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Energy Security
& Net Zero

Market assessment - UK venture capital market for early-stage clean tech companies

Final Report

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Abbreviations

AI: Artificial intelligence

ARIA: Advanced Research and Innovation Agency

ARPA: Advanced Research Projects Agency

AuM: Assets under Management

BBB: British Business Bank

BCG: Boston Consulting Group

BEIS: The Department of Business, Energy & Industrial Strategy (a predecessor to DESNZ)

BSI: British Standards Institution

CAGR: Compound annual growth rate

CBILS: The Coronavirus Business Interruption Loan Scheme

CCUS: Carbon capture, usage and storage

CIF: Co-investment fund

COP26: 26th United Nations Climate Change Conference of the Parties

DARPA: Defense Advanced Research Projects Agency

DESNZ: Department of Energy Security & Net Zero

EEF: Energy Entrepreneurs Fund

EIF: European Investment Fund

EIS: Enterprise Investment Scheme

ESG: Environmental, social and governance

EU: European Union

FCA: Financial Conduct Authority

GBP: Pound sterling

GDP: Gross domestic product

GHG: Greenhouse gas(es)

IMF: International Monetary Fund

IPCC: Intergovernmental Panel on Climate Change

IPO: Initial public offering

LCIF: London Co-Investment Fund

LE: London Economics

Ofgem: The Office of Gas and Electricity Markets

ONS: Office for National Statistics

PRI: Principles for Responsible Investment

PwC: PricewaterhouseCoopers

R&D: Research and development

SDR: Sustainability Disclosure Requirements

SEIS: Seed Enterprise Investment Scheme

SMEs: Small and medium-sized enterprises

STEM: Science, technology, engineering and mathematics

TCFD: Taskforce on Climate-Related Financial Disclosures

TRL: Technology readiness level

UK: United Kingdom

UKBAA: UK Business Angels Association

UN: United Nations

US: United States

USD: United States Dollar

VC: Venture capital

WEO: World Economic Outlook

Glossary

Business angel: ‘a private individual, often with a high net-worth, and usually with business experience, who directly invests part of their assets in new and growing private businesses’.¹

Capitalisation (‘cap’) table: a table summarising the equity ownership of a company.²

Clean tech: technology which enables economic activity to deliver goods and services while generating significantly lower emissions of greenhouse gases.

Convertible loan: ‘a loan which will either be repaid or, in most cases, convert into equity at a future date’.³

Crowdfunding: ‘a way of raising money to finance projects and businesses [that] enables fundraisers to collect money from a large number of people via online platforms’.⁴

Dry powder: the amount of committed but unallocated capital that a venture capital or private equity firm has.⁵

Government funds: these are funds that are capitalised using public money that is disbursed by local/regional/devolved/central government and are managed by either public or private organisations⁶.

Initial public offering: the process by which a privately-owned company lists its shares on a stock exchange for the first time.⁷

Patient capital: long-term investment in innovative firms to facilitate their scaling up.⁸

Regulatory Sandbox: A regulatory sandbox is a ‘safe space’ in which businesses can test innovative products, services, business models and delivery mechanisms without immediately incurring all the normal regulatory consequences of engaging in the activity in question. The regulatory sandbox allows firms to test innovative propositions in the market with real consumers.⁹

¹ European Commission (n.d.), ‘Business angels’. Available at https://ec.europa.eu/growth/access-finance-smes/policy-areas/business-angels_en.

² DLA Piper (2017), ‘Capitalization table fundamentals’. Available at <https://www.dlapiperaccelerate.com/knowledge/2017/capitalization-table-fundamentals.html>.

³ Brodies LLP (2020), ‘Convertible Loans: key terms, advantages and disadvantages’. Available at <https://brodies.com/insights/corporate/convertible-loans-key-terms-advantages-and-disadvantages>.

⁴ European Commission (n.d.), ‘Crowdfunding explained’. Available at https://ec.europa.eu/growth/access-finance-smes/guide-crowdfunding/what-crowdfunding/crowdfunding-explained_en.

⁵ Pitchbook (2021), ‘What is dry powder in private equity?’. 8th July 2021. Available at <https://pitchbook.com/blog/what-is-dry-powder>.

⁶ Definition from Beauhurst Glossary

⁷ Ashford, K. and Schmidt, J. (2021), ‘What Is An IPO?’. Forbes Advisor, updated 25th August 2021. Available at <https://www.forbes.com/advisor/investing/initial-public-offering-what-is-an-ipo/>.

⁸ HM Treasury (2017), ‘Financing growth in innovative firms: consultation’. August 2017. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/642456/financing_growth_in_innovative_firms_consultation_web.pdf.

⁹ See <https://www.fca.org.uk/firms/innovation/regulatory-sandbox>

Seed round: the first formal round of equity investment with institutional participation a company receives after the use of the founders' funds and the friends and family round.¹⁰

Series A round¹¹: the first large round of venture capital investment a company receives.¹² Venture/Series A funding rounds typically follow seed funding rounds.

Venture capital: a form of equity financing for early-stage innovative businesses.

Databases

The analysis contained in the report mostly makes use of the following data sources:

Beahurst

Beahurst (www.beahurst.com) is a searchable database of the UK's high-growth companies collecting information on some of the country's fastest-growing businesses, from seed-stage startups to growing scaleups and beyond.



i3 connect (<https://i3connect.com/>) is part of the Cleantech Group, providing research, consulting and events to catalyse opportunities for sustainable growth powered by innovation.



Crunchbase (<https://www.crunchbase.com/>) collects data from more than 3,700 global investment firms submitting monthly portfolio updates and ensuring that Crunchbase has first-hand access to the most up-to-date information.

¹⁰ Investopedia (2021), 'Series A, B, C Funding: How It Works'. Available at <https://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp>.

¹¹ Beahurst use 'Venture', while Crunchbase and i3 databases use 'Series A' to identify rounds at this stage.

¹² Corporate Finance Institute (n.d.), 'Series A Financing'. Available at <https://corporatefinanceinstitute.com/resources/knowledge/trading-investing/series-a-financing/>.

Executive Summary

In 2021 the UK government published its Net Zero Strategy, setting out policies and proposals for decarbonising all sectors of the UK economy to meet the net zero target by 2050.

As part of its research activities, the Department for Energy Security & Net Zero (DESNZ) commissioned London Economics (LE) to undertake an assessment of the UK venture capital (VC) market for early-stage clean tech companies. Clean technologies are defined as technologies that enable economic activity to deliver goods and services while generating significantly lower emissions of greenhouse gases.

This study looked at the state of early-stage investment (at the seed and venture capital stages, i.e. the two initial stages of formal investment) in UK clean tech companies in 2021 and changes over the last five to ten years. The role of clean tech activities in reducing greenhouse gas emissions while helping to enable economic activity is potentially large. The UK clean tech sector is diverse in its technologies and its activities, reflecting the breadth of change that is likely to be necessary to reach net zero by 2050.

The analysis also considered the UK clean tech sector in an international context (looking at selected other countries) and comparing recent trends for the UK clean sector and two other dynamic technology sectors, namely the Biotech and Artificial Intelligence sectors. Although the figures presented in this report are based on both publicly announced deals and information on deals collected through private research, it should be acknowledged that there is no official definition of the clean tech sector and it is not possible to verify whether the number and size of deals reported cover all relevant deals.

The evidence considered showed that early-stage investment in UK clean tech companies has risen in recent years, both in terms of number of deals and overall value. More specifically, over the last five years (since the UK Government launched the Clean Growth Strategy in 2017), the total volume of seed and venture investments in UK-headquartered clean tech companies grew from approximately £163 million in 2017 to approximately £420 million in 2021 (an overall increase of 158%, corresponding to a compound annual growth rate of 27%). In the same time period, the number of deals (rounds) rose from 165 to 258 (an overall increase of 56%, or 12% per annum).

As a comparison, in two other advanced technology industries in the UK, the Artificial Intelligence and Biotech sectors, total investment rose by 112% and 49% respectively, while the number of deals rose by 57% and 29% respectively over the same time period (2017-2021).

However, AI's growth in absolute terms was higher, and in 2021 the overall volume of early-stage investment in UK clean tech companies was still considerably smaller than the volume of early-stage investment in UK AI and biotech companies (£420 million compared with £710 million and £615 million respectively). Also, the AI sector experienced more rapid growth in terms of both the number of early-stage deals and investment value over a longer time period (between 2012 and 2021).

Between 2020 and 2021, the UK clean tech sector experienced a rapid increase in both the number of rounds (which increased by more than one third, from 192 to 258) and overall investment (which doubled in value from £210M to £420M). The majority of the growth seen in both measures over the period 2017-2021 therefore occurred in the final year (2020-2021), and until 2020 the clean tech sector compared much less favourably to AI and Biotech. It is not yet clear whether this is indicative of a longer-term trend, however; factors such as a “COP pop” (from the UK’s hosting COP26 in 2021) may have inflated growth in clean tech in that particular year.

Over the same time period (2017 to 2021) the median size of the deals also increased, from £260,000 to £410,000 for seed rounds (the first stage of formal investment) and £850,000 to £1,540,000 for venture rounds (the subsequent investment stage). Again, the largest increase was recorded between 2020 and 2021, with a rapid growth in the size of medium and large deals (those with a value in excess of £1 million), in particular of the largest deals (those in excess of £5 million). However, investment in UK-headquartered early stage clean tech companies remains small as a fraction (approximately 1.7%) of total VC investment in the UK.

Geographically, clean tech companies headquartered in London accounted for between 27% and 34% of deals occurring between 2017 and 2020 and for 33% to 39% of investment taking place, meaning that London-headquartered clean tech companies tended to raise slightly larger rounds. They also experienced a relatively large increase in inflow in 2021 (when they accounted for 42% of deals and 45% of investment volumes).

Information on investor characteristics was only available for around one quarter of all deals, typically larger deals that were publicly announced. Based on the (limited) data available, UK based investors represented 73% of all investors in UK clean tech companies, followed by other European investors, US investors (both around 11%) and investors from other areas (5%). Within the UK, slightly more than one half of investors were based in London. There was a marked difference in the type of investors by geographical area: 62% of London based investors were defined as Private Equity and Venture Capital investors compared with 45% for investors based outside London (where various forms of public funding, provided by central, local, regional and devolved administrations to support investment in early stage clean-tech companies, constituted a larger proportion of overall investment than in the London area).

Compared to other high-income countries (Germany, France, Sweden and the US), the UK has shown larger increases in terms of the total value of seed rounds and of series A rounds by clean tech companies as a percentage of GDP since 2017 (with the exception of Sweden, where the clean tech market is particularly developed).

The analysis of secondary data sources was complemented with interviews of market experts and stakeholders. These market participants reported that, despite this recent growth in the number of deals, they still perceived a continuing lack of focus of VC funding across the breadth of the early-stage clean tech sector compared with other sectors, which may be explained by the relatively small number of specialist clean tech VCs that have deep knowledge and experience of the clean tech sector that allows them to better assess the risk and potential returns associated with early-stage clean tech companies. Widening access to

VC funding to a greater number of firms continues to be important to facilitate the commercialisation of the broad range of technologies that is likely to be needed to help reach Net Zero.

Stakeholders also reported that clean tech companies focusing on hardware innovations appear to face greater challenges in accessing funding than those focusing on software innovations. A number of characteristics of hardware innovations contribute to this: in particular companies developing hardware innovations typically have greater funding needs because of the need for capital-intensive equipment and facilities.

However, access to funding is not the only important challenge for early-stage clean tech companies in the UK. These findings suggest that policy interventions that targeted a broader range of issues than just the funding gap would help to increase the rate at which clean tech innovations are successfully commercialised by UK companies.

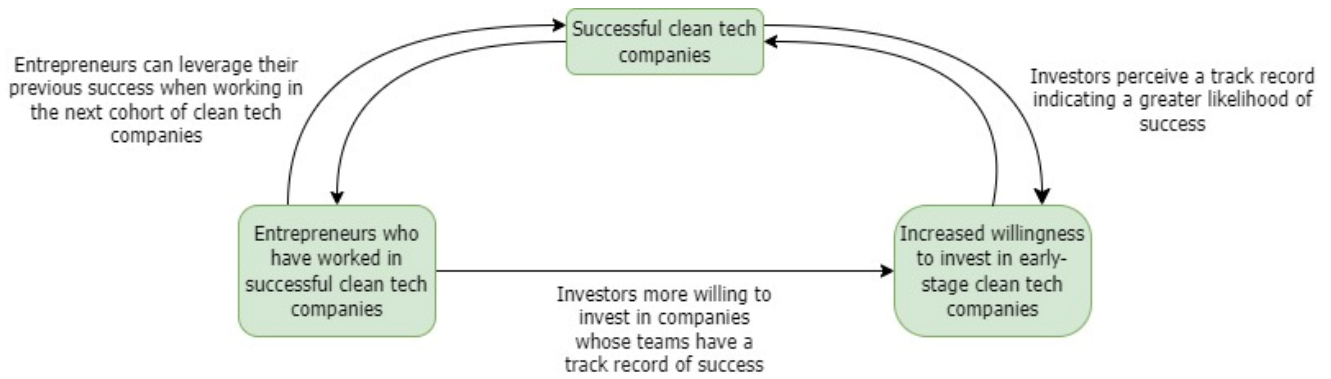
Clean tech companies face particular difficulties in assembling the right team because of the need for technical and STEM skills, often in a novel and interdisciplinary context. Interventions such as educational programmes and training paths, or special visas, could help to improve the pipeline of talent available to UK clean tech companies.

There are also challenges around tight, complex regulatory environments, which both present difficulties in themselves and deter investment. Regulatory sandbox programmes can help innovative companies to navigate regulatory uncertainty. In addition, the UK's smaller domestic market relative to the US can present a challenge, especially where differences in regulations make it more difficult to scale across jurisdictions.

However, the findings in this report overall point to the possibility of virtuous circles from the current surge in early-stage clean tech investment. If the increasing investment volumes seen in recent years produce a cohort of UK clean tech success stories, this is likely to inspire investors to invest more in clean tech; at present, perceptions that there is a lack of a 'track record' of profitable clean tech companies deter investment. Moreover, the entrepreneurs behind those success stories would accumulate experience to lead another wave of clean tech companies. This, in turn, can increase investment. Investors are likely to be more willing to invest in early-stage clean tech companies whose teams have a track record of success. In addition, entrepreneurs who have exited from successful clean tech companies may become angel investors in future clean tech companies.

On the other hand, previous booms in clean tech VC investment has shown that these virtuous circles are not a foregone conclusion, and the right conditions must be present to translate increased investment into success stories.

Figure 1 Virtuous circles in clean tech investment



1. Introduction

In October 2021, the Department for Energy Security & Net Zero (DESNZ, then the Department for Business, Energy and Industrial Strategy (BEIS)) commissioned London Economics (LE) to undertake an assessment of the UK venture capital (VC) market for early-stage clean tech companies. The main question the study seeks to answer is: What does the venture capital market for early-stage clean tech companies seeking seed, late-seed, or venture investment look like in 2021? This introduction provides an overview of what is meant by clean tech and venture capital, the objectives of this study, the structure of the report, and the relevant background.

What is clean tech?

There is no single definition of ‘clean tech’ nor of similar terms such as ‘climate tech’ and ‘green tech’ that are often used in discussions in this area. This study uses the following definition of ‘clean tech’, provided by DESNZ:

Definition: Clean tech

Clean tech is technology which enables economic activity to deliver goods and services while generating significantly lower emissions of greenhouse gases.

Source: DESNZ

This study considers both software (or ‘digital’) and hardware (accounting for much of what is sometimes referred to as ‘deep tech’) technologies and does not limit its attention to one particular area of clean tech (e.g., renewable energy technologies).

In operationalising the clean tech definition above, we drew on a list of clean tech sectors provided by DESNZ as well as relevant government policy documents and industry reports (including the UK Government’s *Ten Point Plan*¹³, the *Net Zero Strategy*¹⁴ and PricewaterhouseCoopers’ (PwC) *The State of Climate Tech 2020* report¹⁵). Further details are provided in the Technical Annex.

Clean tech is often concerned with efficiency and reducing resource consumption per unit of output; this is an important reason why it can be a commercially attractive proposition even aside from its environmental justification.

¹³ UK Government (2020a), ‘The Ten Point Plan for a Green Industrial Revolution’. Available at <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>.

¹⁴ UK Government (2021a), ‘Net Zero Strategy: Build Back Greener’. Available at <https://www.gov.uk/government/publications/net-zero-strategy>

¹⁵ PwC (2020), ‘The State of Climate Tech 2020: The next frontier for venture capital’. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>.

What is venture capital?

Venture capital (VC) is a form of equity financing for early-stage innovative businesses that are perceived to offer the potential for significant growth and returns. VC investments are often made in sectors such as biotech and healthcare, financial services, and ICT.¹⁶ VC investments often fund early-stage companies that have developed technology using research funding (including grants) or funding from friends and family and/or incubators and accelerators, but which have not commercialised their product or service. The main research question for this study relates to seed, late-seed and series A funding. Seed, late-seed and series A funding is used by early-stage companies seeking to develop and commercialise their product or service. Seed funding rounds are the first formal equity funding rounds featuring an institutional investor that start-ups receive, and typically involve investment from VC funds and business angels. Seed rounds typically follow on from funding from friends and family, the founders' own resources and, sometimes, business angels, and come before venture funding rounds.¹⁷ Series A funding rounds tend to be larger than seed and late-seed rounds (with amounts typically being in the millions of pounds) and are typically used by companies with more of a 'track record' than seed rounds.¹⁸ Series A funding tends to come from VC funds. VC funding also includes later rounds called series B rounds, series C rounds, and so on. Each subsequent round is typically associated with a greater degree of commercialisation and larger investment amounts. The Beauhurst dataset used in the analysis in this report uses the term 'venture' rounds¹⁹, which roughly equivalent to series A rounds in other sources.

Seed and series A VC investment in UK tech companies was approximately \$3.45 billion in 2020,²⁰ indicating that these types of investment are a significant source of funding for early-stage companies in the UK.

Study objectives

The aim of this study is to provide an evidence base that DESNZ can use to assess the impact of policy interventions in the UK clean tech market, including DESNZ' investment in the Clean Growth Fund, and that can be used to inform deliberations about future policy interventions in the market. The report will also serve as a source of evidence for clean growth and green finance policy teams in government more widely.

The main research question that the study addresses is:

¹⁶ British Private Equity & Venture Capital Association (2020), 'BVCA Report on Investment Activity 2019'. Available at <https://www.bvca.co.uk/Portals/0/Documents/Research/Industry%20Activity/BVCA-RIA-2019.pdf>.

¹⁷ See, e.g., Investopedia (2021), 'Series A, B, C Funding: How It Works'. Available at <https://www.investopedia.com/articles/personal-finance/102015/series-b-c-funding-what-it-all-means-and-how-it-works.asp>.

¹⁸ Ibid., for example.

¹⁹ Venture (from Beauhurst glossary): 'As a rough guideline: a company that has been around for a few years, has either got significant traction, technology or regulatory approval progression and funding received and valuation both in the millions. Funding likely to come from venture capital firms'

²⁰ Based on statistics in Tech Nation (2021a), 'Tech Nation Report 2021: The future UK tech built'. Available at <https://technation.io/report2021/>.

What does the venture capital (VC) market for early-stage clean tech companies seeking seed, late-seed, or series A investment look like in 2021?

In answering this overarching question, the study addresses the following additional questions:

What do market trends for investing in early-stage, clean tech firms in the UK look like and do they reflect global trends?

How has the market changed over the period between 2017 and 2021 and what (past) trends can be seen?

How does clean tech VC funding compare with VC funding for other advanced technology in the UK in the same period?

What are the levels of VC investment in the UK clean tech sector?

How many funds are targeting the UK early-stage clean tech sector?

What is their investment mandate? (Are they generalist funds or funds investing specifically in this sector?)

Are they international or UK-based funds?

What alternatives are available for the sector (e.g., public funding initiatives)?

How many UK clean tech companies exist and how many people are employed in the sector?

How are existing clean tech companies split in their focus on software/hardware innovations and is there a difference in their ability to access funding and commercialise their products/services?

To what extent is there an existing funding gap for clean tech start-ups?

Where companies fail to progress their innovations, what are the reasons for this (e.g., lack of funding, wrong product, skills/team, market size)?

What do current exit opportunities for clean tech companies look like? What are the challenges?

Structure of the report

The report is structured as follows:

Chapter 2 provides a summary of the methods used in the report;

Chapter 3 provides an overview of the UK clean tech sector;

Chapter 4 examines investment in the UK VC market for early-stage clean tech companies, drawing on relevant literature as well as new analysis;

Chapter 5 examines the investors in the UK VC market for early-stage clean tech companies. It analyses different sources of funding in early-stage companies in the UK VC market and their characteristics;

Chapter 6 assesses the extent to which there is a funding gap for early-stage clean tech companies in the UK and considers other challenges faced by these companies;

A concluding chapter summarises the findings of the study; and,

A technical annex provides further details on the methodology employed in the study and its analysis.

In addition, the executive summary above provides a concise overview of the study's findings across all sections.

Background

The global importance of clean tech

The development of clean tech will help to preserve (insofar as is possible) people's ways and standards of living while helping to achieve the reductions in greenhouse gas emissions needed to limit warming in line with the UK's international and legislative obligations, in particular Net Zero. Boston Consulting Group (BCG) estimate that existing technologies and technologies currently in early adoption can eliminate only 65% of current emissions,²¹ suggesting that new technologies will play a role in reaching net zero. While global gross domestic product (GDP) contracted by approximately 3.4% in 2020²², amidst the COVID-19 pandemic and the associated social and economic restrictions, global emissions fell by 6.4%.²³ This is less than the 7.6% annual reductions that a UN report estimates is necessary to limit warming to 1.5°C.²⁴ This further highlights the potential need for new technology in reaching net zero as it suggests that behaviour modifications alone are unlikely to be sufficient to bring about the reductions in global emissions required for net zero.

Existing analysis suggests that substantial additional investment is required to achieve net zero: in fact, estimates of the annual global investment (through all forms of climate finance, including investment in infrastructure, bonds, etc.) needed to achieve net zero by 2050 range between \$1-7 trillion.²⁵ Meanwhile, the biannual average value of global climate investment in 2019-20 stood at \$632 billion,²⁶ 10% more than the biannual average in 2017 and 2018.²⁷ This 10% rate of growth was much slower than the 25% growth observed both between 2013-14

²¹ Boston Consulting Group (2021), 'Governments That Invest in Climate Innovation Invest in Growth'. Available at <https://www.bcg.com/publications/2021/developing-a-climate-funding-plan>.

²² World Bank (2021), 'GDP growth (annual %)'. Available at <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG>.

²³ Tollefson, J. (2021), 'COVID curbed carbon emissions in 2020 — but not by much'. Nature, 15th January 2021. doi: <https://doi.org/10.1038/d41586-021-00090-3>.

²⁴ United Nations Environment Programme (2019), 'Cut global emissions by 7.6 percent every year for next decade to meet 1.5°C Paris target - UN report'. 26th November 2019. Available at <https://www.unep.org/news-and-stories/press-release/cut-global-emissions-76-percent-every-year-next-decade-meet-15degc>.

²⁵ Boston Consulting Group and Global Financial Markets Association (2020), 'Climate Finance Markets and the Real Economy: Sizing the Global Need and Defining the Market Structure to Mobilize Capital'. Available at <https://www.sifma.org/wp-content/uploads/2020/12/Climate-Finance-Markets-and-the-Real-Economy.pdf>.

²⁶ Climate Policy Initiative (2021), 'Global Landscape of Climate Finance 2021'. Available at <https://www.climatepolicyinitiative.org/wp-content/uploads/2021/10/Full-report-Global-Landscape-of-Climate-Finance-2021.pdf>.

²⁷ Ibid.

and 2015-16, and between 2015-16 and 2017-18.²⁸ The slowdown in growth appears to have been driven by a fall in the amount of public climate investment in 2020 relative to 2019,²⁹ perhaps as a result of the COVID-19 pandemic. The effects of the COVID-19 pandemic on public climate investment may continue for some years into the future because of lasting effects of the pandemic on governments' fiscal positions.

There is also additional evidence that greater investment is needed in clean tech *innovations* in particular: BCG estimate that the required annual investment in climate innovation is \$90-210 billion globally; however, in 2019 approximately only \$30 billion was invested in clean tech by VC and private equity.³⁰ Despite this need for greater investment in clean tech innovations, investment in clean tech accounts for only a small proportion of all VC investment; in 2021, only 14% of VC investment globally was directed at clean tech.³¹

The UK context

In 2019, the UK became the first major economy to pass legislation committing to reaching net zero (greenhouse gas emissions) by 2050.³² In 2020, the UK made a commitment to reduce the UK's greenhouse gas emissions relative to 1990 levels by at least 68% by 2030.³³ This commitment was made under the Paris Agreement, an international treaty adopted in 2015 whose goal is to limit the rise in global temperatures relative to pre-industrial temperatures to below 2°C and preferably to 1.5°C.³⁴ Since then, in April 2021, the UK committed in law to reduce emissions (relative to 1990 levels) by 78% by 2035, building on the target for 2030.³⁵

The *Green Finance Strategy*, published in 2019, seeks to strengthen the competitiveness of the UK finance sector while also 'aligning private sector financial flows with clean, environmentally sustainable and resilient growth, supported by Government action'. The strategy has three pillars, including the 'Financing Green' pillar that is concerned with mobilising and accelerating finance for clean tech and environmentally important sectors in the UK and abroad.³⁶ One of the actions under this pillar was for DESNZ to provide a £20 million capital contribution toward a new clean growth venture capital fund, with a view to attracting a matching or potentially greater capital sum from the private sector..³⁷ The 2019 *Green Finance*

²⁸ Ibid.

²⁹ Ibid.

³⁰ Boston Consulting Group (2021), 'Governments That Invest in Climate Innovation Invest in Growth'. Available at <https://www.bcg.com/publications/2021/developing-a-climate-funding-plan>.

³¹ PwC (2021a), 'Global climate tech investment more than triples, but could be better targeted to cut emissions - PwC State of Climate Tech 2021'. 15th December 2021. Available at <https://www.pwc.co.uk/press-room/press-releases/global-climate-tech-investment-more-than-triples.html>.

³² UK Government (2021b), 'UK enshrines new target in law to slash emissions by 78% by 2035'. Press release, 20th April 2021. Available at <https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035>.

³³ UK Government (2020b), 'UK sets ambitious new climate target ahead of UN Summit'. 3rd December 2020. Available at <https://www.gov.uk/government/news/uk-sets-ambitious-new-climate-target-ahead-of-un-summit>.

³⁴ United Nations (n.d.), 'The Paris Agreement'. Available at <https://unfccc.int/process-and-meetings/the-paris-agreement/the-paris-agreement>.

³⁵ UK Government (2021b), 'UK enshrines new target in law to slash emissions by 78% by 2035'. Press release, 20th April 2021. Available at <https://www.gov.uk/government/news/uk-enshrines-new-target-in-law-to-slash-emissions-by-78-by-2035>.

³⁶ UK Government (2019a), 'Green finance strategy'. Available at <https://www.gov.uk/government/publications/green-finance-strategy>.

³⁷ Ibid.

Strategy cornerstone investment recommendation was preceded by recommendations of the independent Green Finance Taskforce, published in March 2018.³⁸

The Government's *Ten Point Plan for a Green Industrial Revolution*,³⁹ published in November 2020, set out plans to invest in ten clean tech areas to decarbonise the economy while supporting jobs. In this plan the government announced a £1 billion fund called the Net Zero Innovation Portfolio⁴⁰ whose aim is to accelerate the commercialisation of ten priority technology areas in support of the move to net zero. Following this, the UK government's flagship *Net Zero Strategy*, published in October 2021, recognised the opportunity from VC for investment in clean tech.⁴¹

In November 2021, the UK hosted the 26th UN Climate Change Conference of the Parties (COP26).⁴² COP26 was the first occasion on which countries reviewed and built on their commitments under the Paris Agreement, as they agreed to do every five years.⁴³ Climate finance was one of the main focuses of COP26,⁴⁴ and COP26 explicitly recognised the need for 'private finance to fund technology and innovation, and to help turn the billions of public money into trillions of total climate investment'.⁴⁵

The UK is a global leader in financial services and the UK government has articulated an ambition to become a world leader in green finance.⁴⁶ If the UK can successfully leverage this strength in finance to become a preferred location for clean tech start-ups, this could have benefits in terms of soft power and international leadership, and could create export opportunities.

Reliance by businesses on government financing, for instance through grants, typically decreases as the associated technology is 'de-risked' for private investors as it develops and becomes commercially mature.⁴⁷ Between the technology creation stage often funded by public sector financing and the early commercialisation stage where more private funding becomes available, early-stage companies are often said to face a cash flow 'valley of death' in

³⁸ Green Finance Taskforce (2018), 'Accelerating green finance: Green Finance Taskforce report', Available at <https://www.gov.uk/government/publications/accelerating-green-finance-green-finance-taskforce-report>.

³⁹ UK Government (2020a), 'The Ten Point Plan for a Green Industrial Revolution'. Available at <https://www.gov.uk/government/publications/the-ten-point-plan-for-a-green-industrial-revolution>.

⁴⁰ UK Government (2021c), 'Net Zero Innovation Portfolio'. Published 3rd March 2021, Last updated 8th December 2021. Available at <https://www.gov.uk/government/collections/net-zero-innovation-portfolio>.

⁴¹ UK Government (2021a), 'Net Zero Strategy: Build Back Greener'. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

⁴² UK Government (n.d.), 'COP26'. Available at <https://www.gov.uk/government/topical-events/cop26>.

⁴³ COP26 (n.d.), 'What is a COP?'. Available at <https://ukcop26.org/uk-presidency/what-is-a-cop/>.

⁴⁴ Ares, E. and Loft, P. (2021), 'COP26: Delivering on \$100 billion climate finance'. House of Commons Library, published 3rd November 2021. Available at <https://commonslibrary.parliament.uk/cop26-delivering-on-100-billion-climate-finance/>.

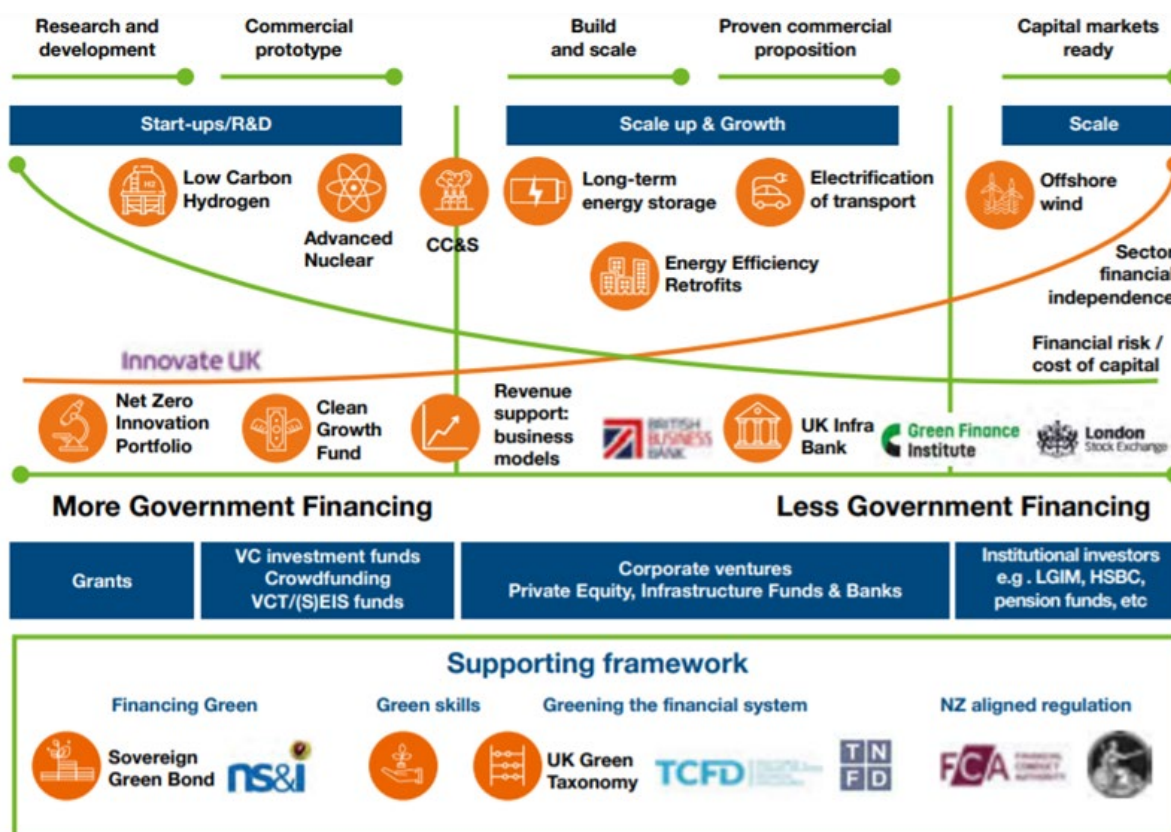
⁴⁵ COP26 (n.d.), 'Finance'. Available at <https://ukcop26.org/cop26-goals/finance/>.

⁴⁶ HM Treasury (2021), 'A new chapter for financial services'. July 2021. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/998102/CCS05_21556086-001_Mansion_House_Strategy_Document_FINAL.pdf.

