million tonnes of CO_2e.
- Water lentils can sequester approximately 300kg of CO_2 per hectare per day during growth.
- Water lentils can also be fed to cattle to produce less methane.

Highlights

- Sustainable Planet won the Global Food Tech challenge in 2024, selected from 667 companies across 79 countries.
- Other accolades include UM World Food Startup Innovation Awards in 2023, UNIDO Award for Manufacturing and Processing in 2024 and Impact Excellence Award for Food Security in 2024.

Industry, manufacturing and resource management

Future50 companies

Recycleye
Hyran Technologies
Kelpi (Kelp Industries Ltd)
Altilium Clean Technology
Tetronics Technologies
E.V.A Biosystems
Monumo
QPT
Xampla
QiO Technologies

3.4 Industry, manufacturing and resource management

% of UK GHG emissions*

19%

UK climate-related VC investment**

£96m

No of start-ups in NZF50

9

The industry, manufacturing and resource management sector produces 19% of UK emissions*, yet received only 11% (£96m) of UK climate-related VC investment** in the 12 months leading to September 2024. In light of this carbon funding gap, greater investment into this area is crucial and we hope the start-ups selected in our Future50 begin to demonstrate the variety of solutions on offer.

Accelerators

EU's and UK's Carbon Border Adjustment Mechanisms (CBAMs): CBAMs will significantly impact the cost of carbon-intensive materials imported into the UK for industrial manufacturing processes. As a result, the development of low-carbon onshore materials will become increasingly important.

Concerns over microplastics: Growing concerns about microplastics are driving research into alternative materials, such as bio-based and biodegradable polymers. This has led to advancements in recycling technologies and the implementation of extended producer responsibility (EPR) schemes. The UK government has committed to the Global Plastic Treaty which aims to eliminate plastic pollution through a circular economy by 2040.

Intensifying physical risks: Industrial facilities, often strategically located near natural resources like rivers for cooling purposes, are experiencing increased disruption due to intensifying physical risks such as flooding, earthquakes, and hurricanes. These risks reduce the reliability of industrial supply chains by disrupting production and transport operations, reducing efficiency and increasing cost. This has increased the demand for resilience technologies tailored to industrial needs, such as climate risk modelling, on-site renewable energy systems, and adaptive cooling technologies.

Barriers

Capex heavy: New technologies in the industrials sector are often asset heavy and require significant upfront capital investment, including the cost of new machinery and retrofitting existing equipment. Development timelines can also be lengthy. The combination of these factors can often deter investors given the associated risks to ROI. In addition, the assets being replaced typically have long lives and are therefore often decommissioned early. Collaborations between government and the private sector, in the form of public-private partnerships, can often help here.

International cooperation: Decarbonising the industrial sector requires international cooperation, as industrial products are traded across global value chains. Initiatives and regulatory changes, such as the First Movers Coalition and CBAM, have begun to develop harmonised standards. However, many countries and companies that are yet to engage for fear that commitments could impact profits and a shift in focus could cause loss of market influence.

Supplier readiness: Industry supply chains can be extensive, complex and global. This creates a significant challenge when seeking to reduce scope three emissions as suppliers may not be equipped to meet green standards. Supplier engagement and incentivisation is likely to be required, although this is rarely straight forward.

*UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Growth areas

Optimised manufacturing: The industrial sector is increasingly using artificial intelligence (AI), digital twins, and machine learning to optimise manufacturing processes, predict maintenance needs, and minimise waste and energy consumption. Advanced manufacturing techniques, such as automation and additive manufacturing, just-in-time ordering, precision material use, and production processes can all enhance operational efficiency while directly lowering costs and carbon.

Circular economy: Manufacturers are increasingly required to evaluate the environmental impacts associated with all stages of a product's lifecycle, from raw materials (including mining and extraction) to end-of-life disposal or recycling. This creates opportunities for technologies supporting the development of more sustainable practices from raw material alternatives to product life extension, recycling and other circular economy models.

Green hydrogen-based alternatives: Hydrogen offers a clean energy solution for the industrial sector, particularly where high temperatures are needed, and electrification is challenging. It can be used in steel manufacturing or as a feedstock in producing chemicals like ammonia or methanol, helping industries reduce their carbon footprint and comply with stringent regulations.

CCUS: Carbon capture, utilisation and storage (CCUS) technologies crucially reduce the carbon released from manufacturing processes. CCUS systems need to continue to be developed to leverage byproducts from manufacturing processes and reuse them in production. CCUS technologies can help companies in the industrials sector make strides towards carbon neutral production lines.

RECYCLEYE

Company: Recycleye

Founders: Victor Dewulf and Peter Hedley

HQ: London

Operating regions: UK, Europe, US

TRL: 8

Funding: Series A

Digitalisation

Waste reduction and circularity

Recycleye uses machine vision and high-speed robotics to automate manual waste sorting in recycling facilities. The technology can conduct up to 65 successful targeted 'picks' per minute using a robotic arm, or sort up to 1,000 in bulk using air blasts, thereby reducing labour costs and increasing the quality of recyclate. Recycleye's technology reduces the amount of waste sent to landfill and associated GHG emissions, release of toxins and leachate.

Recycleye has partnered with several universities to use the data and analytics generated to create WasteNet, which is now the world's largest dataset for waste. Recycleye has also developed a waste taxonomy to provide a global standard for waste classification.

Recycleye is headquartered in London, and has installed units in sorting facilities across Europe and in the US.

Impact

- Recycleye reports facilities have recovered up to 30% more targeted material for recycling.
- Sorts material with purity of up to 98%, meaning plastic types can be recycled into same product.
- Reduces reliance on manual labour in environments with high ignition risk from batteries.

Highlights

- Recycleye equipment already installed and operational in 45+ material recovery facilities (MRFs).
- Accolades include founders listed on the Forbes' 2021 30 under 30 list for Social Impact, and the European Patent Office's inaugural Young Inventors prize.
- Customers include leaders in waste management, such as Veolia and FCC Environment, and a strategic partnership with the Alliance for Beverage Cartons and the Environment.

Company: Hyran Technologies
Founders: Ahmed Zaidi, Jordan Zhang
HQ: Cambridge
Operating regions: UK, US
TRL: 7
Funding: Pre-seed (2023)

Digitalisation

Demand reduction through efficiency

Waste due to overproduction and inaccurate forecasting is a challenge in the fashion industry. Traditionally, brands place binding orders many months in advance which, due to unexpected market conditions and consumer behaviour, can result in excess inventory, waste, and financial losses. Hyran helps to reduce this by enabling brands to delay production decisions using near-season data.

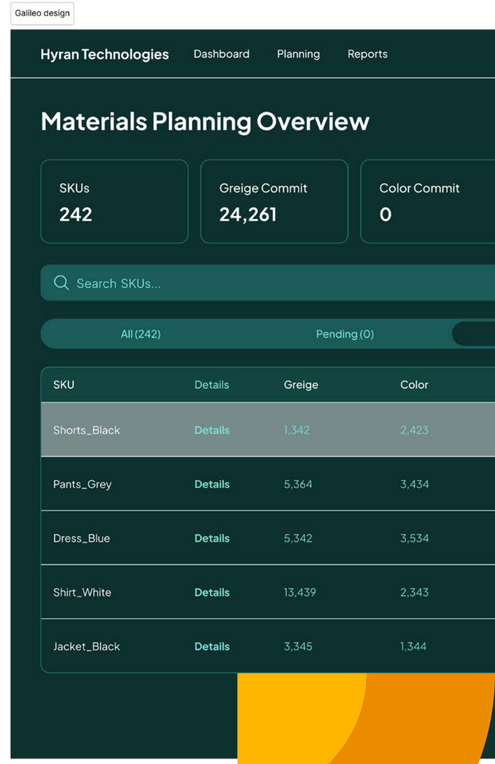
Hyran's AI platform integrates with suppliers' data to provide full visibility into production pipelines, suggesting optimal timing and quantities for material movement. This adaptive approach accounts for unique product and supplier needs, aligning production with real-time demand patterns and lead times to minimise inefficiencies.

Impact

- Hyran reports early adopters of its platform have achieved an average 71% reduction in raw material waste and 27% improvement in on-time delivery through increased material accuracy.

Highlights

- Hyran has projects with New Balance and other well-known brands.
- Accolades include Shop Talk Europe (2023) Judges' Choice Award for its innovative technology.



kelpi

Company: Kelpi (Kelp Industries Ltd)
Founder: Neil Morris
HQ: Bristol
Operating regions: UK, US, Europe
TRL: 6
Funding: Seed (two rounds), Innovate UK grants

- Resource transition
- Waste reduction and circularity
- Nature-based solution

Kelpi has developed a biodegradable seaweed-based polymer designed to line paper, card and moulded fibre packaging. This offers an alternative to non-biodegradable fossil fuel based plastics commonly used in packaging for food, beverages, personal care, and household products.

Unlike many bioplastics, Kelpi's solution performs similarly or better than traditional plastics. It has a proven water barrier but disintegrates during the paper and card recycling process with no special modifications required to equipment.

Kelpi is currently focused on scaling production of the polymer. This involves collaboration with seaweed farmers and refineries for feedstock, as well as fibre packaging manufacturers that produce the substrate for the polymer film. Kelpi is also in the process of obtaining regulatory approval for use in food and drink packaging.

Impact

- Kelpi says that its solution can replace fossil-fuel based plastics as well as high carbon-emission glass.
- Seaweed sequesters carbon and re-oxygenates the ocean as it grows. It doesn't require land, fertilisers, or fresh water to thrive.

Highlights

- Kelpi has R&D contracts with large multinational retail brands, including L'Oreal, Diageo, and Waitrose.
- Accolades include Barclays Entrepreneur of the Year 2024 Award and Start Up Enterprise of the Year – Global Good Awards in London 2024.
- Kelpi has achieved B-Corp status.

