

Barriers and enablers of investment in climate technology

Input paper for G20 Sustainable Finance Working Group

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1. Methodology

PwC has been tracking climate tech investment through our State of Climate Tech reports since 2018, covering more than 4000 climate tech start-ups, more than 9800 climate tech deals and investments totalling US\$260 billion between Q1 2018 and Q3 2022. Our most recent [report](#) was published in 2022.

This input paper draws on that research as well as our experience supporting clients on all sides of climate tech investments. The investment data is sourced from Pitchbook unless otherwise stated, with investment numbers representing PwC analysis of Pitchbook data. The data underpinning the analysis includes venture capital and private equity investment into start-ups. Funding-round types analysed include accelerators/incubators, angel investors, buyouts/LBOs, capitalisation, corporate investment, early stage venture capital, equity crowdfunding, grants, joint ventures, later-stage venture capital, mezzanine, private equity growth/expansion, platform creation, restarts (early venture capital), reverse mergers, and seed rounds. The approach taken highlights financial trends in innovative climate technologies looking to scale up.

The data sources used have stronger coverage in European and North American markets. This analysis may therefore be a conservative estimate of the relative levels of Chinese investment and of overall climate technology investment. The analysis does not include the substantial public markets or project financing of mature climate technologies (for example large scale renewable energy projects such as wind and solar farms), nor does it cover corporate R&D funding into climate tech.

2. The state of climate tech investment

Every sector of the global economy needs to transform and substantially reduce carbon emissions through the deployment of climate tech¹. This urgent need is being partially met by significant flows of capital. In 2022, investment in climate technology accounted for \$52 billion, equal to a quarter of all venture capital funding.

In total US\$260 billion has been raised for climate tech since the start of 2018 with the most funded sectors being:

- **Mobility and transport** - Total investment US\$138 billion. Most funded area: Low GHG light and heavy vehicles
- **Energy** - Total investment US\$49 billion. Most funded area: Renewable energy generation
- **Food, agriculture and land use** - Total investment US\$30 billion. Most funded area: Alternative foods/low GHG protein
- **Industry, manufacturing and resources** - Total investment US\$21 billion. Most funded area: Transformative circularity
- **Built environment** - Total investment US\$11 billion. Most funded area: High efficiency fixtures and fittings

In 2022, there were more than 240 climate tech start-ups valued at more than US\$1 billion each.

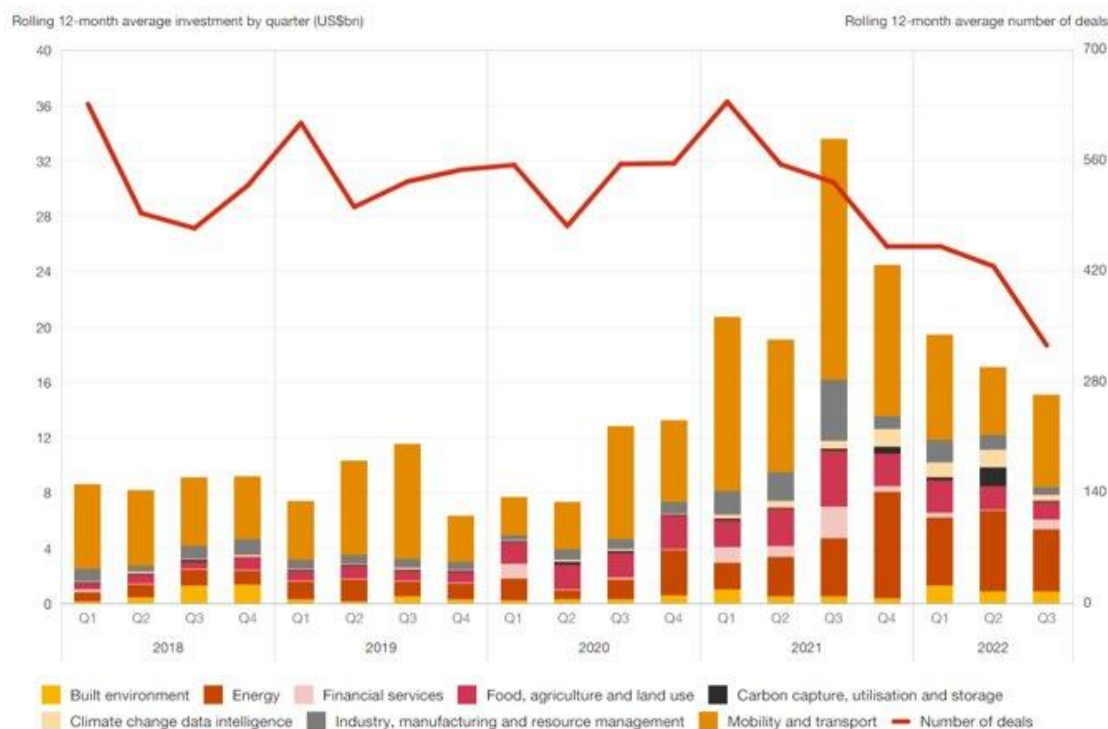
¹ Technologies that are explicitly focused on reducing greenhouse gas (GHG) emissions or addressing the impacts of global warming. The term climate tech is purposely broad to reflect the wide range of technologies and innovations being used to address GHG emissions and the array of industries in which they are being applied.