⁴⁷ UK Government (2021a), 'Net Zero Strategy: Build Back Greener'. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

which they have limited access to funding, yet high cash needs.⁴⁸ A ‘patient capital’ gap⁴⁹ has been identified as hindering the UK’s ability to translate these strengths into the successful scaling up of start-ups.⁵⁰ The figure below, from the UK government’s 2021 *Net Zero Strategy*, shows the different stages of commercial maturity that technologies progress through, and for each stage identifies initiatives backed by public funding that are available to businesses. The figure shows that financial risk is high at the VC funding stage, and sectors become less dependent on government financial support as they progress in commercial maturity. While the figure places several areas of clean tech along the spectrum of commercial maturity, it should be noted that these placements are a generalisation. Each area of clean tech identified in the chart involves a range of different technologies, each of which may be at a different level of commercial maturity. For instance, while offshore wind is overall a commercially mature area of clean tech, there are technologies that could be used in the offshore wind sector that are not yet commercially mature.

Figure 2 Low carbon sectors: commercial maturity and associated capital requirements



Source: UK Government (2021a), ‘Net Zero Strategy: Build Back Greener’. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

⁴⁸ See, e.g., Murphy, L. M. and P.L. Edwards (2003), ‘Bridging the Valley of Death: Transitioning from Public to Private Sector Financing’. NREL/MP-720-34036. Available at <https://www.nrel.gov/docs/gen/fy03/34036.pdf>.

⁴⁹ A need for more a greater amount of investment in innovative firms that has a enables those firms to scale up and over long time horizons in the face of short-term uncertainties,

⁵⁰ HM Treasury (2017), ‘Financing growth in innovative firms: consultation’. August 2017. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/642456/financing_growth_in_innovative_firms_consultation_web.pdf.

British Business Bank (2018), ‘Small Business Finance Markets 2017/18’. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2018/02/Small-Business-Finance-Markets-2018-Report-web.pdf>.

As advocated by the 2017 *Clean Growth Strategy*, the 2018 report of the Green Finance Taskforce and the 2019 *Green Finance Strategy*, the UK government invested in an independently-run Clean Growth Fund in May 2020. The Fund targets early-stage clean tech companies. The £20 million government investment in the Fund, through DESNZ's Energy Innovation Programme, was part of a £40 million cornerstone investment, the other £20 million coming from private sector funding, with the ambition that private sector funding would take the Fund's size to £100 million.⁵¹ In March 2022, the Clean Growth Fund announced the final fund size of £101 million, with 7 private sector investors backing the Fund, alongside DESNZ.

In October 2021, it was announced that Breakthrough Energy Catalyst, part of the Breakthrough Energy network founded by Bill Gates, would match £200 million of the UK government's investment in clean tech projects (including investment made through the Net Zero Innovation portfolio mentioned above).⁵² The £200 million of investment that the Catalyst will provide will target UK-based projects in direct air capture, green hydrogen, long-duration energy storage, and sustainable aviation fuel and aims to 'address the early deployment funding gap' for these technologies.⁵³

⁵¹ UK Government (2020c), 'Government launches new £40 million Clean Growth Fund to supercharge green start-ups'. 21st May 2020. Available at <https://www.gov.uk/government/news/government-launches-new-40-million-clean-growth-fund-to-supercharge-green-start-ups>.

⁵² UK Government (2021d), 'Prime Minister and Bill Gates launch £400m partnership to boost green investment'. Press release, 19th October 2021. Available at <https://www.gov.uk/government/news/prime-minister-and-bill-gates-launch-400m-partnership-to-boost-green-investment>.

⁵³ Breakthrough Energy (2022), 'Breakthrough Energy Catalyst launches UK Request for Proposals'. 18th January 2022. Available at <https://www.breakthroughenergy.org/articles/announcing-catalyst-uk-rfp>.

2. Methods

This chapter provides a brief summary of the methodology for this study. Further details are provided in the Technical Annex.

This study drew on three main sources of information: analysis of secondary data from the Beauhurst⁵⁴ database, stakeholder interviews, and a review of relevant literature.

Analysis of existing data sources

The main quantitative analysis in this report draws on data on companies, funding rounds, investments and acquisitions from Beauhurst⁵⁵, a subscription platform that provides curated data on high-growth companies in the UK. The searches of Beauhurst used industry classifications and keyword searches to identify relevant companies, funding rounds, investments and acquisitions. Manual checks were performed to validate the data gathered through these searches.

More details, including the search strategy used to identify the relevant data, can be found in the Technical Annex.

Stakeholder interviews

We conducted 25 semi-structured interviews with market experts and stakeholders. These interviews were conducted by members of the LE project team via video-conferencing and typically lasted between 30 and 60 minutes. The purpose of these interviews was two-fold. Firstly, the interviews were used to gather views on and insights particularly into the more qualitative research questions involved in the project. Secondly, they were used to validate and refine the findings from the desk research described below.

⁵⁴ <https://www.beauhurst.com/>

⁵⁵ Two alternative data providers were investigated as part of the research: i3 (<https://i3connect.com/>) and Crunchbase (<https://data.crunchbase.com>). See Technical Annex for a discussion of findings from the alternative data sources. Beauhurst has been selected as the preferred data source for the following reasons:

Beauhurst has significantly more complete and structured coverage of unannounced fundraisings ([link](#)). In each year between 2011 and 2020, unannounced rounds accounted for between 65% and 71% – by number – of equity rounds by UK companies. While unannounced rounds tend to be smaller than announced rounds in terms of deal value, they are particularly common for companies at earlier stages of evolution, which is the focus of this study. Hence, coverage of unannounced fundraisings is an important consideration, especially with respect to deal counts.

Beauhurst also has significantly more complete coverage of deal values. Approximately 3% of in-scope rounds in the Beauhurst data had a missing value for their amount; for i3, that is around 28%. In the Crunchbase data, approx. 26% of rounds considered in the original analysis had a missing value for the amount. Beauhurst also has better coverage more broadly, e.g., completeness of location data.

As Beauhurst only covers UK firms, the i3 and Crunchbase databases were used to gather data on companies headquartered in four comparator countries (the US, Germany, France and Sweden), see Technical Annex.

The table below summarises the number of interviews completed with different types of stakeholders.

Table 1 Summary of stakeholder interviews

Stakeholder type	Number of interviews
Funding providers, related associations, and institutional investors	10
Clean tech industry and trade associations	5
Clean tech incubators and accelerators	4
Academics and research institutions	3
Government stakeholders	2
Other (law firm)	1
Total	25

More details can be found in the Technical Annex.

Desk-based research

We conducted a desk-based review of the existing base of evidence and literature. The purpose of this research was to validate and supplement the quantitative findings from the data collection and to gain insights into qualitative issues of interest.

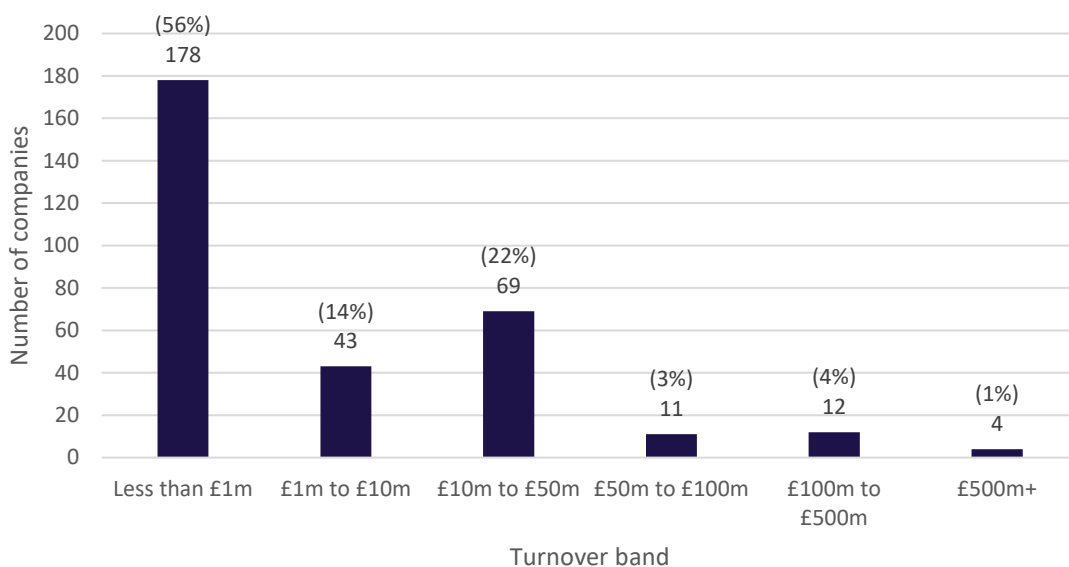
The review considered relevant literature and evidence from a range of sources, including government and public body reports; industry body reports; academic literature; consultancy reports and insights; news and blog articles; and company and fund websites.

3. Overview of the UK Clean Tech Sector

This chapter provides an overview of the UK clean tech sector and the companies within it.

The UK clean tech sector is comprised of 1,449 active companies⁵⁶ identified in Beauhurst by London Economics for this study (and a total of 1,762 companies including those no longer active). Amongst active companies, turnover is recorded only for a minority (317 companies), with revenues mostly concentrated in the lowest turnover band (up to £1 million, for 56% of companies). Companies not reporting turnover are likely to be at pre-revenue stage or have relatively low revenues. A very small number of businesses had revenues in excess of £50 million (8%).

Figure 3 UK clean tech companies by revenue band



n = 317. The percentages use the companies in the sample that have revenue data as the base.

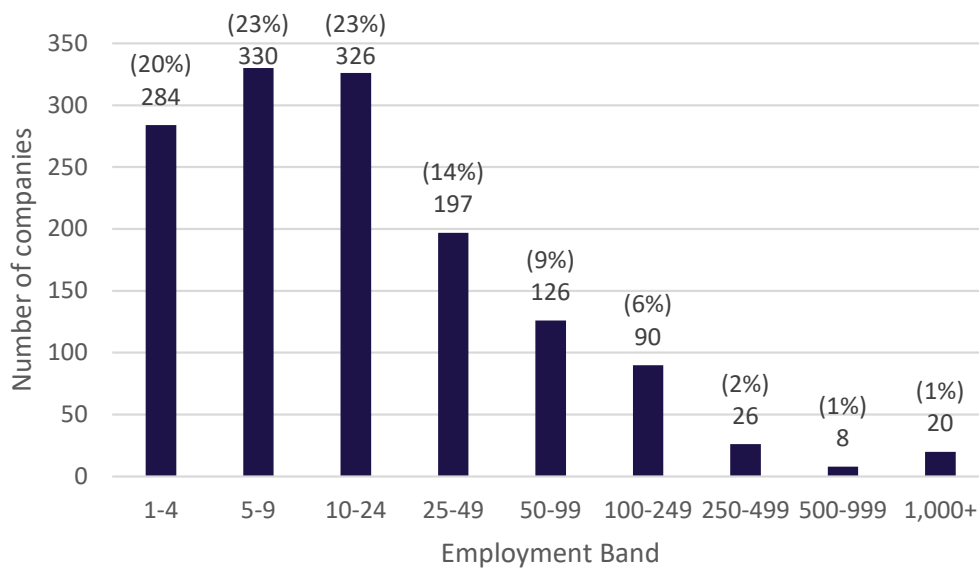
Note: Information on turnover was only available for 317 of 1,449 active companies (22%) in Beauhurst (information mostly referring to 2020 and 2021)

Source: LE analysis of Beauhurst data

Coverage for employment data was much higher (the information was available for around 97% of clean tech companies in Beauhurst) and showed that small companies (those with employment headcount up to 49) accounted for 80% of all clean tech companies in the UK, with micro companies (employment headcount up to 9) accounting for 43%. Large companies (employment of 250+) accounted for only 4% of all UK clean tech companies.

⁵⁶ The estimate refers to the latest account available for the company on Beauhurst. Information for most accounts was updated in 2020 or 2021 (96% combined), while a few records were available from 2019 and 2022 (1.5% each) and fewer than 1% were pre-2019. This figure also includes companies with unknown status

Figure 4 UK clean tech companies by employment band



n = 1,407. The percentages use the companies in the sample that have employment data as the base.

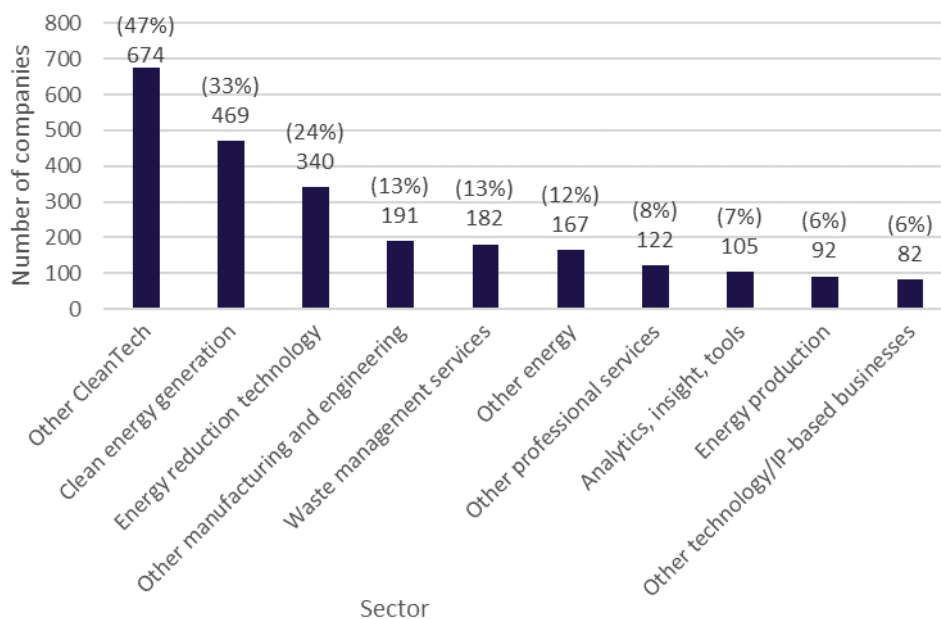
Note: Information on employment was available for 1,407 of 1,449 active companies (97%) in Beauhurst.

Source: LE analysis of Beauhurst data

Stakeholders interviewed for this study identified a number of areas within the clean tech sector where technology was less mature, including (long-term) energy storage, low-carbon hydrogen, wave and tidal energy and carbon capture, usage and storage (CCUS). Solar and wind energy, especially offshore wind, were identified as being more mature. Within the mobility space, land-based electric vehicles (i.e. cars, vans, etc.) were identified as being increasingly mature while electric ships and planes are less mature.

UK clean tech companies were classified as operating in a range of different industry groups in the Beauhurst database (Figure 5), reflecting that clean tech has a diversity of use cases and that clean tech can be deployed extensively in many areas of the economy.

Figure 5 Top 10 UK clean tech company activity areas



n = 3,921

Notes: The total number of active firms with information on sector was 1,440; firms could be in multiple industries across a total of 134 different industries. The percentages shown in the figure show the percentage of the 1,440 companies listed as being in these industries (and therefore sums up to more than 100%).

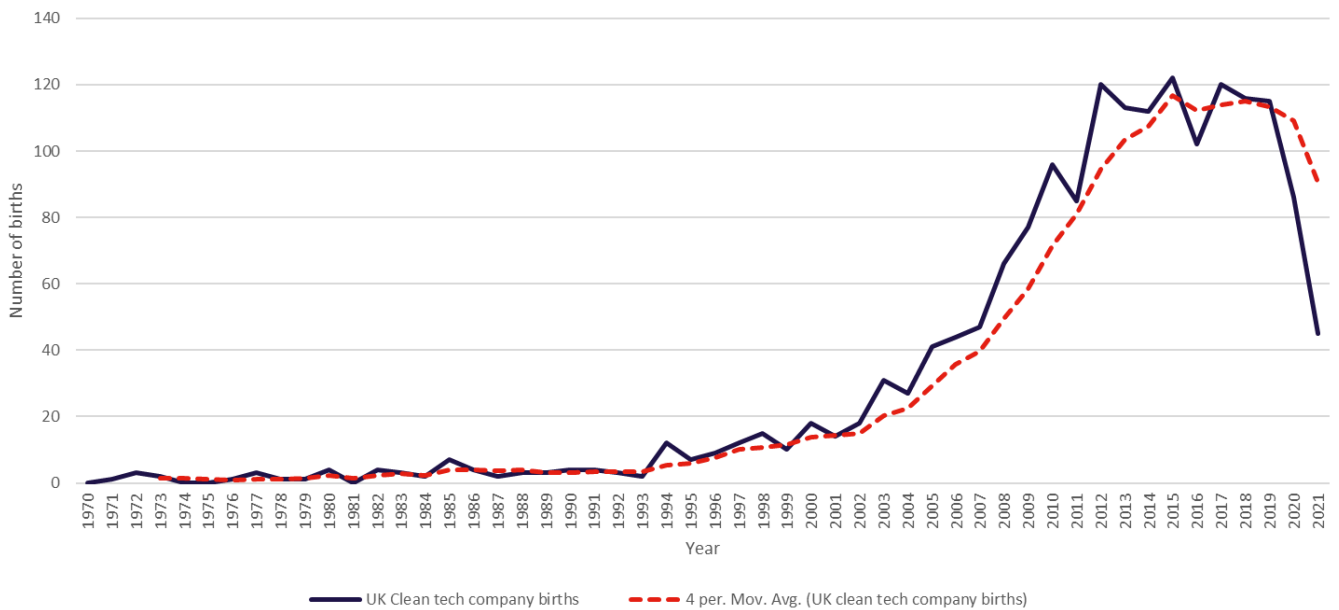
Source: LE analysis of Beauhurst data

Clean tech company births have apparently slowed since the financial crisis of the late 2000s (Figure 6), and plateaued since 2012, with a significant drop off in 2021. This may be reflective of the general slowdown in business creation across the economy in recent years.⁵⁷ The apparent decrease may be an artefact of the data; very young companies are generally less likely to be picked up by VC databases than older ones.⁵⁸ It may also in part be a reflection of the spending review cycle; most grants under the previous spending review were awarded between 2017 and 2019; the most recent spending review in October 2021 may lead to a rebound in 2022 and 2023. The Covid-19 pandemic may have been another external factor affecting clean tech company birth rates.

⁵⁷ Office for National Statistics (2021), 'Business demography, UK - dataset'. Release date 18th November 2021. Available at <https://www.ons.gov.uk/businessindustryandtrade/business/activitysizeandlocation/datasets/businessdemographyreferencetable>.

⁵⁸ If a company is very young, has yet to seek or receive external funding and has little information about it on the internet, it may be less likely to be detectable by Beauhurst or other databases.

Figure 6 UK clean tech company births by year, 1970 - 2021



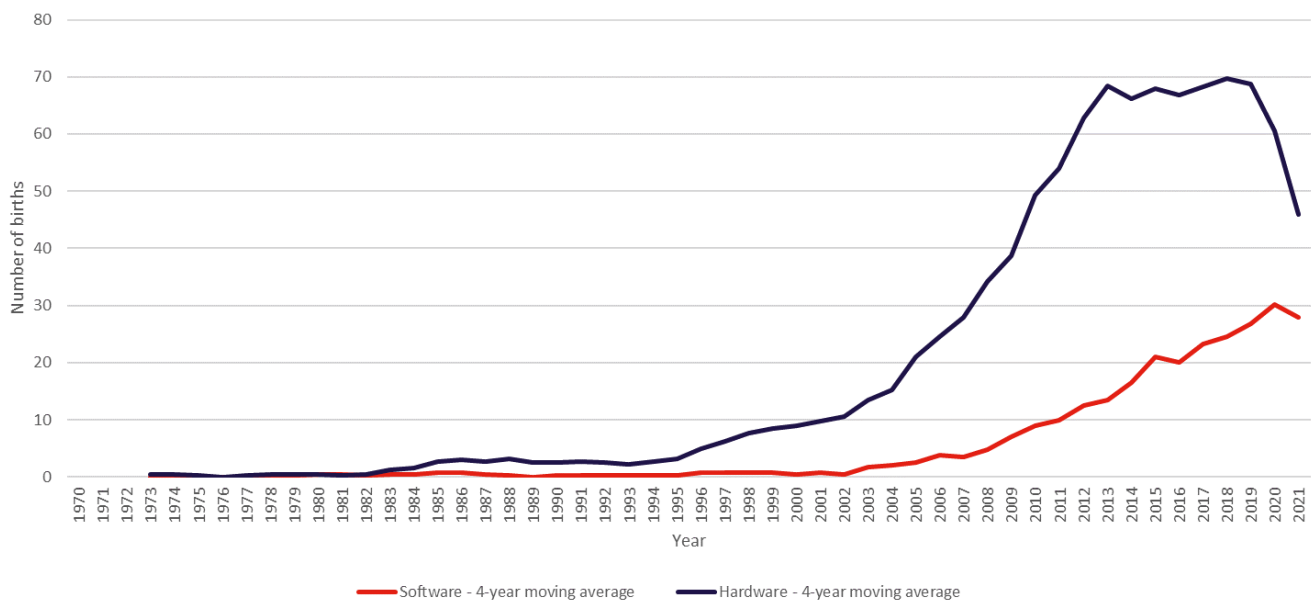
n = 1,737

Notes: The total company sample contains 1,762 companies (including those no longer active). However, not all companies within this sample have data detailing founded year. Additionally, this sample has also been restricted to companies established after 1970.

Source: LE analysis of Beauhurst data

The trend towards growth in the number of hardware companies observed from the mid-1990s appears to have stagnated in the wake of the financial crisis of the late 2000s, whereas this trend continued for software companies (Figure 7; since the Figure presents a four-period moving average this stagnation appears later), perhaps because software companies tend to have lower capital requirements than hardware companies and so may be less sensitive to changes in lending conditions. Hardware and (to a smaller extent) software companies appear to show a decrease in births in recent years, but as noted above this may be affected by the lag between a business being created and it being picked up by VC databases, the spending review cycle, and the effect of the pandemic.

Figure 7 UK clean tech software and hardware company births by year, 1970 – 2021



n = 1,221

Note: the classification of clean tech companies into ‘software’ and ‘hardware’ is not exclusive or exhaustive. Includes companies no longer active.

Source: LE analysis of Beauhurst data

Finally, the regional distribution of clean tech companies (Figure 8 and Figure 9) shows a concentration in London (around one quarter of the total), followed, at a distance, by Edinburgh, Glasgow and Cambridge. In part, the spread of clean tech companies across the UK reflects a natural agglomeration of centres of innovation, skills and finance. However, this is also likely to reflect that some companies may be headquartered in London but have their activities elsewhere in the UK. From a policy perspective, the chief concern is whether valuable technologies go unfunded due to geography. These issues, among others, are explored later in this report.

Figure 8 UK clean tech companies by NUTS1 region

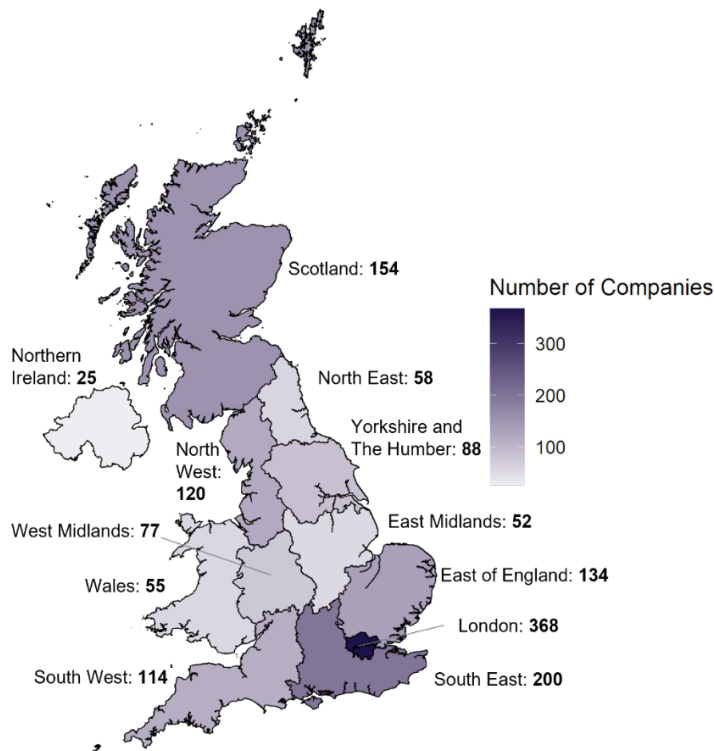
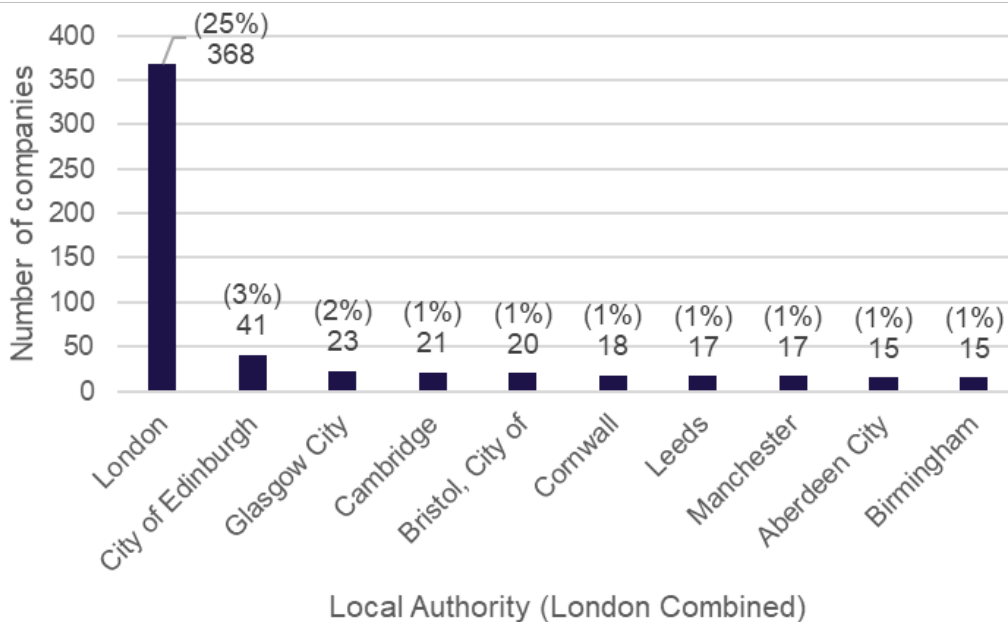


Figure 9 Top 10 local authorities for UK clean tech companies



n = 1,445. The percentages use n as the base.

Notes: This map places active companies according to the location of their headquarters and includes 1,445 of 1,449 active companies (due to incomplete headquarter location data). NUTS1 (or ITL1) refers to international territorial level and is the geocode standard used by the ONS to separate the UK into statistical regions. 'London' includes all London boroughs. Companies may be registered in a given location but have activities elsewhere in the UK. Source: LE analysis of Beauhurst data

4. The UK Venture Capital Market for Early-Stage Clean Tech Companies: Investment

This chapter examines investment in the UK VC market for early-stage clean tech companies. It begins by looking at key trends in the market since 2012. Trends in the UK VC market for early-stage clean tech companies are then compared with trends in the UK VC market for early-stage artificial intelligence (AI) and biotech companies. Next, it examines the geographical distribution of early-stage VC investment in UK clean tech companies. Finally, it examines the exit opportunities for investors in UK clean tech start-ups.

Key trends since 2012

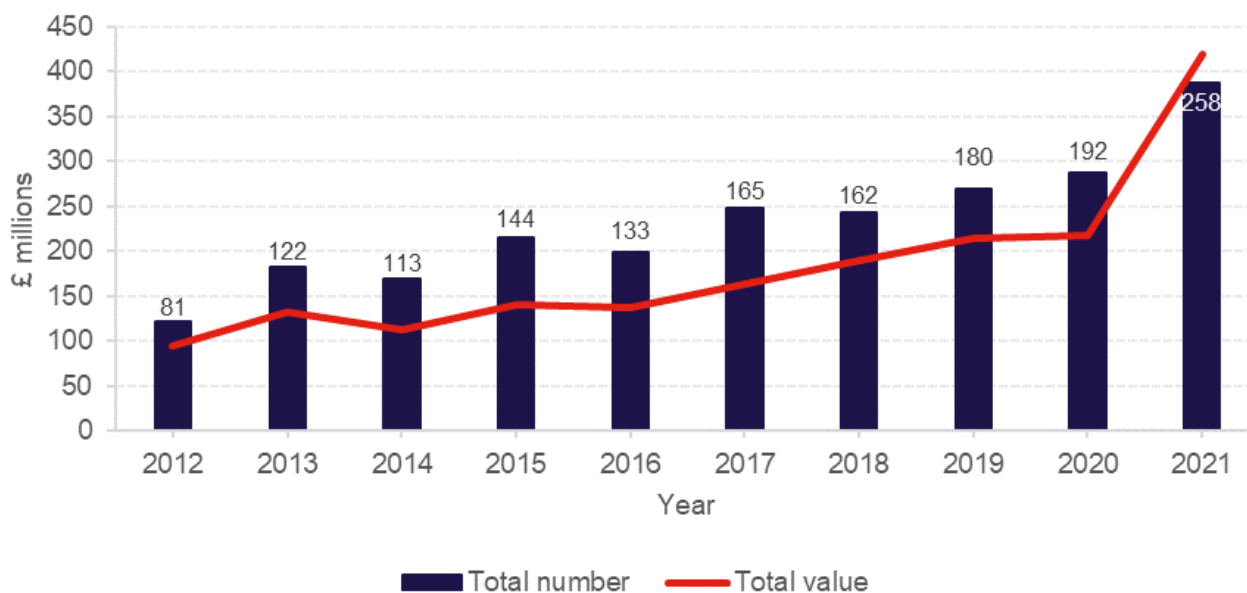
The following key trends can be observed in the UK VC market for early-stage clean tech companies:

- a) rising total quantities of investment;
- b) an increase in the number of deals, with a spike observed in 2021; and
- c) increasing median deal sizes.

These trends can be seen in Figure 10 and Figure 11, which show respectively the development of the total value and number of seed and venture rounds by UK-headquartered clean tech companies between 2012 and 2021 and median deal size over the same period. The rest of this section provides further explanation and discussion of these trends. Throughout this section we focused on deals labelled as “Seed” or “Venture” in the Beauhurst database. However, to ensure that we were capturing genuine “Seed” and “Venture” rounds, we also removed rounds with value below £100,000⁵⁹ (to exclude pre-seed rounds) or value above £20 million (to exclude rounds at later investment stages). This resulted in a total of 1,506 rounds included in the analysis for the period 2012-2021.

⁵⁹ Using £50,000 as the limit for the lower threshold adds a further 208 deals (mostly Seed rounds). Trends were generally similar over time, but clearly the median value of the deals decreased. This is shown in the Technical Annex.

Figure 10 Seed and Venture rounds by UK-headquartered clean tech companies, 2012 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

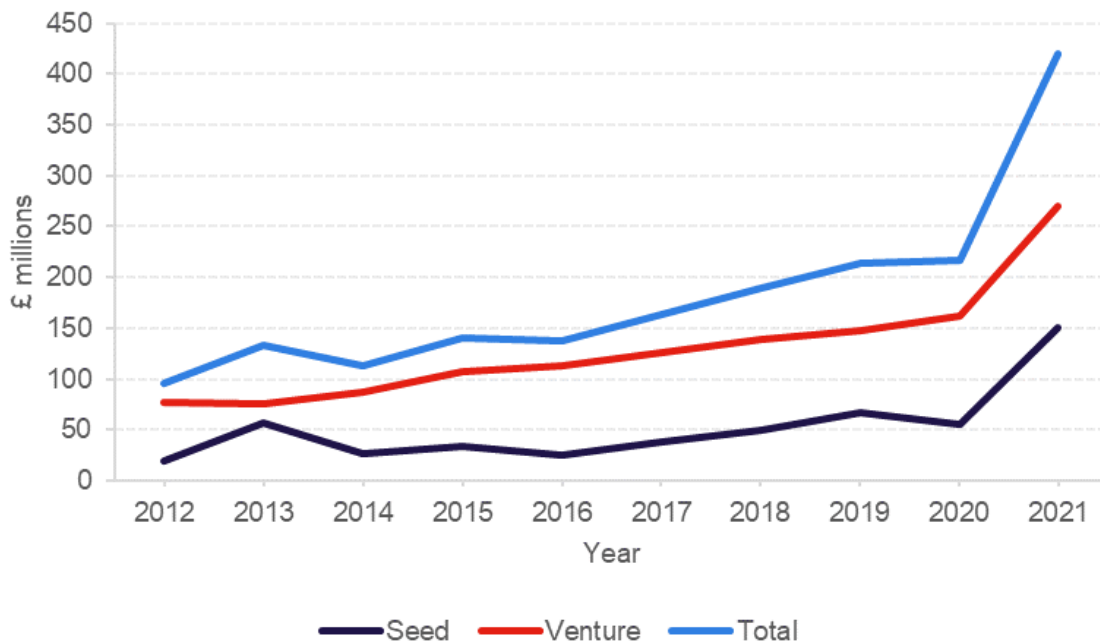
Rising total quantities of investment

Investment in UK-headquartered early-stage clean tech companies has risen since 2017. The total volume of seed and venture investments in UK-headquartered clean tech companies grew between 2017 and 2021, from approximately £163 million in 2017 to approximately £420 million in 2021 (while the number of rounds increased from 165 to 258 over the same time period). This growth rate in investment volume corresponds to a compound annual growth rate (CAGR) of approximately 27% (while the corresponding compound annual growth rate for number of rounds was around 12%).

In 2021 the combined value of both seed and venture investments in the UK clean tech sector almost doubled, from a total of £217 million to £420 million. This rapid growth observed was in line with the high growth rate experienced by total VC investment in the UK tech sector (the fastest since 2013 to 14), which saw total VC investment increasing by around 2.3 times, from £11.5 billion in 2020 to £29.4 in 2021 (across UK startups and scale-ups).⁶⁰ As a consequence, investment in UK-headquartered early-stage clean tech companies remains small as a fraction (approximately 1.7%) of total VC investment in the UK. Moreover, and looking at a longer time horizon, total VC investment in UK tech companies increased by 6.4 times between 2014 and 2021, but only by 3.7 times for investment in UK early-stage companies over the same time period.