Company: Altilium Clean Technology

Founders: Dr Christian Marston, Kamran Mahdavi, Sean Joseph

HQ: Plymouth

Operating regions: UK

TRL: 7

Funding: Series A, Innovate UK grants

Resource transition

Waste reduction and circularity

Altilium specialises in recycling lithium-ion batteries from EVs using its proprietary EcoCathode process. This method recovers valuable minerals such as lithium, cobalt, and nickel from spent batteries and upcycles them into sustainable, low-carbon cathode active materials (CAM) for new batteries. This approach not only reduces the environmental impact of battery disposal but also ensures a sustainable supply of critical materials for the expanding EV and energy storage markets.

Currently, most used EV batteries are exported for processing abroad. Altilium plans to construct a large battery recycling plant in the northeast of England, a project expected to supply 25% of the critical minerals needed for UK electrification – with the feasibility study completed with funding from the UK Government's Automotive Transformation Fund. This initiative aims to strengthen the UK's energy security and support a more sustainable and resilient domestic supply chain.

Impact

- Altilium claims that using its recycled materials could reduce the carbon footprint of new EVs by 25%, equating to around 4 tonnes CO_2e saved per vehicle.
- Materials produced using Altilium's process should cost 20% less and emit 74% less carbon than new materials, based on a life cycle assessment (LCA) conducted by external consultancy Minviro.

Highlights

- Patents are pending for Altilium's EcoCathode technology and proposal for safe collection of used batteries.
- Altilium is involved in an Innovate UK/APC project with Jaguar Land Rover to recycle old EV batteries. New cells will be produced at the UK Battery Industrialisation Centre for validation by a leading automotive OEM.
- First commercial plant opened in Plymouth in February 2025.

Company: Tetronics Technologies

Founder: Graeme Rumbol

HQ: Swindon

Operating regions: UK, US, Europe, Middle East, Asia

TRL: 6/7

Funding: Government grants

Resource transition

Tetronics is an environmental technology company and world leader in plasma arc systems, focussed on decarbonising challenging industrial processes such as steel, glass and cement. With the support of the UK government, Tetronics is developing a brand-new technology, Tetronics Hydrogen Plasmolysis (THP), that uses plasma for green hydrogen production. THP technology aims to generate green hydrogen more efficiently than electrolysers, eliminating CO_2 emissions from industrial processes and providing a zero-carbon fuel for use in heating, power, and transportation.

THP is able to run on salt water and other sustainable feedstocks, such as biomethanol and ammonia, making it a more flexible technology than alternatives. Tetronics is also able to use its plasma technology to convert easily transported ammonia into hydrogen at the site of consumption, addressing a key industry challenge.

Impact

- Tetronics is seeking to scale from a 300KW demonstrator to a 1MW module in 2026, increasing its emissions reduction potential.
- The company aims to create hydrogen fuel points in rural locations with access to wind or solar energy.

Highlights

- Tetronics' technology is patented.
- Grant funding has been received from the UK Government's Department of Energy Security and Net Zero through the Low Carbon Hydrogen Supply 2 competition.
- Multi-million pound contracts have been secured for its technology across various applications, including with clients like Sellafield, where it is used to stabilise and reduce the volume of nuclear waste streams.

Company: E.V.A Biosystems
Founder: Dr Alexander Speakman
HQ: Edinburgh
Operating regions: UK
TRL: 4
Funding: Pre-seed, government grants

Waste reduction and circularity

E.V.A Biosystems is developing synthetic biological additives to be included in the manufacturing process of conventional and recycled plastics.

These additives detect specific environments, such as seawater or landfill, by recognising changes in conditions such as salt or pH levels through tunable biosensors. It then uses enzymes to microbiologically degrade the polymer chains at the molecular level, with the potential to completely break down the plastic and minimise the release of microplastics. This selective degradation serves as a backup plan to mitigate environmental impacts if plastic escapes planned waste management.

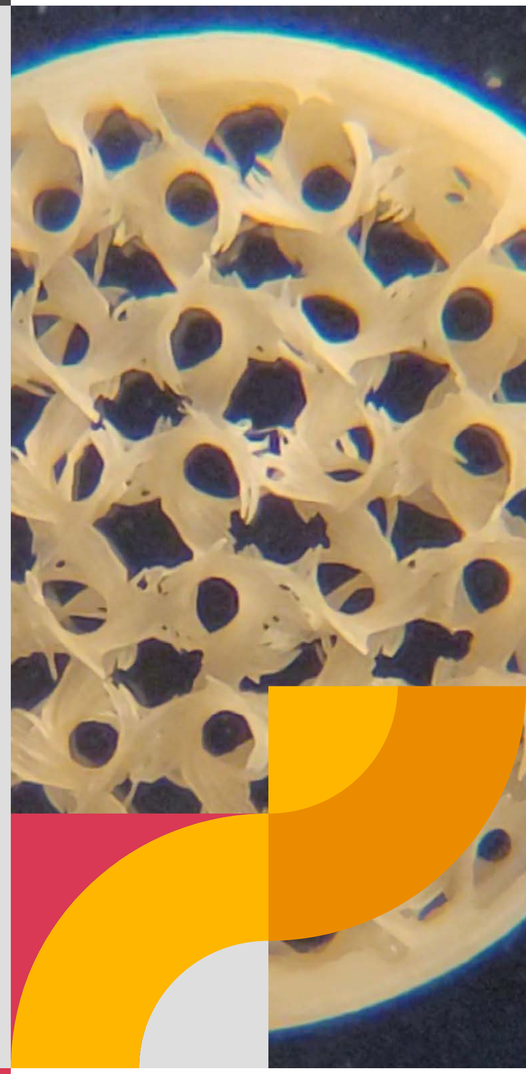
While biodegradable plastics exist, they are in short supply, more expensive, and have poorer material properties than conventional plastics. E.V.A's goal is to maintain the benefits of conventional plastic while improving end-of-life outcomes and reducing plastic pollution.

Impact

- E.V.A estimates that, in the UK, only 17% of plastic is recycled, with plastic pollution massively disrupting ecosystems. By reducing plastic pollution, E.V.A contributes to protect biodiversity and enhance carbon sequestration
- Given that only 0.7% of current global plastic production is bio-based, E.V.A sees significant potential in addressing non-biodegradable plastics, especially in markets with less developed waste management infrastructure like Southeast Asia.

Highlights

- E.V.A Biosystems' technology is in the early stages, focusing on R&D to optimise degradation and performance before seeking regulatory approvals.
- Accolades include Scottish EDGE (2022), Edinburgh Innovations' Inspire Launch Grow (2023) and most recently the SSE Net Zero and IBioIC Industrial Biotech prizes in the 2024 Converge Challenge.



monumo

reinventing electric motors

Company: Monumo

Founders: Dominic Vergine, Ian Murphy, Martin Frost

HQ: Cambridge

Operating regions: : Europe, Asia and others

TRL: 8

Funding: Seed, Innovate UK grants

Digitalisation

Demand reduction through efficiency

Monumo's Anser Engine is a combined simulation and optimisation tool that leverages machine learning and AI to optimise electric motor designs. The Anser Engine can reduce engineering projects that typically take years to complete by exploring millions of prototype designs within hours. Monumo explains that this technology will enhance the efficiency and range of EVs while lowering costs, thereby addressing key barriers to global EV adoption.

The Anser Engine simulates and optimises the entire motor system, including the motor, inverter, and transmission, to understand the symbiotic relationship between components and achieve more sustainable designs. The technology is tailored to each customer's drive system characteristics and parameters, exploring numerous design paths to identify efficient solutions that traditional methods may overlook.

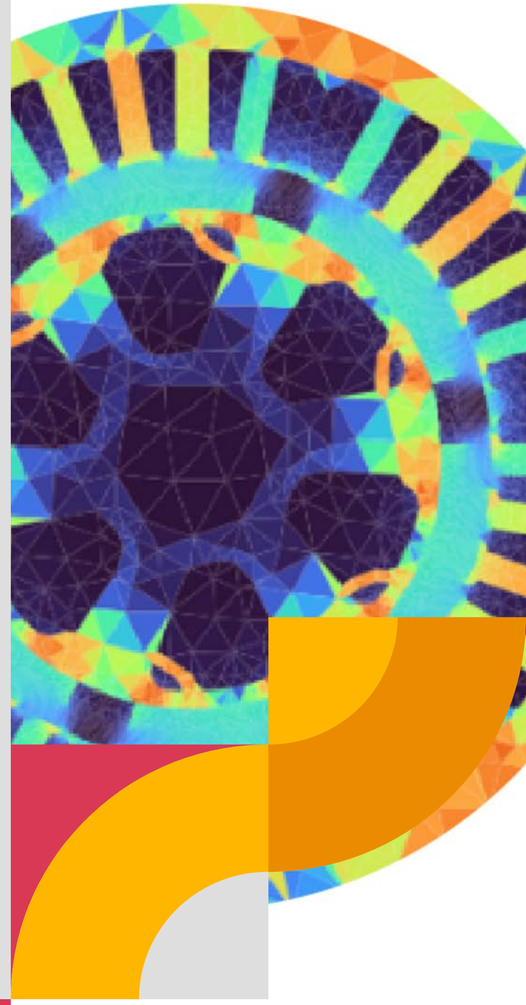
Although the company is currently focused on EVs and their powertrains, Monumo’s long-term ambition is to create an electromagnetics foundation model for all types of electrification.

Impact

- Monumo expects to improve overall motor performance by 20-30%, significantly reducing emissions and costs, and accelerating the adoption of EVs in the pursuit of decarbonising transportation.
- Monumo aims to reduce motor dependency on permanent magnets, thereby reducing the use of rare earth materials currently present in 80% of EVs, while still being manufacturable on existing production lines. Monumo is currently saving car companies and its suppliers tens of millions on a production run of motors.

Highlights

- Monumo's technology is patented.
- Monumo won a contract with one of the world’s largest manufacturers of electric motors, and has partnered with leading German automotive consultancy, Hofer Powertrain.
- Accolades include a place on the prestigious ‘Europas 100’ which showcases the 100 hottest tech start-ups in Europe.