3. Drivers of growth in climate tech investment

Innovation and investment in the climate tech sector have been driven by six key factors over the past few years and these drivers continue to fuel development:

- **Policy and regulation:** the policy and regulatory environment for climate tech is increasingly supportive, with net zero commitments increasingly set in national legislation and specific policy measures being implemented that incentivise reduction in carbon emissions.
- **Corporate demand:** corporate ambition and action is accelerating. For example over 2500 companies have science based emissions reduction targets approved by the Science Based Targets initiative (SBTi)². In their most recent Progress Report, the SBTi claim that companies reflecting over a third of global market capitalisation have set, or committed to set, net zero targets³.
- **Demonstrated success:** the combination of robust demand and the development of high-quality low-carbon products and services have created several high-profile successful companies.
- **Lower cost:** low-carbon technology, particularly regarding renewable electricity generation and battery manufacturing, has become much cheaper and more widely available. This makes it easier to earn adequate returns.
- **People:** increasingly high-quality founders and top talent have been drawn to different parts of this important and urgent challenge, across multiple sectors and geographies.
- **Cost of capital:** Looking back over the last five years, capital has been relatively low cost which has made innovative investments appealing. That is changing as interest rates have risen significantly. Going forward, climate tech will need to compete for more expensive and less available capital.

Figure 1: State of Climate Tech Investment⁴



² Science-Based Targets initiative Target Dashboard accessed June 2023.

³ Science-Based Net-Zero Scaling Urgent Corporate Climate Action Worldwide. Science Based Targets Initiative Annual Progress Report, 2021. Version 1.2 – Updated June 2022. Available here: <https://sciencebasedtargets.org/resources/files/SBTiProgressReport2021.pdf>

⁴ Source: PwC State of Climate Tech report 2022, PwC analysis of Pitchbook data

4. Gaps in climate tech finance

This is a positive story of new markets being created and capital flowing; however the current trajectory is not set to achieve Paris-aligned climate goals and investment fell last year.

There are three significant gaps to close:

Investment in climate tech is not sufficient

Despite showing relative resilience compared to the broader VC investment market and maintaining pre-2021 levels, investment in climate tech in 2022 was 30% below that of the previous year. At a time when the planetary need is for increased development and deployment of climate technology, this decline is a problem, notwithstanding the fact that it reflects a broad pattern of reduced VC investment rather than any particular falling out of love with climate technology.