⁶⁰ [UK tech sector achieves best year ever as success feeds cities outside London - GOV.UK \(www.gov.uk\)](https://www.gov.uk/government/news/uk-tech-sector-achieves-best-year-ever-as-success-feeds-cities-outside-london)

Figure 11 Total value of investment for seed and venture rounds by UK-headquartered clean tech companies, 2012 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

For most of the period from 2017 to 2021, changes in the total value of venture investment in UK clean tech companies grew at a pace around 10% per year, while the growth in seed investment was more volatile (Figure 11). The rise in investment in UK-headquartered early-stage clean tech companies between 2017 and 2021 was driven by a number of factors.

Demand for clean tech from both consumers and corporates is increasing.⁶¹ The percentage of British people listing the environment amongst the top three national concerns for the UK has tended to increase since 2017, reaching 40% in early November 2021.⁶² As of early March 2022, 683 of the 2,000 largest publicly-traded companies globally by revenue have made net zero commitments;⁶³ of these, 590 (86.3%) made this commitment in 2020 or later, and 225 (32.9%) made this commitment in 2021 or 2022. On the supply side, many clean technologies are becoming cheaper and more widely available.⁶⁴ This is particularly the case for, for instance, renewable energy⁶⁵ and electric vehicles.

⁶¹ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>. See p.46.

⁶² YouGov (2021a), 'Concern for environment reaches record high in YouGov top issues tracker'. Available at <https://yougov.co.uk/topics/politics/articles-reports/2021/11/09/concern-environment-reaches-record-high-yougov-top>.

⁶³ Net Zero Tracker (n.d.). Accessed 9th March 2022. Available at <https://zerotracker.net/>.

⁶⁴ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>. See p.46.

⁶⁵ Ibid.

Meanwhile, government policy in the UK (and elsewhere) is increasingly supportive of clean tech.⁶⁶ The UK government has set legally-binding commitments to reducing carbon emissions (see Chapter 1) and has announced and implemented a range of policies, including investments in clean technologies and bans and phase-outs of certain heavily-polluting technologies⁶⁷ (for instance, the sale of new petrol and diesel cars and vans will be banned from 2030⁶⁸), pursuant to these commitments.

The growth in the quantity of investment continued in the face of COVID-19

The growth in investment in UK-headquartered early-stage clean tech companies continued despite the COVID-19 pandemic, which saw a significant contraction in overall economic activity in 2020 and continuing economic uncertainty.

VC funding for SMEs appeared to be more resilient in 2020. The value of venture financing in the UK rose by approximately 12% between 2019 and 2020.⁶⁹ Similarly, a report by Invest Europe and the European Investment Fund (EIF) found that European VC activity hit a record level in 2020.⁷⁰

Other research by EIF staff found that European VC activity in the area of clean tech in particular continued to expand in the wake of the outbreak of the COVID-19 pandemic, outpacing the rest of the VC market.⁷¹ Similarly, our analysis suggests that the rate of growth in early-stage VC investment in UK clean tech companies was over 56% (between 2019 and 2020), exceeding the 12% growth in value⁷² observed in the wider UK VC market.

The COVID-19 pandemic may have accelerated the growth in investment in early-stage clean tech companies by raising the profile of environmental risks and concerns in the minds of consumers, businesses, policy-makers and investors.⁷³ This point was made during a number of the stakeholder consultations conducted in support of this study. Similarly, in a survey of signatories to the UN's Principles for Responsible Investment (PRI), nearly four-fifths of respondents said that they perceive the recovery from COVID-19 as 'an opportunity for governments to step up ambition towards net zero by 2050 and Paris alignment'.⁷⁴ A majority

⁶⁶ Ibid.

⁶⁷ Ibid.

⁶⁸ UK Government (2021a), 'Net Zero Strategy: Build Back Greener'. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

⁶⁹ KPMG (2022), 'Venture Pulse Q4 2021: Global analysis of venture funding'. 19th January 2022. Available at <https://assets.kpmg/content/dam/kpmg/xx/pdf/2022/01/venture-pulse-q4-2021.pdf>.

⁷⁰ European Investment Fund and Invest Europe (2021), 'The VC Factor - Pandemic Edition'. Available at https://www.investeurope.eu/media/4245/2021_eif_invest-europe_the-vc-factor-pandemic-edition.pdf.

⁷¹ Kraemer-Eis, H. et al. (2021), 'The importance of Private Equity and Venture Capital financing for Greentech companies in Europe'. SUERF Policy Note Issue No 258, December 2021.

⁷² KPMG (2022), 'Venture Pulse Q4 2021: Global analysis of venture funding'. 19th January 2022. Available at <https://assets.kpmg/content/dam/kpmg/xx/pdf/2022/01/venture-pulse-q4-2021.pdf>.

⁷³ See, for instance, Skadden, Arps, Slate, Meagher & Flom LLP and FTI Consulting (2020), 'The New Normal: ESG Drivers and the COVID-19 Catalyst'. 12th November 2020. Available at <https://www.skadden.com/insights/publications/2020/11/the-new-normal>.

⁷⁴ Reynold, F. (2020), 'COVID-19 accelerates ESG trends, global investors confirm'. PRI, 3rd September 2020. Available at <https://www.unpri.org/pri-blog/covid-19-accelerates-esg-trends-global-investors-confirm/6372.article>.

of respondents reported that the COVID-19 pandemic had ‘accelerated structural changes in the energy sector which will present opportunities for policy reform and renewable energy’.⁷⁵

The effects, if any, of Brexit are difficult to isolate

The increase in early-stage investment in UK-headquartered clean tech companies continued against the backdrop of Brexit (and the negotiations preceding it). Stakeholders interviewed for the study expressed a range of views about the impact of Brexit on the funding environment for early-stage clean tech companies in the UK. While some suggested that there had been a significant negative impact of Brexit on the UK clean tech sector, others were more sanguine. Some suggested it was too early to identify the impacts of Brexit and/or that these effects were difficult to disentangle from the effects of COVID-19.

Overall, stakeholders interviewed for this study tended to suggest that any negative impacts of Brexit on UK clean tech companies were likely to come from impacts on knowledge exchange, supply chains and the availability of talent.⁷⁶ Worsened access to talent was the negative impact of Brexit most frequently reported by stakeholders. Stakeholders reported that supply chain difficulties had also increased after Brexit – something particularly affecting hardware rather than software companies – although a stakeholder noted that there have been supply challenges globally of late. Another stakeholder reported that there had been hindrances to academic collaboration as a result of Brexit but noted that a lot of international collaboration by UK-based academics is with academics outside the European Union (EU) (e.g., in the US). Multiple stakeholders believed that there would be only limited, if any, impacts on funding opportunities attributable to Brexit since they believed it would not deter investors from seeking out worthy opportunities in the UK.

There was particularly rapid growth in investment between 2020 and 2021, with COP26 potentially encouraging this

There was particularly rapid growth in investment in early-stage UK clean tech companies between 2020 and 2021, with the total value of seed and series A investments in UK-headquartered clean tech companies almost doubling. This may reflect a ‘COP pop’, with the UK’s hosting of COP26 - and the attendant publicity for, and discussion about, environmental issues - driving increased VC investment in clean tech.⁷⁷ Tech Nation’s *Net Zero Report 2021* reported such a ‘COP pop’, with an uptick in investment activity occurring in October 2021, in the lead-up to COP26 in November 2021.⁷⁸ It may also reflect the presence of large amounts of ‘dry powder’ – committed but unallocated capital – in VC funds in 2021 (see the Technical Annex).

⁷⁵ Ibid.

⁷⁶ Moreover, it should be noticed that, as a direct result of Brexit, the European Investment Fund does no longer invest in the UK. The EIF is one of the few investors that invest in first time managers, and, as a consequence, it may now be harder to secure investment funds in the UK.

⁷⁷ KPMG (2021b), ‘Q3 2021 Global and UK analysis of venture funding’. Available at

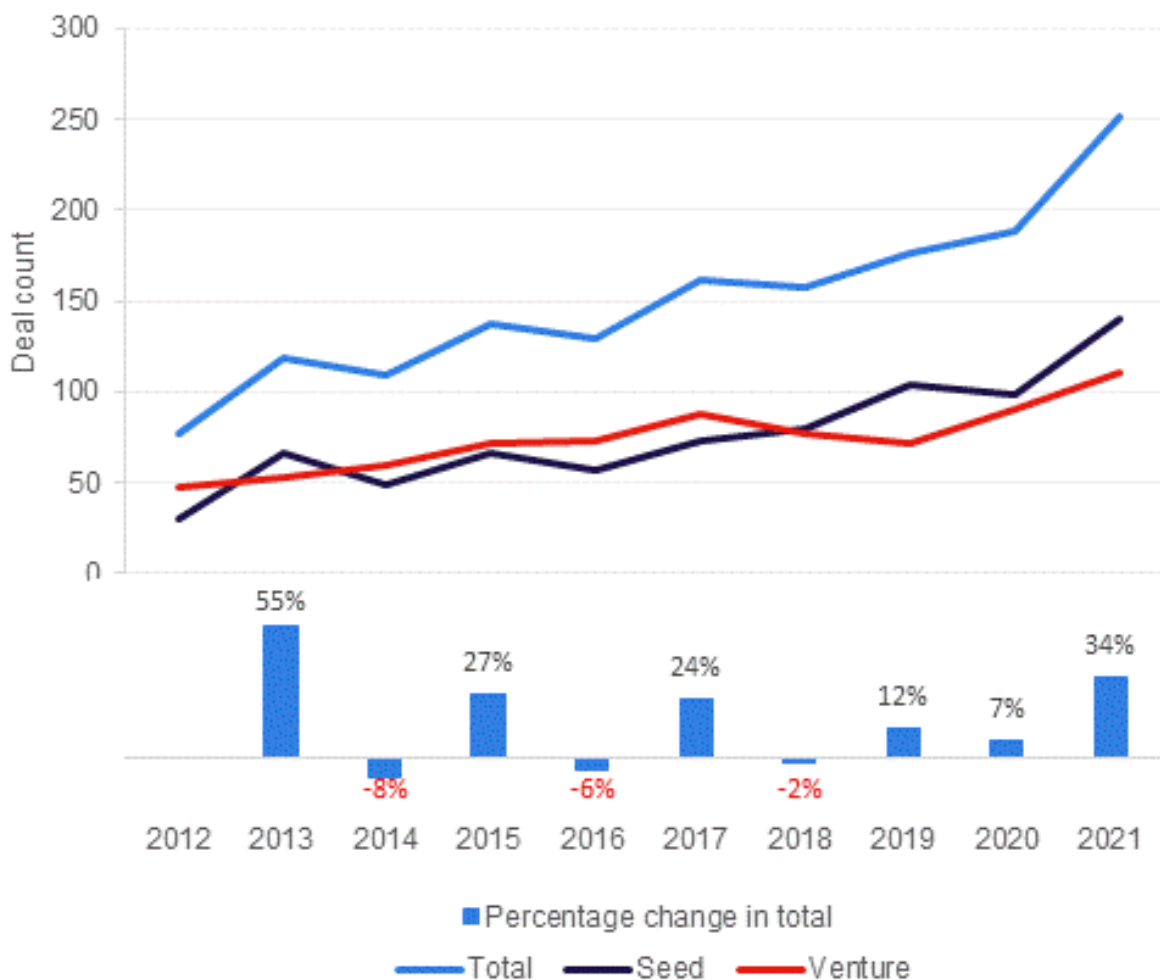
<https://home.kpmg/uk/en/home/insights/2021/10/q-three-global-and-uk-venture-capital-analysis.html>.

⁷⁸ Tech Nation (2021b), ‘Net Zero Report 2021’. Available at <https://technation.io/net-zero-report-2021/>.

Growth in the total number of deals

The number of seed and venture rounds by UK-headquartered clean tech companies grew at an uneven pace over time: the number of rounds increased by around one quarter in both 2015 and 2017, but slightly declined in 2016 and 2018, before recovering in 2019 and 2020. The latest available year (2021) saw a large increase in the number of rounds (more than one third) (see Figure 12).

Figure 12 Deal count for seed and venture rounds by UK-headquartered clean tech companies, 2012 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

As a comparison (given that around 98% of enterprises considered for the clean tech sector can be classified as SMEs), the number of private equity and VC investments in UK SMEs⁷⁹ in general has shown low growth since 2017.⁸⁰ The number of private equity and VC investments

⁷⁹ See section 3.

⁸⁰ British Business Bank (2021a), 'Small Business Finance Markets 2020/21'. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2021/03/BBB-SBFM-Report-2021-Widescreen-AW-tagged-002.pdf>.

in UK SMEs rose by approximately 1% between 2017 and 2018 and then by approximately 5% in each year from 2018 to 2020.⁸¹

Increasing deal sizes

The quantity of investment in early-stage UK clean tech companies has increased significantly between 2017 and 2021 while growth in the number of deals has also increased over the same period, albeit at a slightly lower pace. The increases in early-stage investment volumes are therefore driven largely by increasing deal sizes. As shown in Figure 13 below, the median value of venture rounds by UK-headquartered clean tech companies have shown an increasing trend since 2017 (with the exception of 2020), while the median value of seed rounds appears to have increased significantly in 2019 and 2021 only.

The growth in the median value of seed and venture rounds by UK clean tech companies stalled in 2020. This is aligned with what happened in the wider market in 2020; amongst all UK deals, the median value of seed deals remained approximately the same between 2019 and 2020, while the median value of venture deals fell by 4%.⁸² The British Business Bank (BBB) attributed this to investor caution in response to COVID-19.⁸³ As noted above, however, the overall quantity of early-stage investment rose despite this stalling in the growth in the median values of early-stage deals.

The median value of both seed and venture rounds rose sharply between 2020 and 2021, from approximately £280,000 and £1 million to around £410,000 and £1.54 million respectively. At the same time the proportion of deals with higher value also increased, with medium and large deals (those in excess of £1 million) accounting for 31% of all deals in 2017, but 45% in 2021 (with a particularly rapid rise in the deals worth £5 million and above).

These large rises may reflect investors being willing to commit larger amounts to early-stage clean tech companies given the increased profile of environmental issues in the build-up to, during and in the wake of COP, alongside the increased profile⁸⁴ of environmental, social and governance (ESG) considerations in the wake of the COVID-19 pandemic. They may also reflect the large amounts of dry powder in the market in 2021 (see the Technical Annex), with VC funds overall having large quantities of committed but unallocated capital available to invest.

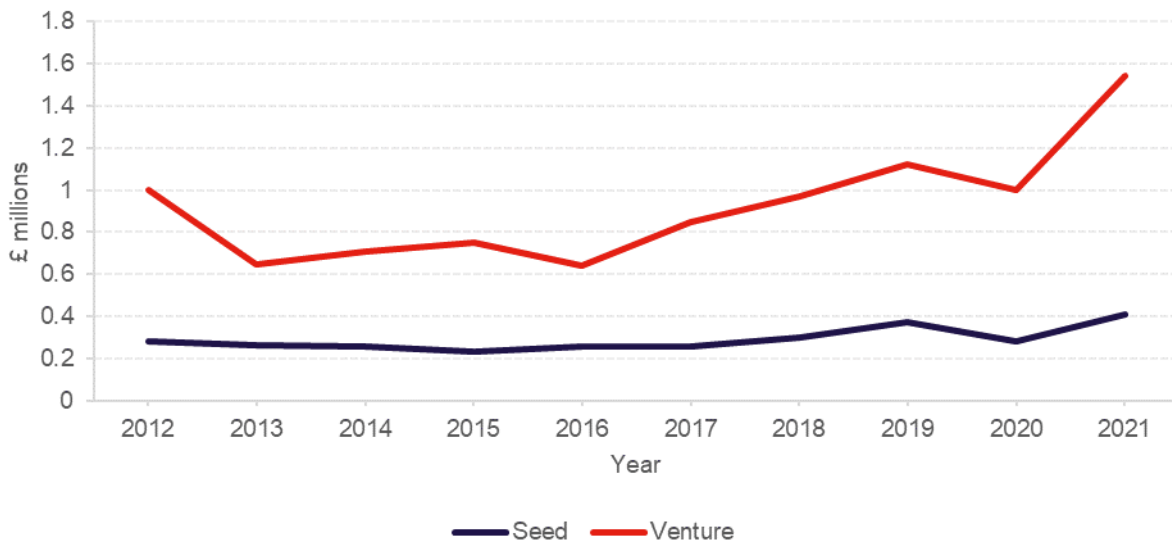
⁸¹ Ibid.

⁸² British Business Bank (2021b), 'Small Business Equity Tracker 2021'. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2021/06/Equity-Tracker-2021-Final-report-1.pdf>.

⁸³ Ibid.

⁸⁴ See, for instance, Skadden, Arps, Slate, Meagher & Flom LLP and FTI Consulting (2020), 'The New Normal: ESG Drivers and the COVID-19 Catalyst'. 12th November 2020. Available at <https://www.skadden.com/insights/publications/2020/11/the-new-normal>.

Figure 13 Median value of seed and series A rounds by UK-headquartered clean tech companies, 2012 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

Comparison with trends in the VC markets for other advanced technologies

This section compares the trends in the VC market for early-stage UK clean tech companies with the trends in the VC markets for early-stage UK AI and biotech companies. AI and biotech were chosen as comparators because both are advanced technologies that have attracted significant interest and ‘hype’ amongst investors and the public and because together they each share similarities with different classes of clean tech companies. AI companies are likely to be relatively similar to clean tech software companies in terms of capital requirements and development cycles, while biotech companies are likely to share similarities with clean tech hardware companies in terms of R&D intensity and requirements for expensive equipment⁸⁵. This choice of comparators also follows the choice of comparators in the 2016 paper from the MIT Energy Initiative, *Venture Capital and clean tech: The Wrong Model for Clean Energy Innovation*, which compared investments in clean tech companies with investments in (non-clean tech) software and medical companies.⁸⁶

In the UK, early-stage VC investment has grown more quickly in clean tech than in AI and biotech since 2017

Looking at the long-term investment trends over the last 10 years, early-stage investments in Artificial Intelligence have initially grown significantly more quickly than comparable

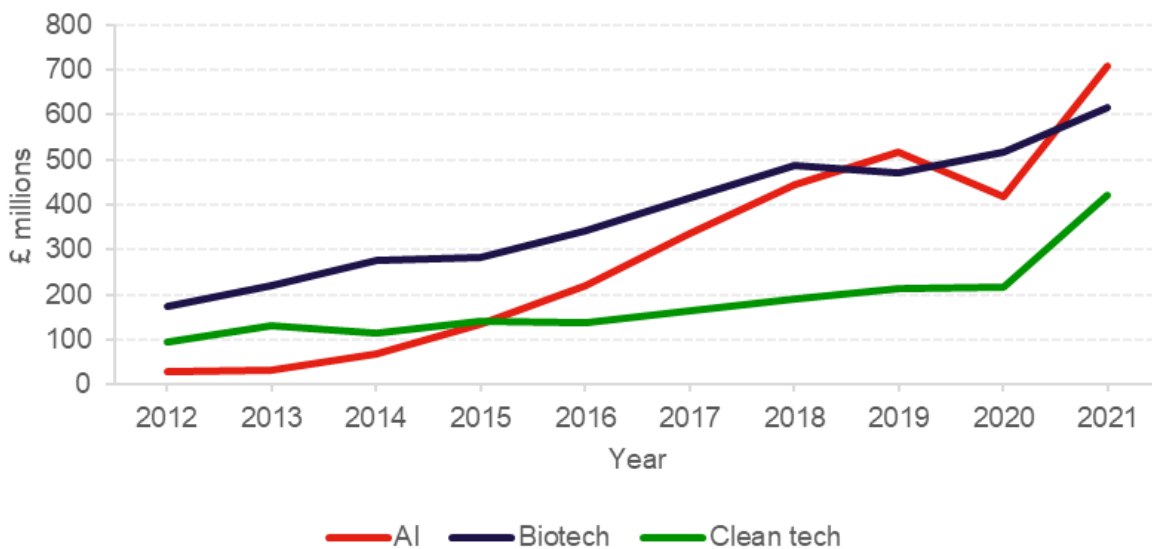
⁸⁵ Gaddy, B., Sivaram, V. and O’Sullivan, F. (2016), ‘Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation’. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

⁸⁶ Ibid.

investments in the clean tech and Biotech sectors. In fact, between 2012 and 2017, early-stage investment in AI companies grew by 1000%, while the clean tech and Biotech sectors only grew by 70% and 140% respectively (see Figure 14).

After 2017, the AI sector continued to grow up until 2019 before experiencing a sudden fall in 2020 and rebounding in 2021 (experiencing an aggregate growth of 112% between 2017-2021). On the other hand, investment in the clean tech sector over the last five years saw initially a moderate growth between 2017 and 2020 before experiencing a strong rise between 2020 and 2021, with a cumulative growth of 158% between 2017 and 2021. However, AI's growth was larger in absolute terms; the higher percentage growth for clean tech is partly due the starting point in 2017 being lower. Over the same time period, early stage investment in UK Biotech companies grew by a cumulative 49%, with an annual growth rate ranging between 10% and 20%, with the exception of a small decline in 2019 (see Figure 15).

Figure 14 Total value of seed and series A rounds by UK-headquartered clean tech, AI and biotech companies, 2012 – 2021

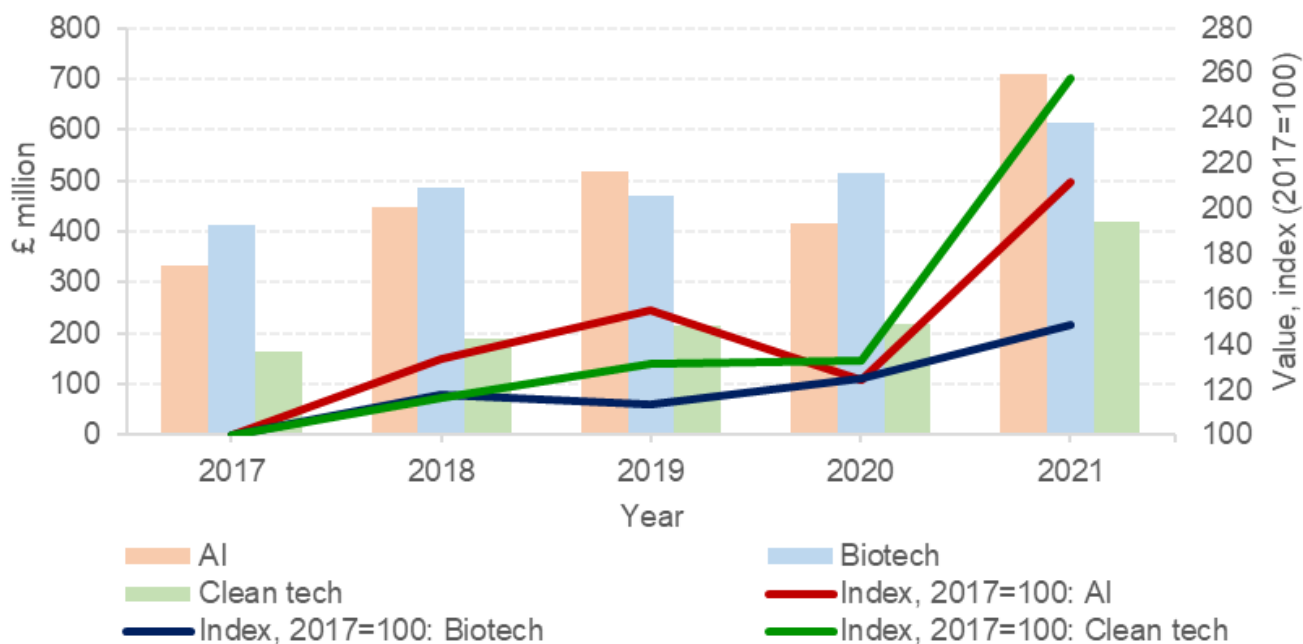


Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

Despite this relatively faster rise in early-stage investments observed over the last five years, the overall amount invested in the UK clean tech sector in 2021 was still substantially below the amount invested in the AI and Biotech sectors (£420 million compared with £710 and £615 million respectively).

Figure 15 Total value of seed and indices of seed and series A rounds by UK-headquartered clean tech, AI and biotech companies, 2017 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis. Left axis: total value. Right axis: value with 2017=100.

Source: LE analysis of Beauhurst data.

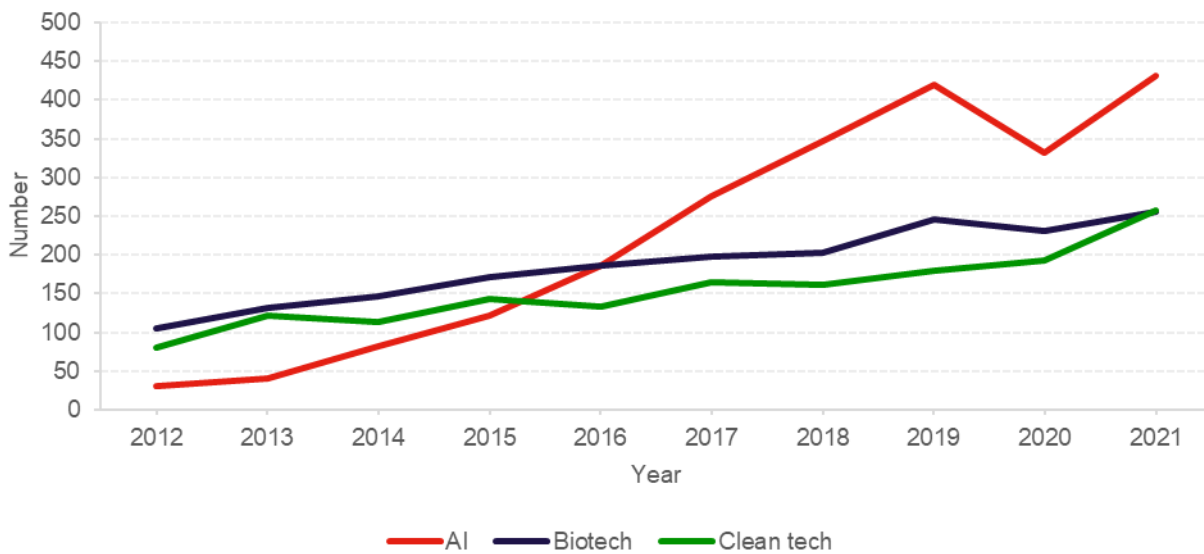
There are fewer early-stage VC investments in UK clean tech companies than in UK AI and biotech companies

Next, we show the evolution in the number of early-stage rounds in the clean tech, AI and Biotech sectors. Figure 16 shows that the number of seed and series A rounds by UK clean tech companies doubled between 2012 and 2017 (from 81 to 165), at a slightly higher pace than the Biotech sector (from 105 to 197, with a cumulative growth rate of 88%), but at a much lower rate compared with the AI sector (where the number of deals grew by more than 9 times, (which was partly a result of the low starting value of just 30). As a result, the number of seed and series A rounds by UK clean tech companies has been smaller than the number of such rounds by UK AI and biotech companies between 2016 and 2020.

Between 2020 and 2021, the number of early-stage UK clean tech rounds increased by more than 34%, compared with 10% for the Biotech sector and almost 30% for the AI sector (which experienced a sharp drop in the number of deals in the year before, consistently with the fall in value of investment already discussed). As a consequence the number of early-stage UK clean tech rounds in 2021 was slightly higher than the number of rounds for UK biotech companies (258 vs. 255), while there was still a large gap between the number of rounds for UK clean tech and UK AI companies (258 vs. 430⁸⁷).

⁸⁷ The evidence presented for AI (showing a large increase since 2012) is also consistent with evidence on global investment in the sector, which shows that the global annual value of VC investments in AI firms has grown by

Figure 16 Deal counts for seed and series A rounds by UK-headquartered clean tech, AI and biotech companies, 2012 – 2021



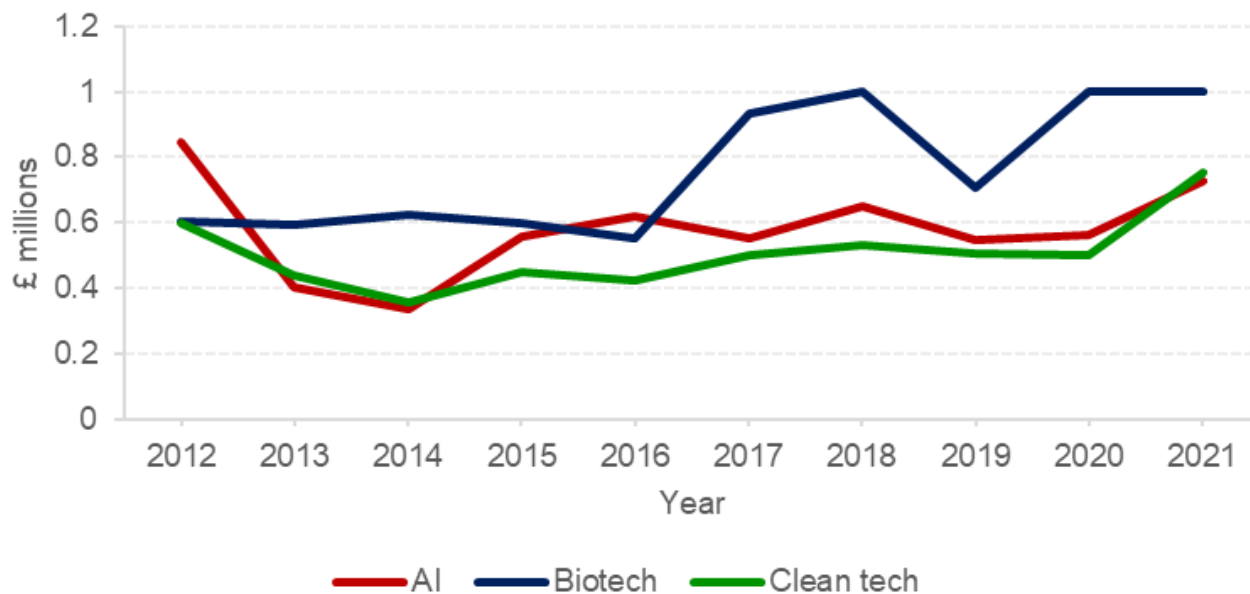
Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

Finally, we look at the median value of the deals over time for the three sectors considered: median value of deals ranged between £350,000 and £530,000 for the clean tech sector between 2013 and 2020, before increasing to £760,000 in 2021. Median value for the AI sector was in line with the clean tech sector in 2013 and 2014, slightly higher between 2015 and 2020 and slightly lower in 2021 (£730,000). On the other hand, the median value for deals in the Biotech sector has been consistently higher than the other two sectors since 2017 and stood at approximately £1,000,000 in 2021.

around 25 times between 2012 and 2020, with the UK absorbing around 3% of global investments. See OECD (2021), 'Venture Capital Investments in Artificial Intelligence: Analysing Trends in VC in AI Companies from 2012 through 2020'. OECD Digital Economy Papers, September 2021, No. 319. Available at <https://www.oecd.org/digital/venture-capital-investments-in-artificial-intelligence-f97beae7-en.htm>.

Figure 17 Median size for seed and series A rounds by UK-headquartered clean tech, AI and biotech companies, 2012 – 2021



Notes: Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

Overall, the evidence presented suggests that early-stage investment in the AI sector grew at a faster pace compared with the clean tech and Biotech sector since 2012 (both in terms of number of deals and value of investment), which was partially influenced by the fact AI was starting from a very low level (only 30 deals in 2012 compared with 81 for clean tech and 105 for biotech). On the other hand, if we look at trends over the last five years (after the launch of the Clean Growth Strategy by the UK Government in 2017), the number of early-stage deals in the clean tech sector has grown by 56% overall (in line with the AI sector and faster than the Biotech sector), while the overall amount invested has grown by 158%, compared with 112% for AI and 49% for Biotech. However, in 2021 the overall volume of early-stage investment in UK clean tech companies was still considerably smaller compared to the early-stage investment in UK AI and biotech companies (£420 million compared with £710 million and £615 million respectively).

Geographical distribution of investment within the UK

This section examines the geographical distribution of early-stage clean tech investment within the UK. In particular, it compares investment in early-stage clean tech companies in London with investment in early-stage clean tech companies elsewhere in the UK. London has been identified as a hub of clean tech VC activity on the national, European and global stage.⁸⁸

⁸⁸ Dealroom.co and London & Partners (2021), 'Five years on: global climate tech investment trends since the Paris Agreement'. Available at <https://dealroom.co/uploaded/2021/10/Dealroom-London-and-Partners-Climate-Tech.pdf>.

Early-stage VC investment in UK clean tech companies is concentrated in London-headquartered companies

Figure 18 shows the distribution of early-stage investment in UK clean tech companies by area, looking at London and rest of the UK.⁸⁹ Although only one quarter of the clean tech companies identified in our search are headquartered in London (see Figure 9), London-headquartered clean tech companies accounted for between 27%-34% of the overall number of seed and venture rounds and 33%-39% in terms of overall deal value between 2017 and 2020 (indicating that London-headquartered clean tech companies tended to raise slightly larger rounds). These figures rose sharply to 42% and 45% respectively in 2021.

Figure 18 Seed and venture rounds by clean tech companies headquartered in London and in the rest of the UK, 2017 – 2021



Notes: Top panel: investment amount. Bottom panel: number of deals. Exclude rounds with unknown information on the location. Deals with value below £100,000 or above £20 million were removed from the analysis.

Source: LE analysis of Beauhurst data.

⁸⁹ It should be noted that a company could be headquartered in London while having its operations elsewhere.