Company: QPT (Quantum Power Transformation)

Founder: Rob Gwynne

HQ: Cambridge

Operating regions: UK, Portugal

TRL: 5

Funding: Angels, seed, Innovate UK grant

Demand reduction through efficiency

QPT's 'Intelligent Power Module' (qIPM) is designed to transform electric motor drive systems by using gallium nitride (GaN) transistors, which operate at higher frequencies than traditional silicon or silicon carbide (SiC) alternatives. This results in improved motor performance, reduced energy losses, and cleaner sine wave outputs, leading to less noise, vibration, and harshness (NVH), higher efficiency, reduced wear, and extended lifespan.

The compact, modular design allows easy adoption by major motor manufacturers with minimal redesign, and QPT has addressed thermal and electromagnetic interference challenges posed by fast switching speeds.

Target applications include industrial, automotive, and HVAC sectors. In EVs, enhanced drive efficiency can extend range or reduce battery size. In industrial motors, qIPM reduces heat and maintenance, extending equipment lifespan and lowering total ownership costs.

Impact

- QPT estimates that its technology could cut global energy consumption by 5%, delivering emissions savings equivalent to removing all planes from the sky.
- QPT estimates qIPM reduces energy losses by up to 80% and improves system efficiency by up to 10%, leading to decreased energy demand, CO_2 emissions, and costs.
- By using the qIPM, QPT estimates that motor drive power density can be increased by up to 20 times, aided by QPT's patented 'die attach' process that enhances waste heat removal by up to 15 times.

Highlights

- QPT is working with ABB to develop the first high-frequency GaN based industrial motor drive, set for completion in Q2 2025.
- Patents have been awarded covering advanced thermal management and electromagnetic interference handling.
- Accolades include the Design Innovation Award at the TechWorks Awards (2024), Young Company of the Year Award at the Business Weekly Awards (2024) and three IET awards in 2024, for Emerging Tech of the Year, Net Zero and Climate Action, and Power and Energy.

Xampla

Company: Xampla

Founders: Dr Marc Rodriguez Garcia, Professor Thomas Knowles

HQ: Cambridge

Operating regions: International

TRL: 9

Funding: Series A and grant funding

Waste reduction and circularity

Nature-based solution

Xampla is a materials innovation company unlocking the power of natural plant polymers to create world-first patented materials.

Xampla's Morro™ materials are designed to eliminate the most polluting plastics, and are made from plants without any chemical modification. Xampla say they are high performance, plastic-free alternatives for a range of products including barrier coatings, flexible films and edible packaging.

In late 2023, Xampla announced its first technology licensing agreement with 2M Group of Companies, enabling Morro™ Coating to be manufactured and produced at tonnes scale, and used by global packaging companies including Huhtamaki and Transcend.

Xampla state that Morro™ is fully biodegradable in all environments, home compostable, and can drop-in to existing manufacturing supply chain as well as being compatible with existing recycling processes.

Impact

- Xampla believes its product has the potential to replace 25,000 tonnes of plastic coating by 2029.

Highlights

- Xampla was spun out of the University of Cambridge.
- The technology is licensed and produced at scale in the UK and EU.
- Accolades include The Sunday Times Ones to Watch (2025), Capsule Scale-Up 50 (2025), WIRED Trailblazer Award (2024), and the Seal Business Sustainability Award (2022).
- High profile partnerships with major brands include Huhtamaki, Elemis, Britvic, Gousto, and Yili.
- Xampla is B-Corp accredited.

Company: QiO Technologies Ltd

Founder: Rick Haythornthwaite, Baz Khuti

HQ: Egham, Surrey

Operating regions: UK, Europe, North America

TRL: 9

Funding: Series B


Demand reduction through efficiency

QiO has developed Foresight Suite for the industrial sector – a collection of products using IoT solutions to optimise industrial assets and processes. The suite can be deployed rapidly and deliver real outcomes in a matter of days, such as reduced costs, energy usage and carbon emissions, increased productivity and output, and improved uptime.

Foresight can operate on the Edge using real-time data to identify anomalies and provide immediate insights and solutions through closed-loop control that interfaces directly with industrial systems. For businesses that have multiple assets, data can be sent to the cloud, providing a full overview of equipment effectiveness, energy use and carbon savings through customisable dashboards.

Impact

- QiO is committed to sustainable practices and helping manufacturers to meet their ESG goals.
- Through Foresight, QiO aims to enhance energy efficiency, cutting carbon emissions and reducing energy costs by up to 15%.

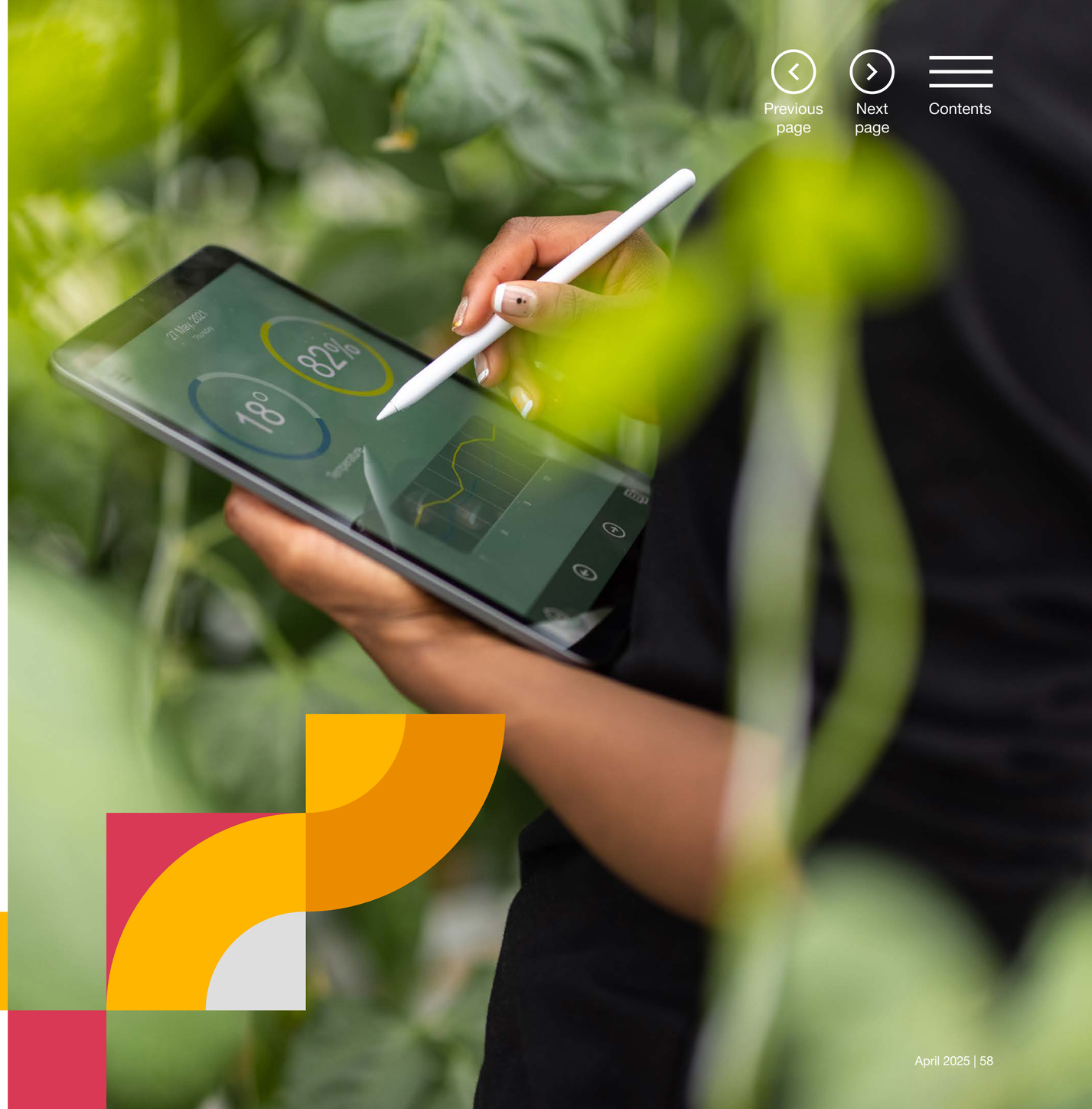
Highlights

- QiO was included in Gartner's Emerging Tech: Techscape for Startups Creating Simulation report and recognised by CIOCoverage as one of the 10 Best Digital Twin Companies to Watch in 2024.
- The company was featured in edie's Green Innovation Trends for 2024.

Built environment

Future50 companies

Biohm
Biozeroc
Grid Edge
Switchee
Seratech
Etopia
tepeo
Concrete4Change
Qflow



3.5 Built environment

% of UK GHG emissions*

20%

UK climate-related VC investment**

£93m

No of start-ups in NZF50

9

The built environment generates 20% of UK GHG emissions* but raised only 10% (£93m) of UK climate-related VC investment** in the 12 months leading to September 2024. The built environment is considered one of the hardest sectors to abate, and significant investment is needed in R&D to close the carbon funding gap and accelerate the decarbonisation of this sector.

Accelerators

Retrofitting: Housing often lacks proper insulation and energy management systems, leading to high utility bills that many inhabitants struggle to afford. This financial strain is driving homeowners to seek ways to improve their home's energy efficiency, thereby reducing their energy costs. Retrofitting of existing housing is also supported by the Social Housing Decarbonisation Fund, and the financial incentives offered under the Renewable Heat Incentive for the installation of renewable heating systems.

Growing population: The government has pledged to construct 1.5 million new homes over the next parliament. This ambitious plan addresses the needs of a growing population but also sets out to integrate advanced climate technologies. The Future Homes Standard, which is set to be implemented in 2025, will ensure new homes produce 75-80% less carbon emissions compared to current standards by integrating technologies such as high-performance insulation, smart energy management systems, and renewable energy solutions.

Industry certifications: BREEAM (Building Research Establishment Environmental Assessment Method) and LEED (Leadership in Energy and Environmental Design) are widely recognised certifications that assess the sustainability of buildings and encourage best practices in design and construction. The increasing adoption of these standards supports investment into the transition to a greener built environment.