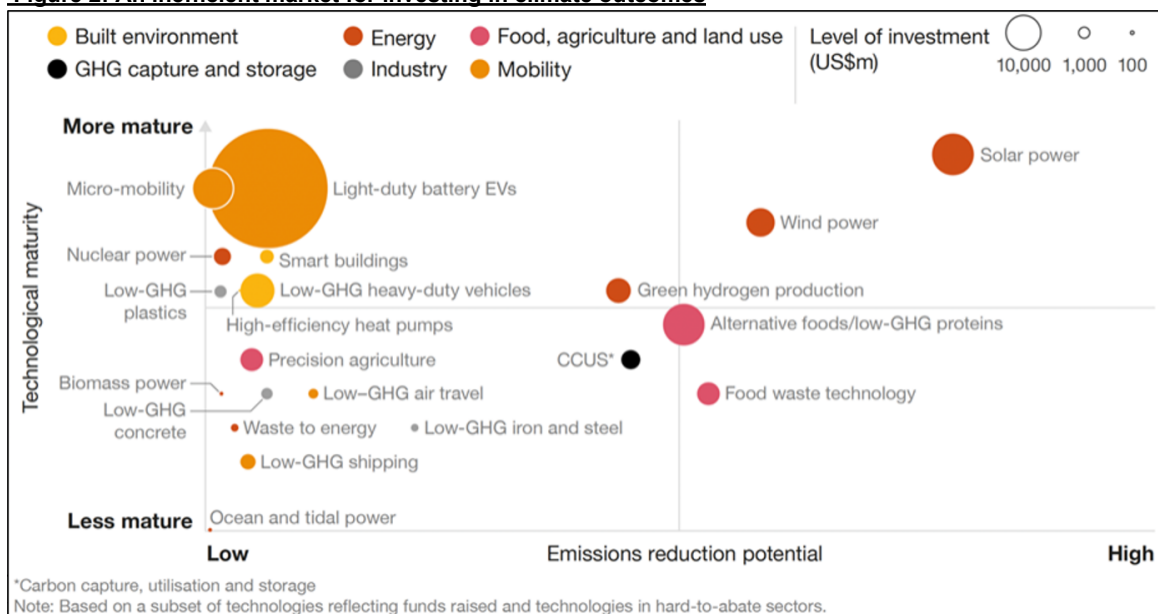
Early-stage start-ups are struggling to access capital to scale up

While deals with financing between US\$5 million and US\$1 billion, typically at later stages of funding, have fared well, there has been a decline in investment in the number and value of small deals, typically at the earliest stages of funding, since 2021. This 'valley of death', risks jeopardising the pipeline for high quality startups upon which late stage venture capital and private equity investors are reliant.

Investment is not aligned with carbon impact

The flow of investment into sectors is not in proportion to each sector's contribution to the flow of GHGs into the atmosphere, with 85% of the emissions receiving 52% of the funding. The investment market is not yet efficient at meeting climate objectives. Areas such as electric batteries, for example, attract disproportionately large amounts of investment compared to, for example, green hydrogen, food waste technology or smart buildings. This under-investment is likely to some extent a function of gaps in technology itself - it is hard to invest in technologies that do not exist. However, it is also a function of the wider context. The remainder of this input paper discusses that context, identifying barriers to investment and proposing solutions for consideration.

Figure 2: An inefficient market for investing in climate outcomes⁵



5. Barriers and potential solutions

Addressing these challenges means identifying the specific barriers to accelerating investment and developing approaches that can remove unnecessary obstacles.

Below we identify a number of issues that we have experienced and propose some initial ideas for policy measures to consider. We would emphasise that the potential solutions are offered tentatively, recognising that the context differs markedly by geography and sector and that what might be a good idea in theory can be an unproductive idea in practice. We have divided barriers into categories: investor side, project side and ecosystem.

5.1. Investor side barriers

Risk perception of climate tech

Many non-specialist investors have limited understanding of climate tech and consequently often perceive climate tech investments to be high risk, or find it hard to evaluate the risk profile. Climate tech projects and businesses typically make use of new technologies and business models that are not necessarily proven or well-understood by traditional investors.

Where technologies are proven (e.g. wind, solar, electric vehicles), risk perception is significantly reduced and investment flows more easily.

Potential solutions:

- Building capability and knowledge of 'traditional investors' so they can better understand emerging climate tech sectors.
- Accelerators and demonstration projects to prove the concept of high potential technologies.
- Supporting the development of climate tech funds that produce more predictable risk profiles.

Gaps in early stage financing

The venture capital and angel investing segments are very limited in most middle and low income countries. As a result, there is a lack of sources of investment in early stage projects and businesses in these areas.

Linked to this, many climate tech investment opportunities require different types of financing to that which has traditionally been offered. For example, traditional debt finance approaches often leverage a business's collateral (e.g. machinery, property, etc) - which are asset types that many climate tech firms lack. Similarly, many nature-based solutions require very patient capital (e.g. whilst trees grow) - which does not fit with the expectations of returns of most investors.