Concentration of investment in London is not unique to early-stage VC investment in clean tech and has potential benefits and challenges

In general, equity finance in the UK is concentrated in London: 62% of equity investment into UK SMEs is in London businesses despite London accounting for only 19% of UK SMEs.⁹⁰ The share of early-stage VC investment in UK clean tech companies directed at London-headquartered businesses has been around 60% for much of the period being analysed (2017 to 2021). The concentration of early-stage VC investment in clean tech in London, therefore, is not unusual.

The concentration of early-stage VC investment in clean tech in London may partly reflect *early-stage* clean tech companies in particular being concentrated in London. Stakeholders interviewed for this study highlighted that a large amount of innovation takes place around the research-intensive universities in the ‘Golden Triangle’ of London, Oxford and Cambridge; Oxford and Cambridge are around an hour’s travel from London. Some founders may choose to locate in London in order to access the greater opportunities for funding.

In addition, there are benefits to the creation of clusters – through, for instance, greater knowledge sharing, access to a larger talent pool, and the greater availability of specialised inputs and services.⁹¹ Greater dispersion of clean tech investment and activity could therefore have costs.

However, if VC investment in early-stage clean tech companies were excessively concentrated in London, that could mean that companies based outside London are unable to access funding when, given a London location, they would otherwise be deemed worthy of investment. The stakeholders interviewed for this study expressed mixed views about the extent to which companies outside London were unable to access funding because of their location. Three quarters of all UK clean tech companies (including but not limited to early-stage clean tech companies) are located outside London (Figure 9 above); one reason for this is the fact that many clean tech companies require manufacturing and hardware solutions, for which skills and supply chains are often concentrated in regions other than London (for instance, in the North-West of England).

Investors prefer to invest in companies located a short journey from them

Part of the reason for the concentration of investment in London, both for investment in UK SMEs in general and for investment in UK clean tech companies, is that London-based investors are an important source of capital, and investors tend to invest in companies that are a short journey from them. The building of relationships and exchange of information, both as part of due diligence pre-investment and monitoring post-investment, are easier and less costly if the investor and the investee company are a short journey from each other.⁹² In addition,

⁹⁰ British Business Bank (2021c), ‘Regions and Nations Tracker 2021’. Available at <https://www.british-business-bank.co.uk/research/regions-and-nations-tracker-2021/>.

⁹¹ Krugman, P.R., Obstfeld, M. and Melitz, M. (2018). ‘International Economics: Theory and Policy’.

⁹² British Business Bank (2021c), ‘Regions and Nations Tracker 2021’. Available at <https://www.british-business-bank.co.uk/research/regions-and-nations-tracker-2021/>.

investors may choose to invest near to them because of a perception that they are something familiar⁹³ or because they want to support businesses in their local area.

BBB analysis of UK equity investments (across sectors and commercialisation stages) since 2011 found that in more than 80% of equity investment deals the investor had an office within two hours' travel of the business in which they are investing.⁹⁴ The average travel time between an investor's office and the company in which that investor is investing fell between 2011 and 2020 despite the increase in remote working and teleconferencing in the wake of the outbreak of the COVID-19 pandemic.⁹⁵ A stakeholder interviewed for this study reported that investors tended to value interacting with businesses face-to-face before investing in them even after the pandemic, and that this is especially true in particular sectors and for larger deals.

Exit opportunities for investors in UK clean tech companies

Investors receive a return on their investments in a start-up when an 'exit' occurs. The two most common⁹⁶ types of exit are IPOs and acquisitions. In an IPO, a company lists its shares on a stock exchange, allowing equity in the company to be traded on public markets. In an acquisition, the company is purchased by a larger company. The acquired company may continue its operations under its previous name or it may trade under the name of the acquirer's company.⁹⁷ Less commonly, an exit can take place through a merger, in which the company joins with one or more other companies to form a new entity.⁹⁸

As noted by stakeholders, IPOs by UK clean tech companies have been very rare in the past five years. There have been between nil and three in each year since 2017 (Table 2). Meanwhile, the total number of IPOs on the London Stock Exchange between 2017 and 2020 ranged between 36 in 2019 and 108 in 2017.⁹⁹ However, electric vehicle maker Arrival was valued at more than £9 billion in its 2021 IPO on the Nasdaq, which was described as the 'UK's biggest tech IPO'.¹⁰⁰ This successful IPO may encourage further IPOs by UK clean tech companies.

Stakeholders reported that larger companies that operate in clean-tech-relevant sectors, such as the large oil and gas majors, were significantly less active in terms of acquisitions than the so-called Tech Giants such as Meta and Microsoft, which frequently purchase start-up

⁹³ Ibid.

⁹⁴ Ibid.

⁹⁵ Ibid.

⁹⁶ Startupxplore (n.d.), 'How can startups 'exit' and investors make money?'. Available at <https://startupxplore.com/en/blog/exit-strategies-for-startups-and-investors/>.

⁹⁷ Corporate Finance Institute (n.d.), 'Merger vs. Acquisition'. Available at <https://corporatefinanceinstitute.com/resources/knowledge/deals/merger-vs-acquisition/>.

⁹⁸ Ibid.

⁹⁹ Statista (2021), 'Number of IPOs on the London Stock Exchange (LSE) from 2010 to 2020, by market'. Available at <https://www.statista.com/statistics/1093408/uk-lse-ipos-numbers-by-market/>.

¹⁰⁰ Williams-Grut, O. (2021), 'Arrival becomes UK's biggest tech IPO with \$13bn Nasdaq float'. Yahoo Finance, 25th March 2021. Available at <https://uk.news.yahoo.com/arrival-e-bus-electric-vehicle-spac-nasdaq-listing-uk-tech-stocks-tesla-nikola-142145860.html>.

companies.¹⁰¹ However, as reported by stakeholders, interest amongst larger firms in acquiring clean tech companies is growing. The number of acquisitions of UK clean tech companies grew between 2020 and 2021 (from 22 to 31). Examples of large acquisitions of UK clean tech start-ups include EDF’s acquisition of Pod Point for £110 million in 2020¹⁰² and BP’s £130 million 2018 acquisition of Chargemaster.¹⁰³ Both Pod Point and Chargemaster are electric vehicle charging companies. While previously the low number of profitable exits has deterred investment in clean tech (see section 6 below), an increasing number of examples of successful exits could encourage more investment by demonstrating a route to profitability.

Table 2 IPOs by and acquisitions of UK clean tech companies, 2017 – 2021

Year	Number of acquisitions	Number of IPOs
2017	15	1
2018	11	1
2019	24	1
2020	22	0
2021	31	3

Source: LE analysis of Beauhurst data

International comparison

Other high-income countries have also made net zero commitments (i.e., commitments to reduce the amount of greenhouse gases emitted domestically to at most the amount of greenhouse gases removed by the country). In particular, we compared trends over the last 10 years for the UK compared with Germany, France, Sweden and the US. The comparison is presented in full in the Technical Annex and it is based on Crunchbase (Figure 33) and i3 (Figure 34) data, as the Beauhurst database used did not contain information on companies headquartered outside the UK.

Compared to these other countries, the UK has shown increases in terms of the total value of seed rounds and of series A rounds by clean tech companies as a percentage of GDP since 2017 (with the exception of Sweden, where the clean tech market is particularly developed).

¹⁰¹ Stacey, K., Fontanella-Khan, J. and Palma, S. (2021), ‘Big tech companies snap up smaller rivals at record pace’. Financial Times, 19th September 2021. Available at <https://www.ft.com/content/e2e34de1-c21b-4963-91e3-12dff5c69ba4>.

¹⁰² Automotive Management (2020), ‘EDF Energy acquires EV charging company Pod Point’. 17th February 2020. Available at <https://www.am-online.com/news/latest-news/2020/02/17/edf-energy-acquires-ev-charging-company-pod-point>.

¹⁰³ Vaughan, A. (2018), ‘BP buys UK’s biggest electric car charger network for £130m’. The Guardian, 28th June 2018. Available at <https://www.theguardian.com/business/2018/jun/28/bp-buys-uks-biggest-electric-car-charger-network-for-130m>.

5. The UK Venture Capital Market for Early-Stage Clean Tech Companies: Investors

This chapter is concerned with investors in UK clean tech companies. It begins with a discussion of the VCs and corporate VCs who invested in UK-headquartered clean tech companies between 2017 and 2021. It then examines other sources of investment for early-stage UK clean tech companies. Finally, it discusses the issues associated with investment in clean tech for institutional investors.

In this section we present the findings from the analysis of the Beauhurst data for investors which have invested in UK clean tech companies (at the seed or venture stage) between 2017 and 2021. In the Technical Annex we discuss more generally the role of different types of investors in early-stage UK clean tech companies.

Analysis of Beauhurst data

Overall, a total of 933 deals were recorded by Beauhurst between 2017 and 2021, 53% at the seed stage and 47% at the venture stage. Only 29% of those deals were recorded by Beauhurst as publicly announced deals, while the others were collected by Beauhurst private research. As a result, for many of the deals, there is no information on investor type or amount invested¹⁰⁴ and some information on investor number, name, type, location and amount invested etc. was only available for a maximum of 238 deals (around one quarter). The availability of information mainly depended on the source of information: information was almost always missing for deals classified as 'not publicly announced', while it was available for 'publicly announced deals' in around 79% of cases. As a result, the deals with available information were typically larger in size (median value of £1.2 million) compared with those with unavailable information (median value around £0.5 million).

Hence, the results presented in this section only applies to a subset of (typically larger) deals and may not be representative of all deals that have occurred in the clean tech sectors over the last five years. All the findings presented should be interpreted accordingly. As a comparison, in the Biotech sector, 40% of deals recorded between 2017 and 2021 were classified as 'publicly announced' and information on investors was available for around 34% of all deals (reflecting the typically larger size of deals). In the AI sector, around 34% of deals were classified as publicly announced, and information on investors was available for around 29% of all deals.

In total it was possible to identify some type of information for 587 investors in UK clean tech companies between 2017 and 2021. In the following sections we present the available information for these investors, but, as mentioned, it should be remembered that information

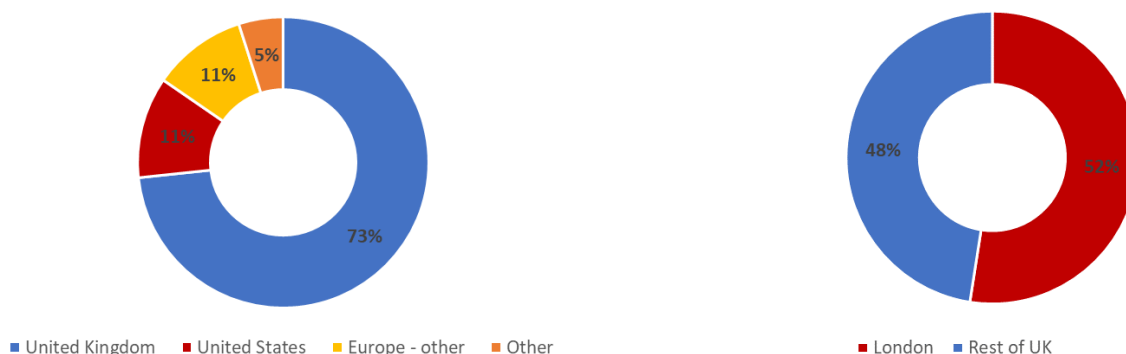
¹⁰⁴ For deals identified by Beauhurst private research information on investors is almost always undisclosed

only relates to a subset of deals and it may also be incomplete (e.g. available for investor type but not location).

Most of the funds targeting the UK clean tech sector were from UK based investors

As shown in Figure 19, almost three quarters of investors in the UK clean tech sector (at the seed or venture stage) between 2017 and 2021 were located in the United Kingdom, with the remaining investors located in the rest of Europe (11%), the United States (11%) and other countries (5%). Looking at the location of UK investors, just over one half were located in London, and the rest in the other regions of the UK.

Figure 19 Location of early-stage investors in UK clean tech companies, 2017-2021



Note: Left panel: country of investor location. Right panel UK area of investor location. In total 587 investors were identified at seed or venture stage and information on location was available for 506 of them. Information on UK area was available for 324 of 371 UK based investors. Overall, some information on investors was only available for 238 of 933 deals.

Source: LE analysis of Beauhurst data

In terms of type of investors, information was scarcely populated for non-UK investors (only reported for 28 cases), with the majority (68%) being recorded as Private Equity and Venture Capital.

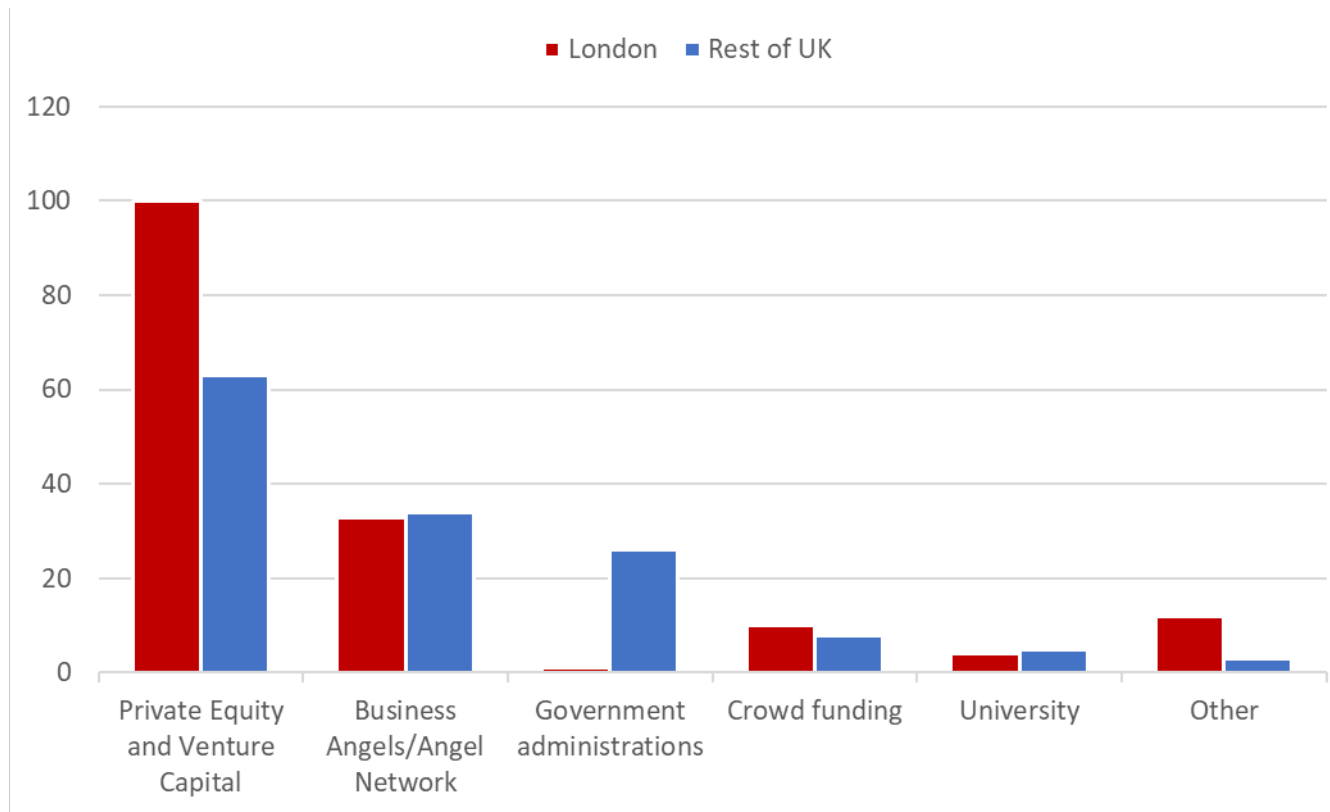
The distribution by type of investors for the United Kingdom is presented in Figure 20 and disaggregated into investors based in the London area or elsewhere in the UK. Investors defined as Private Equity and Venture Capital were the majority in the UK, accounting for 54% of early-stage investments in UK clean tech companies between 2017 and 2021, followed by Business Angels (22%), 'Government funders' (9%)¹⁰⁵, Crowdfunding and Other (6% each).

However, the picture varies significantly if we look at the London area and the rest of the UK separately: more than 60% of early-stage clean tech investments in London were made by Private Equity and Venture Capital firms, while the role of government equity was negligible. On the other hand, in the other UK areas the proportion of Private Equity and Venture Capital investors was relatively lower (accounting for 45% of total investors), while government administrations (e.g. Northern Power House, East Midlands Engine) played a more prominent

¹⁰⁵ Government funders include local, regional, devolved and central administration as explained in the next footnotes. Government funding includes equity funding but not grants, which are excluded from this analysis.

role in supporting early-stage investment in clean-tech companies (accounting for almost one fifth of total funders, this definition includes equity funding from Local, Regional¹⁰⁶, Devolved¹⁰⁷ and Central¹⁰⁸ Government administrations).

Figure 20 Type of UK based investors in UK clean tech companies, 2017-2021



Note: Based on 311 UK investors with information on investor type. ‘Government administrations’ includes funding from Local, Regional, Devolved and Central Government administration

Source: LE analysis of Beauhurst data

UK investor types by year

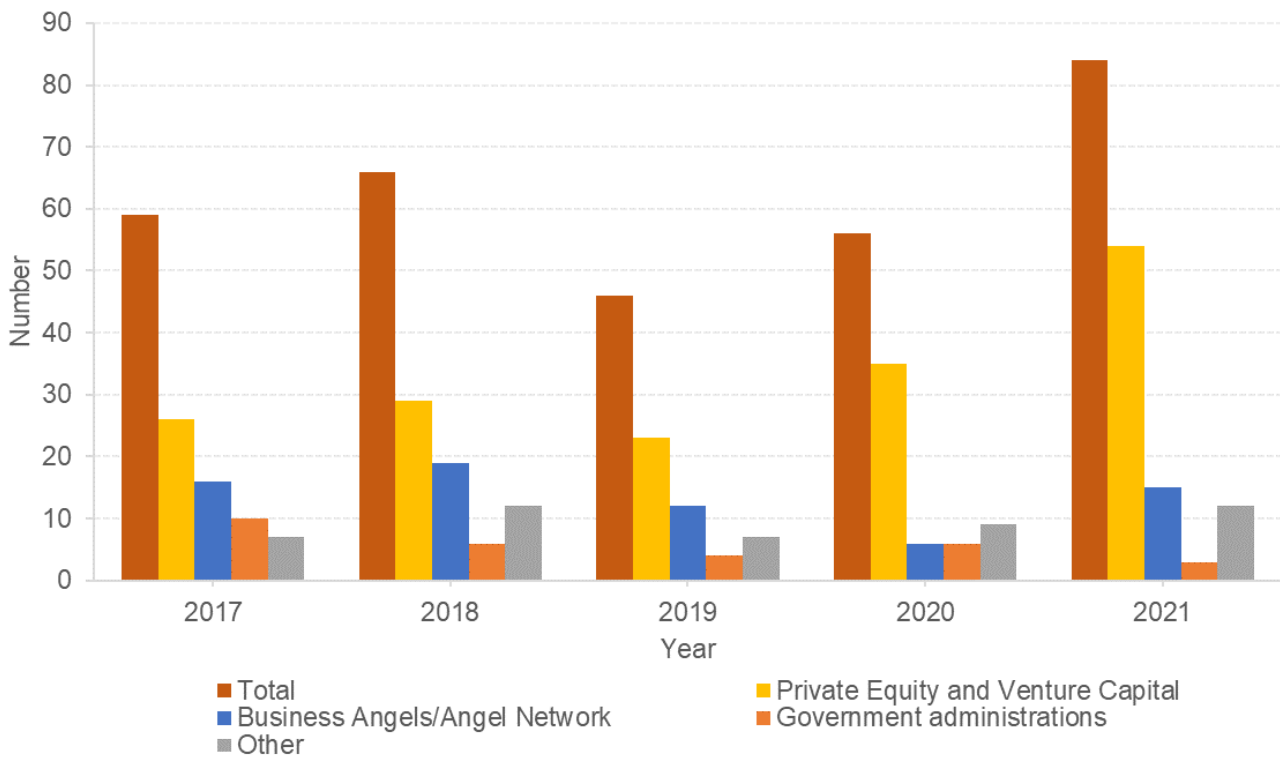
Looking at trends over time by investor type for UK based investors, Figure 21 shows that (based on the available data), there was a general increase in the number of investors from 59 in 2017 to 84 in 2021. In particular Private Equity and Venture Capital investors increased in number between 2017 and 2021 (from 26 to 54, with a large increase after 2019), the number of Business Angels changed from 16 in 2017 to 15 in 2021 (after declining in 2019 and 2020), the number of Government administration funders declined, while the number of ‘Other’ investors (including University and Crowdfunding) increased slightly during the period.

¹⁰⁶ Local and Regional Government: these are funds that are capitalised using public money that is disbursed by local and regional government and are managed by either public or private organisations.

¹⁰⁷ Devolved Government: these are funds that are capitalised using public money that is disbursed by a devolved government and are managed by either public or private organisations.

¹⁰⁸ Central Government: these are funds that are capitalised using public money that is disbursed by central government and are managed by either public or private organisations.

Figure 21 UK based investors by year and type, 2017 – 2021



Note: ‘Other’ also includes the ‘Crowdfunding’ and ‘University’ categories. ‘Government administrations’ includes funding from Local, Regional, Devolved and Central Government administration

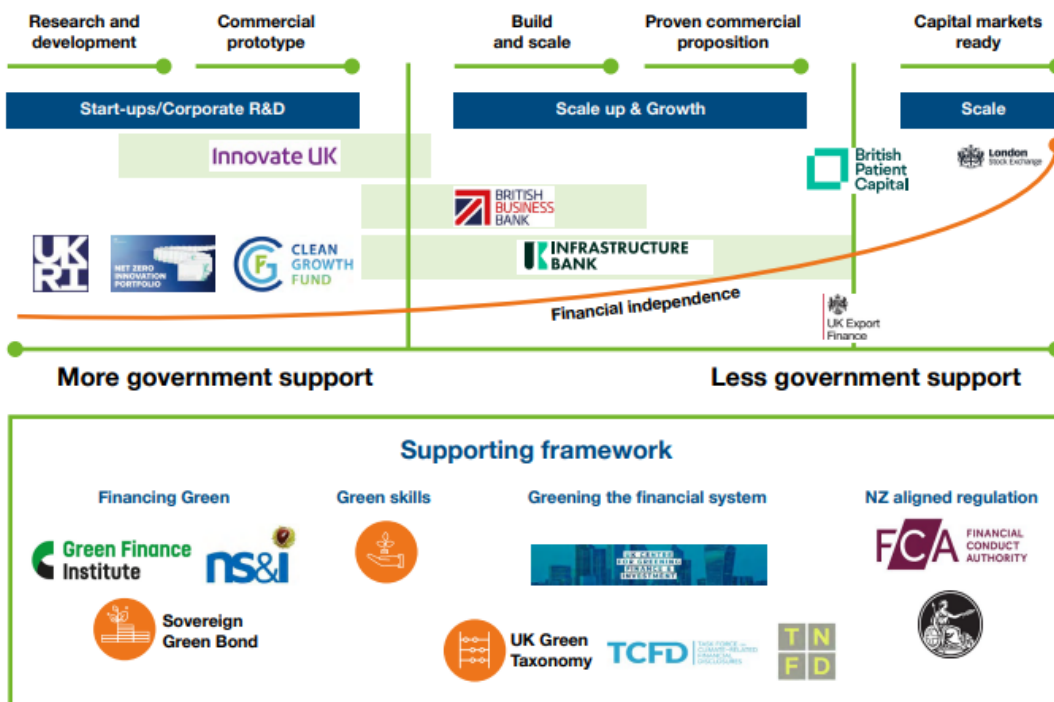
Source: LE analysis of Beauhurst data

Grants and other public funding schemes

There are a number of grant and other public funding schemes available for UK clean tech companies. Stakeholders were generally positive about the provision of grant funding for early-stage UK clean tech companies.

The figure below, from the UK government’s 2021 *Net Zero Strategy*, shows the public finance interventions available to clean tech companies at different levels of commercialisation.

Figure 22 Public finance interventions across the different stages of commercialisation



Source: UK Government (2021a), 'Net Zero Strategy: Build Back Greener'. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

DESNZ's Energy Entrepreneurs Fund (EEF)¹⁰⁹ provides grant funding to companies, especially SMEs and start-ups, developing and demonstrating energy innovations. As of October 2021, it had provided £72 million of grant funding since 2012.¹¹⁰ The EEF focuses on technologies at an early technology readiness level (TRL) ranging from TRL 3 to 8. The EEF forms part of the government's £1bn Net Zero Innovation Portfolio.¹¹¹ The Net Zero Innovation Portfolio typically supports pre-commercial, pre-revenue-generation activity and is focused on ten priority areas, namely:¹¹²

- future offshore wind;
- nuclear advanced modular reactors;
- energy storage and flexibility;
- bioenergy;
- hydrogen;
- homes;
- direct air capture and greenhouse gas removal (GGR);

¹⁰⁹ <https://www.gov.uk/government/collections/energy-entrepreneurs-fund>

¹¹⁰ UK Government (2021a), 'Net Zero Strategy: Build Back Greener'. Available at <https://www.gov.uk/government/publications/net-zero-strategy>.

¹¹¹ See UK Government (2021c), 'Net Zero Innovation Portfolio'. Last updated 8th December 2021. Available at <https://www.gov.uk/government/collections/net-zero-innovation-portfolio>.

¹¹² Ibid.

- advanced CCUS;
- industrial fuel switching; and,
- disruptive technologies.

Separately, Innovate UK, the UK's innovation agency and part of UK Research and Innovation, invested £273 million in 856 clean tech businesses in 2020-21, through grants and other programmes (although not all of this funding went to early-stage companies specifically).¹¹³ Innovate UK operates a Transforming Foundation Industries Investor Partnership programme, which matches private investment in UK SMEs working in reducing resource and energy consumption with grant funding for those SMEs' R&D.¹¹⁴

The Horizon 2020 programme, an EU funding programme for research and innovation that ran between 2014 and 2020 with €79 billion of funding available,¹¹⁵ was also mentioned by stakeholders as a source of funding for UK clean tech companies. We identified three UK clean tech companies that had received a total of £2.8 million in funding from Horizon 2020. UK businesses, charities, partnerships and research organisations should remain able to access funding from Horizon 2020¹¹⁶ and its successor Horizon Europe¹¹⁷ post-Brexit. However, the UK's future participation in EU science programmes has not yet been finalised¹¹⁸.

There are also grant and other public funding schemes available to clean tech companies in particular areas of the UK. A number of local grant schemes open to clean tech companies exist, including EMphasis3 CO2 Reductions (EMphasis3) in southern England¹¹⁹ and the Low Carbon Innovation Grant, part of the Coventry and Warwickshire Green Business Programme.¹²⁰ Scottish Enterprise, the Development Bank of Wales and Invest Northern Ireland have invested in clean tech companies in each of the devolved nations in the UK. In Scotland, the Scottish Government funds Wave Energy Scotland and Zero Waste Scotland, technology development bodies focusing on wave energy and the circular economy respectively.

Four co-investment funds (CIFs) invested in UK clean tech companies between 2017 and 2021: both iterations of the Low Carbon Innovation Fund (funded by the European Regional

¹¹³ Innovate UK (2021), 'Net Zero Annual Review 2020-21'. Available at <https://www.ukri.org/wp-content/uploads/2021/10/IUK-261021-UKRI-IUK-NetZero-FINAL-Web-Enabled.pdf>.

¹¹⁴ See e.g. <https://apply-for-innovation-funding.service.gov.uk/competition/752/overview>.

¹¹⁵ UK Research and Innovation (2021), 'Horizon 2020'. Last updated 5th November 2021. Available at <https://www.ukri.org/councils/innovate-uk/guidance-for-applicants/guidance-for-specific-funds/horizon-2020/> and <https://www.ukri.org/apply-for-funding/horizon-europe/>

¹¹⁶ Ibid.

¹¹⁷ European Commission (2021), 'Q&A on the UK's participation in Horizon Europe'. Available at https://ec.europa.eu/info/sites/default/files/research_and_innovation/strategy_on_research_and_innovation/documents/ec_rtd_uk-participation-in-horizon-europe.pdf.

¹¹⁸ UK Government (August 2022) <https://www.gov.uk/government/news/government-requests-consultations-with-eu-on-participation-in-eu-science-programmes>.

¹¹⁹ Greentech South (n.d.), 'EMphasis3 CO2 Reductions (EMphasis3) Project'. Available at <https://www.greentechsouth.com/emphasis3>.

¹²⁰ Coventry City Council (n.d.), 'Coventry and Warwickshire Green Business Programme: Available grants'. Available at

https://www.coventry.gov.uk/info/240/coventry_and_warwickshire_green_business_programme/2972/coventry_and_warwickshire_green_business_programme/3.

Development Fund, an EU investment programme, and operated by the UK Department for Levelling Up, Housing and Communities¹²¹), the London Co-Investment Fund and ACF Investors. In CIFs, public funding ‘follows’ private funding (by VCs and angels) so as to leverage that private funding.¹²²

Other public funding, such as from the BBB and its subsidiary British Patient Capital, is typically aimed at later-stage companies (see the figure above). Clean tech companies received support from the BBB during the COVID-19 pandemic through the Future Fund and the Coronavirus Business Interruption Loan Scheme (CBILS). The Future Fund scheme provided convertible loans of £125,000 to £5 million to at least 320¹²³ UK-based companies (across different sectors) in 2020-2021 subject to at least equal match funding from private investors.¹²⁴ The CBILS provided support of up to £5 million to smaller UK businesses that suffered a loss of revenue because of the COVID-19 pandemic and associated restrictions.¹²⁵

In the March 2020 Budget, the UK government committed to investing £800 million in the Advanced Research and Innovation Agency (ARIA), a new research funding body modelled on the US’s Advanced Research Projects Agency (ARPA), now called the Defense Advanced Research Projects Agency (DARPA).¹²⁶ ARIA will fund R&D across different stages of the R&D lifecycle and different technology areas.

Characteristics of grant funders using Beauhurst data

In the period 2017-2021, Beauhurst recorded a total of 203 grants for UK clean tech companies at the seed or venture stage (86% of grants were directed to companies at the seed stage). The vast majority of grants (96%) were funded by organisations located in the UK, in particular 49% originated from grant funders located in Scotland, while 45% were based in the London area and London. In the rest of the analysis presented in this section we focus on UK-based grant funders only.

The most relevant type of grant funders for UK clean tech companies were UK devolved government administrations (responsible for 52% of all grants), followed by the private sector (38%) and central government (7%).

The number of grants reported in the Beauhurst data declined over time, from a maximum of 61 in 2018 to 15 in 2020 and 23 in 2021 (see Figure 23). However, the median value observed

¹²¹ Low Carbon Innovation Fund (n.d.), ‘About’. Available at <https://lcif.vc/about/>.

¹²² Owen, R. and Mason, C. (2017), ‘The role of government co-investment funds in the supply of entrepreneurial finance: An assessment of the early operation of the UK Angel Co-investment Fund’. Environment and Planning C: Politics and Space, Vol 35, Issue 3, 2017. DOI: <https://doi.org/10.1177%2F0263774X16667072>.

¹²³ Beauhurst (2021), ‘All The Future Fund Recipients We’ve Identified So Far’. 11th November 2021. Available at <https://www.beauhurst.com/blog/future-fund-recipients/>.

¹²⁴ British Business Bank (2022), ‘Future Fund’. Available at <https://www.british-business-bank.co.uk/ourpartners/coronavirus-business-interruption-loan-schemes/future-fund/>.

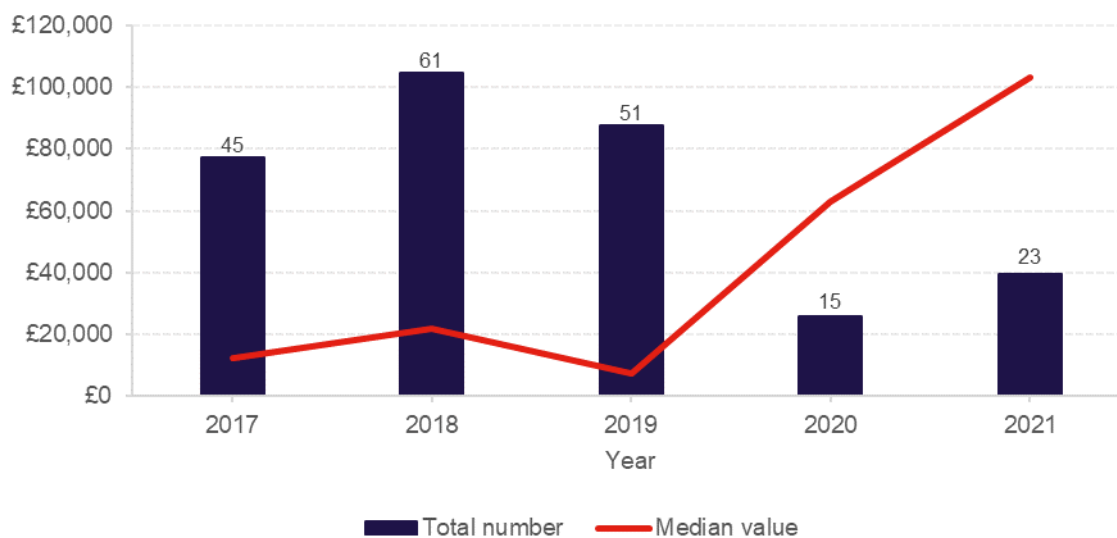
¹²⁵ British Business Bank (2021e), ‘Coronavirus Business Interruption Loan Scheme (CBILS)’. Available at <https://www.british-business-bank.co.uk/ourpartners/coronavirus-business-interruption-loan-scheme-cbils-2/>.