Barriers

Alternative construction materials: The construction sector has a significant environmental impact due to its reliance on cement and steel, which are energy intensive to produce and release significant carbon emissions in their production. Low-carbon alternatives such as engineered timber or bio-based materials are emerging, but their adoption is limited due to high costs, scalability challenges and regulatory hurdles. Investors are hesitant due to the perceived risks, long payback periods and unproven performance.

Existing infrastructure: Elements of existing infrastructure, such as gas boilers and insulation, are expensive to remove and entrenched in building design. Retrofitting old buildings to integrate new, green technologies often requires significant modifications which can be highly complex and costly. In the UK, we lack the skilled professionals to retrofit and upgrade buildings to the required energy efficiency standards and the cost-benefit of making a property green is still not attractive enough without better government incentives or other competitive finance.

Planning permissions: Some local authorities do not appear familiar with or supportive of sustainable construction practices and therefore obtaining permission for green building projects can be time-consuming and challenging.

*UK GHG emissions 2023

**This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Growth areas

Building management systems: Smart metering and IoT-enabled energy monitoring systems are becoming increasingly available, along with AI-driven optimisation for company buildings to reduce their operational consumption. Other monitoring systems include digital twin technologies and predictive design tools to improve maintenance and smart grid optimisation for urban infrastructure.

Circularity: Circular economy principles can be applied to the design, construction, operation and end-of-life phases of buildings. This involves (i) using resources efficiently, including energy and using or re-using non-toxic materials, (ii) minimising waste during construction operation and demolition, and (iii) keeping materials in use for as long as possible before recovering, reusing and recycling them at the end of a building's life. Designing and utilising technologies that facilitate this circularity are crucial to the greening of the built environment.

Construction alternatives: Research and development in low-carbon and circular materials such as carbon-neutral concrete, bio-based insulation, recycled steel and 3D printed components is rapidly growing. These solutions are coupled with modular and prefabricated construction techniques to reduce waste and improve efficiency.

Company: Biohm
Founder: Dr Ehab Sayed
HQ: London
Operating regions: UK, Europe
TRL: 6
Funding: Seed/Series A stage

Resource transition

Waste reduction and circularity

Biohm is a nature-led biotechnology company driving decarbonisation through the development and scaling of regenerative solutions and products.

Biohm's Mycelium Insulation Product (MIP) is a bio-based insulation material made from mycelium (the root structure of fungi) and organic waste. It uses a feedstock-agnostic process that breaks waste down into nature's building blocks and then engineers and reconstructs them, along with self-generating mycelial biomass and green additives derived from mycelium. The result is a high-performing insulating material that actively sequesters carbon while meeting or surpassing construction and building industry performance standards in thermal insulation, fire resistance and indoor air quality.

Biohm also strives for social regeneration through a localised production process supporting local job creation and a community profit-share model at each factory.

Impact

- Biohm states that MIP is carbon-negative, sequestering 4.4 kg CO_2e per square metre.
- Insulating an average home with MIP sequesters 0.66 tonnes of CO_2 instead of emitting ~5 tonnes using conventional materials.
- Biohm is aiming for an annual production of 50 million square metres of MIP by 2035, will sequester 220k tonnes of CO_2, avoiding 1.9 million tonnes CO_2 used to make traditional insulation, and diverting 200k tonnes of waste from landfill.

Highlights

- Biohm is B-Corp certified.
- Accolades include Index award winner (2021), Ray Of Hope Prize finalist (2021), two-time Earthshot Prize Nominee, and winner of the Waitrose & Partners Plan Plastic: The Million Pound Challenge.
- Biohm has been featured by the World Economic Forum.

Biozeroc

Company: Biozeroc

Founders: Liv Andersson, Davor Ivankovic

HQ: Cambridge

Operating regions: UK

TRL: 6

Funding: Seed, Innovate UK grants

Resource transition

Biozeroc has developed biotech alternatives to cement and concrete, focusing on carbon sequestration during their manufacture.

The biotech binder is naturally white and complies well with moulds and has minimal shrinkage, making it ideal for high-end architectural applications, including landscaping, facades, worktops and interiors. The products are also produced using cost competitive raw materials which could make the solution viable for commodity applications at scale.

Biozeroc has commissioned several design projects and is currently producing precast products, such as bricks and cast stone paving slabs for commercial applications. The company is also working towards meeting regulatory approval for widespread structural applications.

Biozeroc is setting up a pilot production facility in Cambridge in 2025, and aims to reach commercial scale in 2028.

Impact

- Biozeroc's technology has the potential to reduce both carbon emissions in the production of construction materials and embodied carbon by replacing traditional, carbon-intensive materials.
- Biozeroc's product can also incorporate 100% recycled materials as a feedstock.
- The company is targeting carbon negativity by 2030.

Highlights

- Biozeroc has been selected for the 2023 Cartier Science and Tech Award, and shortlisted for the 2024 Cleantech Group 50 to watch.
- Letters-of-intent are in place with developers as well as cement and concrete manufacturers, such as Commercial Estates Group, Aggregate Industries (Holcim Group) and Ibstock.

Grid Edge

Company: Grid Edge
CEO: Paul McCorquodale
HQ: Birmingham
Operating regions: UK
TRL: 9
Funding: Series A

Digitalisation

Demand reduction through efficiency

Grid Edge empowers commercial buildings to net zero, using data and machine learning to deliver continuous optimisation of carbon and cost across real estate portfolios, seeking to provide a return on investment within 6 months. The platform continually identifies actionable recommendations to reduce carbon and costs without compromising on comfort, with an overall mission to enable grid-interactive energy efficient buildings.

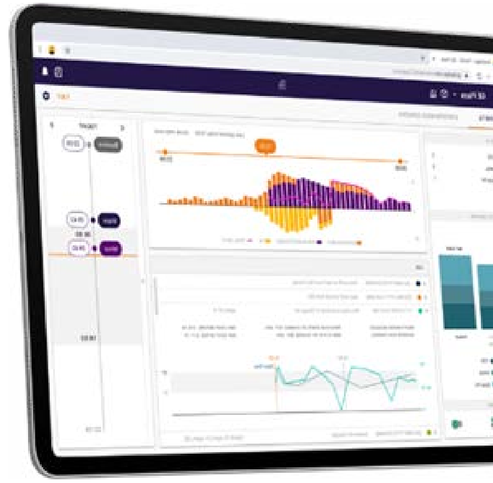
The initial focus is using data to squeeze energy load and accelerate the route to net zero with an end goal of future proofing estates as energy systems become more volatile. Grid Edge is well positioned to leverage its patented flexibility IP when 'time of day' commercial tariffs become widespread. Shifting energy demand to the lowest carbon and lowest cost times of day, without impacting comfort or operational KPIs.

Impact

- Grid Edge estimates up to 150,000 buildings in the UK are large enough to benefit from its technology.
- Decarbonisation potential varies depending on the building use, fabric and existing technologies, but energy savings are typically in the order of 20-40%.

Highlights

- After spinning out of Aston University, Grid Edge secured investment from BP and Centrica to support years of R&D focused on solving the energy challenge.
- The platform is already commercialised with flagship clients including Hammerson's Shopping Centres (which includes Bullring shopping centre, Brent cross, Westquay and Cabot Circus), Amey, Next, OCS, Kings College London, Aston University, and the Royal Opera House.
- Grid Edge is rapidly expanding go-to-market partners to enable faster growth, including international trials.
- Grid Edge has seen growth of nearly 200% in the last 12 months.
- Accolades include V2G Innovation of the Year and Best Innovation Award, Association of Decentralised Energy.



Company: Switchee
Founders: Adam Fudakowski
HQ: London
Operating regions: UK
TRL: 9
Funding: Series A, government grants

- Digitalisation
- Cost out, carbon out
- Demand reduction through efficiency

Switchee is a data and insights company helping social housing providers across the UK transform housing management and improve residents' quality of life. The company has developed a smart thermostat device, which uses sensors to collect valuable data points to deliver remote insights. With real-time intelligence, landlords and local authorities can identify risks like damp and mould, and overheating and resident fuel poverty. This will enable proactive intervention.

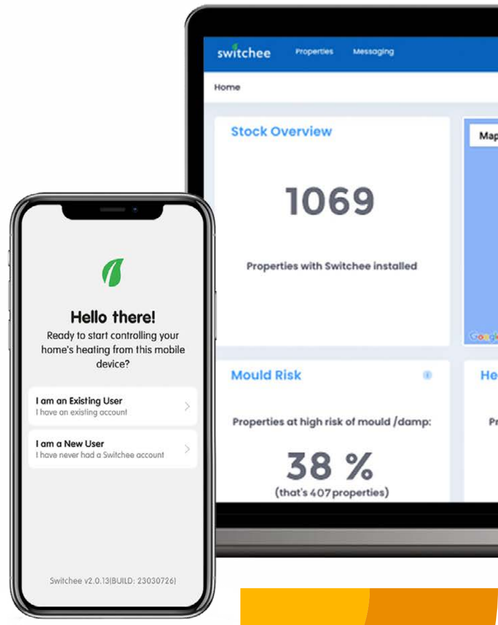
Switchee also provides data to optimise property performance, reduce energy use and measure the impact of retrofit interventions, supporting the improvement of existing housing stock and a data-driven approach to achieving net zero goals.

Impact

- Switchee states its smart thermostat can lower annual heating costs for tenants by up to 17%, with similar carbon savings. It also offers landlords an estimated £180 annual saving per property on management costs.
- Switchee devices collect over 16 billion data points annually, powering the Housing Fuel Poverty Index (HFPI), the first real-time measure highlighting social homes failing to meet the 18°C standard recommended by Public Health England.

Highlights

- Switchee has partnered with AXA IM's Alts' and Octopus Ventures.
- Accolades include the Ashden Award (2017), the Queen's Award (2020), National Energy Efficiency Awards (2023) and Sifted 100 (2024).
- Reached B-Corp status in 2023.
- Switchee also ranked 8th in the hardware category of The Sunday Times 100 Tech, a list of the UK's fastest-growing private technology companies.