Potential solutions:

- Support to encourage the deepening of capital markets, for example through Development Finance Institution (DFI) support for early stage investments with a climate focus.

Unclear pathways for accessing investment

The financing of climate tech is often conducted in a relatively unstructured fashion. This creates inefficiencies for businesses (who struggle to navigate the investment landscape) and investors (who invest significant time in origination).

Potential solutions:

- Clearer pathways to support climate tech businesses to engage with investors and access finance. For example, creating a route for very early stage projects to access grants (e.g. through a competition) to prove their concept, followed by capacity building and structured engagement with VC investors.

5.2. Project side barriers

Financial know-how and connections

Founders of climate tech businesses are typically very technically capable, but often lack the financial expertise to effectively communicate the investment opportunity to investors. Linked to this, much early stage financing is delivered through an ecosystem of small VC firms and individuals that can be opaque and difficult to navigate for founders lacking strong networks.

Potential solutions:

- Provide training and networking opportunities to the developers of climate tech businesses so that they can strengthen the investability of their businesses and engage more effectively with investors.

Investment ticket size

Early stage climate tech businesses and projects generally require relatively small levels of investment in order to prove their concept. These smaller investments are unattractive for most traditional investors, especially banks and institutional investors, as the returns are unlikely to justify the transaction costs of due diligence.

Potential solutions:

- There is a role for funds that aggregate together a large number of climate tech investment opportunities to create a single investable product that is of a size to interest institutional and other large investors. This can have the additional benefit of dispersing the risk associated with individual investments. The UK government's MOBILIST programme is a good example of this approach.

5.3. Enabling environment barriers

Policy and regulation

There are a number of country and sector specific barriers that relate to the policy and regulatory environment. As an example, one area that we commonly encounter is enabling renewable energy providers to effectively connect and sell power to the grid, and to have confidence in the timelines and pricing around this. Another common issue is the pace and predictability of access to relevant permits that are needed to begin operation. The EU Green Industrial plan addresses this for a couple of critical technology areas but this could potentially be expanded into other areas.

Potential solutions:

- It is hard to generalise at a global scale, but there is a role for policy makers to listen to climate-tech entrepreneurs and identify whether particular pinch-points can be safely relaxed.

Availability of skills

The development and scale up of climate technology depends on the availability of people with the relevant skills. This relates both to the capacity of early-stage innovators and entrepreneurs and to access to a workforce with relevant knowledge and capabilities. There is a shortage of green skills in the global economy, with one study from LinkedIn⁶

⁶ LinkedIn/Economic Graph, Global Green Skills Report 2022, <https://economicgraph.linkedin.com/content/dam/me/economicgraph/en-us/globalgreen-skills-report/global-green-skills-report-pdf/li-green-economy-report-2022-annex.pdf>, p. 8

showing that green job postings grew 8% a year over the last five years, while green talent only grew around 6% annually over the same period.

Potential solutions:

- Greater support for climate-related skill development.

6. The specific challenges around climate adaptation

It is worth noting that the challenges outlined above are significantly higher for climate adaptation. While the market for climate mitigation technologies is imperfect, there is at least clarity around some important revenue streams. A combination of government policy, price and non-price measures, consumer and workforce pressure and voluntary commitments made by companies is creating demand for technology that will reduce production of greenhouse gases. These processes are at an earlier stage for climate adaptation, and so barriers, particularly on the investor side, are likely to be significantly higher.

7. Conclusion

There tends to be a focus in this type of discussion on hyper successful startups and cutting edge technology. While these are important, there is also a vital role to be played by large numbers of more normal size projects and businesses that make use of more established tech and business models to deliver climate action. Facilitating the development of such businesses fundamentally comes down to two factors: i) the economics need to be attractive and ii) decision makers, including prospective investors, entrepreneurs, innovators, and employees, need to *know* that is the case.

By supporting policy change that creates demand for climate technology and providing financial support at key points in the development of technology it is possible for policy to address the economic challenge. By taking proactive steps to facilitate engagement between investors and climate entrepreneurs, it is possible to address the knowledge challenge.