¹²⁶ UK Government (2021e), ‘Advanced Research and Invention Agency (ARIA): policy statement’. Policy paper, published 19th March 2021. Available at <https://www.gov.uk/government/publications/advanced-research-and-invention-agency-aria-statement-of-policy-intent/advanced-research-and-invention-agency-aria-policy-statement>.

increased significantly in 2020 and 2021, reaching £63,000 and £103,000 respectively (while it ranged between £7,500 and £22,000 in previous years).

However, this may simply be a reflection of the spending review cycle, with a higher number of grants (at least numerically) being awarded between 2017 and 2019. It is possible that a rebound will be observed in 2022 and 2023 (as grants are disbursed as part of the new spending review period). However this trend may affect the ability of SMEs to secure the necessary funding to continue technology development (which typically requires a constant availability of funds).

Figure 23 Number and median value of grants for UK clean tech companies, 2017-2021



Note: Information on amount only available for 130 of the 195 grants from UK based grant funders.

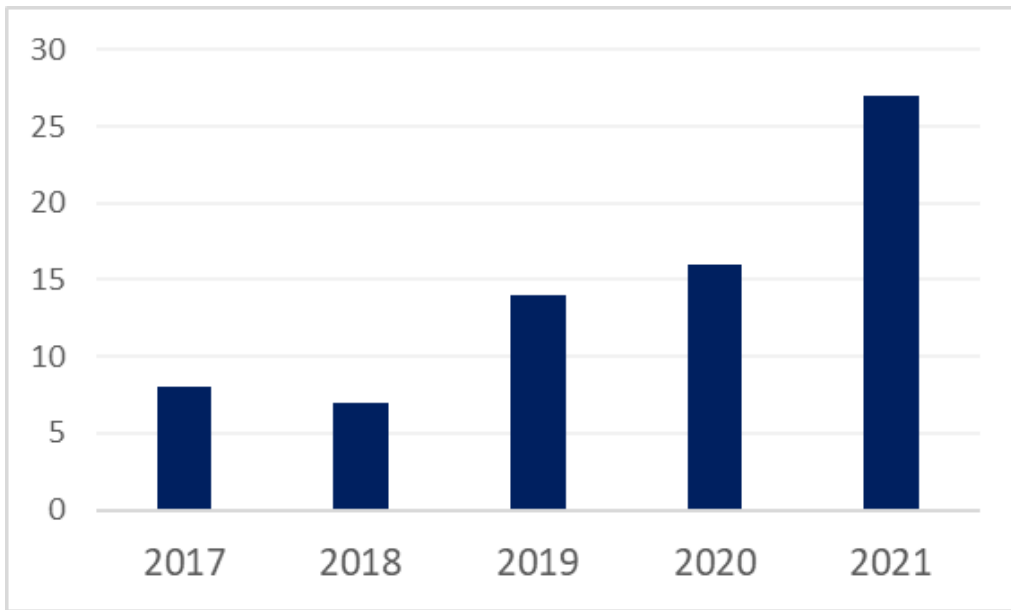
Source: LE analysis of Beauhurst data.

Accelerators

From the Beauhurst database we identified 72 accelerators that had supported UK clean tech companies between 2017 and 2021. Such programmes provide support to early-stage businesses – typically those at a pre-commercial, pre-revenue-generation stage – which often includes space, training and mentoring, and networks. UK clean tech companies have been supported by both technology-agnostic incubators and accelerators, such as Y Combinator, and clean-tech-specific programmes, such as Tech Nation’s Net Zero programme.¹²⁷ All but two of these accelerators were located in the UK, with London accounting for 63% of the UK based ones. As shown in Figure 24, the number of accelerators increased significantly in recent years, from 8 in 2017 to 16 in 2020 and 27 in 2021.

¹²⁷ Tech Nation (n.d.), ‘Net Zero’. Available at <https://technation.io/programmes/net-zero/>.

Figure 24 Number of accelerators, by UK location and year 2017-2021



6. Challenges for Early-Stage Clean Tech Companies in the UK

This chapter discusses the challenges faced by early-stage clean tech companies in the UK. It begins by discussing the evidence for a funding gap for early-stage clean tech companies and examines the drivers of that gap. The chapter finds, consistent with other studies, that there is such a gap and that it affects hardware firms in particular. It then discusses other barriers faced by early-stage clean tech companies, including – but not limited to – skills, talent and recruitment, and regulations and government policy.

Assessment of funding for early-stage clean tech companies in the UK

Previous research¹²⁸ has found that there is a funding gap for early-stage clean tech companies at the stage where they have progressed beyond grant funding and incubator and accelerator programmes, but have not yet reached a level of commercialisation where private funding is more readily available. The Green Finance Taskforce report identified barriers to early-stage clean tech projects being funded privately and recommended a role for public investment through a public-private green venture fund.¹²⁹ While the value of early-stage investment in UK clean tech companies has increased significantly in recent years (see Figure 11 above), this gap still exists. The rise in investment volumes has been driven largely by increasing deal sizes, both in terms of median deal and in terms of the very largest deals; as the total number of deals grew at a slower pace in the five years to 2021 (see Figure 10 above).

The stakeholders interviewed as part of this study were almost unanimous in saying that a lack of funding was an important barrier for early-stage clean tech company growth. There is also empirical evidence of a funding gap. UK clean tech companies may also be less frequently successful in progressing from seed funding to venture funding than UK AI and biotech companies. In our sample of Beauhurst companies, of those companies that raised seed

¹²⁸ See, for instance, Green Finance Taskforce (2018), 'Accelerating green finance: Green Finance Taskforce report', Available at <https://www.gov.uk/government/publications/accelerating-green-finance-green-finance-taskforce-report>.

See also, for instance, Kenney, D. (2021), 'We need more 'patient' capital behind early-stage climate tech'. GreenBiz, 2nd June 2021. Available at <https://www.greenbiz.com/article/we-need-more-patient-capital-behind-early-stage-climate-tech>.

See also, for instance, Owen, R., Brennan, G. and F. Lyon (2018), 'Enabling investment for the transition to a low carbon economy: government policy to finance early stage green innovation'. Current Opinion in Environmental Sustainability 31, April 2018, pp.137-145. DOI: <https://doi.org/10.1016/j.cosust.2018.03.004>.

See also, for instance, Tech Nation (2021b), 'Net Zero Report 2021'. Available at <https://technation.io/net-zero-report-2021/>.

¹²⁹ Green Finance Taskforce (2018), 'Accelerating green finance: Green Finance Taskforce report', Available at <https://www.gov.uk/government/publications/accelerating-green-finance-green-finance-taskforce-report>.

funding in 2017, slightly less than one third (32%) of clean tech companies raised venture funding by the end of 2021, compared with 45% for AI and 36% for Biotech (Table 3).¹³⁰

Table 3 Proportion of UK companies in different sectors receiving Venture funding by 2021 after receiving seed funding in 2017

	Number of UK companies receiving seed funding in 2017	Number of those companies who had raised Venture funding by the end of 2021	Proportion of UK companies receiving seed funding in 2017 who had raised Venture funding by the end of 2021
Clean tech	66	21	32%
AI	152	69	45%
Biotech	107	39	36%

Source: LE analysis of Beauhurst data

This suggests that early-stage clean tech companies may be less likely to be able to progress to a later stage. When Tech Nation surveyed 137 UK-headquartered early-stage clean tech companies for its *Net Zero Report 2021*, more than one in five of them included funding in the top three challenges they faced in scaling up.¹³¹ The authors of the Tech Nation report attribute this to clean tech companies not aligning with the risk appetites and time horizons associated with the ‘classic venture capital model’,¹³² in line with the discussion below about the challenges associated with risk and returns. While funding is not the only reason why companies are unable to progress their innovations, the views expressed by almost all of the stakeholders interviewed for this study and the findings of Tech Nation’s survey suggest that it is an important reason.

There are challenges associated with risk and returns

Risk

Early-stage investment in clean tech is often associated with high levels of risk, especially because of technology risk (the risk that the innovation will not work, either at all or at scale¹³³) as well as risk associated with regulations and government policy; see below.¹³⁴

¹³⁰ LE analysis of Crunchbase data

¹³¹ Tech Nation (2021b), ‘Net Zero Report 2021’. Available at <https://technation.io/net-zero-report-2021/>.

¹³² Ibid.

¹³³ Ghosh, S. and Nanda, R. (2010), ‘Venture Capital Investment in the Clean Energy Sector’. Harvard Business School, Working Paper 11-020. Available at https://www.hbs.edu/ris/Publication%20Files/11-020_0a1b5d16-c966-4403-888f-96d03bbab461.pdf.

¹³⁴ Owen, R., Brennan, G. and F. Lyon (2018), ‘Enabling investment for the transition to a low carbon economy: government policy to finance early stage green innovation’. *Current Opinion in Environmental Sustainability* 31, April 2018, pp.137-145. DOI: <https://doi.org/10.1016/j.cosust.2018.03.004>.

The previous clean tech 'boom and bust'

The large rises in clean tech VC investment seen today comes after a previous boom between 2006 and 2008. In 2008, at the peak of that boom, US VC investment in clean tech exceeded \$5 billion, having stood at just over \$1 billion four years previously, in 2004.¹³⁵ Drivers of this boom included rising fossil fuel prices, the introduction of incentives for renewable energy adoption and increased consumer awareness of environmental issues.¹³⁶ Investment in early-stage clean tech companies specifically also boomed during this period.¹³⁷ However, early-stage VC investment in clean tech companies collapsed after 2008, with VC funding for clean tech shifting to later rounds (investment in these later rounds subsequently collapsed in 2011),¹³⁸ due to the poor performance of the investments made in the years to 2008. Between 2006 and 2011, VC-funded clean tech companies both failed at a higher rate and provided lower returns than medical and (non-clean tech) software companies.¹³⁹

Several stakeholders suggested that there has been a hangover from this episode, saying that investors were deterred from investing in clean tech by having experienced losses from investing in clean tech during this period or by having observed other investors doing so.¹⁴⁰ One stakeholder also suggested that these negative attitudes have since become entrenched, and persisted despite investment opportunities in clean tech having become more viable; and that many VC firms, who have focused during the intervening period on investment in other sectors, no longer possess the necessary skills or knowledge to evaluate and invest in clean tech firms.

In addition, a lack of knowledge hampers the assessment of prospective investments.¹⁴¹ This lack of information can lead to market failures. Stakeholders reported that investors were likely to be more reluctant to invest in companies and sectors that they did not possess knowledge and understanding of; the assessment of risks and returns is more difficult, and more costly,¹⁴² in the absence of such understanding. Specialist clean tech funds have better knowledge of the clean tech sector than generalist funds. However, as the 'Investors' chapter above (Chapter 5) describes, only a small proportion of VCs targeting the UK clean tech sector are specialists in clean tech. This may be reflected in the fact that generalist VCs stick to what they

¹³⁵ Gaddy, B., Sivaram, V. and O'Sullivan, F. (2016), 'Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation'. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

¹³⁶ Ibid.

¹³⁷ Ibid.

¹³⁸ Ibid.

¹³⁹ Ibid.

¹⁴⁰ See also Thornhill, J. (2021), 'Climate tech 2.0 must sell venture capital on its future'. Financial Times, 21st October 2021. Available at <https://www.ft.com/content/33df166e-d921-4c20-92dc-5e1b5a0e6773>.

¹⁴¹ Owen, R., Brennan, G. and F. Lyon (2018), 'Enabling investment for the transition to a low carbon economy: government policy to finance early stage green innovation'. Current Opinion in Environmental Sustainability 31, April 2018, pp.137-145. DOI: <https://doi.org/10.1016/j.cosust.2018.03.004>.

¹⁴² Owen, R., Brennan, G. and F. Lyon (2018).

know – AI and possibly tend to invest in clean tech companies at later stages – where risk and investment durations are generally lower – than specialist clean tech VCs.¹⁴³

Returns

Access to funding for early-stage clean tech companies may be hindered by a lack of a clear route to profitable exits for investors. Several areas of clean tech present less of a historical track record¹⁴⁴ that indicates profitability than other sectors VCs might invest in, such as biotech and (non-clean tech) software.

As highlighted by stakeholders, many clean technologies are novel with nascent or non-existent markets at present, which makes company growth and exits more problematic to predict. For example, the UK Hydrogen Strategy envisages that low-carbon hydrogen could have a range of uses including in power generation, as a fuel and in heating. It notes, however, that at present hydrogen in the UK is usually produced from natural gas without carbon capture and is used in the chemicals industry and in refineries; as such, there is not an established mass market for low-carbon hydrogen in the UK.¹⁴⁵ Also, the commercialisation of clean technologies is often dependent on the commercialisation of other clean technologies. For instance, electric vehicles are reliant on battery technologies. Since the development of each of these technologies involves risk and uncertainty, there is a risk of coordination problems. These coordination problems can themselves contribute to difficulties in market development.

Moreover, a relative lack of acquisitions of early-stage clean tech companies by established corporates reduces the apparent route to a profitable exit in the eyes of some investors. The 2018 report of the Green Finance Taskforce highlighted the lack of a liquid secondary market as a barrier to VC investment in clean tech.¹⁴⁶ Amongst clean tech companies receiving series A investment between 2006 and 2011, the rate of exit by acquisition was much lower for clean tech firms than for (non-clean tech) software firms.¹⁴⁷ This is consistent with our findings. Stakeholders reported that acquisition activity by established companies in clean tech-related sectors, such as the large oil and gas companies, is much lower than in the (non-clean tech) software arena, where large firms like Meta (previously Facebook) and Google often acquire smaller companies. However, stakeholders reported that there appears to be increasing appetite for such acquisitions amongst corporations. In line with these findings from

¹⁴³ Tech Nation (2021b), 'Net Zero Report 2021'. Available at <https://technation.io/net-zero-report-2021/>.

¹⁴⁴ Boston Consulting Group (2021), 'Governments That Invest in Climate Innovation Invest in Growth'. Available at <https://www.bcg.com/publications/2021/developing-a-climate-funding-plan>.

Gaddy, B., Sivaram, V. and O'Sullivan, F. (2016), 'Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation'. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

¹⁴⁵ UK Government (2021f), 'UK Hydrogen Strategy'. August 2021. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1011283/UK-Hydrogen-Strategy_web.pdf.

¹⁴⁶ Green Finance Taskforce (2018), 'Accelerating Green Finance'. March 2018. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/703816/green-finance-taskforce-accelerating-green-finance-report.pdf.

¹⁴⁷ Gaddy, B., Sivaram, V. and O'Sullivan, F. (2016), 'Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation'. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

stakeholder consultations, Table 2 above shows clean tech acquisitions have increased significantly from a low base since 2019.¹⁴⁸

Overall, the route to profitability for early-stage clean tech companies is not always clear; there are fewer success stories that provide investors with precedents for strong returns. By contrast, in the case of (non-clean tech) software, there are more success stories providing such precedents.

There are particular difficulties in obtaining funding for hardware companies

A large number of the stakeholders consulted as part of this study stated that early-stage companies focusing on hardware innovations tend to face greater difficulties in obtaining funding than those focusing on software innovations. Several of these stakeholders argued that it was important that hardware innovations should not be neglected since, while software innovations have an important role to play in helping the UK and the rest of the world to reach net zero, it was likely to be hardware innovations that would primarily drive the deeper changes needed to reach that target.

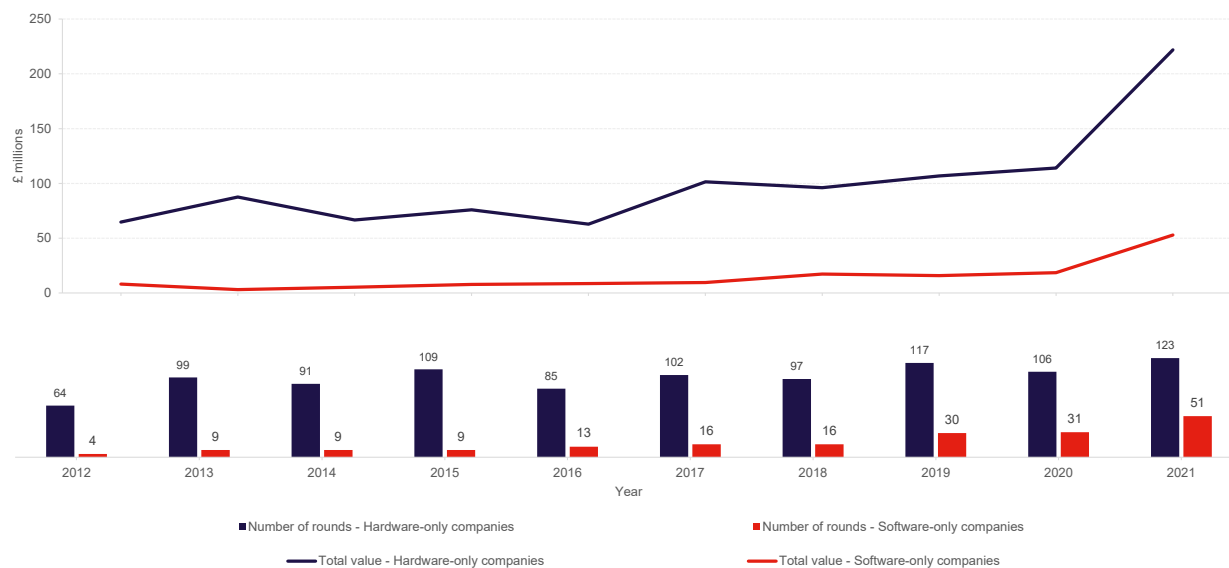
Overall, according to the Beauhurst data used, there are approximately 6 hardware-only companies for every software-only company¹⁴⁹ As hardware-only companies greatly outnumber software-only companies, it may be more difficult for them to raise the appropriate level of funding required, despite the greater number of deals and volume of funds raised over the last 10 years (shown in Figure 25).

In fact, software-only deals seem to have grown more rapidly in recent years, increasing to 30 in 2019 and 51 in 2021^m from a range of 4-16 in the period 2012-2018. Hardware-only deals have also grown in recent years (with the exception of 2020) both in terms of value and number of deals, but at a slower pace, potentially reflecting the difficulties in obtaining adequate funding reported by stakeholders.

¹⁴⁸ While acquisitions showed a trend of decreasing between 2017 and 2019, the findings from stakeholder consultations along with the findings from the literature that corporations are increasingly making net zero commitments suggest that the increasing trend since 2019 is likely to continue into the future.

¹⁴⁹ Of the clean tech firms that attracted early stage funding, there were 921 hardware-only and 153 software-only companies.

Figure 25 Seed and venture rounds by hardware-only and software-only UK-headquartered clean tech companies, 2012 - 2021



Source: LE analysis of Beauhurst data

The VC funding model

For many clean tech companies focused on hardware innovations, the time to market and profitability is long (for example, the time from discovery to market for a new material can be 20 years or longer¹⁵⁰), often because of long and uncertain R&D timelines.¹⁵¹

VC funds, however, typically seek out investments that they expect to deliver returns within three to five years.¹⁵² This is a consequence of their lifespan. VC funds typically have a lifetime of seven to 10 years.¹⁵³ The first five years of this lifetime are typically spent making investments and the latter years of the fund's lifetime are typically spent delivering returns from the fund's investments through exits.¹⁵⁴ Consequently, investments are often active for around three to five years.¹⁵⁵ If VCs do not expect an investment to deliver a return within these timeframes, this will deter investment.

In many cases hardware innovations are not expected to deliver returns to VCs in the time horizons that VCs require. Software innovations are likely to have shorter development times

¹⁵⁰ Kalil, T. and Wadia, C. (2011), 'Materials Genome Initiative: A Renaissance of American Manufacturing'. The White House, 24th June 2011. Available at <https://obamawhitehouse.archives.gov/blog/2011/06/24/materials-genome-initiative-renaissance-american-manufacturing>.

¹⁵¹ Owen, R., Lehner, O., Lyon, F. and G. Brennan (2020), 'Early Stage Investing in Green SMEs: The Case of the UK'. ACRN Journal of Finance and Risk Perspectives 8(1), pp. 163-182. DOI: 10.1109/TEM.2020.3005702.

PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>.

¹⁵² Gaddy, B., Sivaram, V. and O'Sullivan, F. (2016), 'Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation'. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

¹⁵³ Zider, B. (1998), 'How Venture Capital Works'. Harvard Business Review, November-December 1998. Available at <https://hbr.org/1998/11/how-venture-capital-works>.

¹⁵⁴ Zider, B. (1998).

¹⁵⁵ Ibid.

than hardware companies¹⁵⁶ and therefore are more compatible with the time horizon constraints of VCs.¹⁵⁷

There is evidence of a gap in ‘patient capital’ – long-term investment in innovative firms to facilitate their scaling up – in the UK more broadly, with the UK’s strengths in research and start-up creation not translating equally to businesses scaling up successfully.¹⁵⁸ Given the long time horizons associated with investment in hardware innovations, this patient capital gap is likely to hinder access to funding for companies focusing on hardware innovations.

Greater funding needs

Access to funding is often a greater challenge for hardware-focused early-stage clean tech companies as clean tech hardware is generally more expensive to develop, test, demonstrate and scale than software. This is because of the need for expensive equipment and factories, implying a need for larger amounts of capital at early stages,¹⁵⁹ especially in the demonstration phase.

Responsiveness to trial failures and market feedback

Software innovations can often be adjusted more quickly, cheaply and easily in response to failures in trials or market feedback than hardware innovations, since software tends to have shorter development times and lower development costs than hardware.¹⁶⁰ A stakeholder highlighted that demonstration was more challenging and involved longer timescales for hardware than for software. This makes it more challenging for hardware-focused early-stage clean tech companies to access funding.

Investor perception

There is a perception by investors that they understand software better than they do clean tech hardware. This is likely to be pertinent in the case of funds with a generalist investment mandate as opposed to specialist clean tech funds; generalist funds are likely to have a greater degree of experience of investing in AI, non-clean-tech software and digital businesses than in clean tech. A number of the stakeholders interviewed in support of this study highlighted that investors preferred to invest in companies whose products they believed they understood. Stakeholders reported that investors were more likely to believe they understood software innovations than hardware innovations in clean tech. Software is also more likely to

¹⁵⁶ Lerner, J. and Nanda, R. (2020), ‘Venture Capital’s Role in Financing Innovation: What We Know and How Much We Still Need to Learn’. *Journal of Economic Perspectives*, Vol. 34, No. 3, Summer 2020. Available at <https://www.aeaweb.org/articles?id=10.1257/jep.34.3.237>.

¹⁵⁷ Gaddy, B., Sivaram, V. and O’Sullivan, F. (2016), ‘Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation’. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

¹⁵⁸ HM Treasury (2017), ‘Financing growth in innovative firms: consultation’. August 2017. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/642456/financing_growth_in_innovative_firms_consultation_web.pdf.

¹⁵⁹ Gaddy, B., Sivaram, V. and O’Sullivan, F. (2016), ‘Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation’. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

¹⁶⁰ Lerner, J. and Nanda, R. (2020), ‘Venture Capital’s Role in Financing Innovation: What We Know and How Much We Still Need to Learn’. *Journal of Economic Perspectives*, Vol. 34, No. 3, Summer 2020. Available at <https://www.aeaweb.org/articles?id=10.1257/jep.34.3.237>.

align with known, proven business models that investors are familiar with from other contexts.¹⁶¹ This creates a greater challenge for hardware focused early stage clean tech companies to access funding.

There are particular difficulties in obtaining funding for female founders

Women are generally underrepresented amongst founders of UK tech companies. Women are, however, better represented amongst clean tech founders than amongst founders of UK companies more widely. 37.5% of the early-stage UK clean tech companies in the first cohort of Tech Nation's Net Zero programme had at least one female founder,¹⁶² whereas companies with at least one female founder account for 25% of pitchdecks received by UK VCs.^{163, 164}

Women tend to experience greater difficulties in obtaining funding than male founders. In 2017, only 17% of UK VC deals by number and 11% by value went to businesses with at least one female founder.¹⁶⁵ The gap in access to finance between male and female founders differs across funding rounds; the gap is bigger for later, larger rounds. Between 2015 and 2017, 22% of angel and seed stage deals in the UK went to businesses with at least one female founder; for early-stage VC and late-stage VC this proportion was 19% and 15% respectively.¹⁶⁶ Across all fund sizes, mixed-gender founder teams account for a greater proportion of pitchdecks received than investments made.¹⁶⁷

The greater difficulties women face in obtaining start-up funding are not unique to the UK. 49% of female founders responding to the survey conducted for Atomico's *The State of European Tech 2021* report said that their underrepresented background negatively affected their ability to raise funding, with only 18% saying their underrepresented background helped them to raise funding.¹⁶⁸ In each year since 2017, around 90% of capital raised by European tech companies has gone to companies whose founding teams included only men.¹⁶⁹ Female founders also receive a small proportion of venture funding in the US; start-ups with a female founder received 18% of all venture funding raised by US start-ups in September 2021.¹⁷⁰ However, there are signs that investment in US start-ups founded by women is growing.¹⁷¹

Given that women are much better represented amongst clean tech founders than tech founders more generally in the UK, the greater difficulties experienced by female founders in

¹⁶¹ Lerner, J. and Nanda, R. (2020).

¹⁶² Ibid.

¹⁶³ British Business Bank (2019), 'UK VC and Female Founders'. Available at <https://www.british-business-bank.co.uk/uk-vc-female-founders-report/>.

¹⁶⁴ Per Tech Nation's *Net Zero Report 2021*, 25.6% of UK clean tech companies (across all stages) have at least one female founder, whereas 5.5% of all UK tech companies do. However, these figures may overstate the difference in the representation of women amongst founders of current start-ups between clean tech and tech more broadly if UK clean tech companies are younger than tech companies more broadly.

¹⁶⁵ Ibid.

¹⁶⁶ Ibid.

¹⁶⁷ Ibid.

¹⁶⁸ Atomico (2021), 'State of European Tech 2021'. Available at <https://stateofeuropeantech.com/>.

¹⁶⁹ Atomico (2021).

¹⁷⁰ Gupta, A.H. (2021), 'Funding for start-ups founded by women is surging'. New York Times, 2nd November 2021. Available at <https://www.nytimes.com/2021/11/02/business/dealbook/female-founded-startups-vc-funding.html>.

¹⁷¹ Ibid.

obtaining funding are likely to represent a particular barrier to funding for early-stage clean tech companies.

Improvements in access to funding for female founders in the UK appear to be slow. Between 2007 and 2017, the proportion of UK VC deals by *number* going into businesses with all-female founding teams grew slowly, the proportion of UK VC deals by *value* going into businesses with all-female founding teams fell.¹⁷² The proportion of UK VC deals going to businesses with founding teams comprising both men and women showed a general trend of increase between 2007 and 2017, in terms of both number of deals and deal value, but overall these remained low.¹⁷³

Other challenges faced by early-stage clean tech companies in the UK

Skills, talent and recruitment

Recruiting people with the necessary skills and talent is another important challenge for early-stage clean tech companies. Nearly half of the early-stage clean tech companies surveyed for Tech Nation's *Net Zero Report 2021* identified 'team', 'talent' or 'hiring' as one of their top three challenges; this made skills, talent and recruitment the most common challenge for early-stage clean tech companies according to this survey.¹⁷⁴ Moreover, several stakeholders consulted in support of this study identified skills, talent and recruitment as a significant barrier to growth faced by early-stage clean tech companies.

Stakeholders identified a shortage of technical and STEM (science, technology, engineering and mathematics) skills as a challenge for UK clean tech companies. They considered that this skills shortage was exacerbated by the novel nature of many of the technologies early-stage clean tech companies are seeking to develop.

Relatedly, it may be difficult to attract top-quality STEM talent to work on novel technologies especially when the market for them is nascent or even not-yet-existent. In interviews conducted for this study, stakeholders highlighted that there are other, established sectors (such as the financial services sector) that offer high salaries to top-quality STEM talent. However, one stakeholder, when asked about this issue, noted the increasing interest in combating climate change and in purpose-driven careers and suggested that these trends would improve the clean tech sector's ability to compete for talent.

One aspect of the 'team' challenge relates to management. As noted in the literature¹⁷⁵ and as highlighted by a stakeholder interviewed for this study, the skills and knowledge required to

¹⁷² British Business Bank (2019), 'UK VC and Female Founders'. Available at <https://www.british-business-bank.co.uk/uk-vc-female-founders-report/>.

¹⁷³ Ibid.

¹⁷⁴ Tech Nation (2021b), 'Net Zero Report 2021'. Available at <https://technation.io/net-zero-report-2021/>.

¹⁷⁵ Ghosh, S. and Nanda, R. (2010), 'Venture Capital Investment in the Clean Energy Sector'. Harvard Business School, Working Paper 11-020. Available at https://www.hbs.edu/ris/Publication%20Files/11-020_0a1b5d16-c966-4403-888f-96d03bbab461.pdf.

manage an early-stage clean tech company developing an idea for an innovation and those required to run that company once it has commercialised its innovation are different. The number of people who possess all of the required skill sets is relatively small, because of the technical nature of many clean tech innovations and the fact that clean tech companies' business models are often very different from those of IT or biotech start-ups (for instance, involving the management of large factories).¹⁷⁶ While this is a potential barrier to the scaling up of early-stage clean tech companies, there may be a 'virtuous circle' if the current boom in clean tech investment generates a cohort of successful clean tech entrepreneurs who can then lead future clean tech start-ups.

Regulations and government policy

Government policy and regulations in the UK and elsewhere are increasingly supportive of early-stage clean tech companies and of clean tech in general. However, regulations and government policy can also present a challenge for early-stage clean tech companies.

The markets that early-stage clean tech companies are seeking to serve are often subject to extensive regulations, and these regulations often differ between geographies.¹⁷⁷ Having to comply with these regulations can make innovation more difficult and can increase the cost of scaling up.¹⁷⁸ In the UK, the Office of Gas and Electricity Markets (Ofgem) – the UK's energy regulator – established an innovation sandbox service in 2017.¹⁷⁹ The sandbox 'allows innovators to trial new products, services and business models in a real-world environment without some of the usual rules applying'.¹⁸⁰ The sandbox service involves facilitating trials of new products or services, supported by bespoke guidance and assurances of Ofgem's approach to enforcement with respect to the trial, and supporting market entry by confirming the regulatory status of a new product or service and (in some cases) relief from particular regulatory requirements.¹⁸¹ In its document on 'Insights from running the regulatory sandbox', Ofgem noted that 'a significant number' of sandbox applicants sought to use the sandbox to get confirmation from Ofgem that their business model would not encounter regulatory difficulties, in order to reassure prospective investors.¹⁸² PwC's *The State of Climate Tech 2020* report cites Ofgem's innovation sandbox service as an example of a successful intervention reducing the regulatory burden on companies.¹⁸³

Stakeholders interviewed in support of this study suggested that clean tech companies' access to funding could be improved with support from government policy. In particular, one

¹⁷⁶ Ibid.

¹⁷⁷ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>.

¹⁷⁸ Ibid.

¹⁷⁹ Ofgem (2020), 'Innovation Sandbox Service Overview'. Available at <https://www.ofgem.gov.uk/publications/innovation-sandbox-service-overview>.

¹⁸⁰ Ofgem (2018a), 'What is a regulatory sandbox?'. Available at <https://www.ofgem.gov.uk/publications/what-regulatory-sandbox>.

¹⁸¹ Ofgem (2020), 'Innovation Sandbox Service Overview'. Available at <https://www.ofgem.gov.uk/publications/innovation-sandbox-service-overview>.

¹⁸² Ofgem (2018b), 'Insights from running the regulatory sandbox'. Available at <https://www.ofgem.gov.uk/publications/insights-running-regulatory-sandbox>.

¹⁸³ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>.

stakeholder suggested that policy inconsistency, whereby the government fostered markets through subsidies and other interventions before withdrawing support in a too rapid a manner (for instance, the government launched a £1.5 billion grant scheme for households to install insulation or low-carbon heating but closed the scheme after six months¹⁸⁴), was an issue as it created uncertainty. Consultations on frameworks for policy for emerging UK clean tech markets – as was done for heat networks, for instance – may help in this regard.¹⁸⁵ Another stakeholder suggested that the government could increase investment in early-stage clean tech companies by doing more to signal that it believes them to be an important and worthwhile target of investment. Such an increase in signalling could involve ministers visibly interacting and speaking more about early-stage clean tech companies and the work they are doing. This stakeholder was aware of relatively little signalling to date with respect to *early-stage* clean tech companies in particular, as opposed to the likes of large-scale infrastructure-type projects.

Market size

Stakeholders interviewed in support of this study suggested that differences in market size were an important reason why funding was sometimes easier to access for early-stage clean tech companies in the US than in the UK. Early-stage VC investment in clean tech companies was greater as a percentage of GDP in the US than in the UK in seven of the eight years from 2012 to 2019¹⁸⁶; the recent UK's surge saw it outperform the US on this metric. A larger addressable market suggests greater potential returns, which can make investors more willing to supply the often-large amounts of capital required by clean tech companies. Domestic market size may be particularly relevant for clean tech compared to other advanced technologies because the stringent, often-fragmented regulation that exists in the markets that many clean tech companies operate in (as referred to above) may make scaling across geographies and jurisdictions more difficult than in markets with more uniform or lighter regulation.¹⁸⁷

Greenwashing

'Greenwashing' refers to 'misleading or exaggerated sustainability claims made by firms'.¹⁸⁸ A UK government webpage states that 50% of green claims made online could be misleading.¹⁸⁹ Greenwashing may make it more difficult for early-stage clean tech companies to progress and commercialise their innovations.¹⁹⁰ In a market where investors are increasingly concerned

¹⁸⁴ Harvey, F. (2021), 'UK government scraps green homes grant after six months'. The Guardian, 27th March 2021. Available at <https://www.theguardian.com/environment/2021/mar/27/uk-government-scraps-green-homes-grant-after-six-months>.

¹⁸⁵ UK Government (2020d), 'Heat Networks: Building a Market Framework'. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/878072/heat-networks-building-market-framework-condoc.pdf.

¹⁸⁶ See Figure 33 and Figure 34.