SERATECH

Company: Seratech
Founder: Sam Draper, Barney Shanks
HQ: London
Operating regions: UK
TRL: 5
Funding: Seed, government grants

Resource transition

Seratech has developed a carbon-neutral cement using olivine, a type of magnesium silicate rock. The olivine, which is globally abundant, permanently stores CO_2 from direct air capture or industrial sources.

Seratech states that its cement has similar performance characteristics to traditional cement but uses less energy and cheaper feedstocks to produce, providing a viable alternative to traditional carbon-intensive cement in concrete products.

The company is currently developing a pilot plant in collaboration with a specialist in pilot plant engineering. The plant is scheduled to go live in 2025, with an annual production of 1,000 tonnes of Seratech cement.

Impact

- Seratech reports that each tonne of its cement sequesters 0.2 tonnes of CO_2 and replaces one tonne of traditional Portland cement, avoiding another 0.8 tonnes of CO_2.
- Seratech claims its cement cuts embodied carbon by over 95% compared to traditional concrete blocks, and hopes to eventually make its product carbon-negative.
- Storing CO_2 in cement lessens the strain on geological storage solutions and supports growing carbon capture markets.

Highlights

- Accolades include 2022 OBEL Award, 2024 Engineering Matters Awards – Net Zero Champion (Silver), 2024 Engineering Matters Awards – Innovation Champion (Gold), 2024 Innovation Zero Awards – Built Environment Promising Solution.

Company: Etopia

Founder: Joseph Daniels

HQ: London

Operating regions: UK, Saudi Arabia

TRL: 9

Funding: Private funding, government grants

Cost out, carbon out

Etopia has developed a panelised construction system, using patented structurally insulated panels (SIPs), to create energy efficient homes with lower embodied carbon, helping to facilitate the construction industry's transition to net zero.

Etopia's SIPs are highly insulated and lock together to form an airtight structure. For a typical new-build home using Etopia's SIPs, the structure can be assembled and made water-tight within three days, ready for cladding and internal works. Panels come in a variety of stock sizes and are produced at dedicated facilities in Devon.

Etopia has a particular focus on social housing providers who need to build cost-effective new properties at scale.

The system also allows developers to secure green development finance and customers may secure green mortgages.

Impact

- Etopia reports that its SIP panels deliver EPC performance in excess of the requirements for an 'A' rating.
- Etopia says that, operationally, its houses often generate more energy than they use.

Highlights

- Etopia has delivered 200 houses to date and is currently working with Bristol City Council and Lancaster County Council on further home developments.
- Etopia is involved in four large UK frameworks including South West Procurement Alliance, Building Better, Oxford City Council sustainable framework and the Occupational Safety and Health Administration.
- Accolades include Climate Crisis Initiative of the year finalist – Resi Awards (2022), Housing Innovation Award Winner – US DoE (2023), Most Innovative Build Scheme winner – Housing Digital Awards (2024).

tepeo

Company: tepeo
Founder: Johan du Plessis
HQ: Berkshire
Operating regions: UK, Jersey, Ireland
TRL: 9
Funding: Series A, grants including Innovate UK

Cost out, carbon out

tepeo's ZEB is a drop-in low carbon boiler replacement that doesn't require any major reconfiguration of central heating systems. When electricity is greener and lower cost, the ZEB charges a proprietary high-density thermal storage core, which it then uses for central heating when needed (typically at peak times).

The ZEB provides the same heating experience as a standard gas boiler, with flow temperatures of up to 80°C meaning it works effectively with standard radiators. This contrasts with heat pumps, which are most efficient at lower temperatures and must be placed outside, therefore requiring substantial overhauls to central heating systems on installation.

tepeo's algorithms forecast heat demand for each home, optimising electricity usage while providing grid balancing services. tepeo explain that they are positioned to benefit from government support for heat batteries, subject to expected legislative change.

Impact

- tepeo estimates that the ZEB saves around 0.5tCO_2e per year vs. a regular gas boiler and that users can save up to £1.5k per year when using a ZEB vs. a traditional electric boiler.

Highlights

- 180 tepeo-certified installers, with hundreds of units installed since becoming available to the public in January 2022.
- B Corp certified (2024).
- Accolades include the Ashden Award for Innovation (2024).
- Patents granted or pending surrounding the thermal core, measurement of state of charge and thermal release process.

Company: Concrete4Change
Founder: Prof. Sid Pourfalah
HQ: Nottingham
Operating regions: UK
TRL: 6
Funding: Seed, Innovate UK grants

Resource transition

Concrete4Change has developed a concrete additive ('carrier') which mineralises CO_2 allowing it to be sequestered into concrete in a controlled manner with zero leakage. Its patented CO_2 carrier is mixed into the concrete, either wet or dry, and slowly releases CO_2 into the concrete where it binds with the cement.

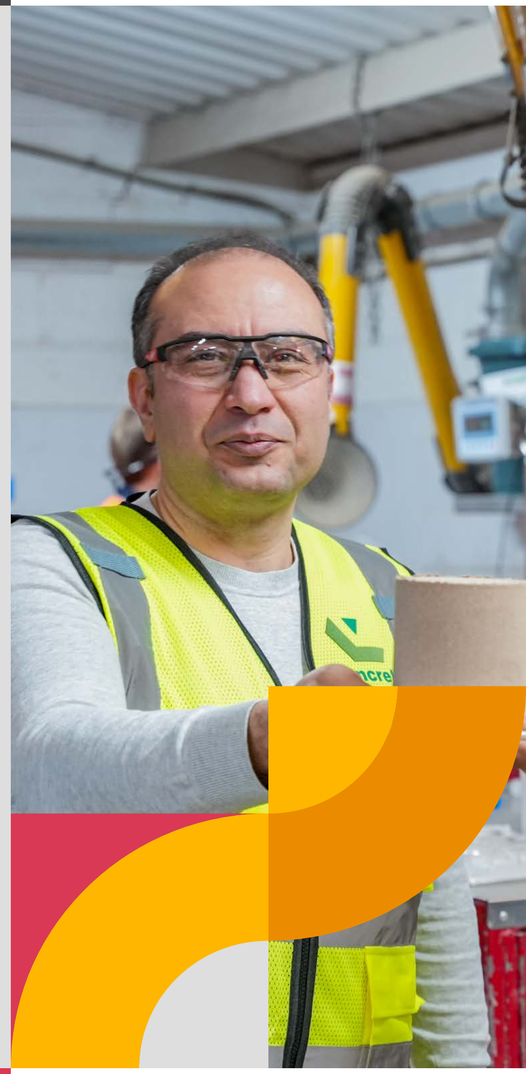
Concrete4Change's process not only permanently sequesters the CO_2 but also makes the concrete stronger, minimising the amount of cement required. The carrier can be produced from waste precursor and be charged with CO_2 from the flue gases emitted during cement manufacture. Using less cement in concrete can reduce costs and lower environmental impact.

Impact

- Concrete4Change says its carrier enables the sequestration of 50kg of CO_2 per m3 of concrete. Alternative technologies generally involve bubbling CO_2 through concrete or curing it in a CO_2 rich environment, which is considered less effective and allows more CO_2 to escape.

Highlights

- Major trial ongoing with Goldbeck (a large producer of pre-cast concrete in Europe), with ambitions to deploy in 2027.
- Trials with other major manufacturers, including Siam Cement Group and Holcim.
- Accolades include UNCOP26 Most Innovative Net-Zero Technology and EUTEC Sustainable Design Goal Award. Also Top 50 start up by Cemex and Fastest Growing Hard-Tech Startup UK 2024.



Qflow

Company: Qflow

Founders: Brittany Harris and Jade Cohen

HQ: London

Operating regions: UK, US, Australia

TRL: 9

Funding: Series A

Digitalisation

Demand reduction through efficiency

Qflow is a data insights platform designed for the construction industry, enabling smarter decision-making, enhanced sustainability, and reduced costs. By capturing and analysing material and waste data, Qflow delivers real-time insights to ensure cost efficiency, quality compliance, and long-term embodied carbon and resource optimisation.

Qflow's tool is specially designed for onsite use, allowing users to scan materials delivery and waste tickets via the app. Qflow audits these in real-time, checking materials for certifications like FSC for timber and ISO141001 for suppliers. For waste, Qflow checks for the 9 Duty of Care points required by the Environment Agency.

The data collected by Qflow is also analysed and used to generate an actionable sustainability report to track and mitigate carbon emissions, fostering improved supply chain engagement and compliance.

Impact

- Qflow states that it has captured 75,000 material and waste movements, which it estimates has avoided approximately 10,000 tonnes of CO_2e.
- Qflow says businesses using its technology save on average about £220,000 annually per project through reduced materials and waste fees.

Highlights

- Qflow has already been deployed on major projects such as HS2, RiverLinx, and TEAM2100, with major contractors including Bouygues and Wates, and on large estates like those managed by Grosvenor.
- Accolades include the People's Prize at the Alliance for Sustainable Building Products Awards, Innovation of the Year for Engineering Talent Awards, AI Global Excellence Award and Technology Businesswomen of the Year for Great British Businesswomen Awards.
- Qflow is a start-up member and advisor of the UK Green Building Council.

Greenhouse gas capture, removal and storage

Future50 companies

CCU International
Mission Zero Technologies
Straw Innovations
Black Bull Biochar
Seafields Solutions

3.6 GHG capture, removal and storage

% of UK GHG emissions

n/a

UK climate-related VC investment*

£57m

No of start-ups in NZF50

5

Greenhouse gas capture, removal and storage is essential in the transition to a low-carbon economy. Carbon capture, usage and storage (CCUS) is one of the most viable decarbonisation pathways for hard-to-abate sectors, such as industrial manufacturing and construction. Despite overall reductions in deal activity over the last few years, UK climate-related VC investments in this area have grown.