¹⁸⁷ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>.

¹⁸⁸ UK Government (2021g), 'Greening Finance: A Roadmap to Sustainable Investing'. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1031805/CCSO_821102722-006_Green_Finance_Paper_2021_v6_Web_Accessible.pdf.

¹⁸⁹ UK Government (n.d.), 'Green Claims Code'. Available at <https://greenclaims.campaign.gov.uk/>.

¹⁹⁰ Tech Nation (2021b), 'Net Zero Report 2021'. Available at <https://technation.io/net-zero-report-2021/>.

with the environmental credentials of their investments, early-stage clean tech companies may be forced to compete for funding with companies that promote themselves as being a clean tech company while not truly working on an innovation that would help to reduce carbon emissions. Once clean tech companies reach commercialisation, greenwashing can make it more difficult for them to compete in markets where they face a 'green premium' such that their products are by necessity more expensive than more carbon-intensive goods and services. While consumers are often willing to pay a green premium for products that they believe are more sustainable,¹⁹¹ companies that can persuade consumers that they are environmentally friendly without needing to charge a green premium could be able to out-compete genuine clean tech companies.

Some of the stakeholder consultations conducted as part of this study suggested that greenwashing by competitors may be a smaller issue for early-stage clean tech companies than it is amongst large corporations. Since early-stage companies tend to be less diversified in their activities than large corporations, it may be harder for early-stage companies that are not genuinely green to greenwash.

The UK government and other institutions are implementing measures to combat greenwashing. The UK's Competition and Markets Authority will carry out a review of misleading green claims made both online and offline in early 2022, having launched an awareness campaign aimed at improving businesses' understanding of the law on claims about their environmental impacts.¹⁹² The UK government has also published a roadmap for the introduction of mandatory climate-related financial disclosures in line with the recommendations of the Taskforce on Climate-Related Financial Disclosures (TCFD).¹⁹³ From 6 April 2022, climate-related financial disclosures as recommended by the TCFD will be made mandatory for around 1,300 large UK-registered companies and financial institutions.¹⁹⁴ Climate-related disclosures will become compulsory for a wider range of companies and financial institutions in the UK by 2025, with most of the measures being in place by 2023.¹⁹⁵ While these disclosures will not be mandatory for unlisted early-stage companies, they may help to prevent greenwashing from impacting their ability to attract investment and to sell goods and services to other (larger) businesses since many investors and larger businesses will be subject to mandatory disclosure rules. The Financial Conduct Authority (FCA) is, at the time of writing, developing policy in relation to Sustainability Disclosure Requirements (SDR), which would build on and widen the disclosure requirements aligned with the TCFD's recommendations, as well as requirements for certain investment products to feature labels

¹⁹¹ YouGov (2021b), 'Global: Consumer willingness to pay for environmentally friendly products'. Available at <https://yougov.co.uk/topics/food/articles-reports/2021/04/29/global-willingness-pay-for-sustainability>.

¹⁹² UK Government (2022), 'Misleading environmental claims'. Last updated on 29 July 2022. Available [here](#)

¹⁹³ HM Treasury (2020a), 'A Roadmap towards mandatory climate-related disclosures'. November 2020. Available at

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/933783/FINAL_TCFD_ROADMAP.pdf.

¹⁹⁴ UK Government (2021i), 'UK to enshrine mandatory climate disclosures for largest companies in law'. Press release, 29th October 2021. Available at <https://www.gov.uk/government/news/uk-to-enshrine-mandatory-climate-disclosures-for-largest-companies-in-law>.

¹⁹⁵ Ibid.

reflecting their sustainability characteristics.¹⁹⁶ The British Standards Institution (BSI) is developing sustainable finance standards (which businesses will be able to adopt on a voluntary basis) as part of a programme sponsored by DESNZ and industry.¹⁹⁷

Meanwhile, the EU is developing a taxonomy for sustainable activities, whose stated aims include 'protect[ing] private investors from greenwashing [...] and help[ing] shift investments where they are most needed'.¹⁹⁸

¹⁹⁶ FCA (2021), 'Sustainability Disclosure Requirements (SDR) and investment labels'. Discussion Paper 21/4, November 2021. Available at <https://www.fca.org.uk/publication/discussion/dp21-4.pdf>.

¹⁹⁷ BSI (2022), 'Sustainable finance standards programme'. Available at <https://www.bsigroup.com/en-GB/about-psi/uk-national-standards-body/BIS-Exploring-new-areas-with-government-funding/projects/Sustainability/sustainable-finance/>.

¹⁹⁸ European Commission (n.d.), 'EU taxonomy for sustainable activities'. Available at https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/eu-taxonomy-sustainable-activities_en.

7. Conclusion

The main research question that the study set out to address is:

What does the venture capital (VC) market for early-stage clean tech companies seeking seed, late-seed, or series A investment look like in 2021?

The role of clean tech in reducing GHG emissions while helping to enable economic activity is potentially large. The UK clean tech sector is diverse in its technologies and its activities, reflecting the breadth of change that is likely to be necessary to reach net zero by 2050.

Early-stage VC investment in UK clean tech companies has risen in recent years, both in terms of number of deals and overall value.

Specifically, the total volume of seed and venture investments in UK-headquartered clean tech companies grew between 2017 and 2021, from approximately £163 million in 2017 to approximately £420 million in 2021 (while the number of rounds increased from 166 to 258 over the same time period). In particular, there was a large increase between 2020 and 2021 in both the number of deals (from 192 to 258) and overall value (from £210 million to £420 million).

In the same period 2017-2021 the median deal size has also increased, from £260,000 to £410,000 for seed rounds and £850,000 to £1,540,000 for venture rounds (and again the largest increase was recorded between 2020 and 2021). Between 2020 and 2021 there has been particular growth in the size of medium and large deals (those with a value in excess of £1 million) and in particular of the largest deals (those in excess of £5 million).

Despite this recent growth, the value of early-stage investment in the clean tech sector in the UK (£420 million in 2021) is still considerably lower than the value of early-stage investment in the UK Artificial Intelligence and Biotech sectors, which attracted a total investment of £710 million and £615 million respectively in 2021.

Information on investor type and location was only available for less than 30% of all deals (mainly those publicly announced, which tend to be larger in size) and hence is unlikely to be representative of all deals and investors. Based on the (limited) available data, the source of these funds was mostly from UK investors (in 73% of cases), followed by other European investors (11%), US investors (11%) and investors from other areas (5%). Looking at UK investors only, London based investors represented slightly more than one half of all investors, with 62% of investors based in London defined as Private Equity or Venture Capital. On the other hand, only 45% of investors based in the rest of the UK were Private Equity or Venture Capital, while business angels accounted for between 21% and 24% of all investors in the UK (with limited difference across areas). Moreover, Government (the definition includes Local, Regional, Devolved and Central Government equity capital in generalist, regional funds) supported clean tech activity in around one fifth of deals recorded outside London.

The UK has shown more rapid growth in early-stage VC investment in clean tech companies than several comparator countries in recent years.

Market participants still perceive a lack of focus of VC funding for on the early-stage clean tech sector in all its breadth compared with other sectors, which may be explained by the relatively small number of specialist clean tech VCs that have deep knowledge and experience of the clean tech sector that allows them to better assess the risk and potential returns associated with early-stage clean tech companies. Ensuring that a large number of different firms receive VC funding continues to be important to facilitate the commercialisation of the broad range of technologies that is likely to be needed to help reach net zero.

As suggested by stakeholders, targeted EIS/SEIS-style tax relief might help to de-risk investment for angel investors, who often invest at the seed stage. Seed rounds help companies to progress to the point where they are ready for series A investment and are thus important for the health of the ecosystem.

Spending review cycles may also have an impact on the availability of funds (in particular for SMEs in need of more constant funding): in fact the number of grant funders has declined in 2020 and 2021 (at the end of the previous spending review period).

Clean tech companies focusing on hardware innovations appear to face greater challenges in accessing funding than those focusing on software innovations. A number of characteristics of hardware innovations contribute to this. Companies developing hardware innovations typically have greater funding needs because of the need for capital-intensive equipment and facilities. Hardware companies typically have lower gross margins than software companies do, typically leading to lower profit margins.¹⁹⁹ Moreover, there is a perception amongst some investors that they understand software innovations better than they do hardware innovations. In addition, in the case of hardware innovations it is typically more costly and time-consuming to alter the product or service in response to trial failures and/or market feedback than is the case for software. Finally, hardware innovations are often characterised by long development times, resulting in a misalignment with the investment cycle in the traditional VC funding model that demands returns within a 5- to 7-year time horizon.

Given the likely importance of hardware innovations in reaching net zero, there may be a role for policy interventions in improving access to funding for hardware companies by increasing the supply of patient capital available to them.

With long-term liabilities and associated long time horizons, institutional investors are in a position to make long-term investments, and are thus theoretically well-placed to provide the large amounts of patient capital needed by early-stage clean tech companies focusing on hardware innovations especially. However, the current operating model of institutional investors remains focused on listed and liquid asset classes and does not facilitate the deployment of institutional investors' capital in early-stage clean tech companies. However, there are promising examples of institutional investors making direct investments in clean tech

¹⁹⁹ Harlem Capital (2020), 'Why are VCs OBSESSED with Software??'. Medium, 11th August 2020. Available at <https://medium.com/@harlemcapital/why-are-vcs-obsessed-with-software-38a4c48cbb08>.

companies (like Legal & General's investment in Oxford PV²⁰⁰) or VC funds with longer lifespans (British Patient Capital, for instance, is open to investing in 'evergreen' funds without end dates, although they only do so through generalist funds rather than through direct investment into clean tech companies). This could improve access to funding for early-stage clean tech companies focusing on hardware innovations. A demonstration of success is likely to be a key driver of any proliferation in these models.

However, access to funding is not the only important challenge for early-stage clean tech companies in the UK. These findings suggest that policy interventions that targeted a broader range of issues than just the funding gap would help to increase the rate at which clean tech innovations are successfully commercialised by UK companies.

Clean tech companies face particular difficulties in assembling the right team because of the need for technical and STEM skills, often in a novel and interdisciplinary context. Interventions such as educational programmes and training paths, or special visas, could help to improve the pipeline of talent available to UK clean tech companies.

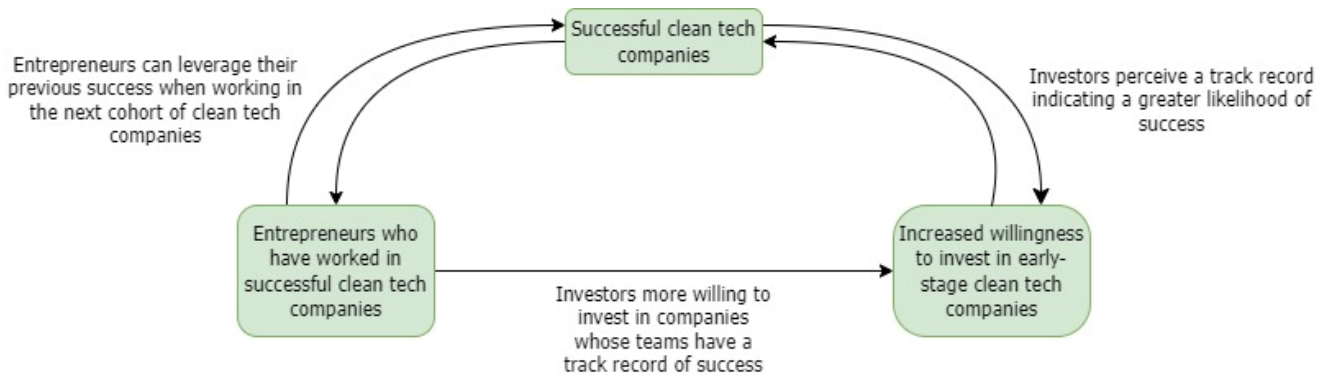
There are also challenges around tight, complex regulatory environments, which both present difficulties in themselves and deter investment. Sandbox programmes can help innovative companies to navigate regulatory uncertainty. In addition, the UK's smaller domestic market relative to the US can present a challenge, especially where differences in regulations make it more difficult to scale across jurisdictions.

"Greenwashing" can make it more challenging for genuine clean tech companies to compete in end-markets and to compete for funding, although the UK government and other authorities are taking measures to tackle this issue.

The findings in this report overall point to the possibility of virtuous circles from the current surge in early-stage clean tech investment. If the investment volumes seen in recent years produce a cohort of UK clean tech success stories, this is likely to inspire investors to invest more in clean tech; at present, perceptions that there is a lack of a 'track record' of profitable clean tech companies deter investment. Moreover, the entrepreneurs behind those success stories would accumulate experience to lead another wave of clean tech companies. This, in turn, can increase investment. Investors are likely to be more willing to invest in early-stage clean tech companies whose teams have a track record of success. In addition, entrepreneurs who have exited from successful clean tech companies may become angel investors in future clean tech companies.

²⁰⁰ Legal & General (2016), 'L&G grows clean energy platform with solar & fusion investments'. Press release, 15th December 2016. Available at <https://www.legalandgeneralcapital.com/media-centre/news/l-amp-g-grows-clean-energy-platform-with-solar--amp--fusion-investments/>.

Figure 26 Virtuous circles in clean tech investment



However, as seen after the previous boom in clean tech VC investment, these virtuous circles are not a foregone conclusion: the right conditions must be present to translate increased investment into success stories. In the previous clean tech VC investment boom, unfavourable end-market conditions - because of the financial crisis of the late 2000s and falls in the prices of oil gas and of solar panels from China – and a lack of successful exits in the timeframe demanded by VCs prevented the operation of these virtuous circles. During this boom, a stable and supportive policy environment, adequate access to talent, receptive markets and viable routes to profitable exits for investors will be important to ensure that those companies benefiting from the increase in early-stage investment ultimately succeed and return capital to their investors.

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Technical Annex

Stakeholder interviews

Summary of stakeholders interviewed

We conducted 25 qualitative depth interviews with market experts and stakeholders. The interviews were designed to cover a range of different stakeholder types in order to understand the market from a range of perspectives. The number of interviews targeted for each stakeholder type depended on the diversity within that stakeholder type (for instance, a large number of funding providers, related associations and institutional investors because this group captures a number of different subgroups) the relevance of the stakeholder type to the specific market being assessed in this study. Participants were recruited by email. These interviews were conducted by members of the LE project team via a video-conferencing solution. The interviews typically lasted between 30 and 60 minutes.

The purpose of these interviews was two-fold. Firstly, the interviews were used to gather views on and insights particularly into the more qualitative research questions involved in the project. Secondly, they were used to validate and refine the findings from the desk research described in Chapter 2 above.

The table below summarises the number of interviews completed with different types of stakeholders.

Summary of stakeholder interviews

Stakeholder type	Number of interviews
Funding providers, related associations, and institutional investors	10
clean tech industry and trade associations	5
clean tech incubators and accelerators	4
Academics and research institutions	3
Government stakeholders	2
Other (law firm)	1
Total	25

Structure of interviews

The interviews were semi-structured and based on the topic guide presented below. Such an approach ensured that a comparable evidence base was collected across all interviews and

that the specific research questions were answered, but allowed interviewers to tailor the interviews to the expertise of the particular stakeholder in question and to follow up on any particularly interesting or significant points made during the interview.

The contents of the interviews were recorded in written notes taken during the interview and in some cases with the interviewee's permission, based on a recording of the call. The notes were reviewed by all of the members of the LE team who attended the interview and then shared with the interviewee for them to verify the notes' accuracy. These notes were then analysed, including thematic analysis, which allowed us to compare and contrast the points made and identify nuances points of consensus.

Topic guide

Introduction

Thank the interviewee for agreeing to participate in this interview.

Explain that the Department for Energy Security & Net Zero (DESNZ), has engaged London Economics to undertake a review of the current state of the UK clean technology venture capital (VC) market, current trends seen in the UK VC market and how reflective these are of global trends. The study will form part of the government's evidence base regarding the UK's clean tech sector.

Explain that the overarching research question this study seeks to answer is:

What does the venture capital (VC) market for early-stage clean tech companies seeking seed, late-seed, or series A investment look like in 2021?

Provide the interviewee with the definition of 'clean tech' as technology which enables economic activity to deliver goods and services while generating significantly lower emissions of greenhouse gases.

Explain that the purpose of these interviews is to help us better understand the UK's clean technology landscape and the funding environment for the UK clean tech sector.

Ask permission to take notes, which will be shared with the interviewee afterwards to verify their accuracy.

Explain that output of the study will be a report that that is planned to be published and whose primary intended audience is policy-makers across government. Explain that individuals will not be named in any published outputs, or in any results shared with DESNZ. Any information that shared with London Economics will be processed and stored securely, in accordance with the Data Protection Act 2018 and the UK General Data Protection Regulation (GDPR).

Check that the interviewee is happy to participate and that it is OK for the interview to last for 30-60 minutes.

For representatives of organisations (companies, funding providers, etc.)

Question 1.1: Please describe what your organisation does.

If unclear, prompt: how is your organisation interacting with the clean tech sector?

Question 1.2: Please describe what you do within your organisation.

For academics

Question 1.1a: Please describe your research interests, especially as they relate to early-stage financing and clean tech.

The UK's clean technology landscape

For interviewees except institutional investors into VC funds (skip this section for institutional investors into VC funds):

Question 2.1: What is the maturity of different clean technology areas?

Prompts: e.g. between energy storage, energy transmission, energy generation, CCUS, transport, food, agriculture and land use, heavy industry, built environment, and climate and earth data generation, or between different forms of clean energy (e.g. hydrogen versus wind)

On the split of clean tech companies between software and hardware:

For interviewees that do not work in a particular area of clean tech (e.g. an academic who looks at the clean tech sector as a whole)

Question 2.2: How are existing clean tech companies split in their focus on software/hardware innovations?

Follow-up: is there a difference in their ability to commercialise their products/services?

Follow-up: is there a difference in their ability to access funding?

For interviewees that work in a particular area of clean tech (e.g. a trade association for the renewable energy sector)

Question 2.2a: How are existing clean tech companies in the area of clean tech that you work in split in their focus on software/hardware innovations?

Follow-up: is there a difference in their ability to commercialise their products/services?

Follow-up: is there a difference in their ability to access funding?

Follow-up: how would your answers differ, if at all, when thinking about clean tech companies in general (i.e. not just those in the area of clean tech that you work in)?

On why companies fail to progress their innovations:

For academics and government policymakers:

Question 2.3: Where companies fail to progress their innovations, what are the reasons for this?

Prompts: lack of funding; product-market fit; skills, talent and recruitment; market size

Follow-up: does this differ for different sorts of clean tech companies? How so?

Prompts: e.g. Does it differ for hardware versus software companies? Does it differ for companies in different clean technology areas (e.g. in energy versus transport)?

For funding providers and related associations, clean tech industry and trade associations, and incubators and accelerators:

Question 2.3a: in your experience, where companies fail to progress their innovations in the UK, what are the reasons for this?

Prompts: lack of funding; product-market fit; skills, talent and recruitment; market size

Follow-up: does this differ for different sorts of clean tech companies? How so?

Prompts: e.g. Does it differ for hardware versus software companies? Does it differ for companies in different clean technology areas (e.g. in energy versus transport)? Location?

Question 2.4: What do current exit opportunities for clean tech companies look like, and what are the challenges?

Follow-up: does this differ for different sorts of clean tech companies? How so?

Prompts: e.g. Does it differ for hardware versus software companies? Does it differ for companies in different clean technology areas (e.g. in energy versus transport)?

Question 2.5: What are the strengths and weaknesses of the UK in clean technology?

Question 2.6: How have the UK's strengths and weaknesses in clean technology changed in the last five years?

Prompt: how has this been affected, if at all, by Brexit and Covid?

On success stories and lessons learned from UK clean tech companies' experiences:

For interviewees except individual funders:

Question 2.7: Can you share any success stories or lessons that can be learnt from UK clean tech companies' experiences?

For individual funders:

Question 2.7a: Can you share any success stories or lessons that can be learnt from the experiences of UK clean tech companies in which you have invested? What made them attractive for investment?

The funding environment for the UK clean tech sector

For interviewees except institutional investors into VC funds:

On the profile of funds targeting the UK clean tech sector:

For interviewees except individual funders and funding provider industry organisations and trade bodies:

Question 3.1: What is their investment mandate?

Prompt: are they generalist funds or funds investing specifically in this sector?

Question 3.2: Are they headquartered in the UK or elsewhere?

Question 3.3: How large are they relative to funds that specialise in other areas?

Question 3.4: Has this changed in the last five years? If so, how?

For individual funders:

Question 3.1a: What is your fund's investment mandate?

Prompt: is your fund a generalist fund or does it invest specifically in this sector?

Follow-up: what are the investment mandates of other funds targeting the UK clean tech sector?

Question 3.2a: Is your fund headquartered in the UK or elsewhere?

Follow-up: are other funds targeting the UK clean tech sector typically international or UK-based funds (in terms of headquarter location)?

Question 3.3a: How large is your fund relative to other funds that invest in innovative technologies?

Follow-up: how large are other funds targeting the UK clean tech sector relative to funds that specialise in other areas?

Question 3.4a: Has this changed in the last five years? If so, how?

For funding provider industry organisations and trade bodies:

Question 3.1b: What are the investment mandates of members of your organisation that target the UK clean tech sector?

Prompt: are your members that target the UK clean tech sector generalist funds or do they invest specifically in this sector?

Follow-up: what are the investment mandates of other funds targeting the UK clean tech sector?

Question 3.2b: Are the members of your organisation that target the UK clean tech sector typically headquartered in the UK or elsewhere?

Follow-up: are other funds targeting the UK clean tech sector typically international or UK-based funds (in terms of headquarter location)?

Question 3.3b: How large are the members of your organisation that target the UK clean tech sector relative to other funds that invest in innovative technologies?

Follow-up: how large are other funds targeting the UK clean tech sector relative to funds that specialise in other areas?

Question 3.4b: Has this changed in the last five years? If so, how?

Question 3.5: What alternatives to VC funding are available for the sector?

Prompt: e.g. public funding initiatives, crowdfunding, etc.

Follow-up: how do these alternatives compare in terms of suitability and attractiveness to VC funding from the perspective of early-stage clean tech companies?

Additional question for clean tech industry and trade associations and incubators and accelerators: what funding options do clean tech companies typically look at? To what extent are they aware of the different funding sources and options open to them?

Question 3.6: What do market trends for investment in early-stage clean tech firms in the UK look like?

Prompt: rates of growth; changes in geographical distribution of firms/investment; changes in which areas of clean tech are being funded; changes in exit opportunities

Follow-up: how do these trends compare with global trends?

Prompt: countries of particular interest are the US, Germany, France and Sweden.

Follow-up: how do they compare with other technology areas?

Prompts: levels of investment; rates of growth; changes in geographical distribution of firms/investment; changes in exit opportunities

Prompts: e.g. biotech, AI, blockchain

Follow-up: what has changed since 2017?

For institutional investors into VC funds:

Question 3.0c: What is your organisation's total assets under management? Within this, what is the allocation to VC? Within that VC allocation, how much is allocated to clean tech?

On the profile of funds targeting the UK clean tech sector:

Question 3.1c: Amongst funds you invest in that target the UK clean tech sector, what is their investment mandate?

Prompt: are they generalist funds or funds investing specifically in this sector?

Follow-up: what are the investment mandates of funds that target the UK clean tech sector generally (i.e. not just amongst those you invest in)?

Question 3.2c: Amongst funds you invest in that target the UK clean tech sector, are they typically headquartered in the UK or elsewhere?

Follow-up: amongst all funds that target the UK clean tech sector (i.e. not just amongst those you invest in), are they typically headquartered in the UK or elsewhere?

Question 3.3c: Amongst funds you invest in that target the UK clean tech sector, how large are they relative to funds that specialise in other areas?

Follow-up: amongst all funds that target the UK clean tech sector (i.e. not just amongst those you invest in), how larger are they relative to funds that specialise in other areas?

Question 3.4c: Has this changed in the last five years? If so, how?

Question 3.5c: How does clean tech differ from other technology areas as a target for investment?

Question 3.6c: When you encounter funds targeting the UK clean tech sector, what makes them stronger candidates for investment? What stops you from making larger investments in them?

Follow-up: Has this changed in the last five years? If so, how?

Question 3.7c: What are the primary sources of information you use when assessing funds targeting the UK clean tech sector?

Prompt: e.g. to what extent are you able to use databases such as Pitchbook and its alternatives?

Question 3.8c: How do you identify 'real' clean tech companies and avoid greenwashing?

Question 3.9c: What trends do you see in the market for investment in clean tech in the UK?

Prompt: a 'COP pop', impacts of Brexit, impacts of Covid, etc.

Follow-up: how do these trends compare with trends in the market for investment in other technologies (e.g. AI, biotech)?

Follow-up: how do the trends in the market for investment in clean tech in the UK compare with such trends in other countries (esp. the US, France, Germany and Sweden)?

End of interview

Thank the interviewee for their time.

Ask if the interviewee is willing to be contacted for follow-up questions or discussions.

If so, ask for the best method of contacting the participant (e-mail or telephone) for any follow-ups.

If appropriate (e.g., if they mentioned during the interview someone at another organisation that we plan to speak to who was interested in the issues being discussed) ask the interviewee if they can suggest the best people to contact at other organisations we have identified as targets for interviews.

Analysis of Crunchbase and i3 databases

In this section we look at the two alternative data sources we explored, the Crunchbase and i3 databases and present the key descriptive statistics. Due to the different coverage of the three data sources (Beahurst, Crunchbase and i3), we do not expect the information to be always fully consistent across the different data sources.

Differences across data sources and rationale for choosing Beahurst

One of the main differences across the data sources is that Beahurst has significantly more complete and structured coverage of unannounced fundraisings²⁰¹, leading to a higher number of deals being reported (including smaller deals). Per Beahurst, in each year between 2011 and 2020, unannounced rounds accounted for between 65% and 71% – by number – of equity rounds by UK companies. While unannounced rounds tend to be smaller than announced rounds in terms of deal value, they are particularly common for companies at lower stages of evolution, which is the focus of this study. Hence, coverage of unannounced fundraisings is an important consideration, especially with respect to deal counts.

Beahurst also has significantly more complete coverage of deal values. Approximately 3% of in-scope rounds in the Beahurst data had a missing value for their amount; for i3, that is around 28% between 2012 and 2021 (although it is around 50% in 2020). In the Crunchbase data, approx. 26% of rounds considered in the original analysis had a missing value for the amount.

Beahurst coverage also extends to biotech and AI companies, but does not include foreign markets; findings for the analysis of early stage investments in clean tech companies using these comparator countries are presented in Figure 33 and Figure 34 using the Crunchbase and i3 databases, while in the remainder of this section we compare key characteristics of rounds using the Crunchbase and i3 databases and focusing on the UK clean tech market.

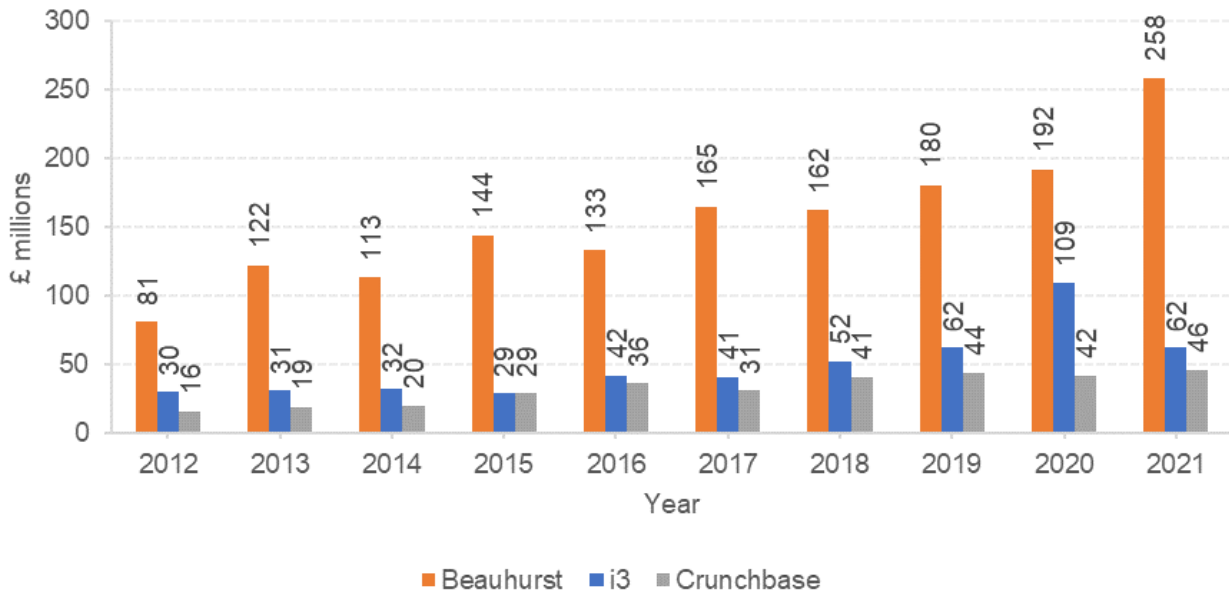
Early stage investment in UK clean tech companies using Crunchbase and i3 data

Figure 27 and Figure 28 show the number and volume of rounds at the seed or venture stage (which is defined as 'Series A' in both the i3 and Crunchbase data) between 2012 and 2021. To enable comparison we also present the corresponding figures based on the Beahurst data are presented in Figure 10. The number of deals and the value recorded in both the Crunchbase and i3 are significantly lower than Beahurst (due to the expanded coverage in Beahurst), although both Crunchbase and i3 also show a rising number of deals after 2017. However, in 2020 there is a significant spike in the number of rounds recorded in the i3 data (but not Crunchbase), followed by a decline in 2021 (as a comparison, Beahurst data show growth in the number of deals in both years, in particular in 2021). On the other hand, according to the Crunchbase data the amount invested increased significantly between 2020 and 2021 (after a decline between 2019 and 2020), while it remained stable according to the i3

²⁰¹ <https://www.beahurst.com/blog/all-the-data-on-unannounced-fundraisings/>

data (again Beauhurst data show a strong increase between 2020 and 2021). However, it should be remembered that the deal value is only reported for a subset of deals (around 26% to 28% have missing values across the two data sources).