Accelerators

Funding: The UK's ambition to reach net zero by 2050 requires significant investment in CCUS technologies. The UK has pledged £22bn over 25 years for CCUS projects around industrial clusters, such as Merseyside and Teesside, where infrastructure and costs can be shared and CCUS implemented at scale. These projects are expected to attract £8bn in private investment and capture 8.5bn tonnes of CO_2 per year by 2028.[21] In addition, several UK institutions and universities are at the forefront of CCUS research and development, making CCUS technologies increasingly efficient and cost effective.

New applications: There has been an increase in use cases for stored carbon. Traditionally, stored carbon has been used in oil recovery or sequestered underground. However, new applications for captured carbon are emerging across a range of sectors including agriculture to improve soil health, in the development of materials, fuels and carbon-neutral chemicals, and even in the food and beverage industry.

Shared infrastructure: The emergence of shared pipeline infrastructure and hubs is accelerating investment into CCUS. By allowing multiple companies to share the costs of building and maintaining pipelines, these initiatives promote faster implementation, increased utilisation, flexibility, and resource efficiency. As a result, project costs for individual companies can be significantly reduced.

Barriers

Regulatory ambiguity: Many CCUS projects are being delayed until the regulatory frameworks that will manage carbon capture operations are finalised, and the ambiguity over timescales, availability of carbon allowances and carbon pricing is reduced so that investors can better forecast returns. CCUS technologies are very expensive and demand a high carbon price or strong incentives to make the economics work.

Value chain: For carbon capture to be successful, there needs to be a well-functioning value chain – from capture, to transport, to storage. If one party isn't making money, the whole eco-system could fall apart. On the other hand, there is a chance that affordable CCUS solutions could invalidate the necessity of other climate tech solutions. For example, the price of CCUS may set the overall ceiling for many decarbonisation technologies.

Energy consumption: Solutions such as Direct Air Capture (DAC) are very energy intensive as CO_2 concentration (400ppm) is very low in the atmosphere. Therefore, DAC is reliant on the availability of low-carbon energy sources to make it a viable decarbonisation pathway.

Leakage: Poor site selection, injection well failures and seal failures faults/fractures can all lead to leakage of compressed carbon which presents a risk to human and environmental health.

Greenwashing: CCUS forms a significant part of the emissions reduction roadmap of many oil giants, often at the expense of reducing carbon production. In addition, the captured CO_2 is used to enhance oil recovery resulting in further emissions.

21. Global CCS Institute, "UK Commits to £21.7 Billion to Advance Carbon Capture Projects, Aiming to Become a Global Leader in CCUS and Hydrogen."

*This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Growth areas

Growing innovation: Innovative CCUS technologies are expanding the range of options available for various business purposes. These include Direct Air Capture (DAC), which removes carbon from the atmosphere using solid sorbents or liquid solvents, and point-source capture, which captures emissions directly at their source – either pre- or post-combustion. Examples of point-source capture include capturing emissions from the flue gases of power plants and industrial processes.

Nature-based solutions: Some CCUS innovations focus on harnessing natural carbon sinks such as seaweed, algae and crops, and then developing technologies (including bioreactors) to refine and utilise the carbon captured in an environmentally friendly manner.

Digital solutions: The use of monitoring technologies, including seismic monitoring and satellite imaging, and verification technologies enabled by AI and the IoT, helps ensure that a project/site isn't releasing carbon and generally increases the safety of CCUS projects. This helps new users to obtain permits and comply with regulations, reducing investor concerns around liabilities.

Company: CCU International

Founder: Beena Sharma

HQ: Edinburgh

Operating regions: UK, Asia and Middle East

TRL: 7-8

Funding: Innovate UK grant

Resource transition

CCU International has developed compact, modular and scalable carbon capture technology for use by industrial emitters, applicable to any chimney, exhaust or flue stack. It can capture CO_2 and refine it to any purity levels for storage or reuse in industries like food and beverage, construction, or chemical and fuel production. This capability is due to the use of pressure swing adsorption technology, which avoids hazardous chemicals.

CCU International aims to create a circular carbon economy by integrating its solutions into existing industrial processes, enabling emitters to reduce reliance on virgin fossil fuels while generating economic returns.

Impact

- CCU International estimates that its technology achieves carbon efficiency rates (the ratio of captured carbon to the carbon used in the capture process) of 91% when using grid energy and 99.5% or higher with renewable energy.
- CCU International's ambition is to scale over the next 10 years and capture a minimum of 5 million tonnes of CO_2.

Highlights

- CCU International has had three successful trial deployments to date, including working with Unilever to capture and refine CO_2 from paper mills to be used in detergent products.
- Accolades include the AccelerateHer Environment Award (2023), FSB UK Innovation Award (2024), FSB Small Business of the Year Award (2024), and and Startup of the Year iChemE Award (2024).

Mission Zero

Company: Mission Zero Technologies

Founders: Nicholas Chadwick, Shiladitya Ghosh, Gaël Gobaille-Shaw

HQ: London

Operating regions: UK, Canada

TRL: 9

Funding: Series A, Various grants

Resource transition

Mission Zero Technologies develops compact, modular direct air capture (DAC) systems to capture and purify atmospheric CO_2 for industrial use, offering carbon-based industries a circular, sustainable carbon source. By employing existing, proven technologies, the company provides a stable CO_2 supply using only water and electricity, while recovering CO_2 from the air.

In the UK, most industrial CO_2 comes as a byproduct from ammonia production, which is reliant on natural gas, leading to fluctuating costs and availability. Mission Zero Technologies aims for a CO_2 price of $350 per tonne, aligning with standard industrial CO_2 prices.

Target customers include construction materials (creating urban carbon sinks), synthetic fuels such as sustainable aviation fuel, and carbon removal project developers. Food and beverage applications require additional purification.

Impact

- Mission Zero Technologies' DAC systems reduce the amount of CO_2 in the atmosphere and the demand for virgin fossil fuels in some of the most carbon-intensive, hard-to-abate industries.

Highlights

- Mission Zero Technologies has delivered the UK's first operational DAC system, and has several other projects underway with the UK government and international customers.
- Accolades include Europas 100 Hottest Tech Startups and Hottest Series A Startup, and XPRIZE Top 100.

straw INNOVATIONS

Company: Straw Innovations

Founder: Craig Jamieson

HQ: Hertfordshire

Operating regions: UK, Philippines, Indonesia, India

TRL: 7

Funding: Innovate UK Energy Catalyst

- Waste reduction and circularity
- Resource transition
- Nature-based solution

Greenhouse gas emissions from burning or decomposing rice straw are estimated to be higher than those from the entire global aviation industry and equivalent to emissions from all other crops combined, totaling 1 gigatonne of CO_2e per year. Straw Innovations has developed an innovative harvesting system to reliably remove rice straw from waterlogged fields in Asia, where normal farm equipment doesn't work. In addition, Straw Innovations are now developing a refinery to convert it from a pollutant into biochar, a carbon-capturing fertiliser.

Straw Innovations set up its first refinery in 2019 and state that it is now scaling up to a facility with a capacity of 10,000 tonnes per year, with plans to reach 100,000 tonnes. The company recently met with leaders of local rice farming communities covering 30,000 hectares who supported the vision and signed a collaborative agreement.

To further boost CO_2 capture, Straw Innovations are also exploring enhanced rock weathering, which involves spreading ground basalt rock on fields for capture through chemical reaction.

Impact

- By removing rice straw, Straw Innovations says that emissions from burning or rotting can be reduced by half to 500mt CO_2e per year, and that a further 1-3 gigatonnes of CO_2 per year could be captured and stored from the straw. This could transform rice production into the world's largest engineered carbon sink.
- Straw Innovations help rice farmers to increase their incomes through increased yields and mechanisation, partially subsidised by selling credits for carbon dioxide removal.

Highlights

- Accolades include being selected by investors for the 'Diamond List' of 60 top climate tech startups globally (2022), Tech Nation Rising Stars finalist (2024) and Engineering Matters Awards Sustainability Champion (Silver, 2024).
- Straw Innovations have partnered with UK company Koolmill who have developed an energy-efficient rice mill and innovative business model, and are also working with Puro Earth and Isometric on the certification of carbon credits.

BLACK BULL BIOCHAR

Company: Black Bull Biochar
Founders: Alex Clarke, Hamish Creber
HQ: London
Operating regions: UK
TRL: 8
Funding: Equity and Government grants

Resource transition

Black Bull Biochar (BBB) utilises biochar, an effective carbon removal method, to produce tailored products that integrate seamlessly into existing farm management systems, helping farmers to improve crop yields and minimise emissions. The process of making biochar (pyrolysis) generates excess renewable heat, which BBB uses to help decarbonise industrial sites. The biomass used to feed the process is sustainably sourced UK sawmill residues, such as woodchip.

BBB's flagship product, PinChar, is a biochar additive for organic fertiliser that enhances nutrient retention and reduces greenhouse gas emissions during storage. When used in livestock bedding, PinChar improves conditions by reducing bacteria and ammonia while increasing the fertilising value of farmyard manure.

BBB leverages carbon finance through the sale of high-quality carbon removal credits. To ensure transparency, they are developing a unique software solution that enables slick, efficient operations and data collection for Monitoring Reporting and Verification (MRV).

Impact

- BBB reports a carbon removal capacity of 1,500 tonnes of carbon annually, with plans to scale-up to 48,000 tonnes per year by 2030.
- BBB's independent biochar trials have resulted in a year-on-year 16% increase in grassland yield and improvements in soil quality.
- Heat generated from the pyrolysis biomass process can be repurposed for on-site diversification of industrial energy supply.

Highlights

- BBB is one of the first companies in the UK to be European Biochar Certificate (EBC) certified.
- BBB is partnered with major organisations including Arla Foods, Ahlstrom, Avara Foods and dss+ Consulting.
- Partnerships with research institutions such as the University of Edinburgh, the UK Centre for Ecology & Hydrology (UKCEH) and Scotland's Rural College (SRUC) have been formed to advance biochar technology and applications.

Seafields

Company: Seafields Solutions

Founders: John Auckland, Sebastian Stephens, Erick Contag, Randall Purcell, Richard Wills

HQ: London

Operating regions: UK, Caribbean

TRL: 6

Funding: Seed, Various grants

Resource transition

Waste reduction and circularity

Seafields has developed AlgaePonix, modular floating farms designed to collect, manage and grow Sargassum seaweed. Sargassum seaweed is particularly efficient at sequestering carbon, and Seafields aims to scale and commercialise its farming efforts, drawing revenue both from seaweed sales as a feedstock for industry and carbon credits generated.

AlgaePonix is designed for use in the Caribbean, where Sargassum has proliferated due to oceanic warming. It causes issues for fisherfolk and can accumulate on beaches, where it rots and produces methane.

By intercepting and managing these blooms, Seafields mitigates these issues, sequesters carbon, and produces a valuable feedstock to replace fossil fuels. Seafields intends to develop a sister technology to farm Sargassum in the South Atlantic gyre.

End products produced using seaweed include agricultural biostimulants, bioplastics, biofuels, vegan leather and biochar.

Impact

- Sargassum is a floating seaweed, which means it can be grown in the open ocean as well as shallow coastal sites. This should make it easier to scale, improving its carbon sequestration potential.
- Seafields says that using Sargassum instead of fossil fuels and preventing methane emissions from decomposing seaweed bolsters carbon reduction efforts, but requires careful ecosystem management.
- Seafields long-term aim is to mitigate a gigatonne of carbon annually.

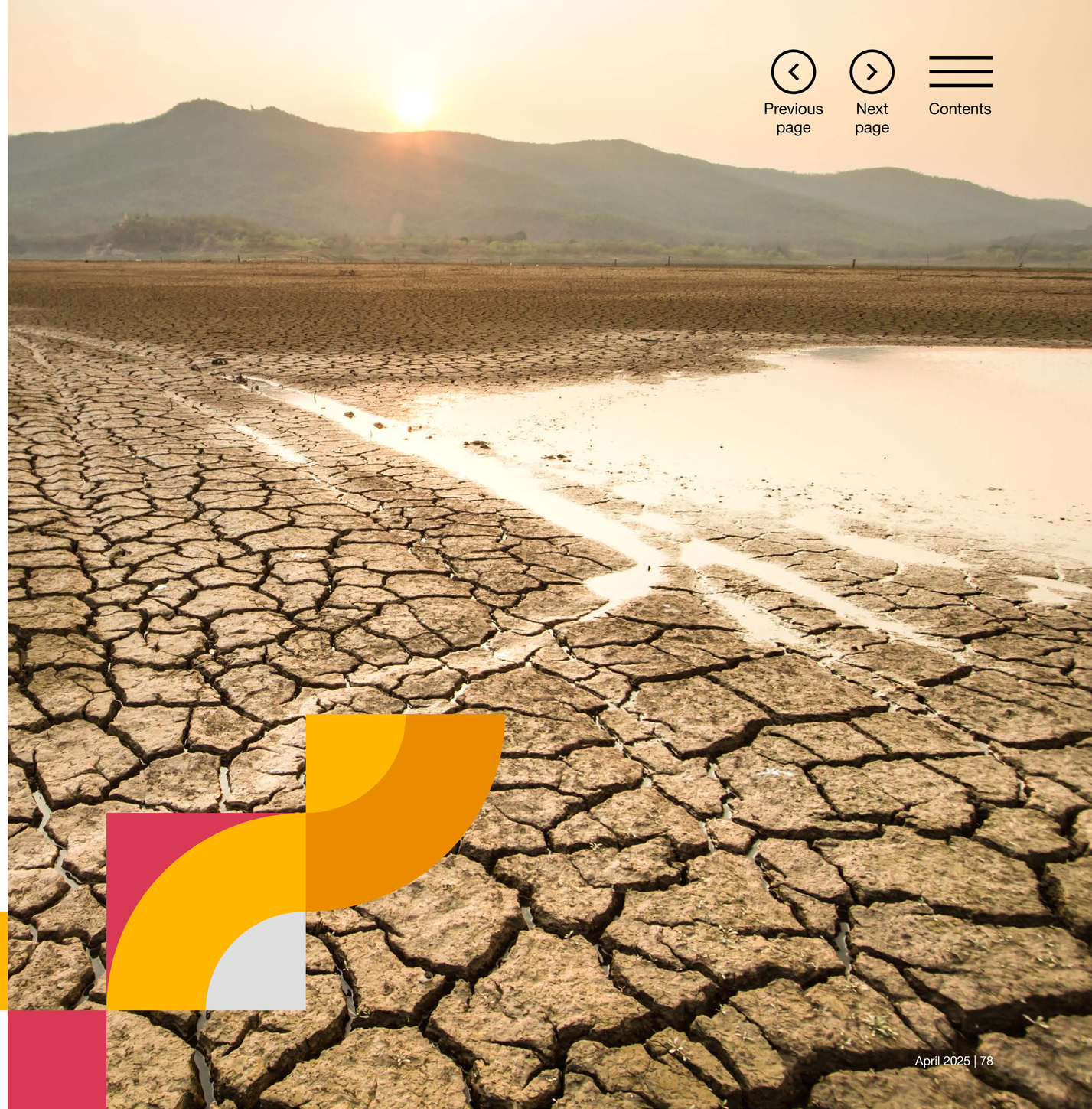
Highlights

- Successful trials of proprietary AlgaePonix technology and a pilot farm have been conducted in St Vincent and the Grenadines.
- Seafields has partnerships with potential off-takers, including MacroCarbon and Carbonwave.
- Accolades include SeedLegals 2024 Start-up of the Year, runner up in XPRIZECarbonRemoval finals and selected by Coldplay as a recipient of funds generated for sustainability causes from their ‘Music of the Spheres’ tour.

Climate change management and reporting

Future50 companies

Neutreeno
EarthSense
Quosient (trading as Earth Blox)



3.7 Climate change management and reporting

% of UK GHG emissions

n/a

UK climate-related VC investment*

£69m

No of start-ups in NZF50

3

Climate change management and reporting involves technologies that support GHG data and enhanced sustainability reporting. Improvements in data and reporting help drive further emissions reductions. Over the past 12 months, there has been significant investment in AI-driven technologies, highlighting the growing emphasis on technological solutions in reporting.

Accelerators

Alphabet soup: The term "alphabet soup" is sometimes used to refer to the multitude of sustainability reporting standards, frameworks, and guidelines that exist today. While these are increasingly being adopted, the Corporate Sustainability Reporting Directive (CSRD) has raised the bar by imposing more detailed and comprehensive reporting requirements. This directive aims to ensure that sustainability information is relevant, comparable, and reliable. The CSRD came into force in 2023 and is being rolled out in phases. Large public-interest companies will be required to report for the first time in 2025, covering the 2024 financial year. The CSRD reports are subject to limited assurance.

Stakeholder pressure: Stakeholders are increasingly demanding transparency and accountability in this area. Investors require robust sustainability reports to help inform both investment decisions and manage the long-term risks and opportunities associated with their investments. Other stakeholders, including customers, employees and communities, are demanding greater transparency including progress versus net zero targets.

Risk management: Sustainability reporting aids companies in managing various risks, including climate risk, and in safeguarding their reputations. By developing and communicating effective strategies, businesses can ensure long-term resilience, maintain a competitive advantage, and attract and retain employees, customers, and business partners.

Barriers

Proposed omnibus: If implemented as proposed by the European Commission, the recent Omnibus proposal will postpone the application of all CSRD reporting requirements for companies due to report in 2026 and 2027. This change will significantly reduce the number of companies captured by the Directive and scale back certain reporting obligations for in-scope companies. The Omnibus proposal also amends compliance requirements associated with the Corporate Sustainability Due Diligence Directive (CSDDD) and CBAM, among others. These changes may result in companies reducing focus and investment on climate change management and reporting in the short term.

Resource constraints: Sustainability reporting can be resource-intensive, requiring significant time and effort. Some organisations lack the capacity, knowledge, skills and expertise needed to collect, analyse and report sustainability data effectively.

Data management: Accurately tracking and measuring GHG emissions can be challenging and may require investment in special equipment. Other data-related challenges include gathering accurate data from suppliers to support scope 3 emissions reporting and aligning sustainability metrics with financial performance indicators.

Growth areas

Big data: Advanced data management and reporting tools are becoming increasingly important for supporting sustainability reporting. IoT devices can collect real-time data on emissions, air quality, energy consumption, and more, while blockchain technology can enhance transparency and traceability of sustainability data.

Emissions footprinting: Carbon footprint calculators can assess both direct and indirect emissions from various sources, such as fuel and electricity usage data and raw materials purchasing data. By applying appropriate emissions factors, these tools can calculate the carbon footprint of business activities, even across complex supply chains.

Climate risk: As climate change leads to more intense weather events, understanding the potential risks and quantifying their impact is essential if society is to successfully adapt. Technologies in this area range from mapping geographical locations of business operations to predictive risk assessments based on expected climate and regulatory changes.

Actionable insights: Reporting technologies are expanding to offer suggested actions businesses can take to reduce their emissions, thereby increasing their value. This helps companies to derive more value from their reporting, using it to help guide emission-reducing actions.

*This reflects global VC investment into UK climate tech companies for the 12 months to Sept-24 [ref, PwC State of Climate Tech]

Company: Neutreeno

Founder: Spencer Brennan

HQ: Cambridge

Operating regions: UK, Europe, North America, Asia

TRL: 9

Funding: Seed

Digitalisation

Neutreeno's software, pioneered by University of Cambridge scientists, enables large enterprises to quantify and reduce Scope 3 emissions while improving resource and cost efficiency.

By mapping global supply chains with primary data, mass balancing, and scientific uncertainty modelling, it pinpoints the critical variables driving carbon emissions and provides direct reduction levers across thousands of suppliers. Neutreeno explains that this delivers two key advantages: faster, more precise measurements at lower costs than traditional LCA methods, and custom, actionable decarbonisation interventions for suppliers.