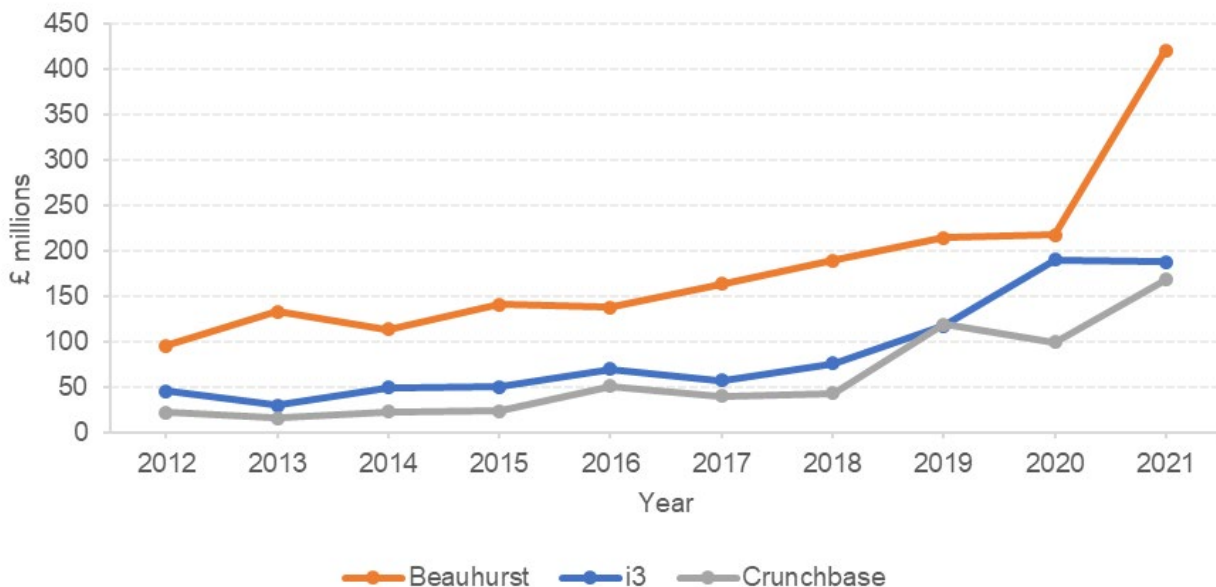
Figure 27 Total number of seed and venture (Series A) rounds by UK-headquartered clean tech companies, 2012 – 2021, Beauhurst, i3 and Crunchbase databases



Note: Beauhurst Venture rounds are defined as Series A in the Crunchbase and i3 data. Deals with value above £20 million were removed from the analysis. No minimum cut-off applied for Crunchbase as it has a separate category for pre-seed rounds

Source: LE analysis of Beauhurst, i3 and Crunchbase databases

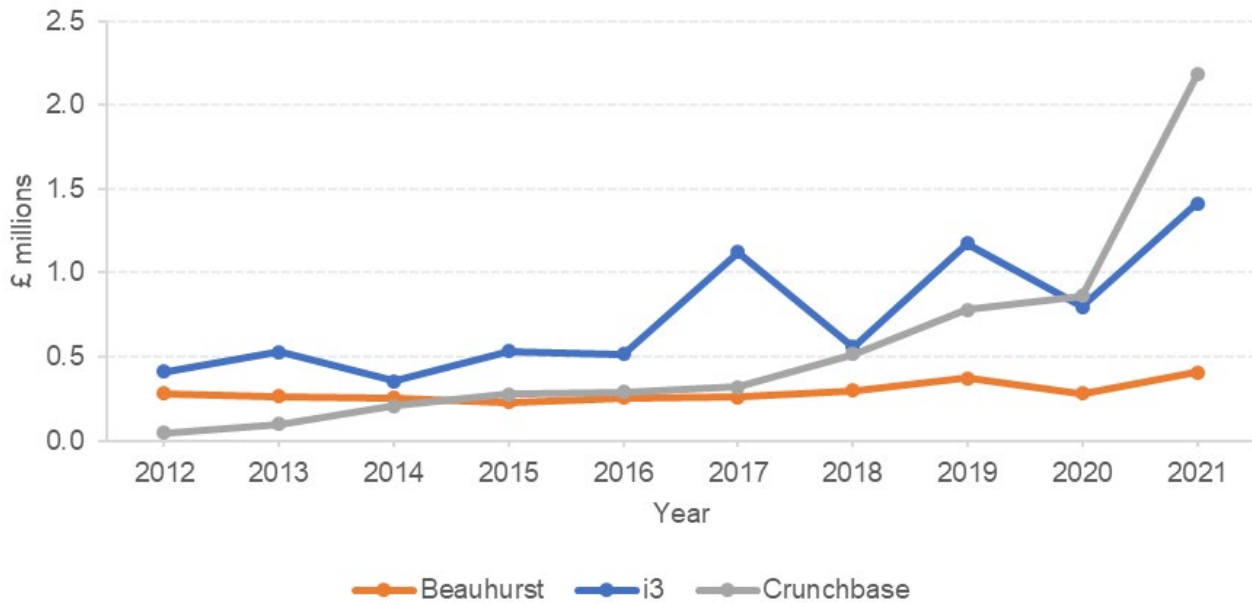
Figure 28 Total value of seed and venture (Series A) rounds by UK-headquartered clean tech companies, 2012 – 2021, Beauhurst, i3 and Crunchbase databases



Note: Beauhurst Venture rounds are defined as Series A in the Crunchbase and i3 data. Deals with value above £20 million were removed from the analysis. No minimum cut-off applied for Crunchbase as it has a separate category for pre-seed rounds

Source: LE analysis of Beauhurst, i3 and Crunchbase databases

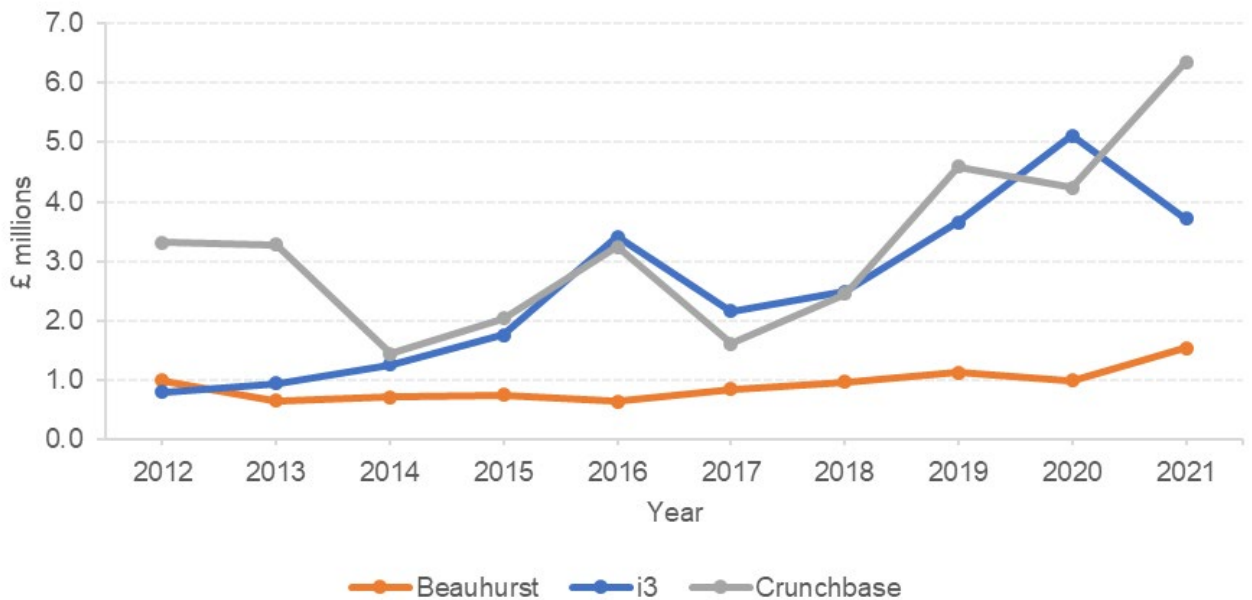
Figure 29 Median value of seed rounds by UK-headquartered clean tech companies, 2012 – 2021, Beauhurst, i3 and Crunchbase databases



Note: Beauhurst Venture rounds are defined as Series A in the Crunchbase and i3 data. Deals with value above £20 million were removed from the analysis. No minimum cut-off applied for Crunchbase as it has a separate category for pre-seed rounds

Source: LE analysis of Beauhurst, i3 and Crunchbase databases

Figure 30 Median value of seed and venture (series A) rounds by UK-headquartered clean tech companies, 2012 – 2021, i3



Note: Beauhurst Venture rounds are defined as Series A in the Crunchbase and i3 data. Deals with value above £20 million were removed from the analysis. No minimum cut-off applied for Crunchbase as it has a separate category for pre-seed rounds

Source: LE analysis of Beauhurst, i3 and Crunchbase databases

Figure 29 and Figure 30 show the median value of seed and venture (series A) rounds using the three datasets considered. As expected, median values reported by Crunchbase and i3 are much higher than those observed using the Beauhurst data as the Beauhurst database also covers unannounced deals (typically smaller in size) and has a better coverage of deal value (with less than 3% of records having missing information, compared to 26%-28% for the other two datasets). Median values recorded by the i3 and Crunchbase databases are also more volatile over time due to the smaller number of deals recorded and the missing values for a part of the records.

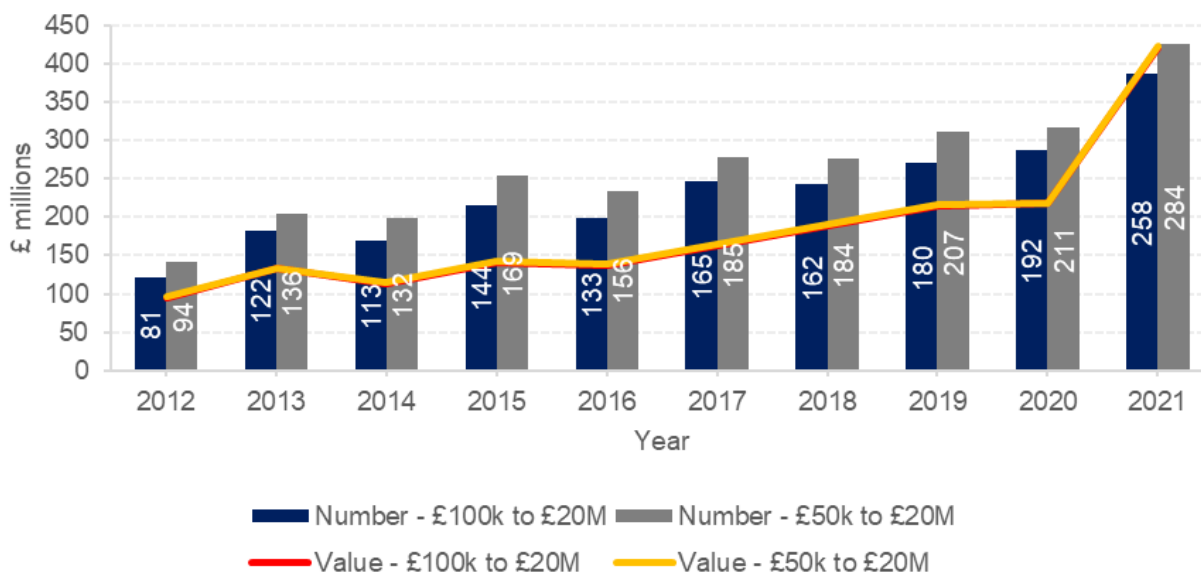
Overall the Beauhurst data has a much better coverage of smaller deals and also more complete information on the value of the deals.

Robustness check using the Beauhurst data

The filters used to screen out deals not relevant for the analysis included a value for seed and venture rounds ranging between £100,000 and £20million. This was to remove pre-seed rounds and later stage rounds. As a robustness checks to the main analysis we also present the equivalent information to that presented in Figure 10 and Figure 11 (based on Beauhurst data), but moving the lower threshold to £50,000 (instead of £100,000). As shown in Figure 31, moving the threshold to £50,000 generally added around 20-25 rounds per year, but the overall additional amount provided by these rounds was limited (as the value of each round is between £50,000 and £100,000 by definition), resulting in an additional value between £1million and £2million in each year (the two lines are overlapping). The overall trend is consistent with the one presented in the main analysis, with a rising trend over time (up to 2020) and a large increase between 2020 and 2021.

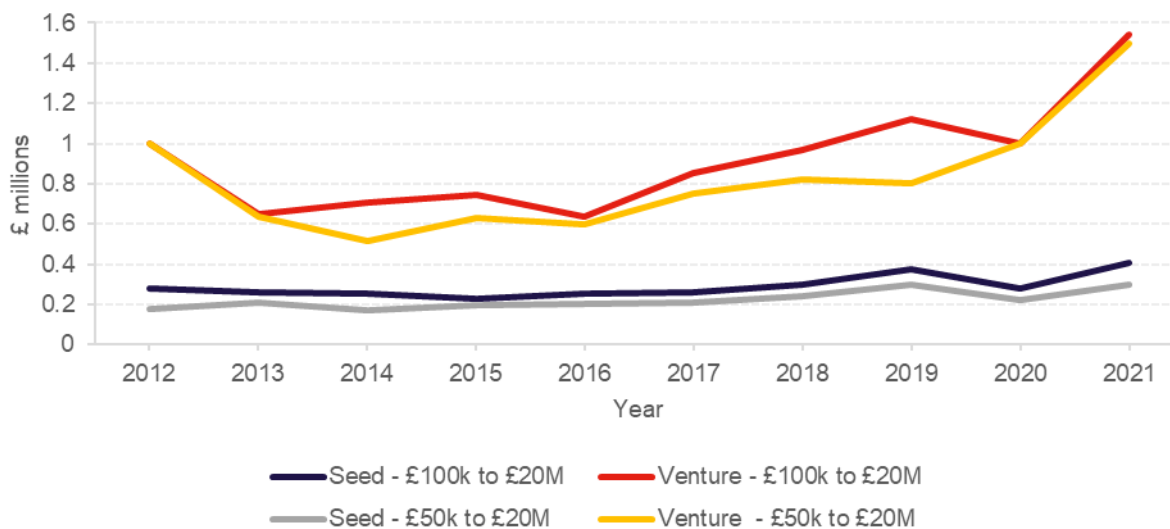
Median values (shown in Figure 32) are clearly lower compared to the main analysis, although the effect is generally small for venture rounds (as they are less affected by the inclusion of deals with smaller values, with the median being 12% lower on average compared to the median used in the main analysis) and larger for seed rounds (the median is on average 22% lower than the median used in the main analysis). For example, in 2021 there were only 3 additional deals included for venture rounds when including deals with value between £50,000 and £100,000 (and the median value only fell from £1.54M to £1.50M, while there were 23 additional seed rounds included, with the median dropping from £0.41M to £0.30M).

Figure 31 Seed and Venture rounds by UK-headquartered clean tech companies, 2012 – 2021. Moving the lower threshold to £50,000. Beauhurst data



Notes: Deals with value below £50,000 or above £20 million were removed from the analysis.
Source: LE analysis of Beauhurst data.

Figure 32 Median value of seed and venture rounds by UK-headquartered clean tech companies, 2012 – 2021. Moving the lower threshold to £50,000. Beauhurst data



Notes: Deals with value below £50,000 or above £20 million were removed from the analysis.
Source: LE analysis of Beauhurst data

Comparison with trends in comparator countries

This section compares the VC market for early-stage clean tech companies in the UK with the markets in the US, Germany, France and Sweden. These countries are, like the UK, high-income countries with significant VC markets that have made net zero commitments (i.e., commitments to reduce the amount of greenhouse gases emitted domestically to at most the

amount of greenhouse gases removed by the country). Germany, France and Sweden have, like the UK, set legally binding targets for reaching net zero.²⁰² Sweden and Germany have committed to reaching net zero by 2045, five years earlier than France and the UK.²⁰³ The US has committed to reaching net zero by 2050, but has not at the time of writing made this commitment legally binding.

As the Beauhurst database only focuses on UK companies, we used the i3 and Crunchbase²⁰⁴ databases for the cross-country analysis²⁰⁵.

Figure 33 and Figure 34 show the total number of seed and series A rounds and their total value as a percentage of GDP²⁰⁶ in each of the UK, Germany, France, Sweden and the US.

The UK is gaining ground on the comparator countries in terms of early-stage clean tech VC investment as a percentage of GDP

The UK has shown increases relative to the four comparator countries in terms of the total value of seed rounds and of series A rounds by clean tech companies as a percentage of GDP since 2017. This percentage has shown an increasing trend in the UK while such an increase was slower in the four comparator countries. Sweden's strong relative performance on this metric since 2017 is notable. Sweden has a strong ecosystem around transport and mobility clean tech.²⁰⁷ Sweden also has high levels of research and development (R&D) intensity as a result of significant public and private investment in R&D²⁰⁸, and between 2015 and Q3 2021, 28% of all Swedish VC and scale-up funding was directed at clean tech companies²⁰⁹. In comparison, clean tech accounted for only 14% of VC funding globally in 2021.²¹⁰

²⁰² Carver, D. (2021), 'Global net zero commitments'. House of Commons Library, 12th November 2021. Available at <https://commonslibrary.parliament.uk/global-net-zero-commitments/>.

²⁰³ Ibid.

²⁰⁴ <https://data.crunchbase.com/>

²⁰⁵ https://i3connect.com/front_page?ref=%2F

²⁰⁶ International Monetary Fund (IMF) World Economic Outlook (WEO) forecasts for GDP are used for 2021, since actual GDP data was not available at the time of writing.

²⁰⁷ UK Science & Innovation Network (2021), 'UK Science & Innovation Network Country Snapshot: Sweden'. Available at

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019265/Sweden_SI_Country_Snapshot_2021.pdf.

Kraemer-Eis, H. et al. (2021), 'The importance of Private Equity and Venture Capital financing for Greentech companies in Europe'. SUERF Policy Note Issue No 258, December 2021.

²⁰⁸ UK Science & Innovation Network (2021), 'UK Science & Innovation Network Country Snapshot: Sweden'. Available at

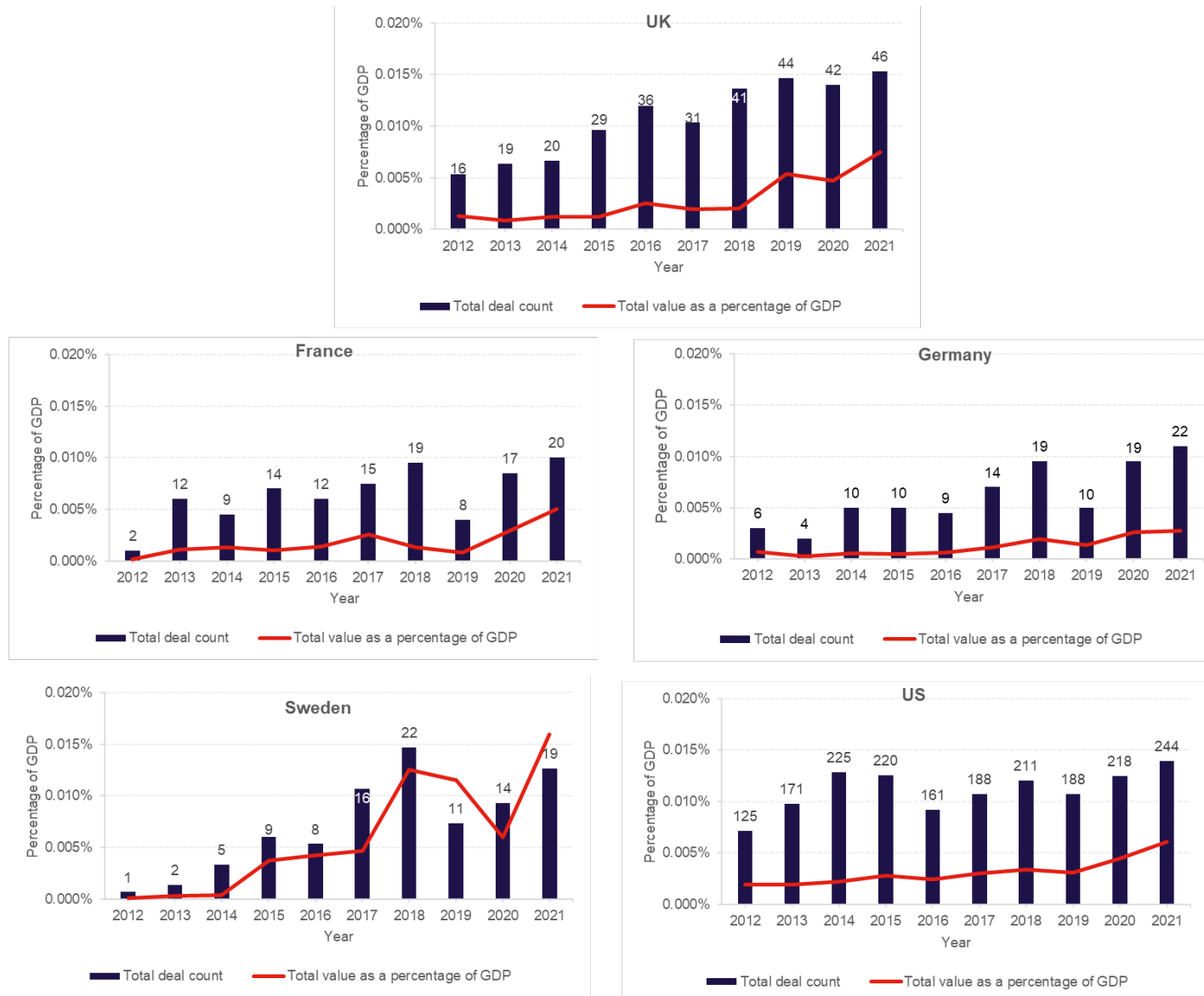
https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1019265/Sweden_SI_Country_Snapshot_2021.pdf.

²⁰⁹ Kraemer-Eis, H. et al. (2021), 'The importance of Private Equity and Venture Capital financing for Greentech companies in Europe'. SUERF Policy Note Issue No 258, December 2021.

²¹⁰ PwC (2021a), 'Global climate tech investment more than triples, but could be better targeted to cut emissions - PwC State of Climate Tech 2021'. 15th December 2021. Available at <https://www.pwc.co.uk/press-room/press-releases/global-climate-tech-investment-more-than-triples.html>.

THE UK VENTURE CAPITAL MARKET FOR EARLY-STAGE CLEAN TECH COMPANIES

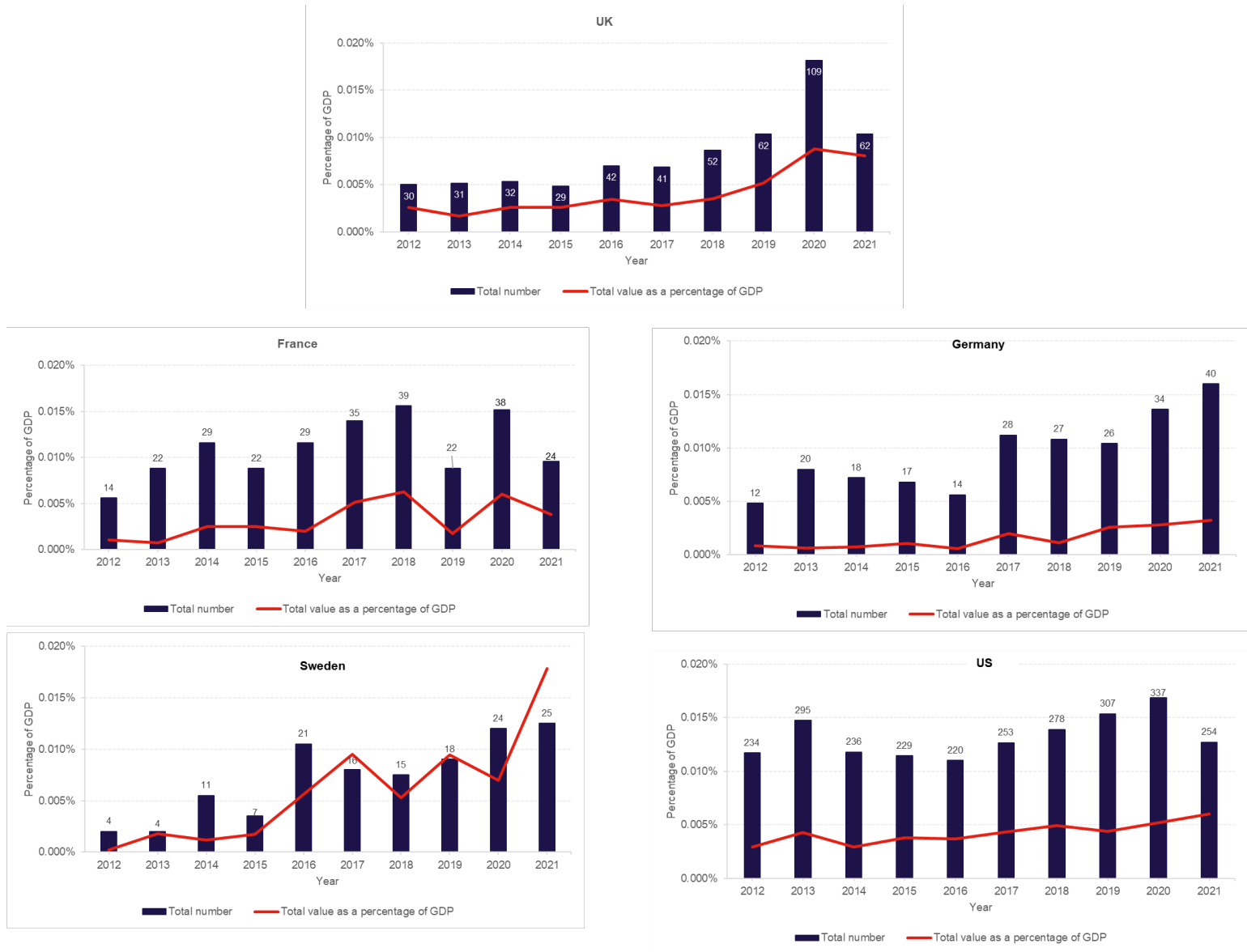
Figure 33 Seed and venture (series A) rounds by clean tech companies in the UK and comparator countries, 2012–2021, Crunchbase



Source: LE analysis of Crunchbase and IMF WEO data

THE UK VENTURE CAPITAL MARKET FOR EARLY-STAGE CLEAN TECH COMPANIES

Figure 34 Seed and venture (series A) rounds by clean tech companies in the UK and comparator countries, 2012 – 2021, i3



Source: LE analysis of i3 and IMF WEO data

The qualitative drivers of investment in the VC market for early-stage clean tech companies seem to be similar across the different countries considered

Sweden exhibits particular volatility in investment volumes because of its small deal counts, which make total volumes more sensitive to the presence or absence of individual large deals. Large rounds by Einride and Voi, two electric vehicle companies, drove the especially large investment volumes in Sweden in 2018 and 2019; these rounds are likely to be an important reason for the large apparent drop between these years and 2020.

However (bearing in mind this caveat in the case of Sweden), the comparator countries largely show the same key trends as the UK since 2017: increasing investment volumes, limited (if any) growth in deal counts and increasing average deal sizes. Tech Nation's *Net Zero Report 2021* found similarly that for clean tech VC in general (i.e., not just early-stage VC specifically) in the top ten clean tech ecosystems globally, deal counts had fallen since 2019 while investment volumes had risen and median deal sizes had grown.²¹¹ Moreover, PwC's *The State of Climate Tech 2021* report states that globally 'the number of early VC, seed and Series A investments has remained largely stagnant since 2018'.²¹² According to the Climate Tech VC Substack, the average size of Series A deals globally doubled between Q2 2020 and Q2 2021, in line with our finding of increased deal sizes.²¹³

Increasing investment volumes in the comparator countries have drivers similar to the increases in the UK; namely, increasing demand from consumers and corporates, falling costs of clean technologies and increasingly supportive government policy.²¹⁴ Each of the comparator countries has, as mentioned above, committed to reaching net zero.

PwC attribute the stagnation in the number of early-stage VC deals in clean tech companies to two factors. First, PwC argue that risk-aversion on the part of investors constricts early-stage investment in clean tech.²¹⁵ Early-stage investors, in general, appear to continue to focus their investments on 'safer' areas in which there is a greater track record of success and profitability, and in which there exists an established funding environment for later stages.²¹⁶ Second, they argue that there is a lack of founders who have the requisite scientific and technical knowledge of climate challenges and their technological solutions.²¹⁷ While a scarcity of talent is an issue for start-ups in general, PwC argue that clean tech faces a particular difficulty in this area because it is more interdisciplinary than areas like biotech, and therefore is reliant on a broader range of talent.²¹⁸ These issues are discussed in further detail below.

²¹¹ Tech Nation (2021b), 'Net Zero Report 2021'. Available at <https://technation.io/net-zero-report-2021/>.

²¹² PwC (2021b), 'The State of Climate Tech 2021: Scaling breakthroughs for net zero'. Available at <https://www.pwc.com/gx/en/services/sustainability/publications/state-of-climate-tech.html>.

²¹³ Purdom, S. and Zou, K. (2021), 'Climate tech \$16b mid-year investment action report'. Climate Tech VC Substack, 27th August 2021. Available at <https://climatetechvc.substack.com/p/-climate-tech-16b-mid-year-investment>.

²¹⁴ PwC (2020), 'The State of Climate Tech 2020: The next frontier for venture capital'. Available at <https://www.pwc.com/gx/en/services/sustainability/assets/pwc-the-state-of-climate-tech-2020.pdf>. See p.46.

²¹⁵ PwC (2021b), 'The State of Climate Tech 2021: Scaling breakthroughs for net zero'. Available at <https://www.pwc.com/gx/en/services/sustainability/publications/state-of-climate-tech.html>.

²¹⁶ Ibid.

²¹⁷ Ibid.

²¹⁸ Ibid.

Investor types

Venture Capital investors

Stakeholders interviewed for this study reported that funds targeting the clean tech sector specifically were typically small in size. However, there is evidence that the number of large funds specifically targeting clean tech (either set up by specialist VCs or set up by generalists) is increasing.²¹⁹ Both of the specialist clean tech ‘mega-funds’ with confirmed sizes of over £500 million that were identified as having invested in UK clean tech companies between 2017 and 2021 (OGCI Climate Investments and Lowercarbon Capital) were announced in 2021. The Climate Tech VC Substack has noted the increasing size of clean tech VC funds.²²⁰

There are advantages and drawbacks of a VC fund being larger. A larger fund is able to fund larger rounds, is better able to provide follow-on funding, can benefit from economies of scale,²²¹ and is better able to diversify and spread risk in their portfolio.²²² The ability to provide larger amounts of funding may be particularly important in the case of clean tech hardware innovations, which often have high capital demands.²²³ However, if a fund is too large, this can make management of the portfolio more challenging, and there may be an insufficient number of profitable deals relative to the fund’s size.²²⁴ In addition, larger funds may be less likely to invest in earlier rounds such as seed and series A rounds (as opposed to series B rounds, series C rounds, etc.), where round sizes are typically smaller (and more risky). Large funds would have to invest in a large number of seed or series A deals to invest all of their capital, and they may not be able to identify a sufficient number of viable opportunities in order to do so (also potentially due to limited team capacity).

Corporate VCs investing in UK clean tech companies

Some corporate VCs may be established by oil and gas companies due to increasing pressure from investors and increasing calls for climate-related disclosures (which will become

²¹⁹ In addition, the amount of committed but unallocated capital (‘dry powder’) held by VCs and private equity firms is currently reported to be large. Globally, clean tech funds announced in 2021 had more than \$37 billion in dry powder (Purdom, S. and Zou, K, 2022). More broadly, in the UK VC industry as a whole, large amounts of dry powder have accumulated recently as a result of strong fundraising conditions. The BBB’s Small Business Equity Tracker 2020 reported that UK VC funds collectively had £9.5 billion in dry powder, corresponding to 13-17 months of investment based on VC investment levels in 2018 and 2019.

²²⁰ Purdom, S. and Zou, K. (2021), ‘Climate tech \$16b mid-year investment action report’. Climate Tech VC Substack, 27th August 2021. Available at <https://climatetechvc.substack.com/p/-climate-tech-16b-mid-year-investment>.

²²¹ British Business Bank (2020a), ‘UK Venture Capital Financial Returns 2020’. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2020/11/BBB-VC>Returns-Report-2020-FINAL-1.pdf>.

²²² Owen, R. (2021), ‘Lessons From Government Venture Capital Funds to Enable Transition to a Low-Carbon Economy: The U.K. Case’. IEEE Transactions on Engineering Management, Special Issue, pp.1-15. DOI: 10.1109/TEM.2021.3094992.

²²³ See, for instance, Ghosh, S. and Nanda, R. (2010), ‘Venture Capital Investment in the Clean Energy Sector’. Harvard Business School, Working Paper 11-020. Available at https://www.hbs.edu/ris/Publication%20Files/11-020_0a1b5d16-c966-4403-888f-96d03bbab461.pdf.

²²⁴ British Business Bank (2020a), ‘UK Venture Capital Financial Returns 2020’. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2020/11/BBB-VC>Returns-Report-2020-FINAL-1.pdf>.

mandatory for many businesses in the UK in the coming years)²²⁵ and are currently encouraging oil and gas companies to decarbonise.²²⁶ Shell Ventures, for instance, recently raised a £1 billion fund²²⁷. Equinor Ventures, the venture arm of the Norwegian energy company Equinor, is more than \$750 million in size²²⁸. Both of these funds have global remits.

Business angels

Angels typically invest in early-stage companies at an earlier stage than VCs do. This means that they can play a role in bridging the gap between R&D funding, such as grants, and VC funding. As well as providing capital, angels typically provide advice and other support to the businesses in which they invest.²²⁹ While the lack of published data about the size of angel investments means that it is difficult to ascertain the total value of angel investment in UK businesses, *The UK Business Angel Market 2020* report from the BBB and the UK Business Angels Association (UKBAA) cites the best estimate as being approximately £2 billion per year.²³⁰

The uneven geographical distribution of angels in the UK has been noted previously and prompted the introduction of the Regional Angels Programme, which was announced as part of the Autumn Budget 2017 and aims to reduce these disparities.²³¹ A stakeholder interviewed in support of this study noted that work was being done to establish angel communities in areas where they are currently less active, but said that this was likely to be a long-term process.

As alluded to above, angel investment in UK clean tech companies is done both by individual angels and by angel syndicates. For instance, the Green Angel Syndicate is a UK angel syndicate that specialises in clean tech investment and that has invested in 28 companies.²³² Angels grouping together into syndicates has several advantages. Syndicates are better able to provide follow-on funding than individual angels, since they have access to more capital.²³³ Angel syndicates reduce search costs since they are likely to be more visible than individual angels.²³⁴ In addition, by pooling the networks, expertise and experience of their members, syndicates can often provide more non-funding 'value-add' than individual angels.²³⁵

²²⁵ HM Treasury (2020a), 'A Roadmap towards mandatory climate-related disclosures'. November 2020. Available at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/933783/FINAL_TCFD_ROADMAP.pdf.

²²⁶ McKinsey & Company (2020), 'The future is now: How oil and gas companies can decarbonize'. 7th January 2020. Available at <https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-future-is-now-how-oil-and-gas-companies-can-decarbonize>.

²²⁷ <https://www.upstreamonline.com/energy-transition/shell-launches-1-4bn-fund-to-support-energy-transition-start-ups-and-scale-ups/2-1-1093408>

²²⁸ <https://www.equinor.com/energy/ventures>

²²⁹ British Business Bank and UK Business Angels Association (2020), 'The UK Business Angel Market 2020'. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2020/10/20201008-BBB-Business-Angels-Report-Final.pdf>.

²³⁰ Ibid.

²³¹ Ibid.

²³² Green Angel Syndicate (n.d.), 'About Us'. Available at <https://greenangelsyndicate.com/about/>.

²³³ Mason, C., Botelho, T. and Harrison, H. (2013), 'The Transformation of the Business Angel Market: Evidence from Scotland'. Available at https://www.gla.ac.uk/media/Media_302219_smxx.pdf.

²³⁴ Ibid.

²³⁵ Ibid.

Syndication also facilitates the sharing of risks between angels.²³⁶ Finally, syndicates can encourage individuals to participate in angel investment by reducing the frictions involved in doing so in terms of the time required to discover opportunities and perform due diligence, expanding the supply of angel investment.²³⁷

According to the UK Business Angel Market survey 2019, 20% of UK angels had invested in the 'Energy, Environment and Clean Tech' sector in 2018/19.²³⁸ The 'Energy, Environment and Clean Tech' sector was therefore the seventh amongst all sectors in terms of the share of angels that responded to the survey that had invested in it.²³⁹ According to stakeholders interviewed as part of this study, angels tend to invest across sectors, although some angels with particular knowledge of the clean tech sector may focus on that sector. Syndication can allow angels without clean tech expertise to access the skills and knowledge of those angels who do have such expertise.²⁴⁰

A majority of UK angels responding to the UK Business Angel Market survey 2019 reported having invested in deep tech.²⁴¹ Deep tech, which is often hardware-based, is characterised by significant engineering or scientific advances²⁴² and (therefore) long R&D timelines. High levels of technology risk and long R&D timelines can deter investment in deep tech.²⁴³ Clean tech includes a number of examples of deep tech, including, for example, nuclear fusion technology and electric aircraft.

Angel investment was identified by stakeholders interviewed for this study as a relative strength of the UK funding ecosystem, and stakeholders highlighted the importance of the Enterprise Investment Scheme (EIS) and Seed Enterprise Investment Scheme (SEIS), which provide tax reliefs to individuals making equity investments in early-stage UK companies.²⁴⁴ Multiple stakeholders suggested that clean tech investment by angels could be increased if there were (S)EIS-like relief targeted at the clean tech sector in particular.

²³⁶ Aernoudt, R. (2005), 'Business Angels: The Smartest Money for Starters? Plea for A Renewed Policy Focus on Business Angels'. *International Journal of Business*, 10(3), 2005. Available at https://papers.ssrn.com/sol3/papers.cfm?abstract_id=778426.

²³⁷ Mason, C., Botelho, T. and Harrison, H. (2013), 'The Transformation of the Business Angel Market: Evidence from Scotland'. Available at https://www.gla.ac.uk/media/Media_302219_smx.pdf.

²³⁸ British Business Bank and UK Business Angels Association (2020), 'The UK Business Angel Market 2020'. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2020/10/20201008-BBB-Business-Angels-Report-Final.pdf>.

²³⁹ Ibid.

²⁴⁰ Mason, C., Botelho, T. and Harrison, H. (2013), 'The Transformation of the Business Angel Market: Evidence from Scotland'. Available at https://www.gla.ac.uk/media/Media_302219_smx.pdf.

²⁴¹ British Business Bank and UK Business Angels Association (2020), 'The UK Business Angel Market 2020'. Available at <https://www.british-business-bank.co.uk/wp-content/uploads/2020/10/20201008-BBB-Business-Angels-Report-Final.pdf>.

²⁴² TechWorks (n.d.), 'What is Deep Tech?'. Available at <https://www.techworks.org.uk/about/what-is-deep-tech>.

²⁴³ See, for instance, Gaddy, B., Sivaram, V. and O'Sullivan, F. (2016), 'Venture Capital and Clean tech: The Wrong Model for Clean Energy Innovation'. MIT Energy Initiative Working Paper, July 2016. MITEI-WP-2016-06. Available at <https://energy.mit.edu/wp-content/uploads/2016/07/MITEI-WP-2016-06.pdf>.

²⁴⁴ See UK Government (2019b), 'Use the Enterprise Investment Scheme (EIS) to raise money for your company'. Last updated 11th July 2019. Available at <https://www.gov.uk/guidance/venture-capital-schemes-apply-for-the-enterprise-investment-scheme>.

See also UK Government (2018), 'Use the Seed Enterprise Investment Scheme to raise money for your company'. Last updated 12th October 2018. Available at <https://www.gov.uk/guidance/venture-capital-schemes-apply-to-use-the-seed-enterprise-investment-scheme>.

Crowdfunding

UK clean tech companies have raised funding through the crowdfunding platforms Crowdcube and Seedrs; they have also raised funding through SyndicateRoom's crowdfunding platform. There do not appear to be any specialist clean tech crowdfunding platforms in the UK at the time of writing.

Crowdfunding can allow clean tech companies to make use of the increasing consumer interest in climate-related issues and clean tech to raise funding. In addition, a successful crowdfunding round could encourage subsequent VC investment by indicating a potentially receptive end-market. However, there are challenges associated with crowdfunding for clean tech companies. Retail investors²⁴⁵ may feel that they do not fully understand clean tech innovations, especially hardware and 'deep tech' innovations, and this may deter investment in them. Some stakeholders interviewed as part of this study questioned if consumer interest in crowdfunding for clean tech companies would continue in the long term given the long timeline for returns when investing in early-stage clean tech companies. Stakeholders highlighted that crowdfunding tended to increase the complexity of the 'cap table' (which shows the split of the company's ownership) more than alternative sources of funding. Finally, stakeholders noted that crowdfunding alone was unlikely to provide sufficient amounts of capital, especially for hardware companies since they tend to require larger amounts of funding, and so funding would be needed from other sources. This difficulty is exacerbated by the fact that hardware innovations are likely to be more difficult for retail investors to understand (see above).

Institutional investors and clean tech

Institutional investors such as pension funds and insurance companies are important investors in VC funds.²⁴⁶ For example, investors in the Clean Growth Fund (which closed in March 2022 with £101m in capital commitments), include the corporate venture arm of Aviva,²⁴⁷ Strathclyde Pension Fund, and CCLA, a fund manager for charities, religious organisations and the public sector.²⁴⁸ The allocation to VC typically accounts for only a very small proportion of an institutional investor's total assets under management (AuM). The median allocation to private equity and VC by institutional investors in 2019 was 6.1% in the US and 3.9% in Europe.²⁴⁹ A survey of European institutional investors suggested that 1/3 of institutional investors allocated less than 1% of their total private equity and VC allocation to VC.²⁵⁰ An investor with an allocation to private equity and VC of 3.9% that allocated 1% of its total private equity and VC allocation to VC would have an allocation to VC of less than 0.04% of AuM.²⁵¹ However, this allocation can still be large in absolute terms since institutional investors often manage very large amounts of capital. Between 2012 and 2016, institutional investors accounted for 55% of

²⁴⁵ Non-professional investors, often members of the general public.

²⁴⁶ BVCA (n.d.), 'Institutional investors'. Available at <https://www.bvca.co.uk/Our-Industry/Institutional-Investors>.

²⁴⁷ Clean Growth Fund (2022), 'Clean Growth Fund achieves target final close at £101m for first fund'. Updated on March 29, 2022. Available at <https://www.cleangrowthfund.com/clean-growth-fund-achieves-target-final-close-at-101m-for-first-fund/>.

²⁴⁸ CCLA (n.d.), 'About us'. Available at <https://www.ccla.co.uk/about-ccla>.

²⁴⁹ Axon Partners Group (2019), 'Participation of Institutional Investors in European Venture Capital'. Available at <https://www.axonpartnersgroup.com/report-participation-of-institutional-investors-in-european-venture-capital/>.

²⁵⁰ Ibid.

²⁵¹ Ibid.

funding for US VC funds and 27% of funding for EU VC funds, for VC funds across all sectors and stages.²⁵²

Amongst investment funds generally, sustainable funds account for a small share but have grown quickly in recent years.²⁵³ ESG issues are increasingly important to institutional investors.²⁵⁴ The number of asset managers and owners that are signatories to the PRI increased from 1,400 in 2015 to 3,000 in 2020 (this number, however, remains small as a proportion of the total number of asset managers and owners; only 14% of US asset owners were PRI signatories as of 2020).²⁵⁵ This increased interest in ESG issues might encourage increased investment by institutional investors in funds targeting the clean tech sector. However, investment in early-stage clean tech companies is likely to appear to institutional investors to be high-risk, especially because, as mentioned by a stakeholder, clean tech funds are likely to have less of a track record than funds specialising in other areas. This may mean that clean tech funds receive fewer and smaller investments from institutional investors, reducing the amount such funds are able to invest into clean tech companies. Within the climate sphere, infrastructure-type investments may be most attractive to institutional investors because they deliver stable returns in the form of income. 40% of the 15 >\$500 million climate investment 'mega-funds' launched in 2021 that were identified by the Climate Tech VC Substack were deployment-ready infrastructure funds.²⁵⁶ Together, the 15 'mega-funds' – which are unlikely to target seed or series A investments – accounted for approximately \$30 billion of the global \$37 billion of capital in the new clean tech funds announced in 2021.²⁵⁷

²⁵² Ibid.

²⁵³ IMF (2021), 'Global Financial Stability Report October 2021 – COVID-19, Crypto and Climate: Managing Challenging Transitions'. Available at <https://www.imf.org/en/Publications/GFSR/Issues/2021/10/12/global-financial-stability-report-october-2021>.

²⁵⁴ Institutional Asset Management (2021), 'ESG factors of increasing importance to institutional investors'. Available at <https://www.institutionalassetmanager.co.uk/2021/10/28/308397/esg-factors-increasing-importance-institutional-investors>.

²⁵⁵ IMF (2021), 'Global Financial Stability Report October 2021 – COVID-19, Crypto and Climate: Managing Challenging Transitions'. Available at <https://www.imf.org/en/Publications/GFSR/Issues/2021/10/12/global-financial-stability-report-october-2021>.

²⁵⁶ Purdom, S. and Zou, K. (2022), '\$40B 2021 climate venture recap'. Climate Tech VC Substack, 28th January 2022. Available at <https://climatetechvc.substack.com/p/40b-2021-climate-venture-recap>.

²⁵⁷ Ibid.

Search strategy

The quantitative analysis in the main body of the report makes use of data from Beauhurst, a subscription platform that provides data on private and public companies. This section describes the search strategy used to obtain relevant data from Beauhurst.

Beauhurst search strategy

Beauhurst clean technology Sector includes:

- Clean energy generation
- Energy reduction technology
- Other clean tech

Other relevant sectors include:²⁵⁸

- Other fuel production
- Other energy

An assessment of the companies returned from a search of these other relevant sectors highlighted a number of companies that from manual inspection were not under the category of 'clean tech' as defined in this study. As a result of this inspection, extra steps were taken to filter these companies out, by:

Excluding companies in **coal** or **oil and gas** sectors

Only including companies with descriptions containing at least one of the following words (hereafter, the **Keywords List**):^{259,260}

- Renewable
- Green
- Efficiency
- Hydrogen
- Clean
- Sustainable
- Emissions
- Wind
- Carbon
- Transition
- Solar
- Environmental

²⁵⁸ This inclusion is based off a recommendation from Beauhurst as relevant for 'Clean Tech'.

²⁵⁹ Beauhurst only allows multiple description filtering based on single words. So adding the phrase 'renewable energy' would return all companies with 'renewable' in their description as well as all companies with 'energy' in their description. It is possible to only return companies with the exact phrase "renewable energy" in their description, but this does not allow adding further filtering phrases to the same search. Consequently, filtering by single words only was chosen to reduce number of searches and improve search repeatability.

²⁶⁰ Words such as 'hydroelectric' and 'geothermal' also returned clean tech companies, but all of these companies had been picked up through other searches. Therefore, these words were dropped from the Keywords List for brevity.

Buzzwords

Beauhurst also allows the user to search for additional ‘buzzwords’. This search strategy will also include the ‘**biomass and biofuels**’ buzzword.²⁶¹

This search strategy describes searches for:

- Companies
- Funds
- Funding rounds²⁶²
- Acquisitions
- IPOs
- Accelerators
- Grants

In all of the above three searches, companies whose **descriptions** contain the word ‘**nuclear**’ are excluded, removing any companies related to nuclear energy.

For each of these three searches, results are compiled into a ‘Beauhurst collection’ – this functionality automatically removes duplicates across the three searches.

The total number of downloads from this complete search strategy is **9955**.

Companies search

Clean tech Sector search

- **Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other Clean Tech**)
- **Head office** (under criteria **Location**) is **United Kingdom**
- Company **description does not contain** the word ‘**nuclear**’

The screenshot shows a search filter configuration interface. At the top, it says 'Find companies where all of the following apply:'. Below this, there are three criteria rows, each with a dropdown menu and a close button (X):

- Row 1: 'sectors are any of Clean technology' (with a dropdown arrow next to 'Clean technology')
- Row 2: 'and head office (where known, otherwise registered address) is United Kingdom' (with dropdown arrows next to 'is' and 'United Kingdom')
- Row 3: 'and description contains none of these words nuclear' (with a dropdown arrow next to 'contains none of these words' and an edit icon next to 'nuclear')

Below the criteria rows, there is a blue information icon (i) and the text: 'The following criteria will only show core Beauhurst companies: sectors, description'. To the right of this text is a link: 'Remove these criteria'. At the bottom left, there is a link: '+ Add company criteria'. At the bottom right, there is a blue button with a magnifying glass icon and the text: 'Search for companies'.

Other Relevant Sectors search

- **Sectors** are **any** of **Other Fuel Production and Other Energy**
- **Sectors** are **none** of **Coal and Oil and Gas**
- **Description** contains **any** of the words in the **Keyword list**
- **Head office** (under criteria **Location**) is **United Kingdom**
- Company **description does not contain** the word ‘**nuclear**’

²⁶¹ This inclusion is based off a recommendation from Beauhurst as relevant for ‘Clean Tech’.

²⁶² The funding rounds search is more involved and also includes searches for comparison sectors of AI and BioTech, described below.

Find where of the following apply:

- sectors are of
- and sectors are of
- and description
- and is
- and description

i The following criteria will only show core Beauhurst companies: sectors , description [Remove these criteria](#)

[+ Add company criteria](#)

Buzzword search

- **Buzzwords** are any of **Biomass and biofuels**
- **Head office** (under criteria **Location**) is **United Kingdom**
- **Company description does not contain** the word **'nuclear'**

Find where of the following apply:

- buzzwords are of
- and is
- and description

i The following criteria will only show core Beauhurst companies: buzzwords , description [Remove these criteria](#)

[+ Add company criteria](#)

Total in collection from all searches: **1762 companies**

Investor search

Clean tech sector search

- The recipient company has **all** of the following criteria:
 - Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other Clean Tech**)
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word **'nuclear'**
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- any of their fundraisings match all of the following criteria:
 - the recipient company has all of the following criteria:
 - sectors are any of Clean technology
 - and head office (where known, otherwise registered address) is United Kingdom
 - and description contains none of these words nuclear
 - + Add company criteria
 - and date of fundraising is from 01/01/2012 to 31/12/2021
 - + Add fundraising criteria
- + Add fund criteria

Other Relevant Sector search

- The recipient company has **all** of the following criteria:
 - Sectors are **any** of **Other Fuel Production** and **Other Energy**
 - Sectors are **none** of **Coal** and **Oil and Gas**
 - Description contains **any** of the words in the **Keyword list**
 - Head office (under criteria **Location**) is **United Kingdom**
 - Description **does not contain** the word 'nuclear'
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- any of their fundraisings match all of the following criteria:
 - the recipient company has all of the following criteria:
 - sectors are any of 2 sectors selected
 - and sectors are none of 2 sectors selected
 - and description contains any of these words renewable green efficiency hydrogen clean sustainable emissions wind carbon transition solar environmental
 - and head office (where known, otherwise registered address) is United Kingdom
 - and description contains none of these words nuclear
 - + Add company criteria
 - and date of fundraising is from 01/01/2012 to 31/12/2021
 - + Add fundraising criteria
- + Add fund criteria

Buzzword search

- The recipient company has all of the following criteria:
 - Buzzwords are **any** of **Biomass** and **biofuels**
 - Head office (under criteria **Location**) is **United Kingdom**
 - Description **does not contain** the word 'nuclear'
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- any of their fundraisings match all of the following criteria:
 - the recipient company has all of the following criteria:
 - head office (where known, otherwise registered address) is United Kingdom
 - and buzzwords are any of Biomass and biofuels
 - and description contains none of these words nuclear
 - + Add company criteria
 - and date of fundraising is from 01/01/2012 to 31/12/2021
 - + Add fundraising criteria
- + Add fund criteria

Total in collection from all searches: **741 funds**

Fundraising search

Beauhurst does not classify funding deals as ‘Series A’, ‘Series B’, etc. Therefore, to target seed and Series A funding, we restrict the company’s stage of evolution to one of **Seed or Venture** to filter out pre-seed funding, and set a maximum value of funding to filter out later-stage funding. The **£20,000,000 maximum value** is justified to filter out Series B and later-round fundraisings through previous analysis of large deals using Crunchbase data, and feedback we have received from the Clean Growth Fund. We further set a **minimum value of funding at £15,000**, in order to stay within the Beauhurst 10,000 row download limit while retaining as many rounds as possible. A minimum value of £15,000 should not exceed seed deals, which are larger than this. Further analysis to remove pre-seed deals was done at the data analysis stage, where we focused only on deals above £100,000 (or £50,000 to test the robustness of the strategy used).

Setting a minimum value of funding at £15,000 excludes **67 clean tech, 101 AI, and 43 BioTech** fundraisings with funding values less than that amount. Of all fundraising deals under £20,000,000, this is 3.3% of the deal count for clean tech, 3.5% for AI, and 2.0% for BioTech.²⁶³ In terms of funding value, these excluded fundraisings are a negligible proportion of the total value of fundraisings under £20,000,000. All but a handful of these excluded fundraisings have funding from undisclosed sources.

Limiting funds raised by value causes all deals with undisclosed values to drop out. There is no way of directly searching for these undisclosed value deals on Beauhurst.²⁶⁴

²⁶³ These otherwise excluded deals will be included in the analysis when comparing deal counts between the sectors.

²⁶⁴ Cases of fundings with undisclosed values are approximately 50 for each of Clean tech, AI, and BioTech, based on comparative searches.

Searching directly for fundraising by fund type (i.e for Private Equity, Venture Capital, and Angel Networks) causes all undisclosed sources of funding to drop out the search. To keep these included, we take a two-step search approach:

Keep fundraisings where **none** of the funders' fund types are all categories **except Private Equity and Venture Capital and Angel Networks**. This results in fundraisings where funders are either only PE/VC/AN, or only undisclosed funding, or a mix of PE/VC/AN and undisclosed funding.

Keep fundraisings where **any** of the funders' fund types are **Private Equity and Venture Capital and Angel Networks**. This includes the remaining fundraisings of interest, where some funding is from PE/VC/AN sources and some funding is from other *disclosed* sources.

For fundraising, further searches are made for comparison sectors of **AI** and **BioTech**. Apart from changing sectors, these searches mirror the criteria used for clean tech fundraising searches.

Sector search

- The recipient company has all of the following criteria:
 - **Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other Clean Tech**)
 - **Head office** (under criteria **Location**) is **United Kingdom**
 - **Description does not contain** the word '**nuclear**'
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed or Venture**
- **Form of funding** is **Equity**
- **Amount raised** is **between £15,000 and £20,000,000**

And the additional criteria in the first step:

- **None** of the **funders** match **all** of the following criteria:
 - **Fund type** is **all categories except Private Equity and Venture Capital and Angel Network**

THE UK VENTURE CAPITAL MARKET FOR EARLY-STAGE CLEAN TECH COMPANIES

Find where of the following apply:

- the recipient company has of the following criteria:
 - sectors are of
 - and is
 - and description
- + Add company criteria
- and company's stage of evolution (at time of fundraising) is
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type is
 - one of
 - Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University
- + Add fund criteria
- + Add fundraising criteria

And the additional criteria in the second step:

- Any of the funders match all of the following criteria:
 - Fund type is Private Equity and Venture Capital or Angel Network

Find where of the following apply:

- the recipient company has of the following criteria:
 - sectors are of
 - and is
 - and description
- + Add company criteria
- and company's stage of evolution (at time of fundraising) is
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type is
- + Add fund criteria
- + Add fundraising criteria

Other Relevant Sector search

- The recipient company has **all** of the following criteria:
 - **Sectors** are **any** of **Other Fuel Production** and **Other Energy**
 - **Sectors** are **none** of **Coal** and **Oil and Gas**
 - **Description** contains **any** of the words in the **Keyword list**
 - **Head office** (under criteria **Location**) is **United Kingdom**
 - **Description does not contain** the word 'nuclear'
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed** or **Venture**
- **Form of funding** is **Equity**
- **Amount raised** is **between** **£15,000** and **£20,000,000**

And the additional criteria in the first step:

- **None** of the **funders** match **all** of the following criteria:
 - **Fund type** is **all** categories **except** **Private Equity** and **Venture Capital** and **Angel Network**

Find fundraisings where all of the following apply:

- the recipient company has all of the following criteria: ✕
 - head office (where known, otherwise registered address) is United Kingdom ✕
 - and sectors are any of 2 sectors selected ✕
 - and sectors are none of 2 sectors selected ✕
 - and description contains any of these words ✕

renewable green efficiency hydrogen clean sustainable emissions wind carbon transition solar environmental ✎
 - and description contains none of these words nuclear ✕

[+ Add company criteria](#)
- and company's stage of evolution (at time of fundraising) is one of Seed or Venture ✕
- and date of fundraising is from 01/01/2012 to 31/12/2021 ✕
- and form of funding is any of Equity ✕
- and amount raised is between £15,000 and £20,000,000 ✕
- and none of their funder(s) match all of the following criteria: ✕
 - fund type is ✕
 one of

Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University ✎

[+ Add fund criteria](#)

[+ Add fundraising criteria](#) 🔍 Search for fundraisings

And the additional criteria in the second step:

- **Any** of the **funders** match **all** of the following criteria:
 - **Fund type** is **Private Equity** and **Venture Capital** or **Angel Network**

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and sectors are of
 - and sectors are of
 - and description
 - and description
- + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type one of
- + Add fund criteria

+ Add fundraising criteria

Buzzword search

- The recipient company has all of the following criteria:
 - Buzzwords** are **any** of **Biomass and biofuels**
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Company **description does not contain** the word 'nuclear'
- Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed or Venture**
- Form of funding** is **Equity**
- Amount raised** is **between £15,000** and **£20,000,000**

And the additional criteria in the first step:

- None** of the **funders** match **all** of the following criteria:
 - Fund type** is **all categories except Private Equity and Venture Capital** and **Angel Network**

THE UK VENTURE CAPITAL MARKET FOR EARLY-STAGE CLEAN TECH COMPANIES

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
 - and description
- + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type
 - one of
 - Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University
- + Add fund criteria
- + Add fundraising criteria

And the additional criteria in the second step:

- Any of the funders match all of the following criteria:
 - Fund type is Private Equity and Venture Capital or Angel Network

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
- + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type one of
- + Add fund criteria
- + Add fundraising criteria

Total in clean tech collection from all searches: **1932 fundraisings**

AI Search

- The recipient company has all of the following criteria:
 - Buzzwords** are **any** of **Artificial Intelligence**
 - Head office** (under criteria **Location**) is **United Kingdom**
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed or Venture**
- **Form of funding** is **Equity**
- **Amount raised** is **between £15,000** and **£20,000,000**

And the additional criteria in the first step:

- **None** of the **funders** match **all** of the following criteria:
 - Fund type** is **all** categories **except Private Equity and Venture Capital** and **Angel Network**

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
 - + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type
 - one of

Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University
 - + Add fund criteria
- + Add fundraising criteria

And the additional criteria in the second step:

- **Any** of the **funders** match **all** of the following criteria:
 - Fund type** is **Private Equity and Venture Capital** or **Angel Network**

Find **fundraisings** where **all** of the following apply:

- the recipient company has **all** of the following criteria:
 - head office (where known, otherwise registered address) is **United Kingdom**
 - and buzzwords are **any** of **Artificial Intelligence**
 - + Add company criteria
- and company's stage of evolution (at time of fundraising) is one of **Seed or Venture**
- and date of fundraising is **from 01/01/2012 to 31/12/2021**
- and form of funding is **any** of **Equity**
- and amount raised is **between** **£15,000** and **£20,000,000**
- and **any** of their funder(s) match **all** of the following criteria:
 - fund type is one of **Angel Network or Private Equity and Venture Capital**
 - + Add fund criteria

+ Add fundraising criteria Search for fundraisings

Total in AI collection from all searches: **2782 fundraisings**

BioTech Search

No category for BioTech exists on Beauhurst, and so a multiple search strategy is used. The first search uses companies in the **Life Sciences** sector under the category of **Technology/IP-based businesses**:

BioTech Sector Search

- The recipient company has all of the following criteria:
 - **Sectors** are **any** of **Life Sciences** (comprising **Pharmaceuticals** and **Research Tools/Reagents**)
 - **Head office** (under criteria **Location**) is **United Kingdom**
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed or Venture**
- **Form of funding** is **Equity**
- **Amount raised** is **between £15,000** and **£20,000,000**

And the additional criteria in the first step:

- **None** of the **funders** match **all** of the following criteria:
 - **Fund type** is **all** categories **except Private Equity and Venture Capital** and **Angel Network**

THE UK VENTURE CAPITAL MARKET FOR EARLY-STAGE CLEAN TECH COMPANIES

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and sectors are of
 - + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type
 - one of
 - Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University
 - + Add fund criteria
- + Add fundraising criteria

And the additional criteria in the second step:

- Any of the funders match all of the following criteria:
 - Fund type is Private Equity and Venture Capital or Angel Network

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and sectors are of
 - + Add company criteria
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type one of
 - + Add fund criteria
- + Add fundraising criteria

The second search uses buzzwords related to BioTech:

BioTech Buzzword Search

- The recipient company has all of the following criteria:
 - **Buzzwords** are **any** of **Biomass and biofuels, Genomics, Precision Medicine, Regenerative Medicine, and Retail Biometrics**
 - **Head office** (under criteria **Location**) is **United Kingdom**
- **Date of fundraising** is between **01/01/2012** and **31/12/2021**
- Company's **stage of evolution** (at time of fundraising) is **one** of **Seed or Venture**
- **Form of funding** is **Equity**
- **Amount raised** is between **£15,000** and **£20,000,000**

And the additional criteria in the first step:

- **None** of the **funders** match **all** of the following criteria:
 - **Fund type** is **all categories except Private Equity and Venture Capital and Angel Network**

Find where of the following apply:

- the recipient company has of the following criteria:

✕

 - head office (where known, otherwise registered address)

is

United Kingdom

✕
 - and buzzwords are

✕

of

[+ Add company criteria](#)
- and company's stage of evolution (at time of fundraising) is one of

✕
- and date of fundraising is

✕
- and form of funding is of

✕
- and amount raised is and

✕
- and of their funder(s) match of the following criteria:

✕

- fund type

✕

one of

Asset Management, Bank, Central Government, Charity/Not-for-profit company, Commercialisation Company, Corporate, Crowd funding, Devolved Government, European, Family Office, Local and Regional Government, Merchant Bank, Private Investment Vehicle, Property Lender, Research Council, Sovereign Wealth Fund, Specialist Lender or University

✕

[+ Add fund criteria](#)

[+ Add fundraising criteria](#) 🔍 Search for fundraisings

And the additional criteria in the second step:

- **Any** of the **funders** match **all** of the following criteria:
 - **Fund type** is **Private Equity and Venture Capital or Angel Network**

Find where of the following apply:

- the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
 - [+ Add company criteria](#)
- and company's stage of evolution (at time of fundraising) one of
- and date of fundraising is
- and form of funding is of
- and amount raised is and
- and of their funder(s) match of the following criteria:
 - fund type one of
 - [+ Add fund criteria](#)
- [+ Add fundraising criteria](#)

Total in BioTech collection from all searches: **2119 fundraisings**

Acquisitions

Sector search

- The acquired company has all of the following criteria:
 - **Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other clean tech**)
 - **Head office** (under criteria **Location**) is **United Kingdom**
 - **Description does not contain** the word 'nuclear'
- **Date of acquisition** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- the acquired company has of the following criteria:
 - sectors are of
 - and
 - and description
 - [+ Add company criteria](#)
- and date of acquisition is
- [+ Add acquisition criteria](#)

Other Relevant Sector search

- The acquired company has **all** of the following criteria:
 - **Sectors** are **any** of **Other Fuel Production** and **Other Energy**
 - **Sectors** are **none** of **Coal** and **Oil and Gas**

- Description** contains **any** of the words in the **Keyword list**
- Head office** (under criteria **Location**) is **United Kingdom**
- Description does not contain** the word '**nuclear**'
- **Date of acquisition** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- the acquired company has of the following criteria:
 - sectors are of
 - and is
 - and sectors are of
 - and description
 - and description
- + Add company criteria
- and date of acquisition is
- + Add acquisition criteria

Buzzword search

- The acquired company has all of the following criteria:
 - Buzzwords** are **any** of **Biomass and biofuels**
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word '**nuclear**'
- **Date of acquisition** is between **01/01/2012** and **31/12/2021**

Find where of the following apply:

- the acquired company has of the following criteria:
 - is
 - and buzzwords are of
 - and description
- + Add company criteria
- and date of acquisition is
- + Add acquisition criteria

Total in collection from all searches: **158 acquisitions**

IPOs

Sector search

- The company has all of the following criteria:
 - Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other clean tech**)
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word '**nuclear**'

■ **Date of trading admission is between 01/01/2012 and 31/12/2021**

Find where of the following apply:

- the company has of the following criteria:
 - sectors are of
 - and is
 - and description
 - + Add company criteria
- and date of trading admission is

+ Add IPO criteria Q Search for IPOs

Other Relevant Sector search

- The company has **all** of the following criteria:
 - Sectors are any of Other Fuel Production and Other Energy**
 - Sectors are none of Coal and Oil and Gas**
 - Description contains any of the words in the Keyword list**
 - Head office (under criteria Location) is United Kingdom**
- **Date of trading admission is between 01/01/2012 and 31/12/2021**

Find where of the following apply:

- the company has of the following criteria:
 - sectors are of
 - and is
 - and sectors are of
 - and description
 - and description
 - + Add company criteria
- and date of trading admission is

+ Add IPO criteria Q Search for IPOs

Buzzword search

- The company has all of the following criteria:
 - Buzzwords are any of Biomass and biofuels**
 - Head office (under criteria Location) is United Kingdom**
 - Description does not contain the word 'nuclear'**
- **Date of trading admission is between 01/01/2012 and 31/12/2021**

Find where of the following apply:

- the company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
 - and description
 - + Add company criteria
- and date of trading admission is
- + Add IPO criteria

[Search for IPOs](#)

Total in collection from all searches: **9 IPOs**

Accelerators

Sector search

- Any of their accelerator attendances have all of the following criteria:
 - The company that attended the accelerator has all of the following criteria:
 - Sectors** are **any** of **Clean Technology** (comprising **Clean Energy Generation, Energy Reduction Technology, and Other clean tech**)
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word **'nuclear'**
 - date the company joined the accelerator is from **01/01/2012** to **31/12/2021**

Find where of the following apply:

- any of their accelerator attendances have of the following criteria:
 - the company that attended the accelerator has of the following criteria:
 - sectors are of
 - and head office (where known, otherwise registered address)
 - and description
 - + Add company criteria
 - and date the company joined the accelerator is
 - + Add accelerator attendance criteria
- + Add accelerator criteria

[Search for accelerators](#)

Other relevant sector search

- Any of their accelerator attendances have all of the following criteria:
 - The company that attended the accelerator has **all** of the following criteria:
 - Sectors** are **any** of **Other Fuel Production** and **Other Energy**
 - Sectors** are **none** of **Coal** and **Oil and Gas**
 - Description** contains **any** of the words in the **Keyword list**
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word **'nuclear'**
 - date the company joined the accelerator is from **01/01/2012** to **31/12/2021**

Find where of the following apply:

- any of their accelerator attendances have all of the following criteria:
 - the company that attended the accelerator has all of the following criteria:
 - sectors are any of 2 sectors selected
 - and head office (where known, otherwise registered address) is United Kingdom
 - and sectors are none of 2 sectors selected
 - and description contains any of these words: renewable green efficiency hydrogen clean sustainable emissions wind carbon transition solar environmental
 - and description contains none of these words: nuclear
 - and date the company joined the accelerator is from 01/01/2012 to 31/12/2021

+ Add accelerator criteria Search for accelerators

Buzzword search

- Any of their accelerator attendances have all of the following criteria:
 - The company that attended the accelerator has all of the following criteria:
 - Buzzwords are any of Biomass and biofuels**
 - Head office (under criteria Location) is United Kingdom**
 - Description does not contain the word 'nuclear'**
 - Date the company joined the accelerator is from **01/01/2012** to **31/12/2021**

Find where of the following apply:

- the acquired company has all of the following criteria:
 - head office (where known, otherwise registered address) is United Kingdom
 - and buzzwords are any of Biomass and biofuels
 - and description contains none of these words: nuclear
- and date of acquisition is from 01/01/2012 to 31/12/2021

+ Add acquisition criteria Search for acquisitions

Results in collection: **86 accelerators**

Grants

Sector search

- Any of the funders match all of the following criteria:
 - Any of their fundraisings match all of the following criteria:
 - Sectors are any of Clean Technology (comprising Clean Energy Generation, Energy Reduction Technology, and Other clean tech)**
 - Head office (under criteria Location) is United Kingdom**

Description does not contain the word 'nuclear'

■ **Date of grant is from 01/01/2012 to 31/12/2021**

Find where of the following apply:

- of the funders match of the following criteria:
 - of their fundraisings match of the following criteria:
 - the recipient company has of the following criteria:
 - sectors are of
 - and is
 - and description
 - + Add company criteria
 - + Add fundraising criteria
 - + Add fund criteria
- and date of grant is
- + Add grant criteria

Other relevant sector search

- Any of the funders match all of the following criteria:
 - Any of their fundraisings match **all** of the following criteria:
 - Sectors** are **any** of **Other Fuel Production** and **Other Energy Sectors** are **none** of **Coal** and **Oil and Gas**
 - Description** contains **any** of the words in the **Keyword list**
 - Head office** (under criteria **Location**) is **United Kingdom**
 - Description does not contain** the word 'nuclear'
 - Date of grant** is from **01/01/2012** to **31/12/2021**

Find where of the following apply:

- any of the funders match of the following criteria:
 - any of their fundraisings match of the following criteria:
 - the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and sectors are of
 - and sectors are of
 - and description

renewable green efficiency hydrogen clean sustainable emissions wind carbon transition solar environment
 - and description
 -
 -
 -
 - and date of grant is
 -

Buzzword search

- Any of the funders match all of the following criteria:
 - Any of their fundraisings match all of the following criteria:
 - Buzzwords are any of Biomass and biofuels**
 - Head office (under criteria Location) is United Kingdom**
 - Description does not contain the word 'nuclear'**
 - Date of grant is from 01/01/2012 to 31/12/2021**

Find where of the following apply:

- any of the funders match of the following criteria:
 - any of their fundraisings match of the following criteria:
 - the recipient company has of the following criteria:
 - head office (where known, otherwise registered address)
 - and buzzwords are of
 - and description
 -
 -
 -
 - and date of grant is
 -

Total in collection: **366 grants**

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