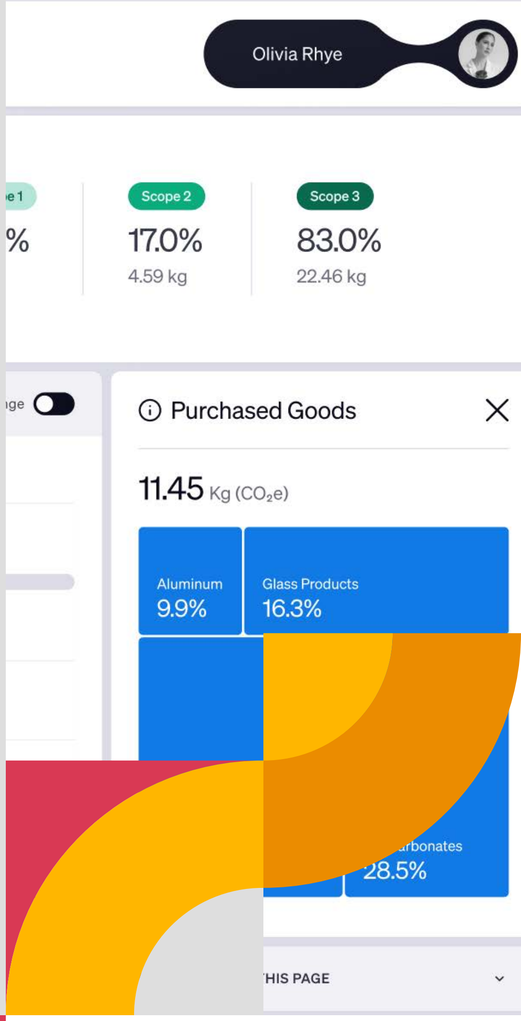
Neutreeno's system enables companies to prioritise high-impact strategies that optimise costs and carbon while tracking progress throughout their supply chain.

Impact

- Neutreeno has uncovered significant emissions reduction and efficiency gains for enterprise suppliers. In a recent implementation, Neutreeno notes that its system automatically identified targeted actions that transformed product designs, procurement practices, and production processes – delivering 41% emissions reduction, 80% energy savings, and €1.6 million in cost reductions for the customer.

Highlights

- Neutreeno is already contracted with major consumer brands, including some of the world's largest, blue-chip companies.



Company: EarthSense
Founders: Roland Leigh, Tom Hall
HQ: Leicester
Operating regions: UK, Global
TRL: 9
Funding: Primarily debt funding

Digitalisation

EarthSense specialises in air quality measurement, mapping and visualisation. Its Zephyr sensors measure 13 different pollutants and transmit information to a cloud ecosystem where customers can analyse their data through the MyAir web app.

EarthSense has also developed a proprietary global air quality model, MappAir, which can help users understand the current and forecast pollution levels and the key emissions sources on a localised basis.

EarthSense states that its combination of hardware, modelling and software provides a complete solution, versus other solutions that commonly only specialise in one of these aspects.

This allows organisations to assess the impact of their emissions mitigation strategies in real-time, helping them to adapt strategies efficiently to meet environmental targets.

While the majority of its customers are in the UK, EarthSense is expanding internationally with particular uptake in South Africa, India and the Middle East.

Impact

- EarthSense says that providing high-resolution air quality monitoring and predictive modelling enables cities, businesses and policymakers to make data-driven decisions around investments to reduce emissions – including implementation of public transport, low emission zones and other green infrastructure.
- EarthSense also assess historic exposure to pollution and future health risks, contributing to cleaner air and real improvements to people's lives.

Highlights

- EarthSense are supplying approximately 60% of local authorities, and are working with government on air quality regulations.
- Accolades include the Queen's Award for Enterprise (Innovation), FSB Environmental Award, and recognition as an EliteBusiness Top 100 SME, among other awards.

EARTH BLOX

Company: Quosient (trading as Earth Blox)

Founders: Dr. Genevieve Patenaude, Ben Butchart, Sam Fleming, Prof. Iain Woodhouse

HQ: Edinburgh

Operating regions: UK

TRL: 9

Funding: Currently raising Series A, Innovate UK and other grants

Digitalisation

Earth Blox is a software platform offering insights into the dependencies and impacts of facilities and assets on nature and climate for major banks, consultancies and companies worldwide. By reducing analysis time and the need for specialists, Earth Blox offers a more efficient and cost-effective solution.

The platform is a flexible tool that adapts to varying levels of location-specific knowledge, ensuring transparency and auditability for replicable results.

It aggregates data from multiple sources, including satellite constellations, to deliver robust risk assessments, trace products to an estimated source location using production data and provide actionable insights for businesses and their supply chains.

Users can access pre-made packages, upload locations and run the software. Alternatively, packages can be customised to meet specific company needs, or companies can even create their own workflows using Earth Blox's modular product builder.

Impact

- Earth Blox aims to accelerate decarbonisation and the transition to nature-positive activities by providing actionable insights for businesses and their supply chains.
- The platform helps companies comply with various regulations such as CSRD, TNFD, and EUDR.

Highlights

- Earth Blox was selected as one of Google's 36 sustainability partners of choice, with the product available on Google Marketplace as well as HSBC's supplier portal.
- Accolades include awards with Tech Nation, Converge Challenge, Scottish Edge, European Space Agency and Royal Society of Edinburgh.
- Key customers include CitiBank and Shell.
- It is ISO 27001 certified.

04 Where they are now

Our original Net Zero Future50 report was published in 2022. We caught up with some of that cohort – here's what they're up to now.

ZEROAVIA | greyparrot | vertical future | Notpla Disappearing Packaging

ZeroAvia

ZeroAvia has achieved significant advancements in hydrogen-electric propulsion over the past two years. The company has successfully tested its ZA600 powertrain on a Dornier 228 aircraft and is working towards certification for commercial use in 9–19 seat aircrafts by 2026.

ZeroAvia has also established its first manufacturing facility in Washington State and is currently setting up another manufacturing facility in Scotland, with support from the Scottish National Investment Bank.

Key partnerships include serving as Ecojet's engine supplier, an agreement with American Airlines to acquire 100 engines, and collaboration with Alaska Airlines to fly the world’s largest zero-emission aircraft. ZeroAvia has also raised $150 million in Series C funding with contributions from major investors such as Airbus, American Airlines and the National Wealth Fund.

ZeroAvia was recognised by TIME magazine as one of the best inventions of 2024.

Greyparrot

Since featuring on the PwC Future50 in 2022, Greyparrot has seen exponential growth. After raising $11 million in Series A funding to develop its AI waste analytics technology, it secured a $500,000 investment from Amcor’s circular economy Lift-Off programme.

Greyparrot announced a strategic partnership with Bollegraaf, one of the world’s largest plant builders, in 2024. The $12.8 million collaboration will drive the largest-ever deployment of AI in the waste sector’s history, retrofitting global sorting facilities with Greyparrot Analyzer – the company’s AI waste analytics system.

Greyparrot’s AI is unique in its ability to identify the brand and stock-keeping unit of waste objects, calculating the real-world recyclability of specific products. Last year, the company began using that insight to help multinational packaged goods brands, packaging producers and materials science companies design more resource-efficient products. In 2024 alone, Greyparrot identified over 40 billion waste objects, with its Analyzer system active in 55+ facilities across 20+ countries. Their customers are amongst the world’s largest waste management organisations, including Veolia, Biffa and USA Waste and Recycling.

Greyparrot was recently named as a finalist in the UK government’s first-ever Manchester Prize for AI innovation and was recognised as one of Fast Company's Most Innovative Companies of 2025.

Vertical Future

Vertical Future has significantly advanced its technology and algorithms over the past two years, enhancing its model for designing, manufacturing, and deploying advanced automated systems in the controlled-environment agriculture (CEA) sector.

The company’s systems have extended beyond simply growing food to include other applications, such as space exploration. Partnerships have been formed with Axiom Space, the ARC Centre of Excellence in Plants for Space, South Australian Space Industry Centre, Saber Astronautics, the University of Western Australia, the University of Adelaide, the University of Cambridge, and the University of Southern Queensland to develop autonomous agriculture systems for space missions. Its growing systems are set to be used on Axiom Space's first commercial space station as early as late 2026.

Vertical Future also has a long-term partnership with the World Economic Forum, with the World Economic Forumand and other affiliates, actively leading and participating in global conferences and climate summits.

Vertical Future raised £21 million in a 2022 Series A funding round, a further £10m a year later and secured major strategic partnerships across 2024.

Notpla

Notpla secured £20m in its 2024 Series A+ funding round, to support the continued roll-out of its seaweed-based packaging solutions.

The company has replaced 17.5 million single-use plastic items to date. In 2023, its coating technology was the only solution recognised as plastic-free by the Dutch government under the EU's Single-Use Plastic Directive.

Major corporations like Levy (part of Compass Group) and Just Eat Takeaway.com, as well as venues like The O2 Arena, have adopted Notpla’s solution. The company has been highly recognised as an Earthshot Prize Winner obtaining support from Prince William.

05 What's next?

Technology alone cannot solve the climate challenge. Achieving meaningful progress requires the right environment, supportive teams, government backing, investors, advisors, and engaged customers, all working together as part of broader systemic change.

Our research shows that innovation is alive and well in the UK – making it difficult to narrow our selection down to just 50 companies. From redefining our relationship with the grid, to taking the carbon out of concrete, these start-ups embody determination, passion, and a drive for progress. We hope you have enjoyed getting to know them as much as we did, and that some of them have resonated with you.

While we take a human-led approach in everything we do, our AI-powered net zero accelerator provides the technical power needed to navigate the complex climate tech market, helping to identify the right net zero suppliers, partners, or M&A targets for your business. Whether you're a start-up looking to expand your reach, an investor seeking new opportunities, or an industry leader looking to futureproof your business, please get in touch to see how we can help.

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PwC's Net Zero Future50 includes a selection of companies that illustrate the opportunity to decarbonise across all sectors, but is neither exclusive nor exhaustive. The company information has been derived from publicly available sources and discussions with management. PwC has not independently verified any of the company information.